

# Head First PMP®

A Brain-Friendly Guide

**4th Edition**

*Covers PMBOK Guide,  
6th Edition*

**A Learner's Companion  
to Passing the  
Project Management  
Professional Exam**



Load the exam  
concepts right into  
your brain



Use risk management  
to avoid embarrassing  
project problems



See how understanding  
matrixed organizations got  
Kate a better job



Test your knowledge  
with hundreds of  
practice questions



Discover the  
secrets of collecting  
requirements

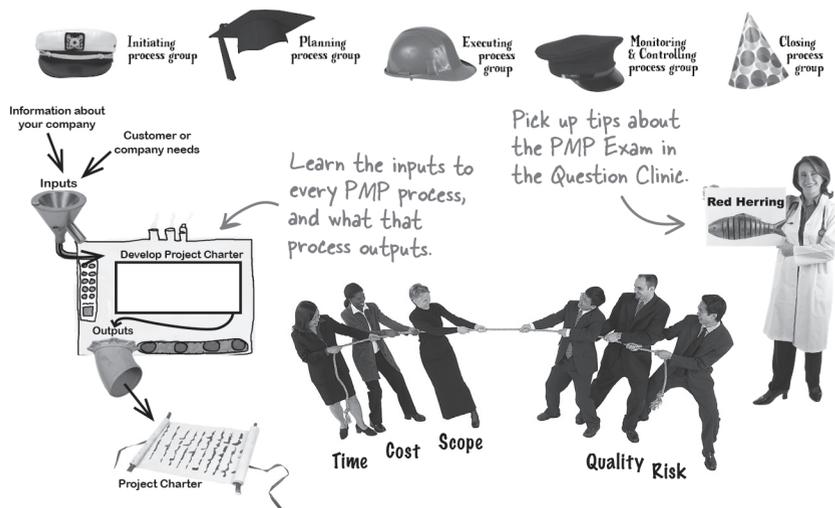


Jennifer Greene, PMP & Andrew Stellman, PMP

# Head First PMP

## What will you learn from this book?

*Head First PMP* teaches you the latest principles and certification objectives in *The PMBOK® Guide* in a unique and inspiring way. This updated fourth edition takes you beyond specific questions and answers with a unique visual format that helps you grasp the big picture of project management. By putting PMP concepts into context, you'll be able to understand, remember, and apply them—not just on the exam, but on the job. No wonder so many people have used *Head First PMP* as their sole source for passing the PMP exam.



“I teach Project Management for a project management firm and its clients. Using *Head First PMP* exclusively as the course material, my students have an 84% first time passing rate for the PMP and CAPM. This is by far the very best and most complete book for anyone looking to improve their project management skills and pass the PMP exam.”

—Rocket Williams,  
PMP, MCITP, MCT

“I have been doing project management for over 30 years and am considered a subject matter expert in the *PMBOK Guide*...I can honestly say that *Head First PMP* is by far the best PMP Exam Preparation book of all I have reviewed in depth. It is...a great tool for practitioners who want to pass the PMP exam.”

—Dennis Bolles, PMP and  
coauthor of *The Power of  
Enterprise-Wide Project  
Management*

## Why does this book look so different?

Based on the latest research in cognitive science and learning theory, *Head First PMP* uses a visually rich format to engage your mind, rather than a text-heavy approach that puts you to sleep. Why waste your time struggling with new concepts? This multi-sensory learning experience is designed for the way your brain really works.

US \$79.99

CAN \$105.99

ISBN: 978-1-492-02964-9



9



twitter.com/headfirstlabs  
facebook.com/HeadFirst

oreilly.com

## Praise for *Head First PMP*

“I have been doing project management for over 30 years and am considered a subject matter expert in the *PMBOK Guide*, Third Edition, primarily because I am the project manager who led the team that developed this edition...I can honestly say that *Head First PMP* is by far the best PMP exam preparation book of all I have reviewed in depth. It is the very best basic education and training book that I have read that presents the processes for managing a project, which makes it a great resource for a basic project management class for beginners as well as a tool for practitioners who want to pass the PMP exam. The graphical story format is unique, as project management books go, which makes it both fun and easy to read while driving home the basics that are necessary for preparing someone who is just getting started and those who want to take the exam.”

— **Dennis Bolles, PMP**  
**Project manager for the *PMBOK Guide*, Third Edition, Leadership Team,  
DLB Associates, LLC, and coauthor of *The Power of Enterprise-Wide Project  
Management***

“This looks like too much fun to be a PMP study guide! Behind the quirky humor and nutty graphics lies an excellent explanation of the project management processes. Not only will this book make it easier to pass the exam, you’ll learn a lot of good stuff to use on the job too.”

— **Carol Steuer, PMP**  
***PMBOK Guide*, Third Edition, Leadership Team**

“This is the best thing to happen to PMP since, well, ever. You’ll laugh, learn, pass the exam, and become a better project manager all at the same time.”

— **Scott Berkun, author of *The Art of Project Management* and *The Myths of  
Innovation***

“I love the brain-friendly approach used by Head First. When was the last time you heard that a PMP prep book was fun to read? This one really is!”

— **Andy Kaufman, host of the *People and Projects Podcast* on iTunes**

“*Head First PMP* is the PMP exam prep book for the rest of us: the people who live project management daily and want an exam prep book that is as interesting as the work we live, prepares them for the exam, and helps them become a better project manager. I’ve taken my copy of the first edition to numerous exam prep classes I have helped teach as a reference book. Students will pick it up, review several pages or topics, and say, ‘That is how I learn. Can I take your copy?’ The impact and satisfaction is immediate.”

— **Ken Jones, PMP and project manager**

“In today’s business world, it’s not just what you get done, it’s how you get it done. To that end, *Head First PMP* has just the right balance of wit and fun that makes learning the Project Management Body of Knowledge engaging and interesting.”

— **Jen Poisson, Director of Production Operations, Disney Online**

## **Praise for *Head First PMP***

“Wow. In the beginning of March I finished and passed a four-hour adventure called the PMP exam. I can honestly say that though I used a few study guides, without the help of *Head First PMP*, I don't know how I would have done it. Jenny and Andrew put together one of the best ‘head smart, brain friendly’ training manuals that I have ever seen. I have to say that I am a *huge* fan and *will* be buying their new *Beautiful Teams* book. Anyone I meet who mentions wanting to take the exam, I send them to <https://github.com/head-first-pmp/4th-edition> to get the sample chapter and free test. Seeing is believing. Thanks, Andrew and Jenny, for putting together an exceptional study guide. Keep up the good work!”

—**Joe Pighetti Jr., PMP, engineer**

“I think that under the fonts and formalized goofiness, the book has a good heart (intending to cover basic principles in an honest way rather than just to pass the test). *Head First PMP* attempts to educate potential project managers instead of being a mere ‘how to pass the PMP exam’ book filled with test-taking tips. This is truly something, which sets it apart from the other PMP certification exam books.”

—**Jack Dahlgren, project management consultant**

“I love this format! *Head First PMP* covers everything you need to know to pass your PMP exam. The sound-bite format combined with the whimsical images turns a dry subject into entertainment. The organization starts with the basics, then drills into the details. The in-depth coverage of complex topics like earned value and quality control are presented in an easy-to-understand format with descriptions, pictures, and examples. This book will not only help you pass the PMP [exam], it should be used as a daily reference for practicing project managers. I sure wish I had this when I was studying for the exam.”

—**Mike Jenkins, PMP, MBA**

“It is like an instructor with a blackboard in a book, and the little devil and angel over your shoulder telling you what is right or wrong. I am getting instant results from the first five chapters. An excellent guide/training tool for all those new and somewhat new to project management methodologies.”

—**BJ Moore, PMP  
Nashville, TN, Amazon.com reviewer**

“Studying for your PMP exam? Would you like the ability to carry not only an instructor but an entire classroom in your briefcase as you prepare? Then buy this book! The drawings and diagrams are reminiscent of your favorite teacher utilizing the whiteboard to step you through the key points of their lecture. The authors’ use of redundancy in making the same point in multiple ways, coupled with the ‘there are no dumb questions’ sections, gave the feeling of being in a classroom full of your fellow PMP-aspiring peers. At times I actually caught myself feeling relieved that someone else asked such a good question. This book is enjoyable, readable, and most importantly takes the fear out of approaching the subject matter. If you are testing the PMP waters with your big toe, this book will give you the confidence to dive into the deep end.”

—**Steven D. Sewell, PMP**

## Praise for other *Head First* books

“With *Head First C#*, Andrew and Jenny have presented an excellent tutorial on learning C#. It is very approachable while covering a great amount of detail in a unique style. If you’ve been turned off by more conventional books on C#, you’ll love this one.”

—**Jay Hilyard, software developer, coauthor of *C# 3.0 Cookbook***

“I’ve never read a computer book cover to cover, but this one held my interest from the first page to the last. If you want to learn C# in depth and have fun doing it, this is *the* book for you.”

—**Andy Parker, fledgling C# programmer**

“Going through this *Head First C#* book was a great experience. I have not come across a book series which actually teaches you so well... This is a book I would definitely recommend to people wanting to learn C#.”

—**Krishna Pala, MCP**

“*Head First Web Design* really demystifies the web design process and makes it possible for any web programmer to give it a try. For a web developer who has not taken web design classes, *Head First Web Design* confirmed and clarified a lot of theory and best practices that seem to be just assumed in this industry.”

—**Ashley Doughty, senior web developer**

“Building websites has definitely become more than just writing code. *Head First Web Design* shows you what you need to know to give your users an appealing and satisfying experience. Another great *Head First* book!”

—**Sarah Collings, user experience software engineer**

“*Head First Networking* takes network concepts that are sometimes too esoteric and abstract even for highly technical people to understand without difficulty and makes them very concrete and approachable. Well done.”

—**Jonathan Moore, owner, Forerunner Design**

“The big picture is what is often lost in information technology how-to books. *Head First Networking* keeps the focus on the real world, distilling knowledge from experience and presenting it in byte-size packets for the IT novice. The combination of explanations with real-world problems to solve makes this an excellent learning tool.”

—**Rohn Wood, senior research systems analyst, University of Montana**

### **Other related books from O'Reilly**

Applied Software Project Management  
Making Things Happen  
Practical Development Environments  
Process Improvement Essentials  
Time Management for System Administrators  
How to Keep Your Boss from Sinking Your Project (Digital Short Cut)

### **Other books in O'Reilly's *Head First* series**

Head First C#  
Head First Java  
Head First Object-Oriented Analysis and Design (OOA&D)  
Head First HTML with CSS and XHTML  
Head First Design Patterns  
Head First Servlets and JSP  
Head First EJB  
Head First SQL  
Head First Software Development  
Head First JavaScript  
Head First Physics  
Head First Statistics  
Head First Ajax  
Head First Rails  
Head First Algebra  
Head First PHP & MySQL  
Head First Web Design  
Head First Networking

# Head First PMP

WOULDN'T IT BE  
DREAMY IF THERE WERE  
A BOOK TO HELP ME STUDY  
FOR THE PMP EXAM THAT **WAS**  
**MORE FUN THAN GOING TO**  
**THE DENTIST?** IT'S PROBABLY  
NOTHING BUT A FANTASY...



Jennifer Greene, PMP  
Andrew Stellman, PMP

**O'REILLY®**

Beijing • Boston • Farnham • Sebastopol • Tokyo

# Head First PMP

## Fourth Edition

by Jennifer Greene, PMP, and Andrew Stellman, PMP

Copyright © 2018 Jennifer Greene and Andrew Stellman. All rights reserved.

Printed in the United States of America.

Published by O'Reilly Media, Inc., 1005 Gravenstein Highway North, Sebastopol, CA 95472.

O'Reilly Media books may be purchased for educational, business, or sales promotional use. Online editions are also available for most titles (<http://oreilly.com/safari>). For more information, contact our corporate/institutional sales department: (800) 998-9938 or [corporate@oreilly.com](mailto:corporate@oreilly.com).

<b>Series Creators:</b>	Kathy Sierra, Bert Bates
<b>Editor:</b>	Jeff Bleiel
<b>Design Editor:</b>	Louise Barr
<b>Cover Designers:</b>	Karen Montgomery, Louise Barr
<b>Production Editor:</b>	Melanie Yarbrough
<b>Indexer:</b>	Bob Pfahler
<b>Proofreader:</b>	Rachel Monaghan
<b>Brain image on spine:</b>	Eric Freeman
<b>Always in our hearts:</b>	Quentin the whippet and Tequila the pomeranian

## Printing History:

March 2007: First Edition.

July 2009: Second Edition.

December 2013: Third Edition.

August 2018: Fourth Edition.



The O'Reilly logo is a registered trademark of O'Reilly Media, Inc. The *Head First* series designations, *Head First PMP*, and related trade dress are trademarks of O'Reilly Media, Inc.

PMP and PMBOK are registered marks of Project Management Institute, Inc.

Many of the designations used by manufacturers and sellers to distinguish their products are claimed as trademarks. Where those designations appear in this book, and O'Reilly Media, Inc., was aware of a trademark claim, the designations have been printed in caps or initial caps.

While every precaution has been taken in the preparation of this book, the publisher and the authors assume no responsibility for errors or omissions, or for damages resulting from the use of the information contained herein.

No dogs, rabbits, or bears were harmed in the making of this book. OK, maybe one bear...but he'll get over it.

ISBN: 978-1-492-02964-9

[MBP]

*To our friends and family, and the people who make us laugh  
(you know who you are)*

THANKS FOR READING OUR BOOK!  
WE REALLY LOVE WRITING  
ABOUT THIS STUFF, AND WE HOPE  
YOU GET A KICK OUT OF IT...

Andrew

Photo by Nisha Sondhe



...AND WE KNOW  
YOU'RE GOING TO DO  
GREAT ON THE PMP  
EXAM!

Jenny

**Andrew Stellman**, despite being raised a New Yorker, has lived in Pittsburgh *twice*. The first time was when he graduated from Carnegie Mellon's School of Computer Science, and then again when he and Jenny were starting their consulting business and writing their first book for O'Reilly.

When he moved back to his hometown, his first job after college was as a programmer at EMI-Capitol Records—which actually made sense, since he went to LaGuardia High School of Music and Art and the Performing Arts to study cello and jazz bass guitar. He and Jenny first worked together at a New York financial software company, where he was managing a team of programmers. He's had the privilege of working with some pretty amazing programmers over the years, and likes to think that he's learned a few things from them.

When he's not writing books, Andrew does a lot of coding for fun, studies martial arts (most recently krav maga and boxing), plays his share of video games, and most of all he loves to help people push their tech careers forward. He has a rambunctious Pomeranian named Samosa.

**Jennifer Greene** studied philosophy in college but figured out pretty soon afterward that she really loved building software. Luckily, she's a great software engineer, so she started out working at an online service, and that's the first time she really got a sense of what good software development looked like.

She moved to New York in 1998 to work on software quality at a financial software company. She's managed a teams of developers, testers, and PMs on software projects in media and finance since then.

She's traveled all over the world to work with different software teams and build all kinds of cool projects.

She loves traveling, watching Bollywood movies, reading the occasional comic book, playing PS4 games, and hanging out with her huge Siberian cat, Sascha.

We've been building software and writing about software engineering together since we first met in 1998. Our first book, *Applied Software Project Management*, was published by O'Reilly in 2005. We published our second book in the Head First series, *Head First C#*, in 2009, and our third, *Head First Agile*, in 2017.

We founded Stellman & Greene Consulting in 2003 to build a really neat software project for scientists studying herbicide exposure in Vietnam vets. When we're not building software or writing books, we do a lot of speaking at conferences and meetings of software engineers, architects, and project managers.

You can learn more about us on our website: <https://www.stellman-greene.com>.

## Table of Contents (Summary)

	Intro	xxv
1	Introduction: <i>Why get certified?</i>	1
2	Organizations, constraints, and projects: <i>In good company</i>	37
3	The process framework: <i>It all fits together</i>	69
4	Project integration management: <i>Getting the job done</i>	97
5	Scope management: <i>Doing the right stuff</i>	163
6	Time management: <i>Getting it done on time</i>	243
7	Cost management: <i>Watching the bottom line</i>	335
8	Quality management: <i>Getting it right</i>	407
9	Human resource management: <i>Getting the team together</i>	459
10	Communications management: <i>Getting the word out</i>	509
11	Project risk management: <i>Planning for the unknown</i>	551
12	Procurement management: <i>Getting some help</i>	611
13	Stakeholder management: <i>Keeping everyone engaged</i>	659
14	Professional responsibility: <i>Making good choices</i>	695
15	A little last-minute review: <i>Check your knowledge</i>	709
16	Practice makes perfect: <i>Practice PMP exam</i>	743

## Table of Contents (the real thing)

### Intro

**Your brain on PMP.** Here you are trying to *learn* something, while here your *brain* is doing you a favor by making sure the learning doesn't *stick*. Your brain's thinking, "Better leave room for more important things, like which wild animals to avoid and whether naked snowboarding is a bad idea." So how *do* you trick your brain into thinking that your life depends on knowing enough to get through the PMP exam?

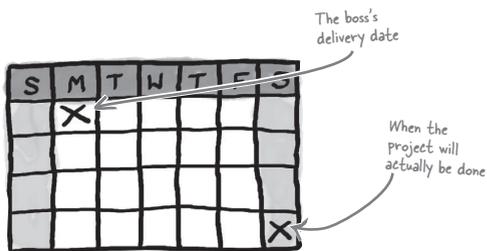
Who is this book for?	xxvi
We know what you're thinking	xxvii
Metacognition: thinking about thinking	xxix
Here's what YOU can do to bend your brain into submission	xxxi
Read me	xxxii
Acknowledgments	xxxiii

# Introduction

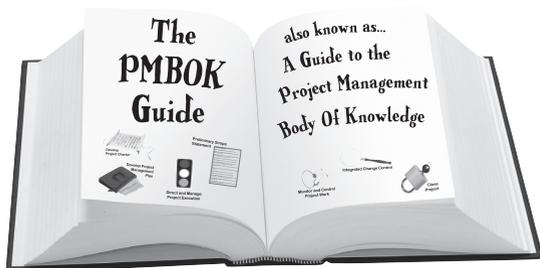
## Why get certified?

1

**Tired of facing the same old problems?** If you've worked on a lot of projects, you know that you face the same problems, over and over again. It's time to learn some common solutions to those problems. There's a whole lot that project managers have learned over the years, and passing the PMP exam is your ticket to putting that wisdom into practice. Get ready to change the way you manage your projects forever.



Do these problems seem familiar?	2
Projects don't have to be this way	4
Your problems...already solved	5
What you need to be a good project manager	6
Understand your company's big picture	10
Your project has value	11
Your project follows a lifecycle	12
Portfolios, programs, and projects have a lot in common	14
Portfolios, programs, and projects all use charters	15
What a project IS...	19
... and what a project is NOT	19
A day in the life of a project manager	21
How project managers run great projects	23
Project management offices help you do a good job, every time	24
Good leadership helps the team work together	25
Project teams are made of people	26
Operations management handles the processes that make your company tick	28
A PMP certification is more than just passing a test	32
Meet a real-life PMP-certified project manager	33
Exam Questions	34



# Organizations, constraints, and projects

## 2

### In good company

If you want something done right...better hope you're in the right kind of organization. All projects are about teamwork—but how your team works depends a lot on the type of organization you're in. In this chapter, you'll learn about the different types of organizations around—and which type you should look for the next time you need a new job.

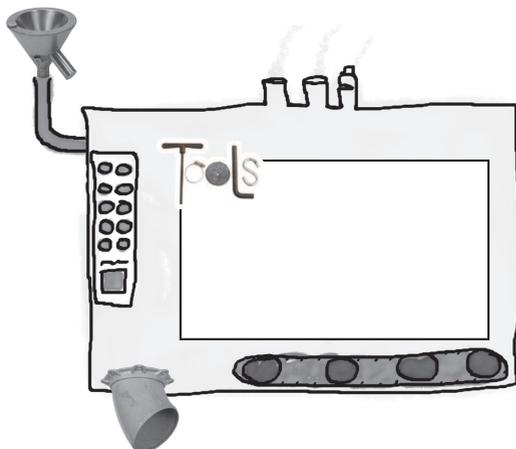


A day in Kate's life	40
Kate wants a new job	41
There are different types of organizational structures	44
A few more types of organizations	46
PMOs can be supportive, controlling, or directive	47
Kate takes a new job	51
Back to Kate's maintenance nightmare	52
Managing project constraints	54
Don't reinvent the wheel	59
You can't manage your project in a vacuum	60
Kate's project needs to follow company processes	61
Kate makes some changes...	62
...and her project is a success!	63
Exam Questions	66

### The process framework It all fits together

## 3

All of the work you do on a project is made up of processes. Once you know how all the processes in your project fit together, it's easy to remember everything you need to know for the PMP exam. There's a pattern to all of the work that gets done on your project. First you plan it, then you get to work. While you are doing the work, you are always comparing your project to your original plan. When things start to get off-plan, it's your job to make corrections and put everything back on track. And the process framework—the process groups and knowledge areas—is the key to all of this happening smoothly.



Cooking up a project	72
Projects are like recipes	74
If your project's really big, you can manage it in phases	76
Phases can also overlap	77
Break it down	78
Anatomy of a process	81
Combine processes to complete your project	84
Knowledge areas organize the processes	85
The project manager's role	90
Leadership is different than management	92
The benefits of successful project management	99
Exam Questions	101

# Project integration management

## Getting the job done

# 4

### Want to make success look easy?

It's not as hard as you think. In this chapter, you'll learn about **a few processes** you can use in your projects every day. Put these into place, and your **sponsors** and **stakeholders** will be happier than ever. Get ready for **Integration Management**.

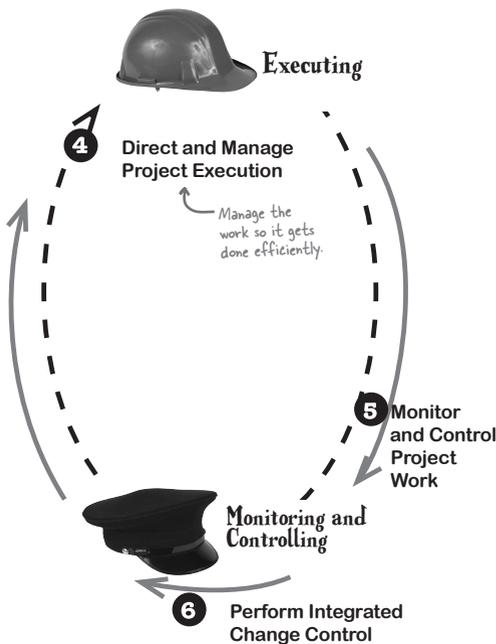


Enterprise environmental factors



Organizational process assets

The day-to-day work of a project manager	111
The seven Integration Management processes	112
Start your project with the Initiating processes	115
Integration Management and the process groups	116
The Develop Project Charter process	118
Make the case for your project	119
A closer look at the project charter	122
Plan your project!	128
The Project Management plan lets you plan ahead	129
A quick look at all those subsidiary plans	131
Question Clinic: The just-the-facts-ma'am question	134
The Direct and Manage Project Work process	136
The project team creates deliverables	137
Executing the project includes repairing defects	138
The Manage Project Knowledge process	140
Knowledge is the lifeblood of any project	141
Eventually, things WILL go wrong...	142
Sometimes you need to change your plans	143
Look for changes and deal with them	144
Make only the changes that are right for your project	145
How the processes interact with one another	146
Changes, defects, and corrections	147
Decide your changes in change control meetings	147
Control your changes; use change control	148
Preventing or correcting problems	150
Finish the work, close the project	152
You don't have to go home, but you can't stay here	153
So why INTEGRATION Management?	154
Integration Management kept your project on track, and the teachers satisfied	157
Exam Questions	166



# Scope management

## 5

### Doing the right stuff

#### Confused about exactly what you should be working on?

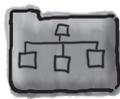
Once you have a good idea of what needs to be done, you need to **track your scope** as the project work is happening. As each goal is accomplished, you confirm that all of the work has been done and make sure that the people who asked for it are **satisfied with the result**. In this chapter, you'll learn the tools that help your project team **set its goals** and keep everybody on track.



Updates



Project Management plan



Work breakdown structure

Project scope statement



It looks like we have a scope problem	183
You've got to know what (and how) you will build before you build it	185
The power of Scope Management	186
The six Scope Management processes	187
Plan your scoping processes	188
Collect requirements for your project	191
Talk to your stakeholders	192
Make decisions about requirements	193
Understand your requirements	194
The stakeholders know a lot about the project already	194
Use a questionnaire to get requirements from a bigger group of people	196
A prototype shows users what your product will be like	197
Now you're ready to write a requirements document	198
Define the scope of the project	201
How do you define the scope?	202
The project scope statement tells you what you have to do	204
Create the work breakdown structure	210
The inputs for the WBS come from other processes	211
Breaking down the work	212
Decompose deliverables into work packages	214
The project scope baseline is a snapshot of the plan	222
The outputs of the Create WBS process	224
Why scope changes	227
The Control Scope process	229
Anatomy of a change	230
A closer look at the change control system	232
Just two Control Scope tools and techniques	233
Make sure the team delivered the right product	237
The stakeholders give you criteria for deciding when you're done	238

# Time management

## Getting it done on time

# 6

**Time management is what most people think of when they think of project managers.** It's where the deadlines are set and met. It starts with **figuring out the work** you need to do, how you will do it, what **resources you'll use**, and how long it will take. From there, it's all about developing and controlling that **schedule**.



**Resource calendar**



**Network diagram**



**Activity list**



**Activity duration estimates**



**Activity resource requirements**



**Activity attributes**

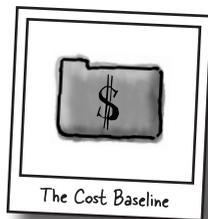
Schedule management helps with aggressive timelines	262
Plan your scheduling processes	266
Use the Define Activities process to break down the work	268
Tools and techniques for Define Activities	269
Rolling wave planning lets you plan as you go	270
Define activities outputs	273
The Sequence Activities process puts everything in order	275
Diagram the relationship between activities	276
Network diagrams put your tasks in perspective	277
Dependencies help you sequence your activities	280
Leads and lags add time between activities	281
Scheduling software can help you see the sequence of activities	282
Create the network diagram	283
Figuring out how long the project will take	284
Estimation tools and techniques	287
Create the duration estimate	290
Use the critical path method to avoid big problems	297
How to find the critical path	298
Finding the float for any activity	300
Float tells you how much extra time you have	302
Figure out the early start and early finish	305
Figure out the latest possible start and finish	306
Add early and late durations to your diagrams	307
Fast-tracking the project	315
Use data analysis techniques when you build your schedule	316
Other Develop Schedule tools and techniques	317
Outputs of Develop Schedule	318
Influence the factors that cause change	322
Control Schedule inputs and outputs	323
Measuring and reporting performance	325
Control Schedule tools and techniques	326
Exam Questions	339

## Cost management

**Watching the bottom line**

## 7

**Every project boils down to money.** If you had a bigger **budget**, you could probably get more people to do your project more quickly and deliver more. That's why no project plan is complete until you come up with a budget. But no matter whether your project is big or small, and no matter how many **resources** and **activities** are in it, the process for figuring out the bottom line is *always the same!*



Time to expand Head First Kitchen	350
The renovation goes overboard	351
Introducing the Cost Management processes	353
Plan how you'll estimate, track, and control your costs	354
Now you've got a consistent way to manage costs	355
What Alice needs before she can estimate costs	356
Other tools and techniques used in Estimate Costs	359
Let's talk numbers	360
Now Alice knows how much the Kitchen will cost	362
The Determine Budget process	364
What you need to build your budget	365
Determine budget: how to build a budget	366
Question Clinic: The red herring	370
The Control Costs process is a lot like schedule control	372
A few new tools and techniques	375
Look at the schedule to figure out your budget	376
How to calculate planned value	377
Earned value tells you how you're doing	379
How to calculate earned value	380
Is your project behind or ahead of schedule?	384
Are you over budget?	386
The earned value management formulas	387
Interpret CPI and SPI numbers to gauge your project	388
Forecast what your project will look like when it's done	392
Once you've got an estimate, you can calculate a variance!	393
Finding missing information	396
Keep your project on track with TCPI	399
A high TCPI means a tight budget	400
Exam Questions	411

## Quality management

# 8

### Getting it right

**It's not enough to make sure you get it done on time and under budget.** You need to be sure you make the right product to suit your stakeholders' needs. Quality means making sure that you build what you said you would and that you do it as efficiently as you can. That means trying not to make too many mistakes and always keeping your project working toward the goal of creating the right product!



The Black Box 3000™

Lisa also inspected the blueprints for the black box when they were designed.



She looked for defects in the parts as they were being made too.



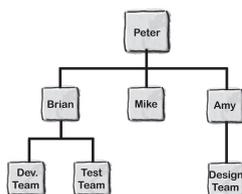
What is quality?	424
You need more than just tests to figure out quality	425
Once you know what the product is supposed to do, it's easy to tell which tests pass and which fail	426
“An ounce of prevention...”	430
Plan Quality is how you prevent defects	433
How to plan for quality	434
The Quality Management plan gives you what you need to manage quality	436
Inspect your deliverables	439
Use the planning outputs for Control Quality	440
Tools for data gathering	441
Tools for data analysis	442
Inspection, testing, and product evaluation	443
Tools for data representation	444
Question Clinic: The which-one question	450
Control Quality means finding and correcting defects	452
Trouble at the Black Box 3000™ factory	455
Introducing Manage Quality	456
A closer look at some tools and techniques	457
More ideas behind managing quality	458
The Black Box 3000™ makes record profits!	463
Exam Questions	470

# Human resource management

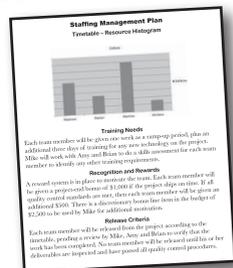
## Getting the team together

# 9

**Behind every successful project is a great team.** So how do you make sure that you get—and keep—the best possible team for your project? You need to **plan carefully**, set up a good **working environment**, and negotiate for the **best people** you can find. But it's not enough to put a good team together... If you want your project to go well, you've got to keep the team motivated and deal with any conflicts that happen along the way. **Human resource management** gives you the tools you need to get the best team for the job and lead them through a successful project.



Organization charts



Staffing Management plan

Mike needs a new team	480
Get your team together and keep them moving	482
Figure out who you need on your team	484
A closer look at the Plan Resource Management outputs	487
Important components of the Resource Management plan	487
The Resource Management plan	488
What you need to estimate resources	490
Estimating the resources	491
Get the team together	492
Develop your team	496
Develop the team with your management skills	497
Your interpersonal and team skills can make a big difference for your team	498
Lead the team with your management skills	500
Motivate your team	502
Stages of team development	504
Managing your team means solving problems	508
Conflict management up close	509
How to resolve a conflict	510
Make sure to control resources to keep your project on track	514
Outputs of the Control Resources process	515
Exam Questions	527

RACI Matrix		Role			
		Mike	Amy	Brian	Peter
Work Package	Project Management	R	I	I	I
	Design	C	R	C	I
	Construction	C	C	R	I
	Testing	C	C	R	I

R = Responsible A = Accountable C = Consult I = Inform

Roles and responsibilities

## Communications management

### Getting the word out

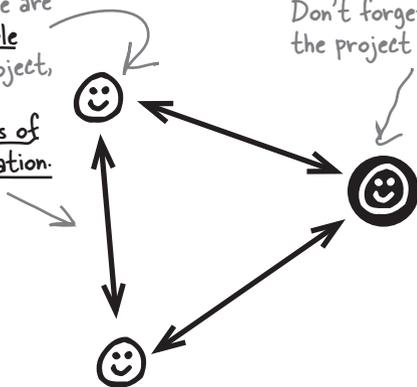
# 10

**Communications management is about keeping everybody in the loop.** Have you ever tried talking to someone in a really loud, crowded room? That's what running a project is like if you don't get a handle on communications. Luckily, there's **Communications Management**, which is how to get everyone talking about the work that's being done, so that they all **stay on the same page**. That way, everyone has the information they need to **resolve any issues** and keep the project **moving forward**.

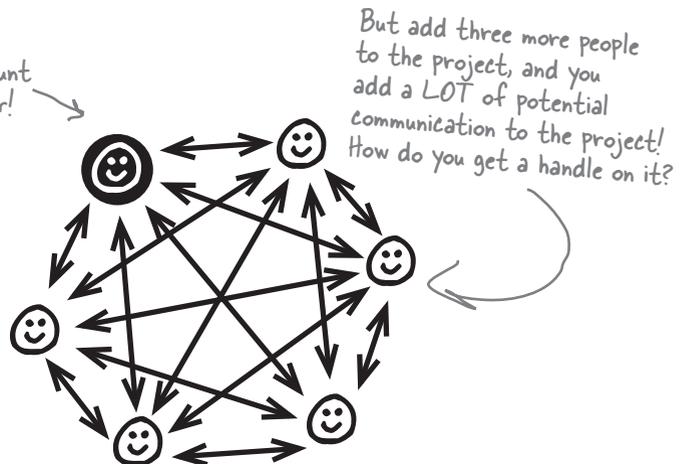


Party at the Head First Lounge!	536
But something's not right	537
Anatomy of communication	538
Get a handle on communication	540
Tell everyone what's going on	546
Get the message?	548
More Manage Communications tools	550
Let everyone know how the project's going	553
Take a close look at the work being done	554
Now you can get the word out	557
People aren't talking!	559
Count the channels of communication	560
It's party time!	563
Question Clinic: The calculation question	566
Exam Questions	572

When there are three people on the project, there are three lines of communication.



Don't forget to count the project manager!



But add three more people to the project, and you add a LOT of potential communication to the project! How do you get a handle on it?

## Project risk management

## 11

**Planning for the unknown**

**Even the most carefully planned project can run into trouble.**

No matter how well you plan, your project can always run into **unexpected problems**.

Team members get sick or quit, resources that you were depending on turn out to be unavailable—even the weather can throw you for a loop. So does that mean that you're helpless against unknown problems? No! You can use **risk planning** to identify potential problems that could cause trouble for your project, **analyze** how likely they'll be to occur, take action to **prevent** the risks you can avoid, and **minimize** the ones that you can't.



What's a risk?	580
How you deal with risk	581
Plan Risk Management	582
Use a risk breakdown structure to categorize risks	584
Anatomy of a risk	586
What could happen to your project?	588
Data-gathering techniques for Identify Risks	589
More Identify Risks techniques	590
Data analysis tools and techniques	590
Where to look for risks	592
Rank your risks	594
Examine each risk in the register	595
Data gathering	595
Qualitative vs. quantitative analysis	600
Perform Quantitative Risk Analysis	601
First gather the data...	602
...then analyze it	603
Calculate the expected monetary value of your risks	604
Decision tree analysis uses EMV to help you make choices	606
Update the risk register based on your quantitative analysis results	608
How do you respond to a risk?	610
Add risk responses to the register	613
Implement Risk Responses	614
Risk response can find even more risks	615
You can't plan for every risk at the start of the project	617
Monitor Risks is another change control process	618
How to monitor your risks	619
More control risk tools and techniques	620
Exam Questions	631



## Procurement management

### Getting some help

# 12

#### Some jobs are just too big for your company to do on its

**OWN.** Even when the job isn't too big, it may just be that you don't have the expertise or equipment to do it. When that happens, you need to use **Procurement Management** to find another company to **do the work for you**. If you find the **right seller**, choose the **right kind of relationship**, and make sure that the **goals of the contract are met**, you'll get the job done and your project will be a success.



**Contract**



**Closed procurements**



Victim of her own success	642
Calling in the cavalry	643
Ask the legal expert	647
Anatomy of an agreement	648
Start with a plan for the whole project	650
Types of contractual agreements	656
More about contracts	659
Figure out how you'll sort out potential sellers	660
Get in touch with potential sellers	663
Pick a partner	664
Interpersonal and team skills: negotiation	669
Data analysis: proposal evaluation	669
Keep an eye on the contract	671
Stay on top of the seller	672
Kate closes the contract	678
Hello, this is Technical Support. How can I help you?	678
Question Clinic: BYO questions	679
Exam Questions	683

## Stakeholder management

# 13

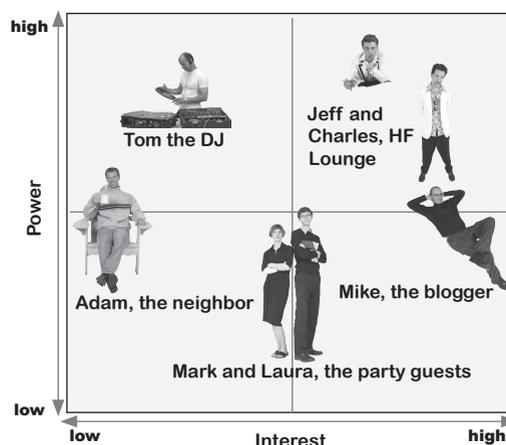
### Keeping everyone engaged

**Project management is about knowing your audience.**

If you don't get a handle on the people who are affected by your project, you might discover that they have needs you aren't meeting. If your project is going to be successful, you've got to satisfy your stakeholders. Luckily, there's **Stakeholder Management**, which you can use to understand your stakeholders and figure out what they need. Once you really understand how important those needs are to your project, it's a lot easier to **keep everyone satisfied**.



Party at the Head First Lounge (again)!	690
Not everybody is thrilled	691
Understanding your stakeholders	692
Find out who your stakeholders are	694
Stakeholder analysis up close	696
How engaged are your stakeholders?	702
Managing stakeholder engagement means clearing up misunderstandings	705
Monitor your stakeholders' engagement	710
Now you can tell when you need to change the way you deal with stakeholders	712
It's party time!	716
Exam Questions	719



# 14

## Professional responsibility

### Making good choices

It's not enough to just know your stuff. You need to **make good choices to be good at your job**. Everyone who has the PMP credential agrees to follow the **Project Management Institute Code of Ethics and Professional Conduct**, too. The Code helps you with **ethical decisions** that aren't really covered in the body of knowledge—and it's a big part of the PMP exam. Most of what you need to know is **really straightforward**, and with a little review, you'll do well.

Doing the right thing	726
Keep the cash?	728
Fly business class?	729
New software	730
Shortcuts	731
A good price or a clean river?	732
We're not all angels	733
Exam Questions	734



A little last-minute review

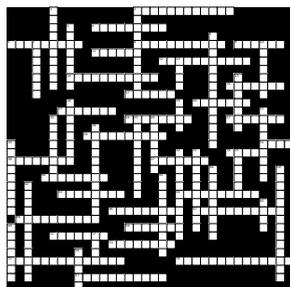
# 15

## Check your knowledge

**Wow, you sure covered a lot of ground in the last 13 chapters!** Now it's time to take a look back and drill in some of the most important concepts that you learned. That'll keep it all fresh and give your brain a final workout for exam day!



**Exercise**



**Sharpen your pencil**

Here's how to do this next section	747
Integration and Overall PMBOK® Questions	748
Scope Questions	749
Time Questions	750
Cost Questions	751
Quality Questions	752
Human Resource Questions	753
Communications Questions	754
Risk Questions	755
Procurement Questions	756
Stakeholder Questions	757
Great job! It looks like you're almost ready	757
Integration Questions	763
Scope Questions	764
Time Questions	765
Cost Questions	766
Quality Questions	767
Human Resource Questions	768
Communications Questions	769
Risk Questions	770
Procurement Questions	771
Stakeholder Questions	772



Pretty soon, this will be YOU!



Practice makes perfect

## Practice PMP exam

# 16

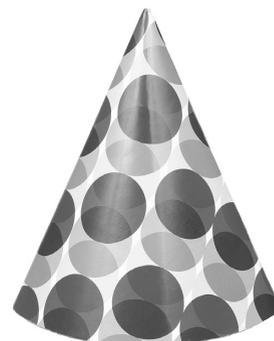
**Bet you never thought you'd make it this far!** It's been a long journey, but here you are, ready to review your knowledge and get ready for exam day. You've put a lot of new information about project management into your brain, and now it's time to see just how much of it stuck. That's why we put together this 200-question PMP practice exam for you. It looks just like the one you're going to see when you take the real PMP exam. Now's your time to flex your mental muscle. So take a deep breath, get ready, and let's get started.

Exam Questions

774

Exam Answers

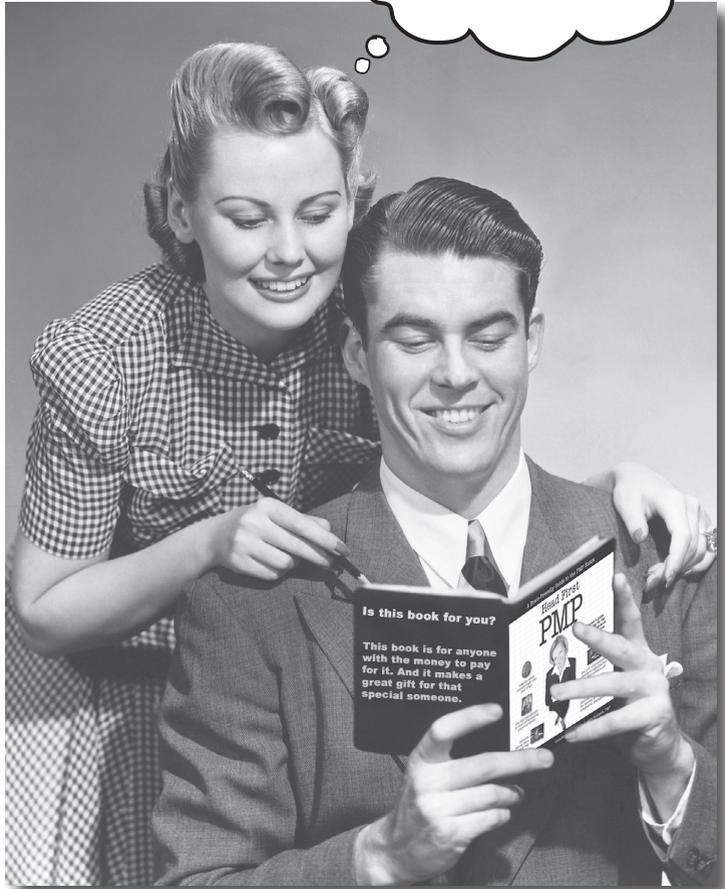
818



# how to use this book

## Intro

I CAN'T BELIEVE THEY PUT THAT IN A PMP EXAM PREP BOOK!



In this section, we answer the burning question:  
"So why DID they put that in a PMP exam prep book?"

## Who is this book for?

If you can answer “yes” to all of these:

You can also use this book to help you study for the CAPM exam—a lot of the concepts are really similar.

- ① Are you a **project manager**?  
Do you want to **learn, understand, remember, and apply** important project management concepts so that you can prepare for **the PMP exam**, and learn to be a better project manager in the process?
- ② Do you prefer **stimulating dinner-party conversation** to **dry, dull, academic lectures**?

We'll help you study for the PMP exam in a way that will definitely make it easier for you to pass.

this book is for you.

## Who should probably back away from this book?

If you can answer “yes” to any of these:

- ① Are you **completely new** to project management?

(To qualify to take the PMP exam, you need to show a certain number of hours of experience as a professional project manager.)

- ② Are you already PMP certified and looking for a **reference book** on project management?

- ③ Are you **afraid to try something different**? Would you rather have a root canal than mix stripes with plaid? Do you believe that a technical book can't be serious if project management concepts are anthropomorphized?

But even if you don't have quite enough hours yet, this book can still help you study now, so you can be ready when you've got those hours under your belt! Plus, the ideas will help you on your job immediately...

this book is not for you.



[Note from marketing: this book is for anyone with a credit card.]

## We know what you're thinking.

“How can *this* be a serious project management book?”

“What’s with all the graphics?”

“Can I actually *learn* it this way?”

## And we know what your *brain* is thinking.

Your brain craves novelty. It’s always searching, scanning, *waiting* for something unusual. It was built that way, and it helps you stay alive.

So what does your brain do with all the routine, ordinary, normal things you encounter? Everything it *can* to stop them from interfering with the brain’s *real* job—recording things that *matter*. It doesn’t bother saving the boring things; they never make it past the “this is obviously not important” filter.

How does your brain *know* what’s important? Suppose you’re out for a day hike and a tiger jumps in front of you—what happens inside your head and body?

Neurons fire. Emotions crank up. *Chemicals surge*.

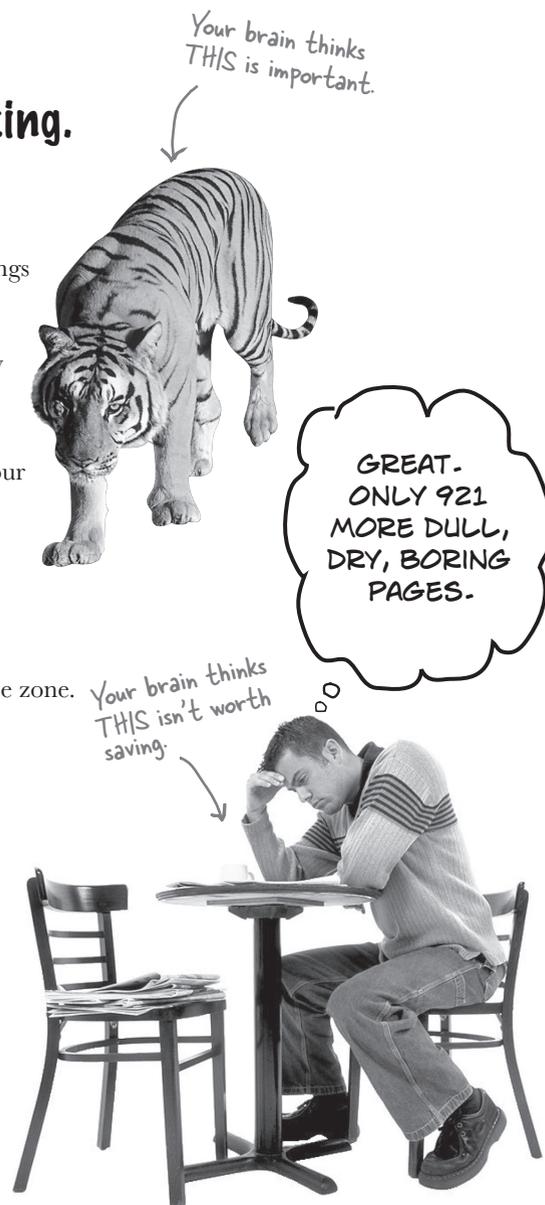
And that’s how your brain knows...

### This must be important! Don’t forget it!

But imagine you’re at home, or in a library. It’s a safe, warm, tiger-free zone. You’re studying. Getting ready for an exam. Or trying to learn some tough technical topic your boss thinks will take a week, 10 days at the most.

Just one problem. Your brain’s trying to do you a big favor. It’s trying to make sure that this *obviously* unimportant content doesn’t clutter up scarce resources. Resources that are better spent storing the really *big* things. Like tigers. Like the danger of fire. Like how you should never again snowboard in shorts.

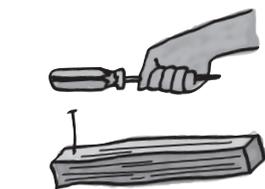
And there’s no simple way to tell your brain, “Hey brain, thank you very much, but no matter how dull this book is, and how little I’m registering on the emotional Richter scale right now, I really *do* want you to keep this stuff around.”



## We think of a “Head First” reader as a learner.

So what does it take to *learn* something? First, you have to *get* it, then make sure you don't *forget* it. It's not about pushing facts into your head. Based on the latest research in cognitive science, neurobiology, and educational psychology, *learning* takes a lot more than text on a page. We know what turns your brain on.

### Some of the Head First learning principles:



You could pound in a nail with a screwdriver, but a hammer is more fit for the job.

**Make it visual.** Images are far more memorable than words alone, and make learning much more effective (up to 89% improvement in recall and transfer studies). It also makes things more understandable. **Put the words within or near the graphics** they relate to, rather than on the bottom or on another page, and learners will be up to *twice* as likely to solve problems related to the content.

THERE HAVE BEEN REPORTS OF BEARS CAUSING PROBLEMS FOR PEOPLE AROUND HERE LATELY. BE CAREFUL OUT HERE.

**Use a conversational and personalized style.** In recent studies, students performed up to 40% better on post-learning tests if the content spoke directly to the reader, using a first-person, conversational style rather than taking a formal tone. Tell stories instead of lecturing. Use casual language. Don't take yourself too seriously. Which would you pay more attention to: a stimulating dinner-party companion, or a lecture?

**Get the learner to think more deeply.** In other words, unless you actively flex your neurons, nothing much happens in your head. A reader has to be motivated, engaged, curious, and inspired to solve problems, draw conclusions, and generate new knowledge. And for that, you need challenges, exercises, and thought-provoking questions, and activities that involve both sides of the brain and multiple senses.

THIS SUCKS...THEY LOST FRANK'S LUGGAGE, AND IT GOT MY WALLET STOLEN!



**Get—and keep—the reader's attention.** We've all had the “I really want to learn this, but I can't stay awake past page one” experience. Your brain pays attention to things that are out of the ordinary, interesting, strange, eye-catching, unexpected. Learning a new, tough, technical topic doesn't have to be boring. Your brain will learn much more quickly if it's not.

**Touch their emotions.** We now know that your ability to remember something is largely dependent on its emotional content. You remember what you care about. You remember when you *feel* something. No, we're not talking heart-wrenching stories about a boy and his dog. We're talking emotions like surprise, curiosity, fun, “what the...?”, and the feeling of “I rule!” that comes when you solve a puzzle, learn something everybody else thinks is hard, or realize you know something that “I'm more technical than thou” Bob from engineering *doesn't*.



## Metacognition: thinking about thinking

If you really want to learn, and you want to learn more quickly and more deeply, pay attention to how you pay attention. Think about how you think. Learn how you learn.

Most of us did not take courses on metacognition or learning theory when we were growing up. We were *expected* to learn, but rarely *taught* to learn.

But we assume that if you're holding this book, you really want to learn about project management. And you probably don't want to spend a lot of time. And since you're going to take an exam on it, you need to *remember* what you read. And for that, you've got to *understand* it. To get the most from this book, or *any* book or learning experience, take responsibility for your brain. Your brain on *this* content.

The trick is to get your brain to see the new material you're learning as Really Important. Crucial to your well-being. As important as a tiger. Otherwise, you're in for a constant battle, with your brain doing its best to keep the new content from sticking.

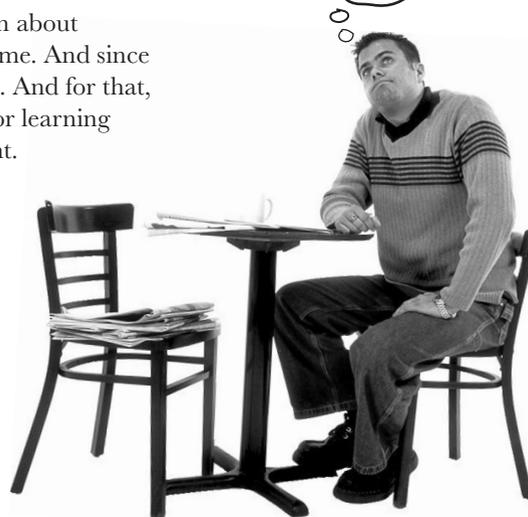
### So just how **DO** you get your brain to think that the stuff on the PMP exam is a hungry tiger?

There's the slow, tedious way, or the faster, more effective way. The slow way is about sheer repetition. You obviously know that you *are* able to learn and remember even the dullest of topics if you keep pounding the same thing into your brain. With enough repetition, your brain says, "This doesn't *feel* important to him, but he keeps looking at the same thing *over* and *over* and *over*, so I suppose it must be."

The faster way is to do **anything that increases brain activity**, especially different *types* of brain activity. The things on the previous page are a big part of the solution, and they're all things that have been proven to help your brain work in your favor. For example, studies show that putting words *within* the pictures they describe (as opposed to somewhere else in the page, like a caption or in the body text) causes your brain to try to make sense of how the words and picture relate, and this causes more neurons to fire. More neurons firing = more chances for your brain to *get* that this is something worth paying attention to, and possibly recording.

A conversational style helps because people tend to pay more attention when they perceive that they're in a conversation, since they're expected to follow along and hold up their end. The amazing thing is, your brain doesn't necessarily *care* that the "conversation" is between you and a book! On the other hand, if the writing style is formal and dry, your brain perceives it the same way you experience being lectured to while sitting in a roomful of passive attendees. No need to stay awake.

But pictures and conversational style are just the beginning.



## Here's what WE did

We used **pictures**, because your brain is tuned for visuals, not text. As far as your brain's concerned, a picture really *is* worth a thousand words. And when text and pictures work together, we embedded the text *in* the pictures because your brain works more effectively when the text is *within* the thing the text refers to, as opposed to in a caption or buried in the text somewhere.

We used **redundancy**, saying the same thing in *different* ways and with different media types, and **multiple senses**, to increase the chance that the content gets coded into more than one area of your brain.

We used concepts and pictures in **unexpected** ways because your brain is tuned for novelty, and we used pictures and ideas with at least *some* **emotional content**, because your brain is tuned to pay attention to the biochemistry of emotions. That which causes you to *feel* something is more likely to be remembered, even if that feeling is nothing more than a little **humor, surprise, or interest**.

We used a personalized, **conversational style**, because your brain is tuned to pay more attention when it believes you're in a conversation than if it thinks you're passively listening to a presentation. Your brain does this even when you're *reading*.

We included more than 80 **activities**, because your brain is tuned to learn and remember more when you **do** things than when you *read* about things. And we made the exercises challenging-yet-doable, because that's what most people prefer.

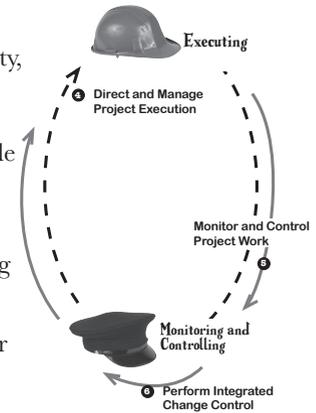
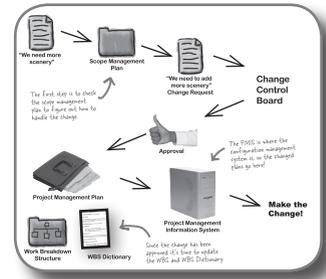
We used **multiple learning styles**, because *you* might prefer step-by-step procedures, while someone else wants to understand the big picture first, and someone else just wants to see an example. But regardless of your own learning preference, *everyone* benefits from seeing the same content represented in multiple ways.

We include content for **both sides of your brain**, because the more of your brain you engage, the more likely you are to learn and remember, and the longer you can stay focused. Since working one side of the brain often means giving the other side a chance to rest, you can be more productive at learning for a longer period of time.

And we included **stories** and exercises that present **more than one point of view**, because your brain is tuned to learn more deeply when it's forced to make evaluations and judgments.

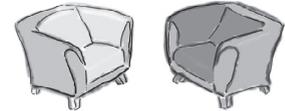
We included **challenges**, with exercises, and by asking **questions** that don't always have a straight answer, because your brain is tuned to learn and remember when it has to *work* at something. Think about it—you can't get your *body* in shape just by *watching* people at the gym. But we did our best to make sure that when you're working hard, it's on the *right* things. That **you're not spending one extra dendrite** processing a hard-to-understand example, or parsing difficult, jargon-laden, or overly terse text.

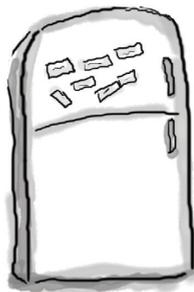
We used **people**. In stories, examples, pictures, and so on, because, well, because *you're* a person. And your brain pays more attention to *people* than it does to *things*.



**BULLET POINTS:  
AIMING FOR THE EXAM**

Fireside Chats





Cut this out and stick it on your refrigerator.

## Here's what YOU can do to bend your brain into submission

So, we did our part. The rest is up to you. These tips are a starting point; listen to your brain and figure out what works for you and what doesn't. Try new things.

### 1 Slow down. The more you understand, the less you have to memorize.

Don't just *read*. Stop and think. When the book asks you a question, don't just skip to the answer. Imagine that someone really *is* asking the question. The more deeply you force your brain to think, the better chance you have of learning and remembering.

### 2 Do the exercises. Write your own notes.

We put them in, but if we did them for you, that would be like having someone else do your workouts for you. And don't just *look* at the exercises. **Use a pencil.** There's plenty of evidence that physical activity *while* learning can increase the learning.

### 3 Read the "There are No Dumb Questions"

That means all of them. They're not optional sidebars—***they're part of the core content!*** Don't skip them.

### 4 Make this the last thing you read before bed. Or at least the last challenging thing.

Part of the learning (especially the transfer to long-term memory) happens *after* you put the book down. Your brain needs time on its own, to do more processing. If you put in something new during that processing time, some of what you just learned will be lost.

### 5 Drink water. Lots of it.

Your brain works best in a nice bath of fluid. Dehydration (which can happen before you ever feel thirsty) decreases cognitive function.

### 6 Talk about it. Out loud.

Speaking activates a different part of the brain. If you're trying to understand something, or increase your chance of remembering it later, say it out loud. Better still, try to explain it out loud to someone else. You'll learn more quickly, and you might uncover ideas you hadn't known were there when you were reading about it.

### 7 Listen to your brain.

Pay attention to whether your brain is getting overloaded. If you find yourself starting to skim the surface or forget what you just read, it's time for a break. Once you go past a certain point, you won't learn faster by trying to shove more in, and you might even hurt the process.

### 8 Feel something!

Your brain needs to know that this *matters*. Get involved with the stories. Make up your own captions for the photos. Groaning over a bad joke is *still* better than feeling nothing at all.

### 9 Create something!

Apply this to your daily work; use what you are learning to make decisions on your projects. Just do something to get some experience beyond the exercises and activities in this book. All you need is a pencil and a problem to solve...a problem that might benefit from using the tools and techniques you're studying for the exam.

## Read me

This is a learning experience, not a reference book. We deliberately stripped out everything that might get in the way of learning whatever it is we're working on at that point in the book—although we didn't take anything out that you might see on the PMP exam. And the first time through, you need to begin at the beginning, because the book makes assumptions about what you've already seen and learned.

### **The chapters are ordered the same way as the *PMBOK Guide*.**

We did this because it makes sense.... The PMP exam focuses on your understanding of the *PMBOK Guide* and the inputs, outputs, tools, and techniques it references. It's a good idea for you to understand the material the way the test organizes it. If you are cross-referencing this book with the *PMBOK Guide*, it will really help that the structure has been pretty much maintained throughout this book, too.

### **We encourage you to use the *PMBOK Guide* with this book.**

This book talks about the practical applications of a lot of the ideas in the *PMBOK Guide*, but you should have a pretty good idea of how the guide talks about the material, too. There's some information that's on the test that isn't in the guide, so we haven't limited this book to a reread of what's in the *PMBOK Guide* at all. But it's a great reference, and you should be cross-referencing the two books as you go. That will help you understand all of the terminology better and make sure that there are no surprises on exam day.

### **The activities are NOT optional.**

The exercises and activities are not add-ons; they're part of the core content of the book. Some of them are to help with memory, some are for understanding, and some will help you apply what you've learned. **Don't skip the exercises.** Even crossword puzzles are important—they'll help get concepts into your brain the way you'll see them on the PMP exam. But more importantly, they're good for giving your brain a chance to think about the words and terms you've been learning in a different context.

### **The redundancy is intentional and important.**

One distinct difference in a Head First book is that we want you to *really* get it. And we want you to finish the book remembering what you've learned. Most reference books don't have retention and recall as a goal, but this book is about *learning*, so you'll see some of the same concepts come up more than once.

### **The Brain Power exercises don't have answers.**

For some of them, there is no right answer, and for others, part of the learning experience of the Brain Power activities is for you to decide if and when your answers are right. In some of the Brain Power exercises, you will find hints to point you in the right direction.

# Acknowledgments

Lisa Kellner



Kevin Kovalic



## Technical reviewers:

For the fourth edition, we had a whole new batch of amazing tech reviewers. They did a great job, and we're really grateful for their incredible contribution.

**Kevin Kovalic** is a certified project management trainer for Springhouse. He currently teaches each of the project management classroom and custom offerings. Kevin has over 20 years of working project management experience combined with over 25 years within the IT industry. As a result, he is able to apply practical experience with the class curriculum to enhance the student experience and consistently achieve extremely high marks from students. He has continued growing within the profession through multiple certifications.

And, as always, we were lucky to have **Lisa Kellner** return to our tech review team. Lisa always provides a thorough review, which frankly we might be taking a bit for granted at this point. And we also want to thank the technical reviewers from the previous editions: **Jennifer Poisson** and **Joe Pighetti** (3rd edition); **Andy Kaufman** and **Ken Jones** (2nd edition); and **Carol Steuer** and **Dennis Bolles** (1st edition). Thanks so much for your hard work—we couldn't have done this without all of your important contributions!

## Our editor:

We want to thank our editor, **Jeff Bleiel**, for editing this book. Thanks!



Jeff Bleiel

## The O'Reilly team:



Melanie Yarbrough

As a reader, you probably don't realize just how much work goes into production for a book. **Melanie** is a real pro who gets the job done!

There are so many people at O'Reilly we want to thank that we hope we don't forget anyone. Special thanks to production editor **Melanie Yarbrough**—it was a pleasure working with you again!—indexer **Angela Howard**, and **Rachel Head** for her sharp proofread. As always, we love **Mary Treseler**, and are grateful for everything she's done for us! And a big shout-out to our other friends, editors, and all the people who have helped us so much over all these years: **Mike Hendrickson**, **Tim O'Reilly**, **Laurel Ruma**, **Andy Oram**, **Lindsay Ventimiglia**, **Ron Bilodeau**, **Lucie Haskins**, and **Jasmine Kwityn**. And if you're reading this book right now, then you can thank the greatest publicity team in the industry: **Marsee Henon**, **Kathryn Barret**, and the rest of the folks in Sebastopol.

## O'Reilly Safari



Safari (formerly Safari Books Online) is membership-based training and reference platform for enterprise, government, educators, and individuals.

Members have access to thousands of books, training videos, Learning Paths, interactive tutorials, and curated playlists from over 250 publishers, including O'Reilly Media, Harvard Business Review, Prentice Hall Professional, Addison-Wesley Professional, Microsoft Press, Sams, Que, Peachpit Press, Adobe, Focal Press, Cisco Press, John Wiley & Sons, Syngress, Morgan Kaufmann, IBM Redbooks, Packt, Adobe Press, FT Press, Apress, Manning, New Riders, McGraw-Hill, Jones & Bartlett, and Course Technology, among others.

For more information, please visit <http://oreilly.com/safari>.

# 1 Introduction

## ***Why get certified?***

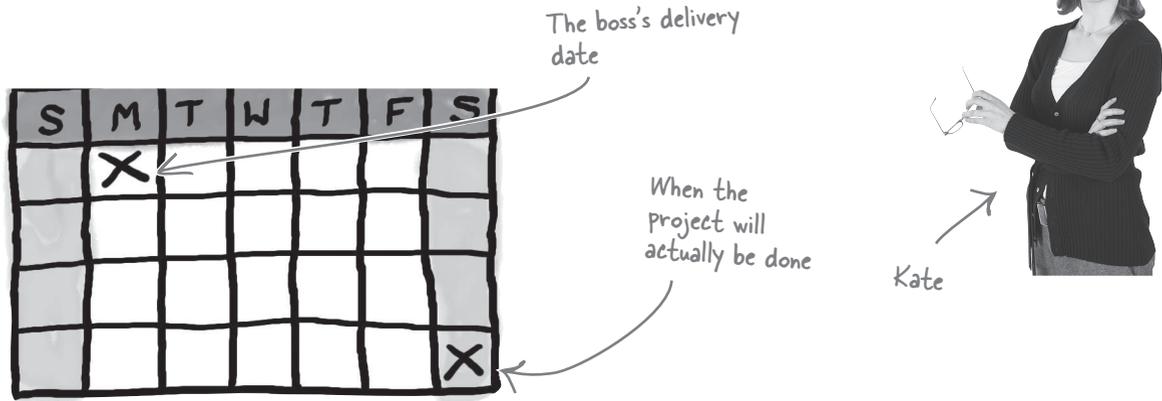


**Tired of facing the same old problems?** If you've worked on a lot of projects, you know that you face the same problems, over and over again. It's time to learn some common solutions to those problems. There's a whole lot that project managers have learned over the years, and passing the PMP exam is your ticket to putting that wisdom into practice. Get ready to change the way you manage your projects forever.

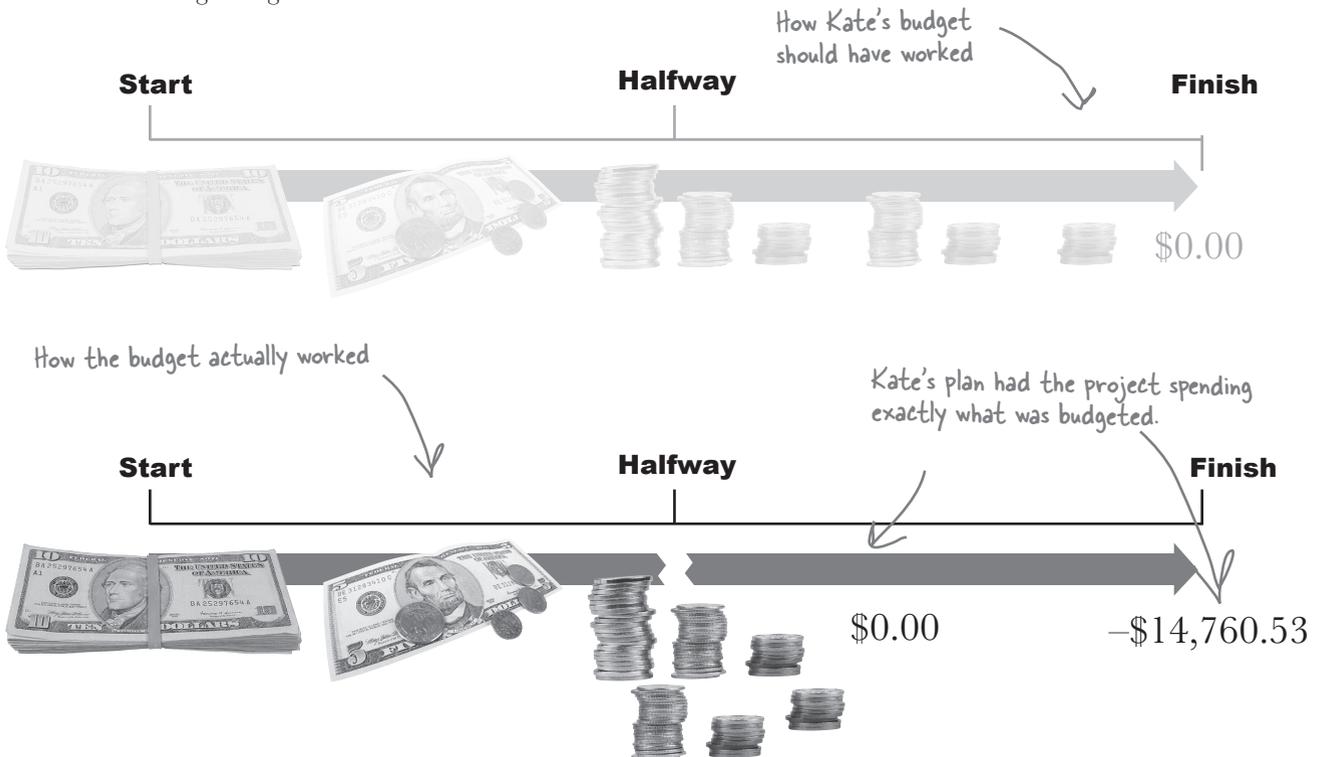
same old, same old

## Do these problems seem familiar?

Kate's boss promised a delivery date that she couldn't possibly meet.



Then, when the project was halfway done, the customer demanded a big change.



Then, just as the project was about to be completed, someone noticed a couple typos, and 10,000 leaflets had to be reprinted.

Two simple typos, and now the project is over budget and dissatisfying to the customer.



Then, when it was time to fix those typos, Kate realized that the printer was booked for another project.

The short timeframe didn't give Kate enough time to plan for risks.

Identified Risk	Potential Response	Root Cause	Risk Owner	Cost	Priority	Urgency
1. Unavailable printer to finish game and finish the nearby region	Put up banner of 4g bench	Outdated data	Joe S	Weather	High	Low
2. High winds can lead to cell disaster	Reduce text content, obtain waterproof equipment	Historical weather service predicts 25% chance of high winds	Sanya T	Weather	High	Medium
3. Truck used is unreliable	Pay to transport equipment at a second company	Original team selected equipment for equipment for wrong	Joe S	Equipment	Low	High
4. Disease predicted through the first few weeks of project schedule	Buy storm insurance to cover the equipment in case the equipment is damaged	Original team selected equipment for wrong	Michael R	Weather	High	High
5. Supply shortage if the exact accuracy perfect food reach		Historical data is 20 miles away	James S	Equipment	Low	High
6. A someone path up to could be a problem getting medical care	Bring a doctor with us on the project	Nearest hospital is 30 miles away	Sanya T	Human	Low	Low
7. Someone could tap in the landscape	Set up a trench post to make sure no one gets hurt	Dig trench for sandboxes	Joe S	Human	Low	Low

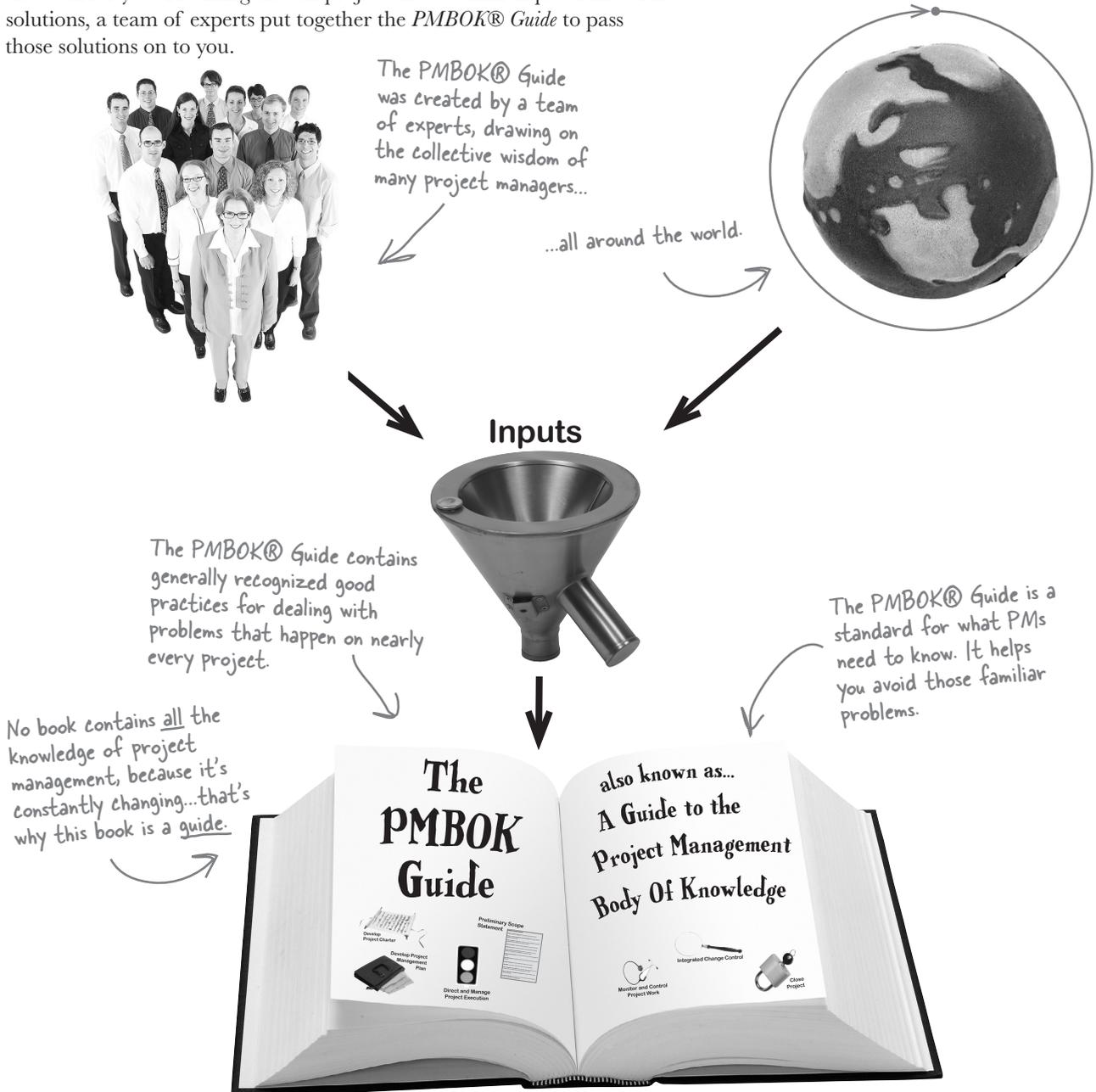
And even though she knew there was a pretty good chance that someone else might need the printer, she didn't have time to come up with a backup plan.

Now the project's going to be late and over budget, and the customer won't be happy.



## Projects don't have to be this way

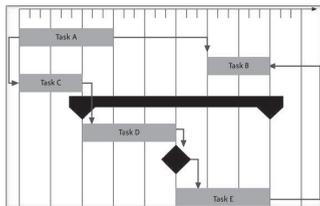
It may seem like all projects have these types of problems, but there are proven solutions to them...and someone else has already done a lot of the work for you! Realizing that all projects have common problems with solutions, a team of experts put together the *PMBOK® Guide* to pass those solutions on to you.



## Your problems...already solved

Every project eventually runs into the same kinds of issues. But a project manager with good training can spot them early, and quickly figure out the best solutions. The *PMBOK® Guide* will help you:

- ✓ Learn from past projects that have run into similar problems to avoid running into them again.
- ✓ Learn a common vocabulary for project management that is used by PMs around the world.
- ✓ Plan and execute your projects to avoid common pitfalls.



The *PMBOK® Guide* has great ideas on how to estimate your tasks and put them in the right sequence to get your projects done as quickly and efficiently as possible.



It outlines techniques for planning and tracking your costs.



It helps you learn how to plan for and protect against defects in your project.

# What you need to be a good project manager

The *PMBOK® Guide* is full of practical tools that can help you manage your projects better. But all of that doesn't mean much if you don't have the three core characteristics of a successful project manager. You've got to pay attention to all three if you want to make your project a success. This is what you'll need if you're going to take on the role of project manager:

1

## Knowledge

If you pay attention to what's going on in the field of project management, you can learn from everyone's successes and mistakes so that you can be better at your job.

This means knowing a wide range of project management tools and techniques—and how and when to use them.

2

## Performance

It's not enough to know what you need to do—you've got to deliver, too. This one is all about keeping your nose to the grindstone and doing good work.

You and your team will have to work hard to deliver a successful project, too.

3

## Personal skills

Since you're managing people, you've got to pay attention to what motivates them and what makes things harder on them. Your job as a PM is to make personal connections with your team and help keep everybody on the right track.

As a PM, you've got to lead your team through the project lifecycle, so you need to be skilled at managing people if you're going to be successful, even if they don't report to you directly.

Are you comparing this book side by side with the *PMBOK® Guide*? If you are, then you won't see these things in its first chapter. We've carefully optimized the material in this book to make it as easy to learn as possible. That means sometimes we tackle things in a different order than the *PMBOK®*. Expect to see some repetition and even some additional background material to help you learn that you won't find in the *PMBOK®*. It's all done to get the material into your brain faster!



Not paying attention to these characteristics is sure to give your project problems. Which of the characteristics of a successful project manager was neglected in the failed projects listed below? Sometimes, more than one will apply; just pick the one that makes the most sense to you.

The project was delivered early, but it didn't have all of the features that the customers asked for. The VP had suggested a new requirements gathering technique, but the PM shot it down because he'd never heard of it.

**Neglected characteristic:**

.....

The project was late because the team couldn't meet the company's standards for productivity. They were always coming into work late and leaving early and taking long lunches. It seemed like the project manager just didn't think the project was important.

**Neglected characteristic:**

.....

The project manager thought his job was to meet the deadline above all else. So he demanded that the product be released on the date it was due, regardless of quality. The team wanted to create a high-quality product, and they fought with the PM throughout the project to try to get him to change his mind. In the end, the team washed their hands of the product after it was released and refused to support it.

**Neglected characteristic:**

.....

The project team had so many conflicts about the project that they couldn't work together. They made decisions that undercut one another, and in the end they couldn't deliver anything at all.

**Neglected characteristic:**

.....

The project was late because the team cut corners that led to sloppy work, and they had to go back and fix all of their mistakes.

**Neglected characteristic:**

.....

The project manager refused to learn to use the scheduling software and templates the company had bought for the team. Instead, he kept track of the schedule in his head and on his whiteboard. Near the end of the project, he realized that he'd forgotten about some important tasks, and his ship date slipped by two months.

**Neglected characteristic:**

.....



## Exercise Solution

Not paying attention to these characteristics is sure to give your project problems. Which of the characteristics of a successful project manager was neglected in the failed projects listed below? Sometimes, more than one will apply; just pick the one that makes the most sense to you.

Your project was delivered early, but it didn't have all of the features that the customers asked for. The VP had suggested a new requirements gathering technique, but the PM shot it down because he'd never heard of it

**Neglected characteristic:**

**Knowledge**

The project was late because the team couldn't meet the company's standards for productivity. They were always coming into work late and leaving early and taking long lunches. It seemed like the project manager just didn't think the project was important.

**Neglected characteristic:**

**Performance**

The project manager thought his job was to meet the deadline above all else. So he demanded that the product be released on the date it was due, regardless of quality. The team wanted to create a high-quality product and they fought with the PM throughout the project to try to get him to change his mind. In the end, the team washed their hands of the product after it was released and refused to support it.

**Neglected characteristic:**

**Personal skills**

The project team had so many conflicts about the project that they couldn't work together. They made decisions that undercut one another, and in the end they couldn't deliver anything at all.

**Neglected characteristic:**

**Personal skills**

The project was late because the team cut corners that led to sloppy work, and they had to go back and fix all of their mistakes.

**Neglected characteristic:**

**Performance**

The project manager refused to learn to use the scheduling software and templates the company had bought for the team. Instead, he kept track of the schedule in his head and on his whiteboard. Near the end of the project, he realized that he'd forgotten about some important tasks, and his ship date slipped by two months.

**Neglected characteristic:**

**Performance**

*This could be a knowledge issue too, because the manager didn't learn enough about the stakeholders' expectations.*



*This could also be a knowledge issue because the manager didn't learn the scheduling software or templates. The differences aren't always 100% clear-cut.*



## there are no Dumb Questions

**Q:** How can the *PMBOK® Guide* claim to be the entire body of knowledge for project management?

**A:** Actually, it doesn't claim that at all. That's why the *PMBOK® Guide* is called "A Guide to the Project Management Body of Knowledge." It's a reference book that organizes a lot of information about how project managers do their jobs—but it doesn't claim to have all the information itself. Instead, it provides you with a framework for managing projects and tells you what information you need to know.

A lot of people are surprised to find out that there are a bunch of things on the PMP exam that are never explicitly mentioned in the *PMBOK® Guide*. (Don't worry: we'll cover that stuff in the rest of this book.) There's a whole lot of information that modern project managers should know about risk management and time management and cost and quality...and you're expected to learn more about the knowledge areas as you move forward in your career. That's why you should never limit your study to just what's in the *PMBOK® Guide*. It's meant only as a guide to all of the knowledge areas that project managers use on the job.

**Q:** What if I don't do all of this stuff in my job?

**A:** The *PMBOK® Guide* isn't necessarily meant to be followed like a recipe for every project. It's a broad collection of many tools and processes that are used across the project management profession, and project managers have a lot of discretion about how they run their projects. So you shouldn't throw out all that you're doing at work and replace it with every single one of the tools in this book immediately. But you'll notice as you go that some of the tools you're learning about will solve problems

for you on the job. When you find places where these tools can help, you really should start using them. Seriously, it's the best way to learn. You might find that your projects go better after you start using a new concept that you learn while you study.

**Q:** I've heard that there are a whole bunch of formulas you have to memorize for the PMP exam. Will I have to do that?

**A:** Yes, but it won't be that bad. The formulas are actually really useful. They help you understand how your project is doing so you can make better decisions. When you read about them later in the book, you'll focus on how to use them and why. Once you know that, it's not about memorizing a bunch of useless junk. The formulas will actually make sense, and you'll find them intuitive and helpful in your day-to-day work.

**Q:** Aren't certification exams just an excuse that consultants use so that they can charge their clients more money?

**A:** Some consultants charge more money because they are certified, but that's not the only reason to get certified. The best reason to get PMP certification is because it helps you understand all of the project management concepts available to help you do your job better. If you learn these tools and apply them to your job, you will be a better project manager. And hey, if it turns out you can make more money too, that's great.

What's more, it's worth keeping in mind that for a project manager, being PMP-certified is a requirement for a large amount of contracting work, especially in government, and it's increasingly seen in job postings of all kinds. Some employers won't even interview project managers who don't have a PMP certification!

**Q:** Doing all of the stuff in the *PMBOK® Guide* seems like it will take a long time. How much of this really applies to me?

**A:** That's a great question. You might find that there are documents that are mentioned in the *PMBOK® Guide* that you're not used to writing or creating for your projects, and some planning steps that you've never taken before. That's because the *PMBOK® Guide* is a framework, not a recipe for a successful project.

When you get your certification, it means that you have a solid understanding of all of the tools and techniques that are typically used by project managers to plan projects, track them, and deal with problems that come up along the way. It doesn't mean that you follow the exact same recipe for project success every time you lead a project.

**Q:** But I work for a company that always runs projects on really tight deadlines. You can't honestly expect me to write a bunch of project documents and use all of these formulas for my projects.

**A:** One of the useful things that you'll learn in Chapter 8 of this book is that sometimes the processes that seem like a lot of work up front actually end up saving you time in the end.

If you find a problem in a two-hour planning meeting that would've cost you two weeks to fix, then that two hours you spent planning actually saved your project two weeks of time. A lot of the planning and documentation that you'll be tested on is there to help you head off problems before they derail your project. So in the end, doing all of that work up front and writing it all down can actually make your project go faster and be cheaper than not doing it would've been!

**The PMBOK® Guide is just a guide, but if you understand all the material in it, then you'll ultimately be a better project manager.**

## Understand your company's big picture

Your project is an important part of the work your company is doing, but you need to understand how it fits in to the higher-level strategy your company is executing, too. That's where programs and portfolios come in.

Portfolios might include programs and projects.



Programs are groups of projects that should be managed together.



Projects have a beginning and an end and produce something specific.



### Portfolio

A portfolio is a group of projects or programs that are linked together by a business goal. If an architecture firm was venturing into remodeling existing buildings as well as designing new ones, it might split its efforts into separate New Construction and Remodeling portfolios, since the goals for each are quite different.

### Program

A program is a group of projects that are closely linked, to the point where managing them together provides some benefit. The firm knows from experience that creating huge skyscrapers is dramatically different than building residential homes, so residential home construction would be its own separate program.

### Project

A project is any work that produces a specific result and is temporary. Projects always have a beginning and an end. Building a house is a classic example of a project. Projects can be part of programs or portfolios, but portfolios and programs can't be part of a project.

Projects in a program are often dependent on each other. Program management focuses on these interdependencies.

## Your project has value

Think about the projects you've worked on in your career. Each one of them did something beneficial for your company. You might've created a product and sold it to customers to make money directly. You might've made someone's job easier by automating work that would've taken time and effort to do. No matter how you count the benefit you created when you completed your project, that benefit is the real reason that your company decided to do the work in the first place. That benefit has an impact on the overall **business value** of the company you work for. Sometimes it can be easy to spend so much time dealing with your project's issues that you lose track of the goals you set out to achieve. It's important to think about the value of your project with every decision you make.



### Portfolio

Portfolio managers divide up the projects, programs, and operations your company is doing so that they align with business goals. That way, they can be sure that projects get the most out of managing their timelines, budgets, and resource commitments so that the company's goals are met.

### Program

Program managers focus on the places where projects depend on each other and coordinate activities to make sure that the work gets done in the most direct way possible.

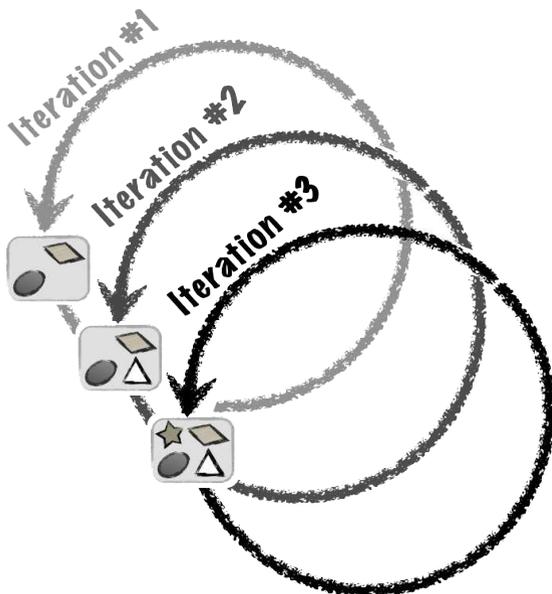
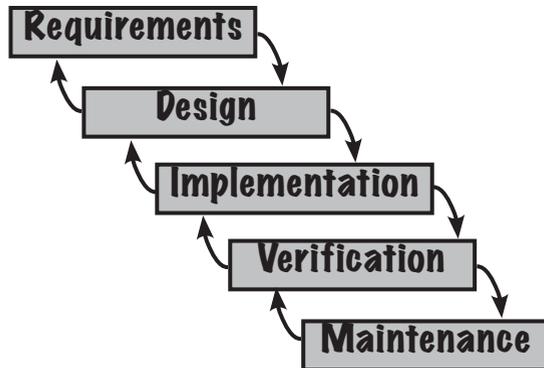
### Project

Project managers keep the team focused on the business value the project is providing. By constantly helping each team member to understand how his or her work impacts the project's value, project managers make sure that everyone on the team makes the best decisions to keep the project on track.

**Business value is the sum of all of the things your company is made of, from desks and chairs to people and the intellectual property they produce.**

## Your project follows a lifecycle

The *PMBOK® Guide* defines a few patterns of work that projects follow. Those patterns are called **lifecycles**, and thinking about the lifecycle your project will follow determines a lot about the approach you'll take to delivering the product you set out to create.



### Predictive

In predictive lifecycles the project's schedule, scope, and costs are defined up front. The early phases of the project determine how the rest of the project will be executed, and the project team does its best to execute the plan and minimize the impact of changes as they happen. Predictive lifecycles are all about predicting what will happen, preparing the best plan possible, and then working to follow it.

### Adaptive

Adaptive lifecycles are all about change. Instead of planning the work and working the plan, teams that approach their work in an adaptive way repeatedly perform all project activities to deliver small pieces of the project that have value to its stakeholders. Those pieces are called *increments*, and most agile lifecycles are all about delivering valuable increments to customers as soon as possible. Because the lifecycle is repeatedly and frequently executed, change can happen without disrupting the work. The product of each iteration is an opportunity for feedback, and each iteration provides a means of changing the scope of the work that will be done.

## Iterative

Iterative lifecycles are closer to predictive lifecycles than adaptive ones. When using an iterative approach, the team still tries to plan most of the work up front but uses repeated loops within the project lifecycle to identify possible changes to scope, schedule, and cost baselines. Those changes can be made throughout the project's feedback loops.

## Incremental

Teams that use incremental lifecycles deliver small, usable pieces of work to their stakeholders for feedback through a series of iterations. Incremental development lifecycles are much closer to adaptive ones but differ in that the increments produced here cannot be considered final products but must be combined in a final iteration to be considered complete.

## Hybrid

The term hybrid describes any combination of predictive and adaptive approaches. Project managers often have an important role in helping the team decide which approach to take. You can follow one of the lifecycles defined here, or make a new combination of predictive and adaptive practices that better suits your organization.

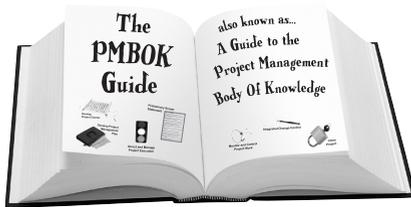


## Tailoring

Throughout this book, you'll see advice on tailoring lifecycles. Each organization has a unique culture and set of considerations that affect all of the dimensions of project planning and execution. For each of the main chapters in this book, we'll try to call out the types of questions you might ask yourself when thinking about which approach to use for your project.

# Projects, programs, and portfolios have a lot in common

We've talked about the differences between portfolio management, program management, and project management, but there are a lot of similarities between them, too.



## Professions with proven processes

Portfolio managers and program managers have a set of proven processes, tools, and techniques that have been used to manage many successful programs and portfolios. Like the PMP, the Project Management Institute offers certifications in Portfolio (PfMP) and Program Management (PgMP) too.



## Business value

Portfolio managers prioritize work to meet a company's strategic goals. Managing a program is all about keeping track of resources and other constraints affecting groups of projects so that all of those projects can achieve some shared benefit. Projects, on the other hand, are about managing the work to achieve some result. A portfolio's strategic goals, a program's shared benefit, and the result of that project all add business value to your company.



## Deal with constraints

Portfolio managers need to prioritize work in environments with limited resources, budgets, risk tolerance, and many other constraints that set up the environment for their portfolio's success. Program managers need to manage groups of projects that are being produced by the same resource pool or from the same budget. Project managers often have predefined schedules, resource constraints, and scope requirements to manage. All three need to use the processes, tools, and techniques that have worked for other managers to balance all of the constraints in their business environments.

# Projects, programs, and portfolios all use charters

All of the work you do to initiate, plan, execute, control, and close your project helps your program and portfolio managers understand how your project is doing and keep it on track. Following all of the processes in the *PMBOK® Guide* will ensure that the programs and portfolios of which your project is a part always know how you're doing and what you'll accomplish. While there are many differences in the documents that are used in portfolio and program management, all three use a **charter** to define their objectives.

## Charter

Portfolios, programs, and projects all use a charter to define their goals and initiate work. A charter lists any known constraints and goals and gives the manager authority to get the work started.



### Portfolio charter

A portfolio charter lays out the strategic benefits that a portfolio is going to accomplish. It lists all of the programs and projects included in the portfolio.



### Program charter

A program charter defines the shared benefit that the program is achieving as well as the list of projects it includes.



### Project charter

A project charter gives a project description, summary schedule, and business case, and assigns a project manager.



**We'll talk about the project charter in depth in Chapter 4.**

While the charter is used in projects, programs, and portfolios, you really only need to focus on the project charter for the exam. We'll spend a lot of time on the project charter later in the book.



# Projects, Programs, and Portfolios Way Up Close

Let's take a look at a charter for a portfolio, a program, and a project for a software company called Ranch Hand Games to get a better understanding of how they break down.

## Ranch Hand Games: Portfolio Charter

### Project Description: *The Online Gaming Portfolio*

Market research shows that console gaming and PC gaming will not increase as fast as the online market in the coming fiscal year. Ranch Hand has launched a number of programs to target the online gaming market and increase our market share by 10% in the next 15 months.

The following programs and projects are planned:

#### Programs:

- Online Arcade Program
- Online Gaming Sales and Marketing Campaign
- Server Upgrade Program
- Online Store Program

#### Projects:

- *Cows Gone Wild II*
- *Zarthak and the Flugelhorn*

## Ranch Hand Games: Program Charter

### Project Description: *The Online Arcade Program*

This is a targeted rewrite of all of our early games from the late 1980s and early 1990s for the online gaming market. All of these products will be released at the same time to coincide with a major trade show. Since many of these games were created using shared code, they'll need to be managed together to make configuration management easier and coordinate development activities.

#### Projects:

## Ranch Hand Games: Project Charter

### Project Description: *Cows Gone Wild II*

This is a follow-up to the hugely successful *Cows Gone Wild* title. It will include an online gaming component and is part of the Online Gaming portfolio.

#### Project Requirements:

- Must allow for up to eight online players per team
- Real-time text and voice communication between players
- Faster, more realistic graphics rendering
- New characters and scenery

#### Summary Milestone Schedule

Requirements complete	Mar 4
Code complete	Jun 1
Alpha release for internal testing	Jun 20
Beta release for external testing	Aug 31
General release	Nov 15

A portfolio manager monitors the combined performance of all of the programs and projects to evaluate how the portfolio is doing.

Portfolios can contain both programs and projects. And other things too, like sub-portfolios and operations!

You can tell if this project succeeds if the requirements are met and the product is high quality.

Your project sponsor provided the charter. We'll learn more about sponsors and charters in Chapter 4.

This program needs to be managed because all of the projects in it share code. If the projects were all managed independently, there would be time and effort wasted on all of the project teams trying to coordinate with one another.



You'll need to know the difference between a portfolio, a program, and a project on the exam. Which one of those does each story below describe?

A consulting company wanted to increase the amount of billable time for each consultant, so it started several company-wide programs to help consultants to get more productivity out of each year.

.....

A company wanted to switch from a paper-based Human Resources group to a software-based one. It spent some time looking into the best software packages for the job, and decided to manage all of the HR functions together since it needed the same people to help with all of the work.

.....

A software game company wanted to build up its online presence. It started several marketing and sales initiatives, created some new games, and rewrote some old ones in order to reach more gamers online.

.....

A university wanted to build admissions websites for all of its departments. It realized that all of the sites would be feeding into the same registration interface and decided to manage all of them together in order to save time.

.....

A company wanted to build a better reporting interface so that it could have more accurate data on year-end goals.

.....

A construction company bid on several parking garage projects at the same time. It won one of the bids, and built the garage a month under schedule and \$5,000 under budget.

.....



You'll need to know the difference between a portfolio, a program, and a project on the exam. Which one of those does each story below describe?

A consulting company wanted to increase the amount of billable time for each consultant, so it started several company-wide programs to help consultants to get more productivity out of each year.

### **Portfolio**

---

A company wanted to switch from a paper-based Human Resources group to a software-based one. It spent some time looking into the best software packages for the job, and decided to manage all of the HR functions together since it needed the same people to help with all of the work.

### **Program**

---

A software game company wanted to build up its online presence. It started several marketing and sales initiatives, created some new games, and rewrote some old ones in order to reach more gamers online.

### **Portfolio**

---

A university wanted to build admissions websites for all of its departments. It realized that all of the sites would be feeding into the same registration interface and decided to manage all of them together in order to save time.

### **Program**

---

A company wanted to build a better reporting interface so that it could have more accurate data on year-end goals.

### **Project**

---

A construction company bid on several parking garage projects at the same time. It won one of the bids, and built the garage a month under schedule and \$5,000 under budget.

### **Project**

---

## What a project IS...

### Temporary

Projects always have a start and a finish. They start when you decide what you are going to do, and they end when you've created the product or service you set out to create. Sometimes they end because you decide to stop doing the project. But they are never ongoing.

Operations are ongoing. If you're building cars on an assembly line, that's an operation. If you're designing and building a prototype of a specific car model, that's a project.

### Creating a unique result

When you create the product of your project, it is measurable. If you start a project to create a piece of software or build a building, you can tell that software or that building from any other one that has been produced.

You might also see the word "process" instead of "operation." A team might run a project to build software, but the company might have an ongoing process for keeping the servers that run the software from going down. In fact, the group that keeps those servers running is often called "IT Operations." Get it?

### Progressively elaborated

You learn more and more about a project as it goes on. When you start, you have goals and a plan, but there is always new information to deal with as your project progresses, and you'll always have to make decisions to keep it on track. While you do your best to plan for everything that will happen, you know that you will keep learning more about your project as you go.

## ... and what a project is NOT

Projects are NOT: always strategic or critical

Projects are NOT: ongoing operations (or processes)

Projects are NOT: always successful

## Sharpen your pencil



Which of these scenarios are operations, and which are projects?

1. Building an extension on a house

Operation

Project

2. Shelving books at the library

Operation

Project

3. Baking a wedding cake

Operation

Project

4. Stapling programs for a play

Operation

Project

5. Watering your plants twice a week

Operation

Project

6. Walking the dog every day

Operation

Project

7. Knitting a scarf

Operation

Project

8. Making a birdhouse

Operation

Project

9. Changing your air filters every six months

Operation

Project

10. Running an assembly line in a toy factory

Operation

Project

11. Organizing a large conference

Operation

Project

12. Going to the gym three times a week

Operation

Project

—————> **Answers on page 22**



## BULLET POINTS: AIMING FOR THE EXAM

- **Knowledge, performance, and personal skills** are the three areas that project managers focus on to get better at their jobs.
- A **project charter** is a document that describes a project's requirements and high-level schedule, assigns a project manager, and authorizes the project.
- A **program** is a collection of projects that should be managed together in order to achieve a specific goal or benefit to the company.
- A **portfolio** is a collection of projects or programs.
- A **project** gathers a team together to do work that's **temporary**, creates a **unique result**, and is **progressively elaborated**.
- An **operation** (or **process**) is work that's done in a way that's repeatable and ongoing, but is not a project.

# A day in the life of a project manager

You probably already know a lot of what a project manager does: gets a project from concept to completed product. Usually a project manager works with a team of people to get the work done. And PMs don't usually know a lot about the project when they start. When you think about it, you can categorize pretty much everything a project manager does every day into three categories.

CGW III Requirements Doc	
<b>1. Introduction</b> CGW III was a huge hit. We've done some market research and some internal brain- storming and compiled these requirements for Cows Gone Wild III. The following is: <b>2. Organizational Impact</b> This product will have an impact on the many departments at Ranch Hand Games, in- cluding Research and Development, Marketing, Distribution, Shipping, Administration, Finance, and Customer Service. <b>3. Functional requirements</b>	
Name	RU001 - Include Under water levels
Summary	The cows will need to be able to move around under water
Rationale	Under water environment was the single biggest request from pooled gamers.
Require- ment	Cows will need to be able to swim and underwater puzzles will need to be developed that require swimming.
<b>4. Nonfunctional requirements</b>	
Name	RNF001 - Performance as good or better than CGWIII
Summary	The new functionality cannot slow down game play.

## Gather product requirements

Being a project manager almost always means figuring out what you're going to build. It's one of the first things you do when you start to plan the project! But as you go, you are always learning more and more. Sometimes that can mean changes to your product, while other times it's just more detail on what you already knew.

One of the most important stakeholders is the sponsor. That's the person who provides financial and political support for the project.



## Manage stakeholder expectations

There are a lot of people involved in making most projects happen: the team that actually does the work, the people who pay for it, everybody who will use the product when you're done, and everybody who might be impacted by the project along the way. Those people are called your **stakeholders**. And a big part of the PM's job is communicating with everybody and making sure their needs are met.

You'll need to use your interpersonal and team skills to keep everyone on the same page.



## Deal with project constraints

Sometimes there will be **constraints** on the project that you'll need to deal with. You might start a project and be told that it can't cost more than \$200,000. Or it absolutely **MUST** be done by the trade show in May. Or you can do it only if you can get one specific programmer to do the work. Or there's a good chance that a competitor will beat you to it if you don't plan it well. It's constraints like these that make the job more challenging, but it's all in a day's work for a project manager.

Even though you're constantly gathering requirements, managing stakeholders, and working within constraints, different situations can call for different tools for dealing with all of those challenges.

When you think about it, all of the tools and techniques that are discussed in the *PMBOK® Guide* are there to help you do those three things at different points in your project's lifecycle. That's why the *PMBOK® Guide* divides up the work you do on a project into the five process groups. The groups help you organize all of the work you do as your project progresses and keep your role in the project straight.

You'll learn all about the process groups in Chapter 3!

## Sharpen your pencil Solution



Which of these scenarios are operations, and which are projects?

1. Building an extension on a house

Operation



Project

2. Shelving books at the library



Operation

Project

3. Baking a wedding cake

Operation



Project

4. Stapling programs for a play

Operation



Project

5. Watering your plants twice a week



Operation

Project

6. Walking the dog every day



Operation

Project

7. Knitting a scarf

Operation



Project

8. Making a birdhouse

Operation



Project

9. Changing your air filters every six months



Operation

Project

10. Running an assembly line in a toy factory



Operation

Project

11. Organizing a large conference

Operation



Project

12. Going to the gym three times a week



Operation

Project

## there are no Dumb Questions

**Q:** Do project constraints just mean restrictions on time and cost?

**A:** No. A project constraint is any limitation that's placed on your project before you start doing the work. It's true that project managers are really familiar with time and cost constraints, because those are really common. But there are lots of other kinds of constraints, too.

Here's an example. Let's say that some of your team members won't be available for three weeks because they have to attend a

mandatory training session. That's called a *resource constraint*, because some of your project resources (people you need) are restricted.

There are lots of other kinds of constraints, too: risk constraints, scope constraints, and quality constraints.

**Q:** Wait a minute—a quality constraint? Shouldn't I always run my project to build high-quality products?

**A:** Of course. But quality is more important for some projects than it is for

others, and as a project manager, you need to be realistic about it.

If you're running a project to build a playground, quality is important. You don't want to build unsafe playground equipment, because children could get hurt. Does that mean that you spend the highest possible portion of your budget on quality? Take a minute and think about how you'd approach quality for that project, as compared to, say, a project to build a heart monitor for a medical device company. It's likely that quality is a much more important constraint for the heart monitor than it is for the playground.

## How project managers run great projects

There are plenty of ways that you can run a project; people have been running projects for about as long as civilization has been around. But some project managers run their projects really effectively, while others consistently come in late, over budget, and with poor quality. So what makes the difference between a great project and one that faces challenges?

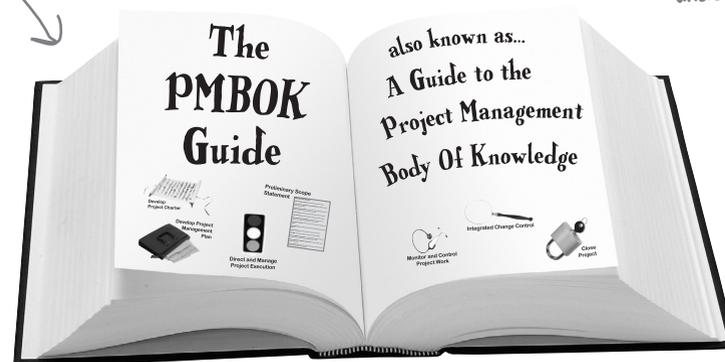
That's exactly the question that the folks at the Project Management Institute asked when they started putting together their *Guide to the Project Management Body of Knowledge*. They surveyed thousands of project managers and analyzed tens of thousands of successful and unsuccessful projects to come up with a structured way of thinking about how to effectively run a project.

One goal of the *PMBOK® Guide* is to give you a repeatable way to run your projects. It does so by breaking the work down into 49 processes that describe different, specific kinds of work that project managers do. To help you understand how those processes fit together, they came up with two different ways to think about them. Each process falls into one of the five process groups, which tell you the sequence in which the processes are performed on a project. But the *PMBOK® Guide* is also a tool for organizing knowledge about project management, so each process also falls into one of 10 knowledge areas. The *PMBOK® Guide* is organized around these knowledge areas...and so is this book!

The *PMBOK® Guide* describes 49 processes your project will go through from start to finish.

There are also 10 knowledge areas that help organize the processes to make them easier to learn and understand.

It has five process groups that show you the order of the processes on a project, and how they interact with one another.

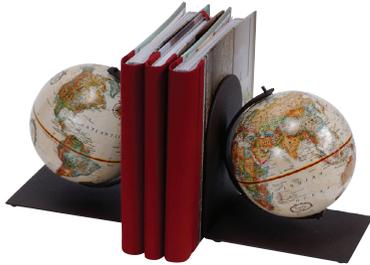


Head First PMP has one chapter per knowledge area...and so does the *PMBOK® Guide*.

**Each process is assigned to a process group, and it's also in a knowledge area.**

## Project management offices help you do a good job, every time

Every project your company completes can teach you a lot about what works and what doesn't within your company's culture. **Project management offices** (PMOs) help you to learn from all of the work that's been done in the past. They'll give you the templates and the guidance you need to make sure your project takes the right approach and makes sense to everyone you work with. There are three different kinds of PMOs that you might run into in your career.



### Supportive

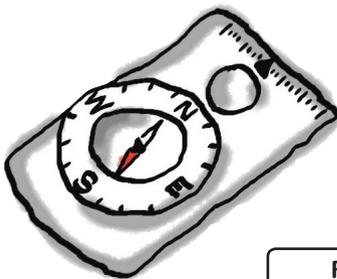
PMOs that play a supportive role provide all of the templates you need to fill out while your project is under way. They'll lay out the standards for how you should communicate your project's scope, resources, schedule, and status as your project progresses from its initial stages through to delivery and closing.

### Controlling

PMOs that control the way project management is done in a company will be able to check that you're following the processes they prescribe. Like supportive PMOs, they'll tell you what templates you should fill out and prescribe a framework for doing project management in your company. They'll also periodically review the work that you're doing on your project to make sure you're following their guidelines.



Directive PMOs have a lot of control over the way things are done on projects.



### Directive

PMOs that take a directive approach actually provide project managers to project teams. In a directive PMO, the project manager usually reports to the PMO directly. That reporting structure makes sure that the project managers follow the frameworks and templates prescribed by the PMO, because their job performance depends on it.

Remember how we told you to expect some repetition? This page is a good example! We'll cover this in more depth in the next chapter. It corresponds to material in Chapter 2 of the *PMBOK® Guide*... but again, don't expect there to be a perfect alignment between our chapters and *PMBOK®* chapters. It's all done because it will help you learn more quickly!

There are even a few things in Chapter 1 of the *PMBOK® Guide* that don't appear until later chapters of this book, because they make more sense when explained in context.

# Good leadership helps the team work together

It's not enough to have a good plan and all the resources you need to make your project a success. You need to think about your **interpersonal and team skills** if you want to keep your project on track. Here are a few examples:

## Leadership

A good leader gets the team to see the end goal and focus on getting there. With the right leadership, team members feel like they can take control of the work they're doing, and make good decisions to help the team achieve its goals as directly as possible.

## Team building and trust building

Everything you do to help team members feel like they can rely on one another is part of team building. When a team feels like they're all working together to achieve the project's goals, they're able to do so much more than each member can do individually. Trust building is all about sharing information with all of your stakeholders so that they know they can trust one another.



## Motivation

Some people are motivated by the kind of work they do, some are looking for experience that will help their résumés, and others are hoping for a promotion or a pay raise. Understanding what motivates your team members and helping them to achieve their personal goals will help your project, too.

Some teams can be so motivated by the value of the project that their personal goals are secondary to making the project a success. When that happens, they can be really productive as a team.

## Project teams are made of people

Keeping your team motivated and helping them to feel included are just a couple of the interpersonal and team skills that make your project a success. You also need to help your team members work through problems and maintain an environment where it's easy for everyone to get along. Here are a few more **interpersonal and team skills** that a good project manager uses to keep the team on track:

### Influencing

Sometimes you need to collaborate with others to get your work done. When you influence people, you focus on the shared benefit of the work with them and share power toward a common goal. You're probably using your influence to make things happen every day on the job.

You usually can't just tell people to do what you want and have them do it.

### Conflict management

When people work together, there will always be disagreements. A good project manager works to find positive solutions when conflicts pop up.

We'll talk more about conflict management in Chapter 13.

There are a few more interpersonal and team skills discussed in the PMBOK® Guide that we'll talk about along the way:

- \* Communication (Chapter 10 is all about communication).
- \* Negotiation and decision making (we'll talk more about those in Chapter 9).

### Coaching

As the people on your team grow and take on new responsibilities, they might want some help developing new skills. That's where coaching comes in. When you coach people, you help them develop their skills and get better at what they do. Sometimes this means helping them find training, while other times it's just acting as a sounding board to help your team members sort through the problems they run into.

A good PM is always looking for ways to help the team get better at what they do.

### Political and cultural awareness

It's important to make sure that everybody on the team feels included. You need to be aware of the topics that might alienate people or make them feel uncomfortable, so that you can maintain an open and inclusive environment on your team.



Can you think of a time when one of these skills helped your team succeed on a past project?

## there are no Dumb Questions

**Q:** Directive and controlling PMOs seem pretty similar to me. What's the difference again?

**A:** That's a good question. Both of them are pretty active in managing the projects they govern, but there are some differences.

Controlling PMOs tend to review the work a project team does at various points in the project to make sure that they are following the company's agreed-upon process. The people who work in the controlling PMO are like auditors who take a look at a project team's work products to make sure they're complying with the company's project management rules.

Directive PMOs actually manage the projects on their own. The people who work in the PMO take on the role of project manager for all of the projects the PMO is responsible for.

**Q:** My company doesn't have a PMO at all. Do the 49 processes apply only to companies that have PMOs? How much of what's in the *PMBOK® Guide* applies to plain old project managers who aren't in a PMO?

**A:** Yes! The *PMBOK® Guide* is all about project management, and all of the processes it talks about are meant to be used on projects to help them succeed. If your company has a PMO, following the 49 processes will help you work with that PMO. But if you don't have a PMO where you work, it's still good for a project to follow all 49 of them.

**Q:** Does the PMP exam test you on your interpersonal and team skills?

**A:** Yes. You need to know what all of the interpersonal and team skills are and when you would use them in managing your project. Interpersonal and team skills are an

important part of managing a team. If your team members each feel like their opinion is valued and they are motivated to do good work, you'll have a much better chance at success.

**Q:** Hold on, how are team building and coaching different?

**A:** Another good question. Team building usually means going out, having lunch, doing group exercises, and in general socializing as a team so that the group gets more familiar with one another and can have a better internal set of relationships. Coaching is about identifying your team members' talents and helping them develop those.

Say a member of your team is really good at explaining technical concepts to other people. You might want to coach that person to write project documents that will help the whole team understand what they're doing better. That would let the team member get better at using her talent, and also help with team communication.

# Operations management handles the processes that make your company tick

Think about all of the processes your company goes through every day to keep things running smoothly. You probably have worked with operations teams on many of your projects—from accounting departments to support teams to infrastructure teams who maintain software environments. Each operations team is staffed with specialists in the aspect of your company that they run. Sometimes, you'll work with them to build out parts of your project; sometimes, you'll depend on them to do work before your project can proceed. Operations teams are almost always stakeholders in your projects.

*Operations management will direct, oversee, and control the business processes you work with on your project every day.*



*You'll learn more about stakeholders when we talk about stakeholder management in Chapter 13.*

## Sharpen your pencil

Which kind of project management office is being described?

1. Provides the process documents and templates for your project.

Supportive  Controlling  Directive

2. You meet with them once a month to go over project docs and make sure you're following the right process.

Supportive  Controlling  Directive

3. Provides a knowledge base of common project problems and lessons learned for you to use.

Supportive  Controlling  Directive

4. A centralized group of project managers who are assigned to manage projects.

Supportive  Controlling  Directive

5. When a project gets started, this group makes sure that they've followed all of the initiating processes and have the right approvals to start working.

Supportive  Controlling  Directive

6. When you sit down to do your risk planning for your project, you go to them to find a good example of a risk plan that's been useful on other projects.

Supportive  Controlling  Directive

7. This team audits your project work at regular intervals to confirm the status reports you're giving and guide you when you run into trouble.

Supportive  Controlling  Directive

—————▶ **Answers on page 30**

# Who am I?



A bunch of interpersonal and team skills, in full costume, are playing a party game called “Who am I?” They’ll give you a clue—you try to guess who they are based on what they say. Assume they always tell the truth about themselves. Fill in the blanks to the right to identify the attendees.

**Any of the charming skills you’ve seen so far just might show up!**

**Name**

I get everybody on the team to understand the goals of the project so that they can get behind them.

---

I work to maintain an open and inclusive environment by paying attention to the things that team members might be sensitive to.

---

I try to figure out what each team member wants out of the project, and then I help him or her get it.

---

I share power with other people in order to get some shared benefit.

---

I help team members get better at doing project work.

---

When arguments or disagreements happen, I try to solve them in a way that benefits the team as much as possible.

---

I help everybody on the team feel like they can rely on one another.

---

I’m transparent with all of the stakeholders in my project so that everyone has all of the information they need to make good decisions.

---

—————> **Answers on page 31**

# Sharpen your pencil Solution



Which kind of project management office is being described?

1. Provides the process documents and templates for your project.

- Supportive    Controlling    Directive

2. You meet with them once a month to go over project docs and make sure you're following the right process.

- Supportive    Controlling    Directive

3. Provides a knowledge base of common project problems and lessons learned for you to use.

- Supportive    Controlling    Directive

4. A centralized group of project managers who are assigned to manage projects.

- Supportive    Controlling    Directive

5. When a project gets started, this group makes sure that the team has followed all of the initiating processes and have the right approvals to start working.

- Supportive    Controlling    Directive

6. When you sit down to do your risk planning for your project, you go to them to find a good example of a risk plan that's been useful on other projects.

- Supportive    Controlling    Directive

7. This team audits your project work at regular intervals to confirm the status reports you're giving and guide you when you run into trouble.

- Supportive    Controlling    Directive

It's true that all of the types of PMOs provide process documents, but only the supportive PMO provides them as its main function.

# Who am I?



A bunch of interpersonal and team skills, in full costume, are playing a party game called “Who am I?” They’ll give you a clue—you try to guess who they are based on what they say. Assume they always tell the truth about themselves. Fill in the blanks to the right to identify the attendees.

**Any of the charming skills you’ve seen so far just might show up!**

**Name**

**Leadership**

---

**Political and cultural awareness**

**Motivation**

---

**Influencing**

---

**Coaching**

---

**Conflict resolution**

---

**Team building**

---

**Trust building**

---

I get everybody on the team to understand the goals of the project so that they can get behind them.

I work to maintain an open and inclusive environment by paying attention to the things that team members might be sensitive to.

I try to figure out what each team member wants out of the project and then I help him or her get it.

I share power with other people in order to get some shared benefit.

I help team members get better at doing project work.

When arguments or disagreements happen, I try to solve them in a way that benefits the team as much as possible.

I help everybody on the team feel like they can rely on one another.

I’m transparent with all of the stakeholders in my project so that everyone has all of the information they need to make good decisions.

## **A PMP certification is more than just passing a test**

**Getting your PMP certification means that you have the knowledge to solve most common project problems.**

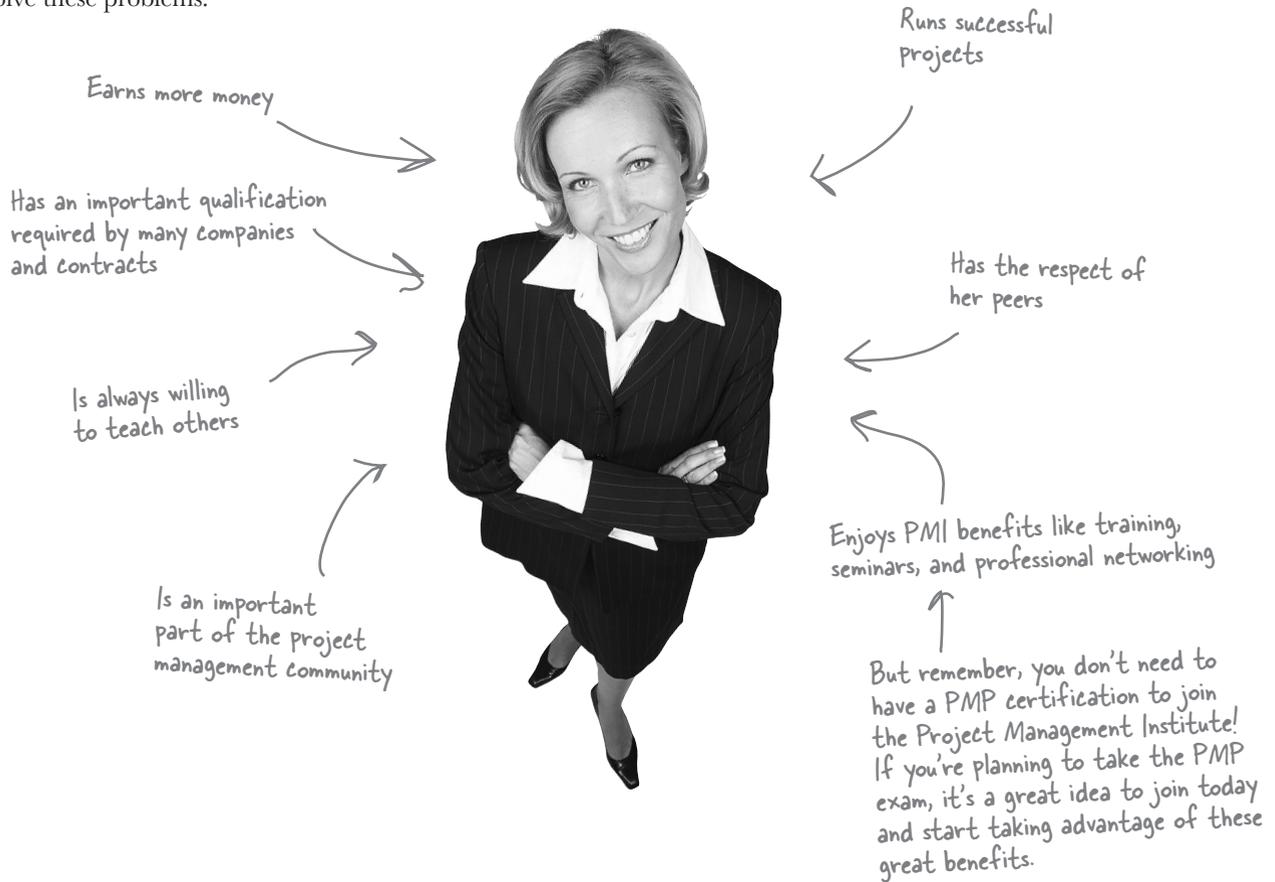
**It proves that you know your stuff.**

**Once you're certified, your projects are more likely to succeed because:**

**you have the skills and knowledge to make them successful.**

## Meet a real-life PMP-certified project manager

PMs have demonstrated that they understand the tools it takes to be successful at leading projects. They know what it means to juggle their project priorities and still have their projects come out on top. Being certified doesn't mean you won't have problems on your projects anymore, but it does mean that you'll have the wisdom of many experienced and smart project managers behind you when you make decisions about how to solve these problems.



This could be YOU!

## Exam Questions

1. Which of the following is NOT a type of project management office?

- A. Directive
- B. Value-driven
- C. Supportive
- D. Controlling

2. Which of the following is NOT a distinguishing characteristic of a project?

- A. Temporary
- B. Strategic
- C. Specific result
- D. Progressively elaborated

3. An energy company is investing in a series of initiatives to look for alternative energy sources so that the company can be competitive in 10 years. The initiatives are tracked and managed together because this goal is vital to the success of the company. This is an example of:

- A. A portfolio
- B. A program
- C. A project
- D. A enterprise environmental factor

4. Which of the following is NOT a responsibility of a project manager?

- A. Managing stakeholder expectations
- B. Managing project constraints
- C. Gathering product requirements
- D. Sponsoring the project

5. Which of the following is NOT an interpersonal skill?

- A. Motivation
- B. Brainstorming
- C. Team building
- D. Coaching

## Exam Questions

**6. Which of the following is NOT true about interpersonal and team skills?**

- A. Coaching means helping your team to get more exercise.
- B. Motivation means helping team members get what they want out of the project.
- C. Influencing means sharing power with people to get something done.
- D. Conflict management means finding positive solutions to conflicts during the project.

**7. Which of the following is NOT true about portfolio management?**

- A. The portfolio manager judges the success of the portfolio by combining data from all of its programs and projects.
- B. A portfolio can contain projects and programs.
- C. A portfolio is organized around a business goal.
- D. A portfolio is always a group of programs.

**8. You're managing a project to remodel a kitchen. You use earned value calculations to figure out that you're going to run \$500 over budget if your project continues at the current rate. Which of the following core characteristics of a project manager are you using to find the problem?**

- A. Knowledge
- B. Performance
- C. Personal skills
- D. None of the above

**9. At the beginning of a project, a software team project manager is given a schedule with everyone's vacations on it. She realizes that because the software will be delivered to the QA team exactly when they have overlapping vacations, there is a serious risk of quality problems, because there won't be anyone to test the software before it goes into production. What BEST describes the constraint this places on the project?**

- A. Quality constraint
- B. Time constraint
- C. Resource constraint
- D. Risk constraint

**10. A project manager is having trouble with his project because one of his team members is not performing, which is causing him to miss an important date he promised to a stakeholder. He discovers that the team member knew about the project problem, but didn't tell him because the team members are all afraid of his bad temper. Which BEST describes how the project manager can avoid this situation in the future?**

- A. Increasing his knowledge of the *PMBOK® Guide*
- B. Measuring personal performance
- C. Improving his personal skills
- D. Managing stakeholder expectations

## Exam Questions

### 1. Answer: B

Although PMOs are usually value-driven, that's not a valid type of PMO. The three types of PMOs are supportive, controlling, and directive. Supportive PMOs provide templates and guidelines for running projects, controlling PMOs audit projects to ensure adherence to processes and standards, and directive PMOs provide project managers to manage projects.

### 2. Answer: B

A project doesn't have to be strategic or critical. It only needs to be temporary, have a specific result, and be progressively elaborated.

← Look out for questions like this one on the exam. Common sense might tell you that a project should be important for a company to want to do it, but that's not what the question is asking.

### 3. Answer: A

Since the initiatives are being managed together because of a strategic business goal, you can tell that this is a portfolio.

← Portfolios are organized around business goals, and programs are organized around a shared benefit in managing them together.

### 4. Answer: D

The sponsor is the person who pays for the project. The project manager doesn't usually play that role.

### 5. Answer: B

← In fact, you'll learn more about its role in defining project requirements in a couple of chapters.

Brainstorming is an activity that you do with other people, but it's not an interpersonal skill that you need to hone to help manage all of the stakeholders on your project.

### 6. Answer: A

Coaching is really about helping your team members to get better at what they do. Anything you do to challenge them to develop their skills is coaching.

### 7. Answer: D

Since a portfolio can be a group of programs and projects, option D is the one that's not true. It *can* be a group of programs, but it doesn't *have to be*.

**Exam Questions****8. Answer: A**

Your knowledge of earned value management techniques is how you can predict that the project will be over budget. Knowing that could help you plan ahead to avoid further cost overruns. Minimally, it can help you to reset expectations with your stakeholders so they have a better idea of what's coming.

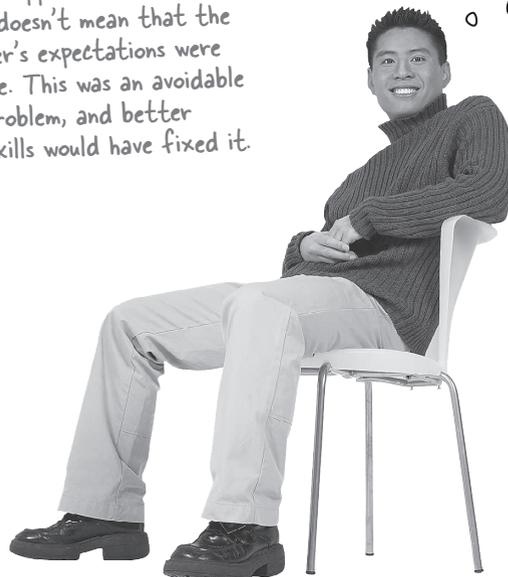
**9. Answer: C**

This is a resource constraint, because the project manager's resources—in this case, the people who will be testing the software—are not going to be available to her when she needs them. Yes, this will cause problems with the quality, introduce risks, and cause schedule problems. But they're not schedule, time, or risk constraints, because there's no outside limitation placed on the project quality, schedule, or risks. The only outside limitation is the resource availability. If they were available, there wouldn't be a problem!

**10. Answer: C**

The way that the project manager interacts with the people on his team interfered with his work getting done. This is a good example of how a lack of personal skills can lead directly to major project problems down the line, and it's why this particular project manager needs to work on his personal skills.

The project manager's temper led to a disappointed stakeholder, but that doesn't mean that the stakeholder's expectations were out of line. This was an avoidable project problem, and better personal skills would have fixed it.



YOU MADE IT  
THROUGH YOUR  
FIRST CHAPTER AND  
EXAM QUESTIONS!  
HOW'D IT GO?



## 2 The organizational environment

### *In good company*



**If you want something done right...better hope you're in the right kind of organization.** All projects are about teamwork—but how your team works depends a lot on the type of organization you're in. In this chapter, you'll learn about the different types of organizations around—and which type you should look for the next time you need a new job.

# A day in Kate's life

## Morning

WE JUST FINISHED TESTING, AND THE PRODUCT SHOULD BE READY TO GO TO TEST ON SCHEDULE.



## Lunch time

WE'RE HALFWAY DONE UPDATING THE USER MANUAL.



## Afternoon

THE WEBSITE NEEDS NEW GRAPHICS.



This is Kate's job—writing status reports.



**Status Report**

**Programming**

"We just finished testing, and the product should be ready to go to test on schedule."

**Tech Writing**

"We're halfway done updating the user manual."

**Information Systems**

"The website needs new graphics."



All Kate does all day is document what people say in status meetings.

## Kate wants a new job

Now that she's working on getting her PMP certification, Kate's learning a whole load of new skills. And she's even started to look for a new job—one where she does more than write down what other people say all day...

Kate's not responsible for the success or failure of her project. She just keeps everybody informed of its progress.



ALL I DO ALL DAY IS COLLECT STATUS. EVEN IF I HAVE IDEAS ABOUT HOW TO IMPROVE THE PROJECT, IT'S NOT LIKE I HAVE THE POWER TO ACTUALLY CHANGE ANYTHING.

### **Kate is a project expediter right now.**

Kate may have the job title of “project manager,” but even though that's what's printed on her business cards, that's not really her job. Kate's job is to document what's happening on a project, but she doesn't have the authority to make decisions on it. She may *work* on projects, but she's certainly not *managing* anything.



When Kate checks out a job searching app, what types of things do you think she should look for in a new organization?



Kate spilled a hot cup of Starbuzz half-caf nonfat latte on her job-hunting checklist. Can you match the notes she scribbled at the bottom of the page to what's covered up by coffee stains?

Job Hunting Checklist

- I should have a [redacted] on my projects
- I am allowed to [redacted] k to people on my project team
- I am in control of my project's [redacted]
- I focus on [redacted] projects, not [redacted] tasks.
- I shouldn't spend my whole day [redacted]
- I can assign [redacted] to my [redacted] team without having to [redacted] with their bosses.

filing stuff  
managing  
work

budget  
irrelevant  
authority over

project team

clear it  
assign work

→ Answers on page 64

## BRAIN POWER

What would **you** look for in your perfect job? Does your wish list look anything like Kate's?



## Organization Magnets

In a **functional organization**, which is what Kate works in, project managers don't have the authority to make major decisions on projects. **Projectized organizations**, on the other hand, give all of the authority to the PM.

Can you work out which description goes with which organization type?

In this kind of company, the team reports to the project manager, who has a lot more authority.



### Functional organization



In a functional organization, the teams working on the project don't report directly to the PM. Instead, the teams are in departments, and the project manager needs to "borrow" them for the project.

### Projectized organization

1. ....

1. ....

2. ....

2. ....

3. ....

3. ....

Teams are organized around projects.

Project managers estimate and track budget and schedule.

PMs don't set the budget.

Project managers choose the team members, and release them when the project is over.

PMs spend half their time doing admin tasks.

Project managers need to clear major decisions with department managers.

—————> Answers on page 65

## There are different types of organizational structures

Kate's got a few options when looking at the kinds of organizations she can work for. First up are **organic organizations**, where people have varied roles that might make project management a part-time role depending on what's needed at the time. Then there are **functional organizations**, which are set up to give authority to functional managers. **Multidivisional** organizations might operate each division almost like its own company, with each one having its own governance framework and management roles. **Project-oriented organizations** give authority to the PM, and **matrix organizations** share responsibility and authority between the functional managers and project managers.



### Organic

You might see this structure in a very small company



- Project management is handled as a part-time responsibility for someone on a project team.
- Project managers are usually contributors to the project who take on the added responsibility of helping stakeholders understand project status.
- In an organic organization, it's likely that the project manager has little responsibility for budget decisions. Usually those kinds of decisions are made by the company owner.

### Functional

In this kind of organization, the project team members always report to a functional manager who calls all the shots.



- Project management decisions need to be cleared with functional managers.
- Project managers are the functional managers in getting the work done.
- Project managers spend a lot of time doing administrative tasks and often work as PMs only part of the time.
- You're likely to find project expeditors in functional organizations.

### Multidivisional

- PMs might operate in a completely different way from division to division.
- PMs are often project coordinators or part-time expeditors who actually work on the project team as a full-time contributor but take on the added responsibility of communicating project status.
- Decisions about budget or resource allocation need to be made by functional managers.

### Weak matrix

- PMs have some authority, but they aren't in charge of the resources on a project.
- Major decisions still need to be made with the functional manager's cooperation or approval.
- Project expeditors (like Kate) and project coordinators can work in weak matrix organizations, too.

# The project manager has the most authority and power in a project-oriented organization.



## Balanced matrix

## Strong matrix

## Project-oriented

### Matrix organizations

- Project managers share authority with the functional managers.
- PMs run their people-management decisions by the functional manager, but the functional manager runs project decisions by the PM, too.

- Project managers have more authority than functional managers, but the team still reports to both managers.
- The team might be judged based on performance on their projects, as well as on their functional expertise. In a strong matrix, delivery of the project is most important.

- Teams are organized around projects. When a project is done, the team is released, and the team members move on to another project.
- The project manager makes all of the decisions about a project's budget, schedule, quality, and resources.
- The PM is responsible for the success or failure of the project.

Folks who work in a balanced matrix organization report to a project manager AND a functional manager equally.

For the PMP exam, most questions assume that you work in a matrix organization unless they say otherwise.

**and that's not all!**

Flip the page to learn about even more organization types!

## A few more types of organizations

There are a few additional structures that build on some of the other organizational structures. These three organization types add new dimensions to the basic functional, matrix, and project-oriented structures we just discussed.



### Virtual

*Virtual teams bring people together from different parts of the organization who might have different ways of working.*

- Virtual teams can be made up of people from many different parts of an organization who might have different reporting structures and work in different offices.
- Project managers often take on the role of facilitating team communications on virtual teams.
- PMs in this organizational structure sometimes have authority over budget and resource allocation.

### Hybrid

- Hybrid organizations put together practices for working in predictive lifecycles with practices for working in adaptive ones.
- Predictive lifecycles tend to rely more on management for understanding scope and status, while adaptive ones make that data transparent and focus on self-management within each team.
- Since the teams are using a combination of practices, the way the project manager works varies along with the team.

### Project Management Office

- The PMO has almost total authority over all of the projects that are done within an organization.
- The funding and workflow of projects is managed by the PMO and all of the data that is used to make decisions about projects is prepared by project managers.
- Project managers make decisions about how to allocate resources to projects.

*PMOs give project managers the most authority of all of the organization types.*

## PMOs can be supportive, controlling, or directive

When an organization sets up a PMO, it can operate in a few different ways. A PMO can be **supportive**, helping teams standardize their project approaches by using the same document templates and practices for estimating and reporting on their progress. Some PMOs are **controlling**, confirming that teams are following all of the processes they've defined through audits, interviews, and observation of project documents and practices. Still others are **directive**, actually managing each project by assigning a PMO member to each one.



Supportive



Controlling



Directive

Remember these  
from Chapter 1?



### Exercise

Here are a couple of scenarios where a PMO is taking action on a project. Tell us whether the PMO approach is supportive, controlling, or directive.

**Scenario #1:** As each project kicks off, members of the team sit down with a PMO member to talk about the approach they'll take to do the work. The PMO member gives them some copies of good examples of project schedules and scope documents and then walks them through some blank templates so they'll know how to fill them out when they've completed their planning activities.

Supportive     Controlling     Directive

**Scenario #2:** As each project kicks off, a member of the PMO is assigned to lead the project and make sure that the team approaches their work in the way the PMO would want. The PMO member makes sure that the correct templates are used and that the PMO is consulted as decision points arise throughout the project.

Supportive     Controlling     Directive

—————▶ **Answers on page 58**

## there are no Dumb Questions

**Q:** I'm still not clear on the difference between a project coordinator and a project expeditor.

**A:** They're actually pretty similar. A project expeditor is somebody who keeps track of status but has no decision-making authority on a project at all. A project coordinator is someone who does pretty much the same thing, but does get to make some of the minor decisions on the project without having to run them by the functional manager. Coordinators usually report to somebody who is pretty high up in the organization, while expeditors are more like assistants to the functional manager. Both of them usually exist in weak matrix or functional organizations.

**Q:** What's the difference between the way teams are run in a functional organization and a projectized one?

**A:** Think of a major bookkeeping project being run by the admin department. Usually the head of admin is the one who is ultimately responsible for what happens to the project. If a project manager is called in to help out, she's just there to keep things straight for the admin department manager. The team is made up of people who already report to the admin manager, so nobody questions his authority. That's an example of a functional organization.

Contrast that with the way the bookkeeping project would be run if a consulting company that specialized in bookkeeping were contracted to do it. The company would assemble a team of bookkeepers and

assign a project manager to lead them. When the project was over, the team would dissolve, and the team members would go join other teams working for other project managers. That's how a projectized organization works. The team is organized around a project and not around a job function.

**Q:** Can I be an effective PM in a functional organization?

**A:** Since project managers don't have much authority in a functional organization, it's hard to have as much impact in a functional organization as you would in a matrix or projectized one.

Of course, you can be good at your job in any kind of organization. But, for your company to really get the most out of having project managers on staff, it really pays for it to look into changing the way it balances power. The project managers who are accountable for project success or failure should also have the chance to influence the team, budget, and schedule for those projects.

**Q:** Does the PMP exam favor any kind of organization?

**A:** When you're taking the PMP exam, if you see a question that mentions a PM, then you should assume that the question is asking about a matrix organization if it doesn't say up front which kind of organization is being described. Functional organizations are usually painted in a negative light because they tend to give less authority to project managers.



### BULLET POINTS: AIMING FOR THE EXAM

- Functional managers have all the power in a functional organization. Project managers have the power in a projectized organization.
- If a question on the exam doesn't state an organization type, assume it's referring to a matrix organization. That means the PM is responsible for making budgets, assigning tasks to resources, and resolving conflicts.
- Project coordinators and expeditors don't exist in a projectized organization.
- A project expeditor keeps track of project status only. A project coordinator has some authority, and usually reports to someone higher up in the company. Neither role has as much power or authority as a real project manager, even though expeditors or coordinators may have "Project Manager" printed on their business cards.



Here are a few excerpts from some of Kate's job interviews. Can you figure out what kind of organization each interviewer is representing?

**Interviewer #1:** We're looking for someone who can work with our development manager to deliver our products on time. We have a good programming team; they just need a little encouragement to meet their deadlines. You'll be expected to keep really good status meeting notes. If you run into any trouble with the team, just kick it back to the dev manager, and she'll address the problem.

- |                                      |                                     |  |                                 |
|--------------------------------------|-------------------------------------|--|---------------------------------|
| <input type="checkbox"/> Organic     | <input type="checkbox"/> Functional | <input type="checkbox"/> Multidivisional | <input type="checkbox"/> Matrix |
| <input type="checkbox"/> Projectized | <input type="checkbox"/> Virtual    | <input type="checkbox"/> Hybrid          | <input type="checkbox"/> PMO    |

**Interviewer #2:** We need someone who can manage the whole effort, start to finish. You'll need to work with the client to establish goals, choose the team, estimate time and cost, manage and track all of your decisions, and make sure you keep everybody in the loop on what's going on. We expect the project to last six months.

- |                                      |                                     |  |                                 |
|--------------------------------------|-------------------------------------|--|---------------------------------|
| <input type="checkbox"/> Organic     | <input type="checkbox"/> Functional | <input type="checkbox"/> Multidivisional | <input type="checkbox"/> Matrix |
| <input type="checkbox"/> Projectized | <input type="checkbox"/> Virtual    | <input type="checkbox"/> Hybrid          | <input type="checkbox"/> PMO    |

**Interviewer #3:** We have a project coming up that's needed by our customer service team. The project is a real technical challenge for us, so we've assembled a team of top-notch programmers to come up with a good solution. We need a project manager to work with the programming manager on this one. You would be responsible for the schedule, the budget, and managing the deliverables. The programming manager would have the personnel responsibilities.

- |                                      |                                     |  |                                 |
|--------------------------------------|-------------------------------------|--|---------------------------------|
| <input type="checkbox"/> Organic     | <input type="checkbox"/> Functional | <input type="checkbox"/> Multidivisional | <input type="checkbox"/> Matrix |
| <input type="checkbox"/> Projectized | <input type="checkbox"/> Virtual    | <input type="checkbox"/> Hybrid          | <input type="checkbox"/> PMO    |

**Interviewer #4:** Most of the work you'll be doing is contract work. You'll put together three different teams of software engineers, and you'll need to make sure that they build everything our customer needs. And don't forget: you've got to stay within budget, and it's got to be done on time! It's a big job, and it's your neck on the line if things go wrong. Can you handle that?

- |                                      |                                     |  |                                 |
|--------------------------------------|-------------------------------------|--|---------------------------------|
| <input type="checkbox"/> Organic     | <input type="checkbox"/> Functional | <input type="checkbox"/> Multidivisional | <input type="checkbox"/> Matrix |
| <input type="checkbox"/> Projectized | <input type="checkbox"/> Virtual    | <input type="checkbox"/> Hybrid          | <input type="checkbox"/> PMO    |



**Exercise Solution**

Here are a few excerpts from some of Kate's job interviews. Can you figure out what kind of organization each interviewer is representing?

**Interviewer #1:** We're looking for someone who can work with our development manager to deliver our products on time. We have a good programming team; they just need a little encouragement to meet their deadlines. You'll be expected to keep really good status meeting notes. If you run into any trouble with the team, just kick it back to the dev manager, and she'll address the problem.

*This is just like the job Kate wants to leave. Just gathering status sounds pretty boring.*

- |                                      |  |  |                                 |
|--------------------------------------|--|--|---------------------------------|
| <input type="checkbox"/> Organic     | <input checked="" type="checkbox"/> Functional | <input type="checkbox"/> Multidivisional | <input type="checkbox"/> Matrix |
| <input type="checkbox"/> Projectized | <input type="checkbox"/> Virtual               | <input type="checkbox"/> Hybrid          | <input type="checkbox"/> PMO    |

**Interviewer #2:** We need someone who can manage the whole effort, start to finish. You'll need to work with the client to establish goals, choose the team, estimate time and cost, manage and track all of your decisions, and make sure you keep everybody in the loop on what's going on. We expect the project to last six months.

*Project management isn't a formal role in this organization.*

- |   |                                     |  |                                 |
|---|-------------------------------------|--|---------------------------------|
| <input type="checkbox"/> Organic                | <input type="checkbox"/> Functional | <input type="checkbox"/> Multidivisional | <input type="checkbox"/> Matrix |
| <input checked="" type="checkbox"/> Projectized | <input type="checkbox"/> Virtual    | <input type="checkbox"/> Hybrid          | <input type="checkbox"/> PMO    |

**Interviewer #3:** We have a project coming up that's needed by our customer service team. The project is a real technical challenge for us, so we've assembled a team of top-notch programmers to come up with a good solution. We need a project manager to work with the programming manager on this one. You would be responsible for the schedule, the budget, and managing the deliverables. The programming manager would have the personnel responsibilities.

*Authority is shared between the PM and the functional manager.*

- |                                      |                                     |  |  |
|--------------------------------------|-------------------------------------|--|--|
| <input type="checkbox"/> Organic     | <input type="checkbox"/> Functional | <input type="checkbox"/> Multidivisional | <input checked="" type="checkbox"/> Matrix |
| <input type="checkbox"/> Projectized | <input type="checkbox"/> Virtual    | <input type="checkbox"/> Hybrid          | <input checked="" type="checkbox"/> PMO    |

**Interviewer #4:** Most of the work you'll be doing is contract work. You'll put together three different teams of software engineers, and you'll need to make sure that they build everything our customer needs. And don't forget: you've got to stay within budget, and it's got to be done on time! It's a big job, and it's your neck on the line if things go wrong. Can you handle that?

*Most contractors are projectized: the PM builds the team and makes sure the work gets done.*

- |   |                                     |  |                                 |
|---|-------------------------------------|--|---------------------------------|
| <input type="checkbox"/> Organic                | <input type="checkbox"/> Functional | <input type="checkbox"/> Multidivisional | <input type="checkbox"/> Matrix |
| <input checked="" type="checkbox"/> Projectized | <input type="checkbox"/> Virtual    | <input type="checkbox"/> Hybrid          | <input type="checkbox"/> PMO    |

## Kate takes a new job



**Kate:** Hi, Ben. I'm excited to be here. It's such a relief to be hired as a project manager, and not just a project expediter anymore.

**Ben:** We're excited, too, since you'll be taking care of our main software development project. It's in maintenance mode right now.

**Kate:** Sounds great. How do we handle that here?

**Ben:** Well, we're constantly getting business reports from the field, and when people think of new ideas, we just add them to the project.

**Kate:** Umm...so how do you know when you're done? Who exactly adds them to the project? How do we know if we've taken on more work than we can handle?

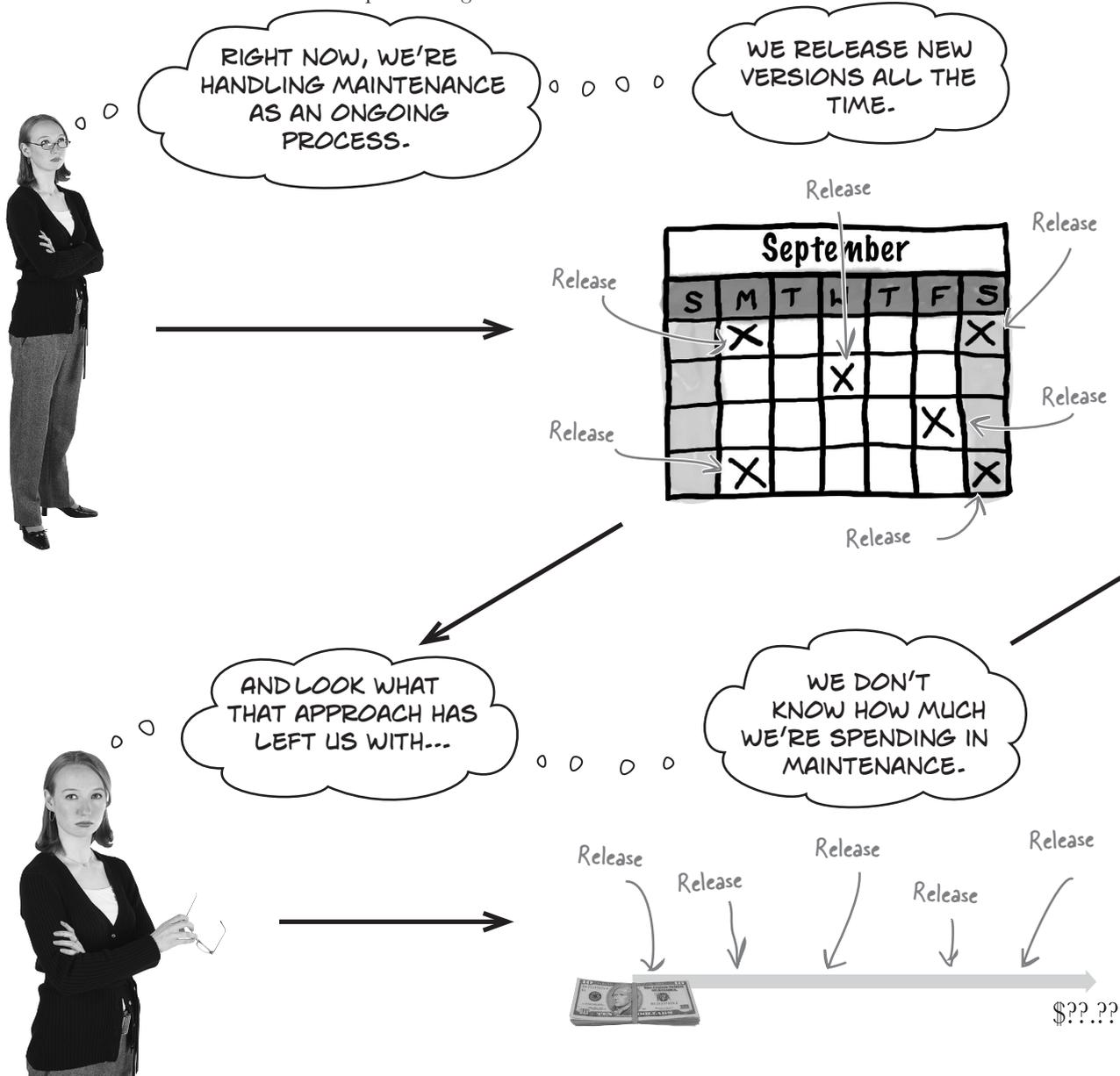
**Ben:** We're never really done and pretty much everyone on the team can add work to the project. We try to release new versions as often as possible. If we run into problems with how much we've taken on, we just talk to the CEO and he irons it out for us.

## Kate's working in an organic organization

It seems like there's no formal definition of the project she'll be taking on. The team doesn't seem to have a clear definition of the project manager's role either.

## Back to Kate's maintenance nightmare

Let's figure out how things are working in Kate's new organization, and start to think about how we can improve things.



WE NEVER HAVE A "FINAL" VERSION OF THE PRODUCT...

... AND IT LOOKS LIKE OUR USERS ARE UNHAPPY WITH THE BUGS AND THE UNCERTAINTY OF THE VERSION STABILITY.

The customer service department's report on user feedback

S	M	T	W	T	F	S
	X					X
			X			
					X	
X						X



THAT'S JUST THE WAY OUR SOFTWARE DEVELOPMENT MAINTENANCE PROCESS HAS ALWAYS WORKED. YOU MEAN THERE'S SOMETHING WE CAN DO TO MAKE IT WORK BETTER?

YES! WE CAN DEFINITELY DO BETTER THAN THIS!



# BRAIN POWER

What would you do to fix this problem?

## Managing project constraints

When Kate thinks about solutions, she's going to have to deal with the project's constraints. Every project, regardless of what is being produced or who is doing the work, is affected by the **constraints** of time, scope, cost, quality, resources, and risk. These constraints have a special relationship with one another, because doing something to deal with one of the constraints always has an effect on the others.



If you don't manage all six constraints at the same time, you risk managing in favor of just one constraint.

**Any time your project changes, you'll need to know how that change affects all of the constraints.**

For Kate's project to succeed, she needs to think about the project **constraints**. If she doesn't manage these six constraints at the same time, she'll find that her project is either late, over budget, or unacceptable to her customers.



Can you figure out the constraint that's causing the biggest headache for the project manager in each of these scenarios?

The project was running late, so the project manager decided to release it on time even though it was missing some of its features.

**Constraint affected:**

.....

The team wanted to add more testers to find defects, but the project manager overruled them.

**Constraint affected:**

.....

A construction project manager assumed that the weather would cooperate with the plans to complete the job, but thunderstorms have derailed the project.

**Constraint affected:**

.....

The company didn't have enough money to invest in the project, so they had to draft people from other departments to work part-time to get the job done.

**Constraint affected:**

.....

About halfway through the project, the PM realized that the money was running out faster than expected. She went through the schedule to try to find ways to move up the deadline.

**Constraint affected:**

.....

The project manager didn't take software license fees into account, which caused the budget to balloon out of control.

**Constraint affected:**

.....

constraints affect each other



Exercise Solution

Can you figure out the constraint that's causing the biggest headache for the project manager in each of these scenarios?

The project was running late, so the project manager decided to release it on time even though it was missing some of its features.

Constraint affected:

scope

The PM stuck to the original budget and schedule, but released a product that wasn't complete. That means the scope was affected.

The company didn't have enough money to invest in the project, so they had to draft people from other departments to work part-time to get the job done.

Constraint affected:

resources

Resources are people or materials that you need for your project, and when you cut corners you end up straining them.

The team wanted to add more testers to find defects, but the project manager overruled them.

Constraint affected:

quality

Any time you're talking about tests and defects, you're talking about quality.

About halfway through the project, the PM realized that the money was running out faster than expected. She went through the schedule to try to find ways to move up the deadline.

Constraint affected:

time

There are lots of ways to change how long it'll take to do your project, but sometimes there simply isn't enough time.

A construction project manager assumed that the weather would cooperate with the plans to complete the job, but thunderstorms have derailed the project.

Constraint affected:

risk

It's the project manager's job to always look after the bottom line.

The project manager didn't take software license fees into account, which caused the budget to balloon out of control.

Constraint affected:

cost

Whenever you make assumptions about a project, you're introducing risk.

These are the answers we thought fit best!

Did you get different answers? That's okay! For this exercise, a good case can be made for almost any of the constraints. Don't worry about which answer is "right" for now—it's more important to get some practice thinking about projects in terms of constraints. And when you get to the actual exam questions, there will always be a clear, correct, BEST answer.

## there are no Dumb Questions

**Q:** I've heard project constraints referred to as the "triple constraint." But there are six of them here. What gives?

**A:** Some project managers focus on cost, scope, and time as the main constraints of a project. But just thinking about those three constraints doesn't give a clear picture of all of the constraints you need to account for when planning a project. The important thing here is to understand that cost, time, scope, quality, risk, and resources are all related to each other. You need to pay attention to all of them and if you manage your project in favor of one of them, it will affect the others.

**Q:** I've heard of an old saying: "Faster, cheaper, better—pick two," but doesn't that mean that there are only two constraints that you can manage at any given time?

**A:** No, that's an old (and somewhat cynical) project management saying. When a project manager says it to a customer or stakeholder, what he is saying is that there's no way to reduce cost, shorten the schedule, and increase quality all at the same time. At least one of those things absolutely has to give...but the saying is a little disingenuous! We already know that all six of the constraints are related to each other, and there's almost never an easy, obvious trade-off where you can sacrifice one to improve the others.

**Q:** What if I know that a change will impact just scope, but not schedule or cost or any of the other constraints? Can I go ahead and make it?

**A:** Whenever you are making a change that affects the project constraints, you need to be sure that the change is acceptable to **your stakeholders**. They're the people who will be impacted by your project. The term applies to your team, your customer, your sponsor, and anybody else who is affected by the change.

A lot of project management is about evaluating what a change is going to do to your project constraints, and using that impact analysis to help stakeholders make choices about what to do when changes come up. Sometimes a change that affects the quality of your product is completely unacceptable to your stakeholders, and they would rather delay the project than sacrifice the product's quality.

**Q:** In my organization, we have some projects that sound like they're functional and some that are fully projectized. Where does that kind of organization fit in?

**A:** Sometimes a company that mostly runs its projects in a functional way will create a special team that gives the project manager more authority. When a company manages using many different types of organizational structure, it's called a **composite organization**.

**Q:** Wait, this is a little confusing. What's the difference between a composite organization and a hybrid one?

**A:** A **composite organization** is made up of multiple organizational structures. A **hybrid organization** takes practices from multiple types of lifecycles and creates its own approach to doing work. An example of a composite organization might be one where the organization is mostly functional but creates a project team where the project manager has authority in order to accomplish a temporary result. A hybrid organization, on the other hand, is one where the teams might be using predictive processes where they identify scope and deadlines up front for projects, but then put incremental delivery goals into the process so that they can get fast feedback from customers on unfinished products. Think of hybrid organizations as using a mix of traditional and agile development techniques and composite organizations as a mix of functional and cross-functional project teams.

# A hybrid organization uses a mix of traditional and agile development practices.



Here are a couple of scenarios where a PMO is taking action on a project. Tell us whether the PMO approach is supportive, controlling, or directive.

**Scenario #1:** As each project kicks off, members of the team sit down with a PMO member to talk about the approach they'll take to do the work. The PMO member gives them some copies of good examples of project schedules and scope documents and then walks them through some blank templates so they'll know how to fill them out when they've completed their planning activities.

Supportive     Controlling     Directive

The PMO is there to give the team help if they need it, but they aren't telling them exactly what to do.

**Scenario #2:** As each project kicks off, a member of the PMO is assigned to lead the project and make sure that the team approaches their work in the way the PMO would want. The PMO member makes sure that the correct templates are used and that the PMO is consulted as decision points arise throughout the project.

Supportive     Controlling     Directive

The PMO is actually running the project here and not just giving the team guidance.



Can you think of examples of problems where a controlling PMO would help an organization get better at delivering products?

## Don't reinvent the wheel

Your organization is constantly learning from each project. As teams learn new lessons, they are recorded our in your **organizational process assets** so they can be shared and help future teams to avoid mistakes that have been made in the past. If all of the project teams are thinking about the best way to work and keeping track of the practices that help them deliver products better and the ones that don't, they can help future teams to keep improving the process new projects will use.

### Organizational process assets

#### Process

The way your organization does its work.

#### Policies

The rules your organization follows when it works on a project.



#### Procedures

The practical guides that describe the steps each team will follow when they do work. These include:

- Templates
- Vendor/supplier lists
- Change control guidance
- Financial control guidance
- Estimation methods

#### Knowledge repositories

The records of past projects that the organization has done. Here you'll find all of the lessons learned from past teams. This is where the teams record their project metrics, past schedules, key takeaways, financial data, descriptions of configuration management, and other documentation that will be of use to others in the organization.

## You can't manage your project in a vacuum

Even the best project managers can't control everything that affects their projects. The way your company is set up, the way people are managed, the processes your team needs to follow to do their jobs...they all can have a big impact on how you manage your project. On the exam, all of those things are called **enterprise environmental factors**.

It's easy to fall into the trap of thinking that these factors only apply to big companies. In fact, they apply to all organizations of all sizes and types...and you need to understand them about *YOUR* company if you want your projects to be successful! Your company's culture is one of its most important enterprise environmental factors.

### Enterprise environmental factors



#### People

The skills and organizational culture where you work.

#### Risk tolerance

Some companies are highly tolerant of risk and some are really risk-averse.

#### Market

The way your company is performing in the market can affect the way you manage your project.

#### Standards

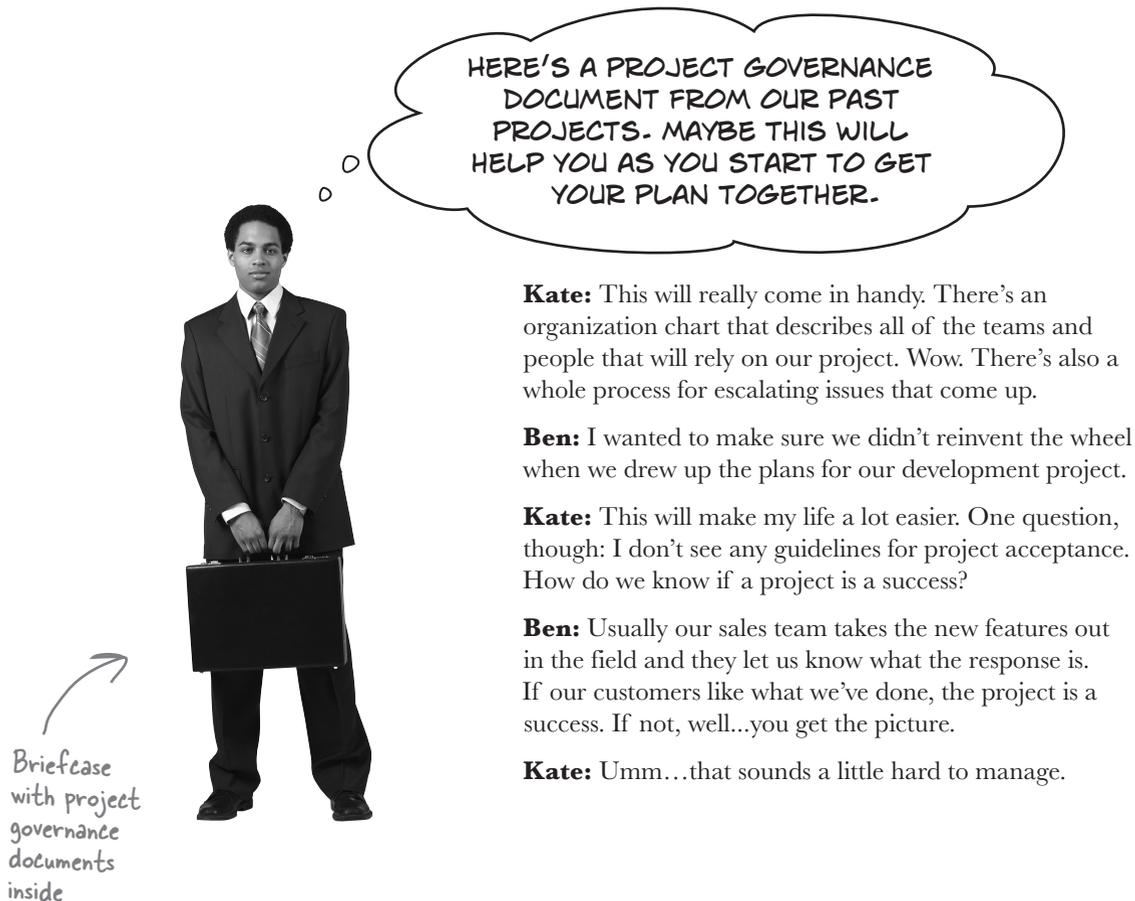
Some companies depend on government standards to run their business and when they change, it can have a big impact.

#### Databases

Where your company stores its data can make a big difference in the decisions you make on your project.

Projects will often face **external** enterprise environmental factors, like compliance with government regulations. This is especially common for projects in regulated industries like banking and health care.

## Kate's project needs to follow company processes



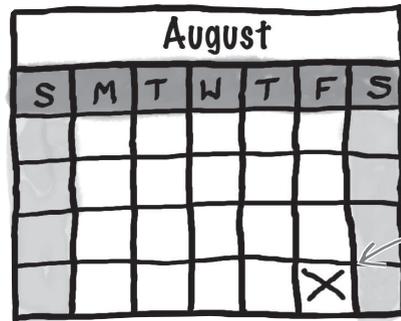
## Kate's project needs clear acceptance criteria

It's a lot harder for a project to be successful if the team doesn't have a clear goal in mind. Kate's project needs to follow all of the company governance guidelines, but she also needs to write down the goal her team is shooting for. That way, it will be clear that the project has met its goals when it completes. Most projects aim to finish within the constraints we talked about earlier (time, cost, resources, quality, risk, and scope). It helps to write down concrete goals for those constraints as acceptance criteria up front. That way, there are no surprises when the project ends.

## Kate makes some changes...

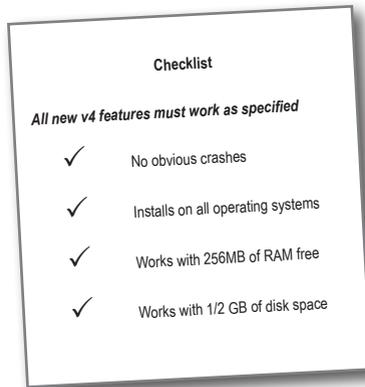
- 1 She divides maintenance into releases, each with a well-defined start *and* finish.

...and once Ben saw that Kate's careful planning made the project go faster, not slower, he stopped being a negative stakeholder and started being a project advocate!



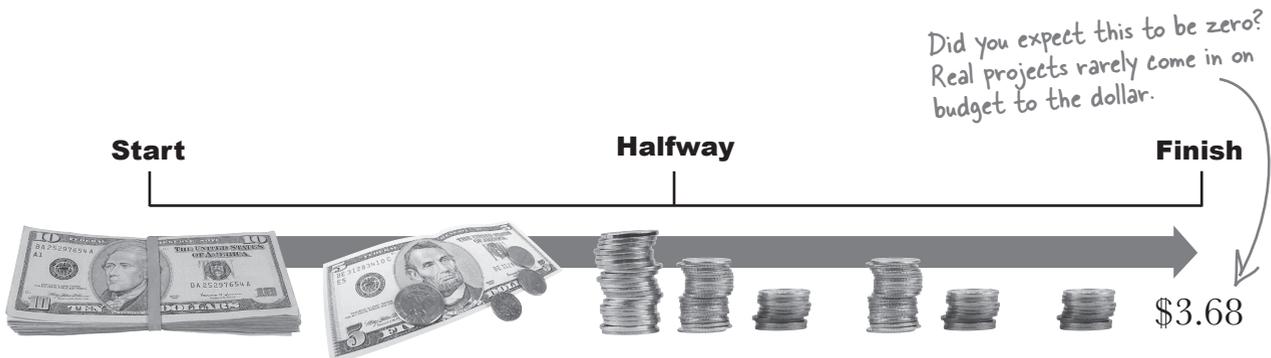
One BIG release

- 2 She follows the company's project governance guidelines and works with stakeholders to set scope goals that each release must meet.



All these acceptance criteria must be completed before the project can end.

- 3 She manages the budget for each release and keeps the costs contained.



## **...and her project is a success!**

Now the company knows when its products will be done, how much they will cost, and that the products will satisfy its customers...



## **...and that earns Kate and Ben big bonuses!**



Kate spilled a hot cup of Starbuzz half-caf nonfat latte on her job-hunting checklist. Can you match the notes she scribbled at the bottom of the page to what's covered up by coffee stains?

### Job Hunting Checklist

- I should have authority over my projects
- I am allowed to assign work to people on my project team
- I am in control of my project's budget
- I focus on managing projects, not irrelevant tasks
- I shouldn't spend my whole day filing stuff
- I can assign work to my project team without having to clear it with their bosses.



## Organization Magnets Solutions

In a functional organization, which is what Kate works in, project managers don't have the authority to make major decisions on projects. Projectized organizations give all of the authority to the PM.

Can you work out which description goes with which organization type?

In this kind of company, the team reports to the project manager, who has a lot more authority.

In a functional organization, the teams working on the project don't report directly to the PM. Instead, the teams are in departments, and the project manager needs to "borrow" them for the project.

### Functional organization

1. Project managers need to clear major decisions with department managers.
2. PMs don't set the budget.
3. PMs spend half their time doing admin tasks.

### Projectized organization

1. Teams are organized around projects.
2. Project managers choose the team members, and release them when the project is over.
3. Project managers estimate and track budget and schedule.

## Exam Questions

1. Which of the following is NOT a project constraint?

- A. Quality
- B. Scale
- C. Time
- D. Cost

2. A project manager is running a data center installation project. He finds that his stakeholder is angry that he's run over his budget because the staff turned out to be more expensive than planned. The stakeholder's unhappy that when the project is over, the servers won't have as much drive space as he needs. Which of the following constraints was not affected by this problem?

- A. Quality
- B. Resources
- C. Time
- D. Cost

3. Which of the following is NOT an example of operational work?

- A. Building a purchase order system for accounts payable
- B. Submitting weekly purchase orders through a purchase order system
- C. Deploying weekly antivirus software updates
- D. Yearly staff performance evaluations

4. You're managing a project to build a new accounting system. One of the accountants in another department really likes the current system and is refusing to be trained on the new one. What is the BEST way to handle this situation?

- A. Refuse to work with him because he's being difficult
- B. Appeal to the accountant's manager and ask to have him required to take training
- C. Get a special dispensation so that the accountant doesn't have to go to the training
- D. Work with him to understand his concerns and do what you can to help alleviate them without compromising your project

5. Which of the following is used for identifying people who are impacted by the project?

- A. Resource list
- B. Stakeholder register
- C. Enterprise environmental factors
- D. Project plan

## Exam Questions

6. Your manager asks you where to find a list of projects that should be managed together. What is the BEST place to find this information?

- A. Project plan
- B. Project charter
- C. Portfolio charter
- D. Program charter

7. You want to know specifically which business goal a group of projects and programs is going to accomplish. Which is the BEST place to look for this information?

- A. Project plan
- B. Project charter
- C. Portfolio charter
- D. Program charter

8. A project coordinator is having trouble securing programmers for her project. Every time she asks her boss to give a resource to the project he says that they are too busy to help out with her project. Which type of organization is she working in?

- A. Functional
- B. Weak matrix
- C. Strong matrix
- D. Projectized

9. A project manager is having trouble getting customer feedback on her project. Even though she knows the product won't be complete for several months, the company guidelines say she should release an early version and get feedback from end users. Which type of organization is she working for?

- A. Functional
- B. Virtual
- C. Hybrid
- D. Projectized

10. The project manager for a construction project discovers that a new water line is being created in the neighborhood where he's managing a project. Government regulations require that a series of forms for city environmental changes need to be filled out before his team can continue work on the project. This is an example of:

- A. A portfolio
- B. A program
- C. An enterprise environmental factor
- D. A project

## Exam Questions

**1. Answer: B**

Scale is not a project constraint. The constraints are scope, time, cost, quality, resource, and risk.

**2. Answer: C**

There is no mention of the project being late or missing its deadlines in the example. The project was over budget, which affects the project's cost. The project won't meet the stakeholder's requirements, which is a quality problem. And the staff was more expensive than planned, which is another cost problem.

**3. Answer: A**

Building a purchase order system for accounts payable is a project. It's a temporary effort that has a unique result.

**4. Answer: D**

When a stakeholder is negatively impacted by your project, you need to manage his expectations and help him to buy into your project.

**5. Answer: B**

The stakeholder register is where you identify all of the people who are impacted by your project.

**6. Answer: D**

A program is a group of projects that should be managed together because of interdependencies. A program charter fits the description in this question.

← Usually there's some benefit to the company by managing them together.

**7. Answer: C**

A portfolio charter will give the business goal that a group of projects and programs will accomplish as part of a portfolio.

Answers

## Exam Questions

### 8. Answer: A

Since the project manager has to ask permission from the functional manager and can't overrule him, she's working in a functional organization.

### 9. Answer: C

The project manager in this scenario is working for a hybrid organization. She used predictive methods to understand that her project won't be completed for several months and is about to use adaptive methods to get early feedback on the unfinished product.

### 10. Answer: C

Since the project manager is filling out the forms because of a government regulation, this is a good example of an enterprise environmental factor—specifically, an external enterprise environmental factor.



### 3 The process framework and the project manager's role

## *It all fits together*

THESE PLANE PARTS  
FIT TOGETHER....JUST  
LIKE THE KNOWLEDGE  
AREAS AND PROCESS  
GROUPS!



**All of the work you do on a project is made up of processes.**

Once you know how all the processes in your project fit together, it's easy to remember everything you need to know for the PMP exam. **There's a pattern** to all of the work that gets done on your project. First you plan it, and then you get to work. While you are doing the work, you are always comparing your project to your original plan. When things start to get off-plan, it's your job to make corrections and put everything back on track. And the **process framework**—the **process groups** and **knowledge areas**—is the key to all of this happening smoothly.

## Cooking up a project

When you cook something from a recipe for the first time, there are certain steps you always follow:

- 1 First, figure out what you're going to make.

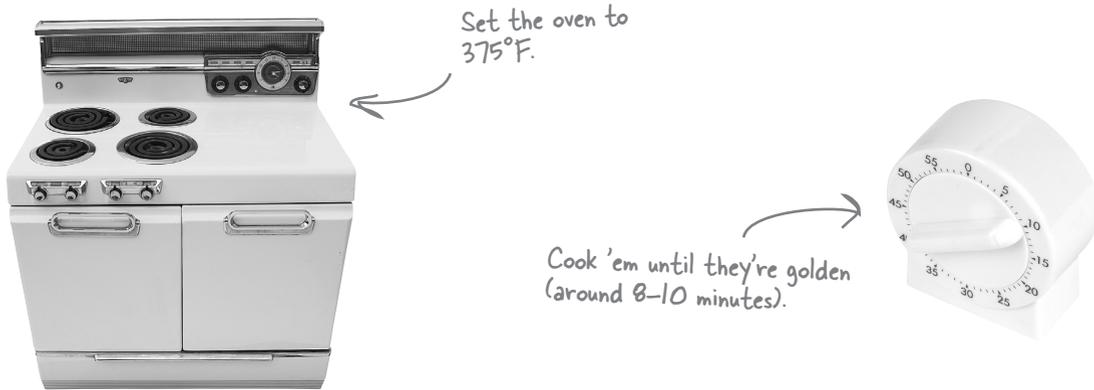


- 2 Then make all your plans.

Make a shopping list of everything you need.



**3** Next, it's time to start cooking!



**4** Finally, you can give the cookies to a loved one.



## Projects are like recipes

All projects, no matter how big or small, break down into process groups. **Process groups** are like the steps you use when following a recipe.

### Needs

---



This is where you figure out what it is you need: a huge product, or maybe just some homemade cookies.



### Initiating process group



Then you initiate your project—researching and deciding what you're going to build to fulfill the project's needs.

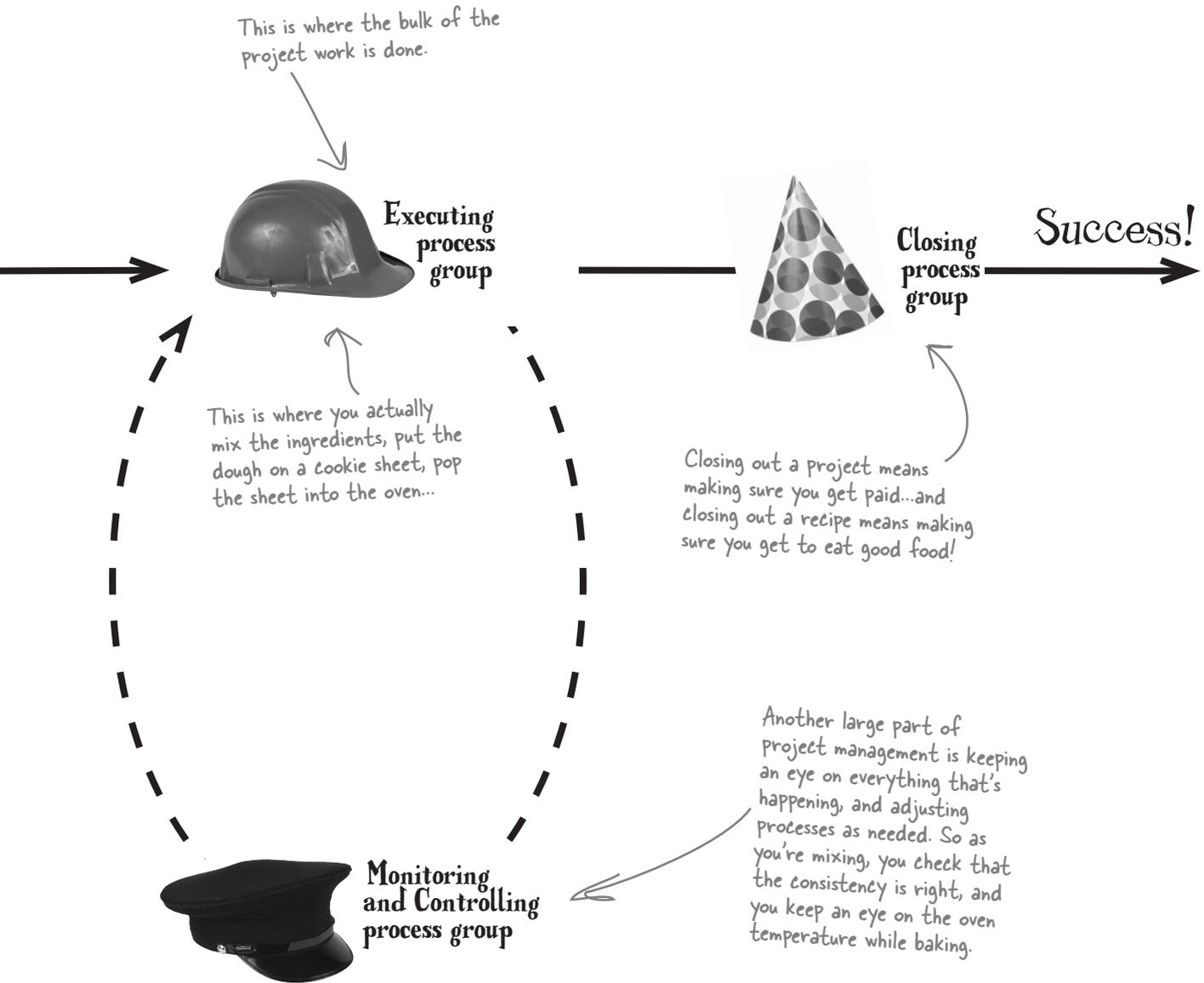


### Planning process group

---



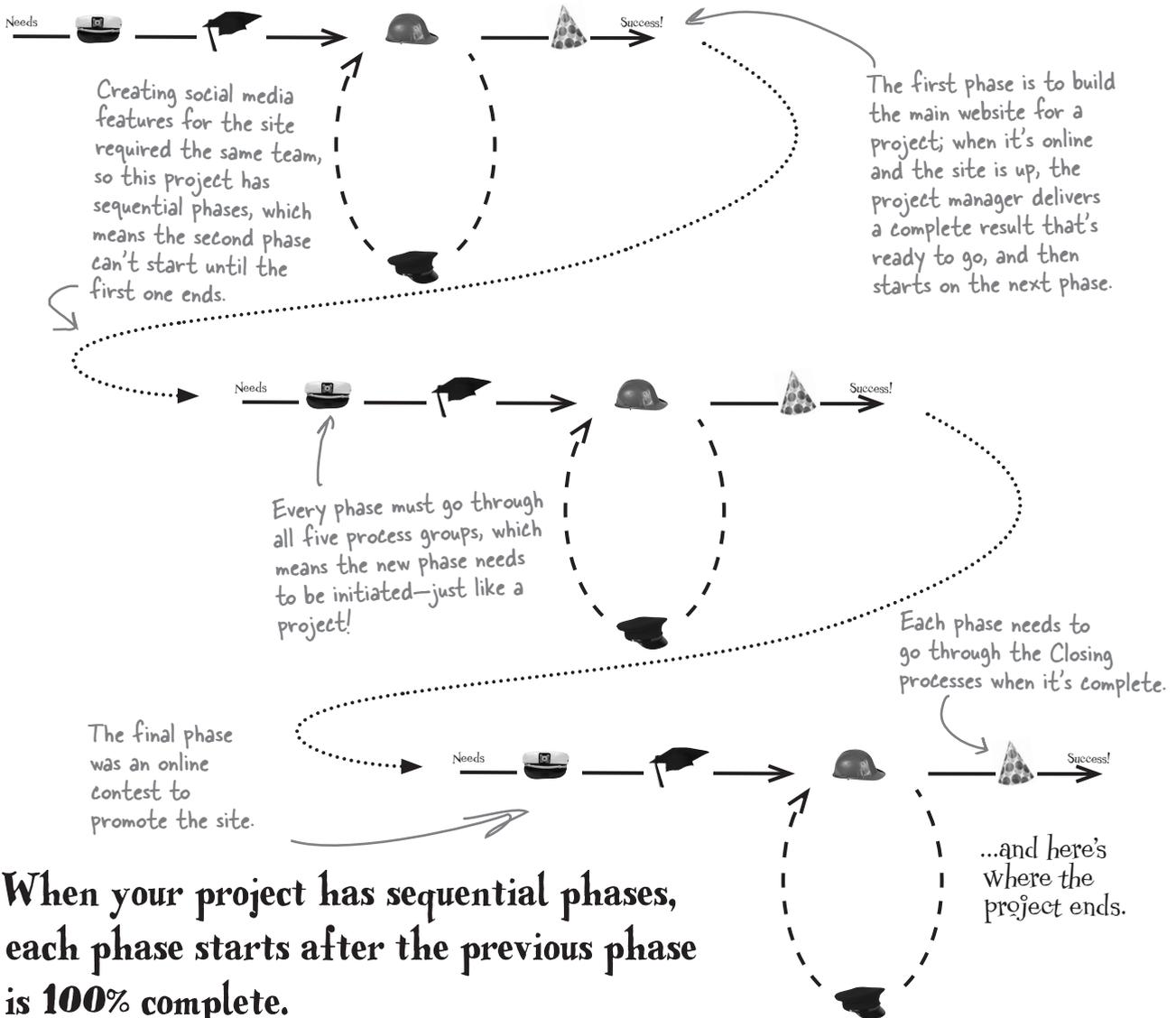
Next, you determine what "ingredients" you already have and which ones you still need. You'll figure out where to get those missing resources, and think about what they'll cost.



## If your project's really big, you can manage it in phases

A lot of project managers manage projects that are big or complex, or simply need to be done in stages because of external constraints, and that's when it's useful to approach your project in **phases**. Each phase of the project *goes through all five process groups*, all the way from Initiating to Closing. The end of a phase is typically a natural point where you want to assess the work that's been done so that you can hand it off to the next phase. When your project has phases that happen one after another and don't overlap, that's called a **sequential relationship** between the phases.

You're managing a large web development project...

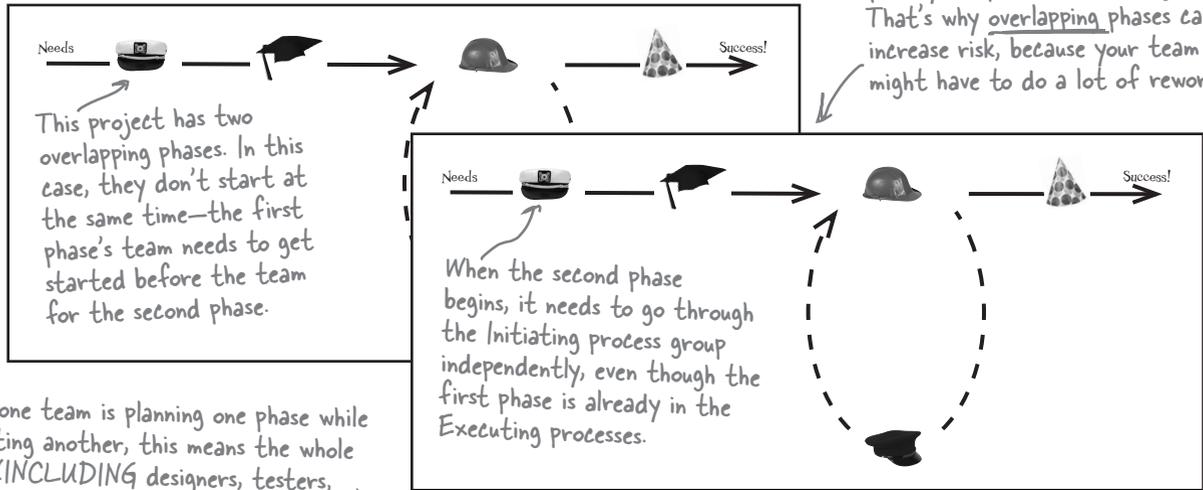


**When your project has sequential phases, each phase starts after the previous phase is 100% complete.**

## Phases can also overlap

Sometimes you need teams to work independently on different parts of the project, so that one team delivers their results while another team is still working. That's when you'll make sure that your phases have an **overlapping relationship**. But even though the phases overlap, and may not even start at the same time, they still need to go through all five process groups.

The project's first phase is set to deliver while the second is still executing... but for some projects you might have an overlapping phase that ends before the previous phase. As a result, overlapping phases can get pretty complicated to manage! That's why overlapping phases can increase risk, because your team might have to do a lot of rework.



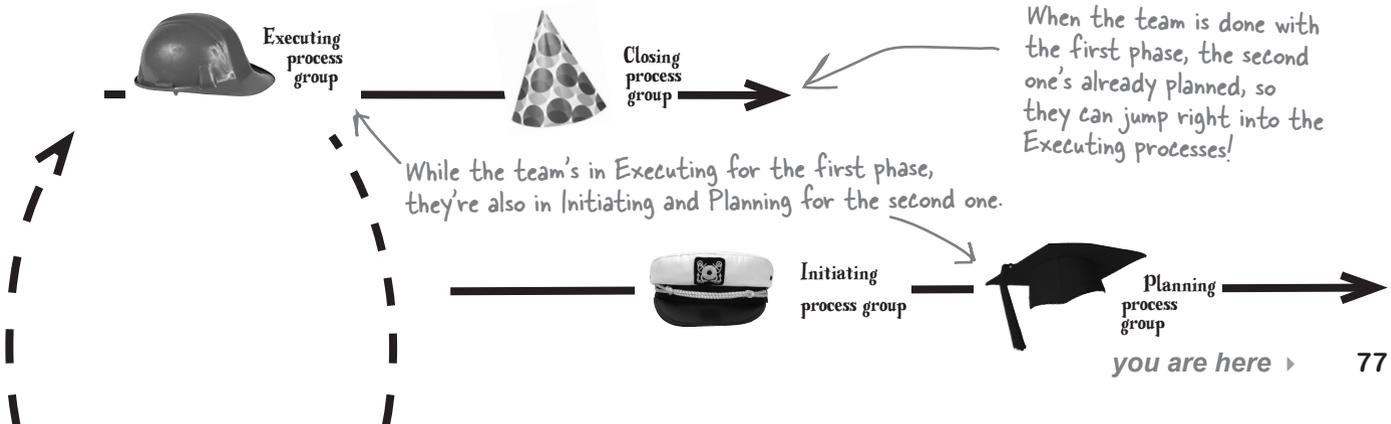
Since one team is planning one phase while executing another, this means the whole team (INCLUDING designers, testers, etc.) is usually working at the same time.

## Iteration means executing one phase while planning the next

There's a third approach to phased projects that's partway between sequential and overlapping. When your phases have an **iterative relationship**, it means that you've got a single team that's performing the Initiating and Planning processes for one phase of the project while also doing the Executing processes for the previous phase. That way, when the processes in the Executing and Closing process groups are finished, the team can jump straight into the next phase's Executing processes.

Iteration is a really effective way to run certain kinds of software projects. **Agile software development** is an approach to managing and running software projects that's based on the idea of iterative phases.

This is a really good way to deal with an environment that's very uncertain, or where there's a lot of rapid change. Does this sound like any of the projects you've worked on?



## Break it down

Within each process group are several individual **processes**, which is how you actually do the work on your project. The *PMBOK® Guide* breaks every project down into 49 processes—that sounds like a lot to know, but don't start looking for the panic button! In your day-to-day working life, you actually use most of them already...and by the time you've worked your way through this book, you'll know all of them.



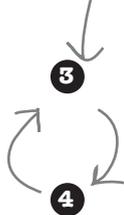
### Taking a vacation is simple, even though there are several steps.

Forty-nine processes might seem like a lot to remember, but once you've been using them for a while, they'll be second nature—just like all the things you do without thinking when you go on a trip.

Stuff you do when you take a vacation

- 1 Figure out how much time you have off, how much money you can spend, and where you want to go.
- 2 Find your flights and hotel information and put together an itinerary using a travel website.
- 3 Book your flight, hop on the plane, stay in the hotel, see the sights. Enjoy yourself.
- 4 Make sure you get the seat you want on the plane, your hotel room is clean, and the sightseeing tours are worth your money. If not, complain, correct any problems that come up, and try to get better service.
- 5 Come home, pay all the bills, and write up your reviews of the trip for the hotel feedback website.

Simultaneous



The PMBOK® Guide processes that those steps correspond to

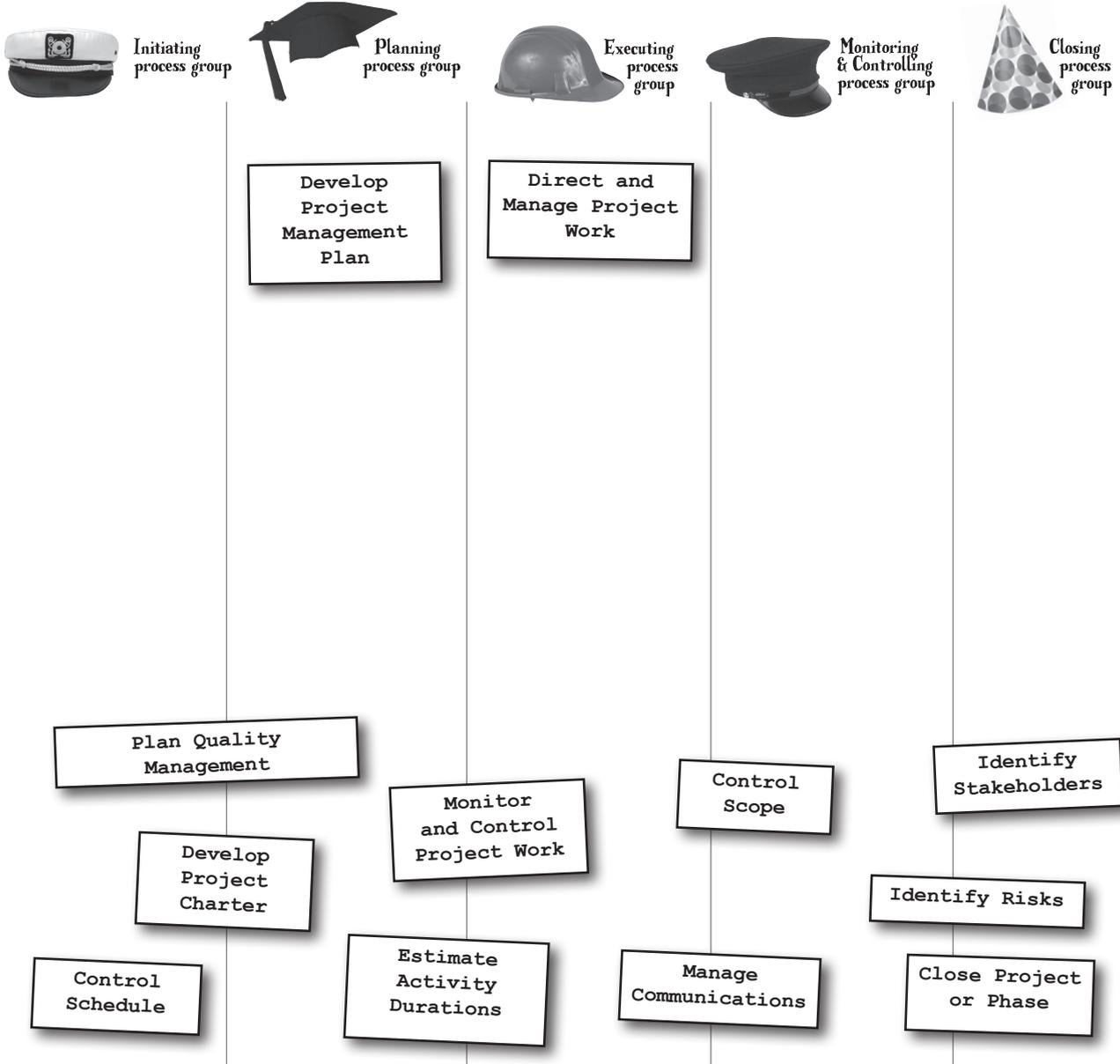
- 1 Develop Project Charter.
- 2 Develop Project Management Plan.
- 3 Direct and Manage Project Work.
- 4 Monitor and Control Project Work.
- 5 Close Project.

Don't worry about memorizing these process names now... you'll see a lot more of each of them throughout the book.



## Process Magnets

Below are several of the 49 processes. Try to guess which process group each process belongs to just from the name. We've done the first two for you.





# Process Magnets

Below are several of the 49 processes. Try to guess which process group each process belongs to just from the name!



Initiating process group



Planning process group



Executing process group



Monitoring & Controlling process group



Closing process group

Develop Project Charter

Identify Stakeholders

There are only two processes in the entire Initiating process group!

Develop Project Management Plan

Estimate Activity Durations

Identify Risks

Plan Quality Management

Direct and Manage Project Work

Manage Communications

This one was a little tricky, but if you keep in mind that the Executing process is where you do your work, it makes more sense.

Control Scope

Monitor and Control Project Work

Control Schedule

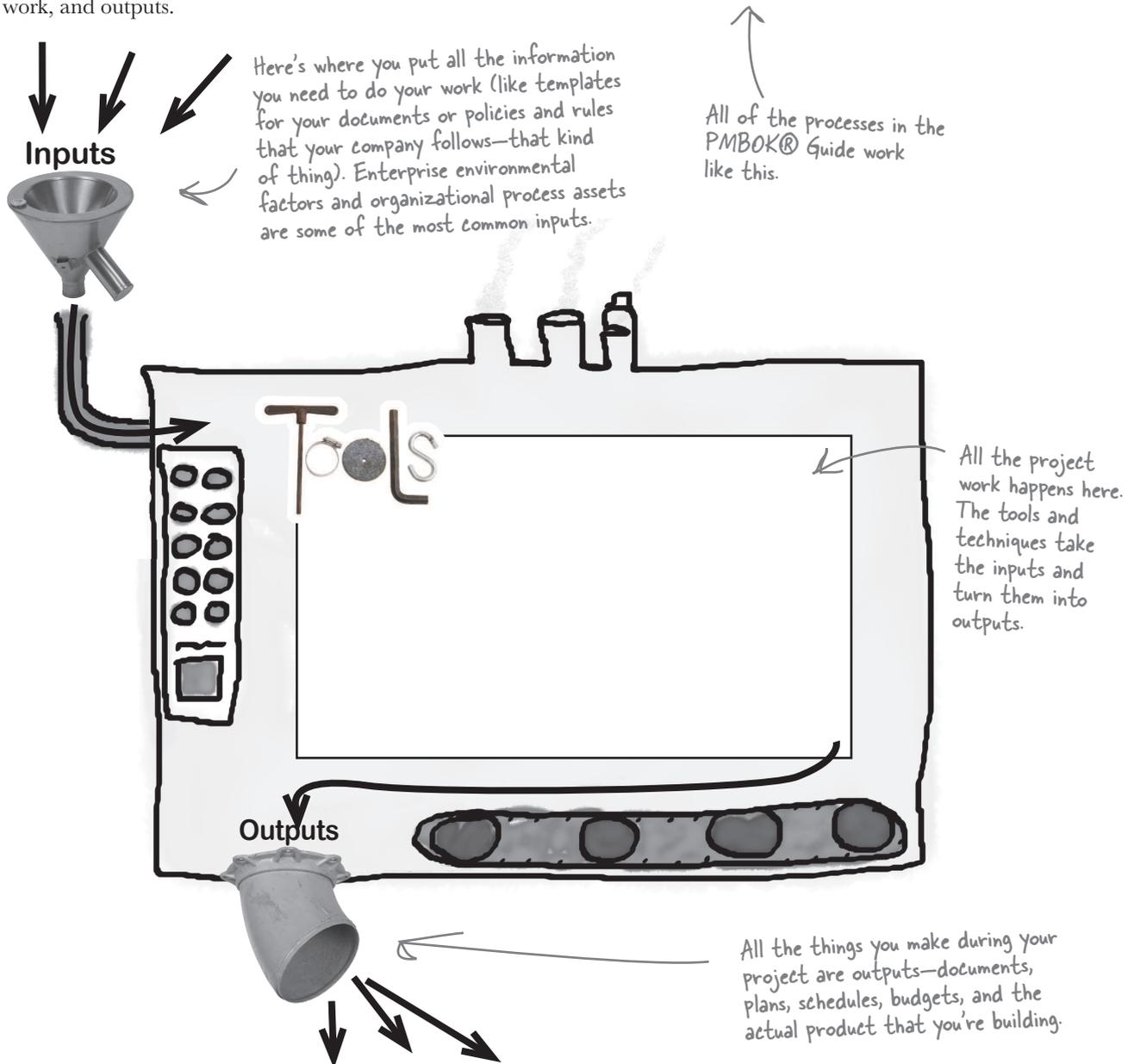
When a process starts with "control," it's part of the Monitoring and Controlling group.

Close Project or Phase

Some of these exercises are hard—and it's OK to get some answers wrong! Making mistakes actually helps you remember.

## Anatomy of a process

You can think of each process as a little machine. It takes the **inputs**—information you use in your project—and turns them into **outputs**: documents, deliverables, and decisions. The outputs help your project come in on time, within budget, and with high quality. Every single process has inputs, **tools and techniques** that are used to do the work, and outputs.



## Sharpen your pencil



Think of the vacation we talked about on page 78 as a project, and each of its steps as a process. Here are some inputs, tools, and outputs that could be used in each of the vacation steps. Can you look at each of the underlined words and figure out if the words represent an input, tool, or output? (Here's a hint: some of them are an output from one process and an input for another.)

Look at each of these underlined terms, and figure out if it's an input, output, and/or tool.

1. You log in and check your company's vacation calendar to see how much vacation time you have for your trip.  
 Input       Tool       Output
2. You create an itinerary on a travel website. You'll use the itinerary when you board your flight.  
 Input       Tool       Output
3. You have some hotel reservation documents you created on the travel website, too. You'll use those when you check in to your hotel.  
 Input       Tool       Output
4. You use a travel website to book the plane, hotel, and sights you'll see on your trip.  
 Input       Tool       Output
5. You verify your bank account balance to make sure you have enough money to pay for everything.  
 Input       Tool       Output
6. You use a hotel feedback website to review your stay in the hotel once you get back home.  
 Input       Tool       Output

—————> **Answers on page 100.**



OK, I UNDERSTAND HOW THIS WORKS FOR VACATIONS AND COOKIES, BUT 49 PROCESSES ON EVERY PROJECT? YOU'VE GOT TO BE KIDDING ME...

**These processes are meant to work on any type of project.**

The processes are there to help you organize how you do things. But they have to work on small, medium, and large projects. Sometimes that means a lot of processes—but it also ensures that what you're learning here will work on all your projects.

Keep your eyes out for discussion of "tailoring" later in the book, where we'll go into more detail about this topic.

---

there are no  
**Dumb Questions**

---

**Q:** Can a process be part of more than one process group?

**A:** No, each process belongs to only one process group. The best way to figure out which group a process belongs to is to remember what that process does. If the process is about defining high-level goals of the project, it's in Initiating. If it's about planning the work, it's in Planning. If you are actually doing the work, it's in Executing. If you're tracking the work and finding problems, it's in Monitoring and Controlling. And if you're finishing stuff off after you've delivered the product, that's Closing.

**Q:** Do you do all of the processes in every project?

**A:** Not always. Some of the processes apply only to projectized organizations or subcontracted work, so if your company doesn't do that kind of thing, then you won't need those processes. But if you want to make your projects come out well, then it *really does make sense* to use the processes. Even a small project can benefit from your taking the time to plan out the way you'll handle all of the knowledge areas. If you do your homework and pay attention to all of the processes, you can avoid most of the big problems that cause projects to run into trouble!

**Q:** Can you use the same input in more than one process?

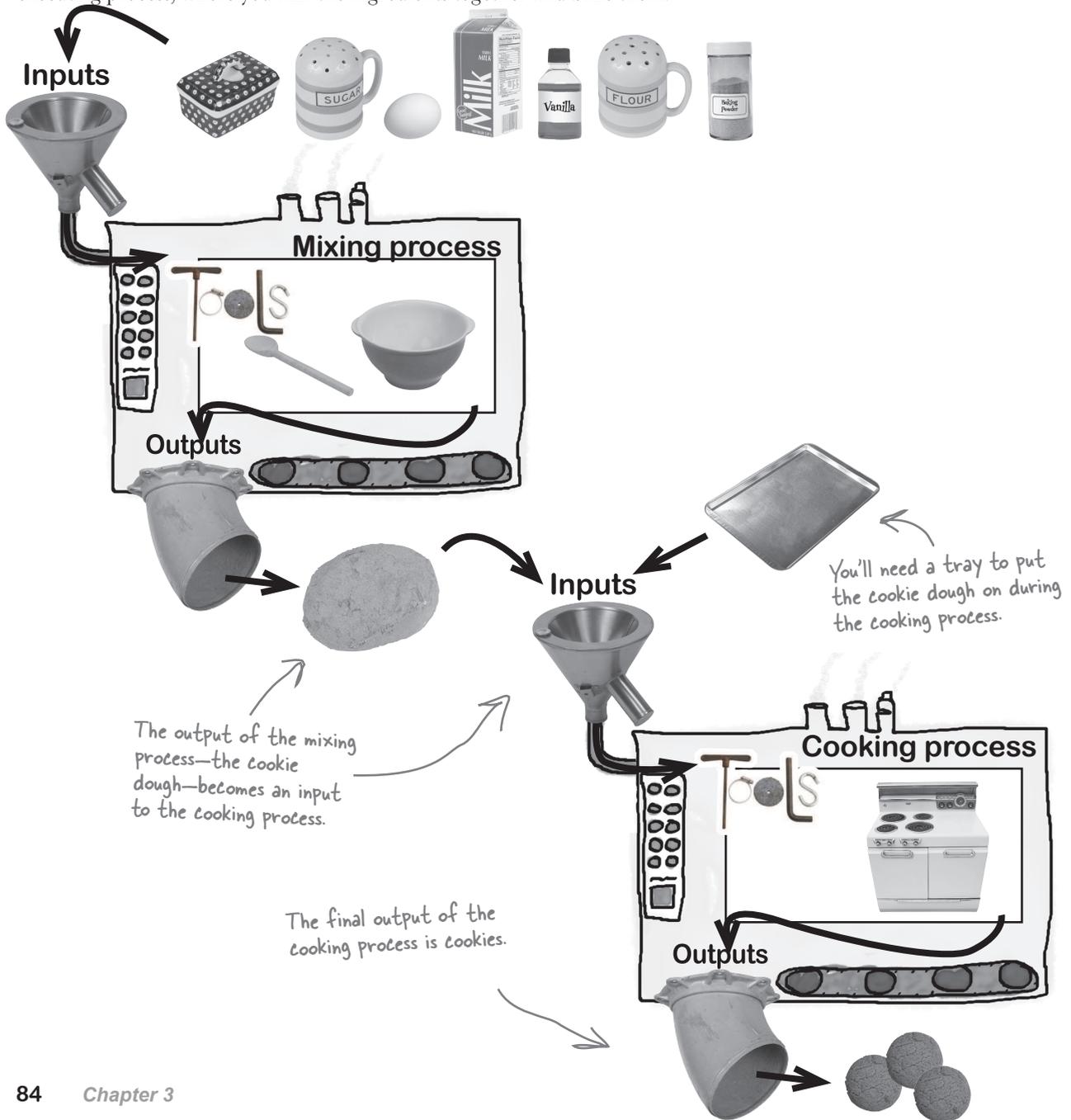
**A:** Yes. There are a lot of inputs that show up in multiple processes. For example, think about a schedule that you'd make for your project. You'll need to use that schedule to build a budget, but also to do the work! So that schedule is an input to at least two processes. That's why it's really important that you *write down* exactly how you use each process, so you know what its inputs and outputs are.

Your company should have records of all of these process documents, and the stuff the PMs learned from doing their projects. We call these things "organizational process assets," and you'll see a lot of them in the next chapter.

outputs can also be inputs

## Combine processes to complete your project

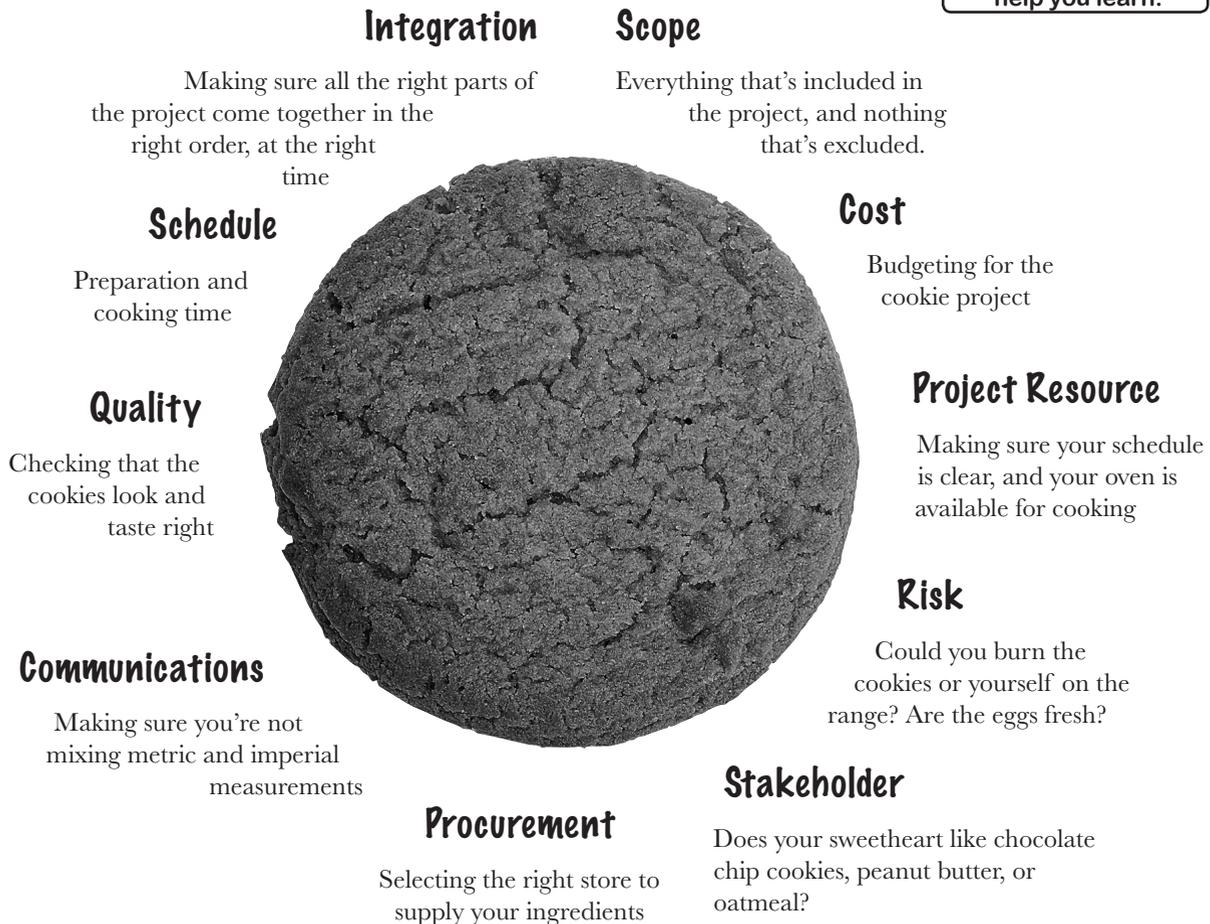
Sometimes the output of one process becomes an input of the next process. In the cookie project, the raw ingredients from the store are the outputs of the planning process, but they become the inputs for the executing process, where you mix the ingredients together and bake them:

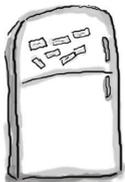


## Knowledge areas organize the processes

The **process groups** help you organize the processes by the *kind of work* you do. The **knowledge areas** help you organize by the *subject matter* you're dealing with. The following 10 elements of the cookie process are the *PMBOK® Guide* knowledge areas.

The processes are organized in two ways—the process groups are about how you do the work, and the knowledge areas are there to help you categorize them and help you learn.





## Knowledge Area Magnets

Match each of the 10 knowledge area magnets to each description. We've filled in a couple for you. (In the print editions of this book, this exercise—and several others—stretch across two pages.)

Schedule  
Management

Coordinating all of the work so that it happens correctly. Making sure changes are approved before they happen.

Figuring out what work needs to be done for your project. Making sure your end product has everything you said it would.

Figuring out how long it will take to do your work and the order you need to do it in. Tracking your schedule and making sure everything gets done on time.

Knowing how much you're able to invest in the project and making sure you spend it right.

Making sure you work as efficiently as you can and don't add defects into the product.

Risk  
Management

Procurement  
Management

Resource  
Management

Quality  
Management

**Communications Management**

Getting the people to work on the team and helping them stay motivated. Rewarding them for a job well done and resolving conflicts that come up.

Making sure that everybody knows what they need to know to do their job right. Tracking how people talk to each other and dealing with misunderstandings or miscommunications if they happen.

Figuring out how to protect your project from anything that could happen to it. Dealing with the unexpected when it does happen.

Finding contractors to help you do the work. Setting the ground rules for their relationships with your company.

Identifying the group of people who might have an impact on your project or who your project will affect. Understanding what they need and making sure your project delivers it.

**Scope Management**

**Integration Management**

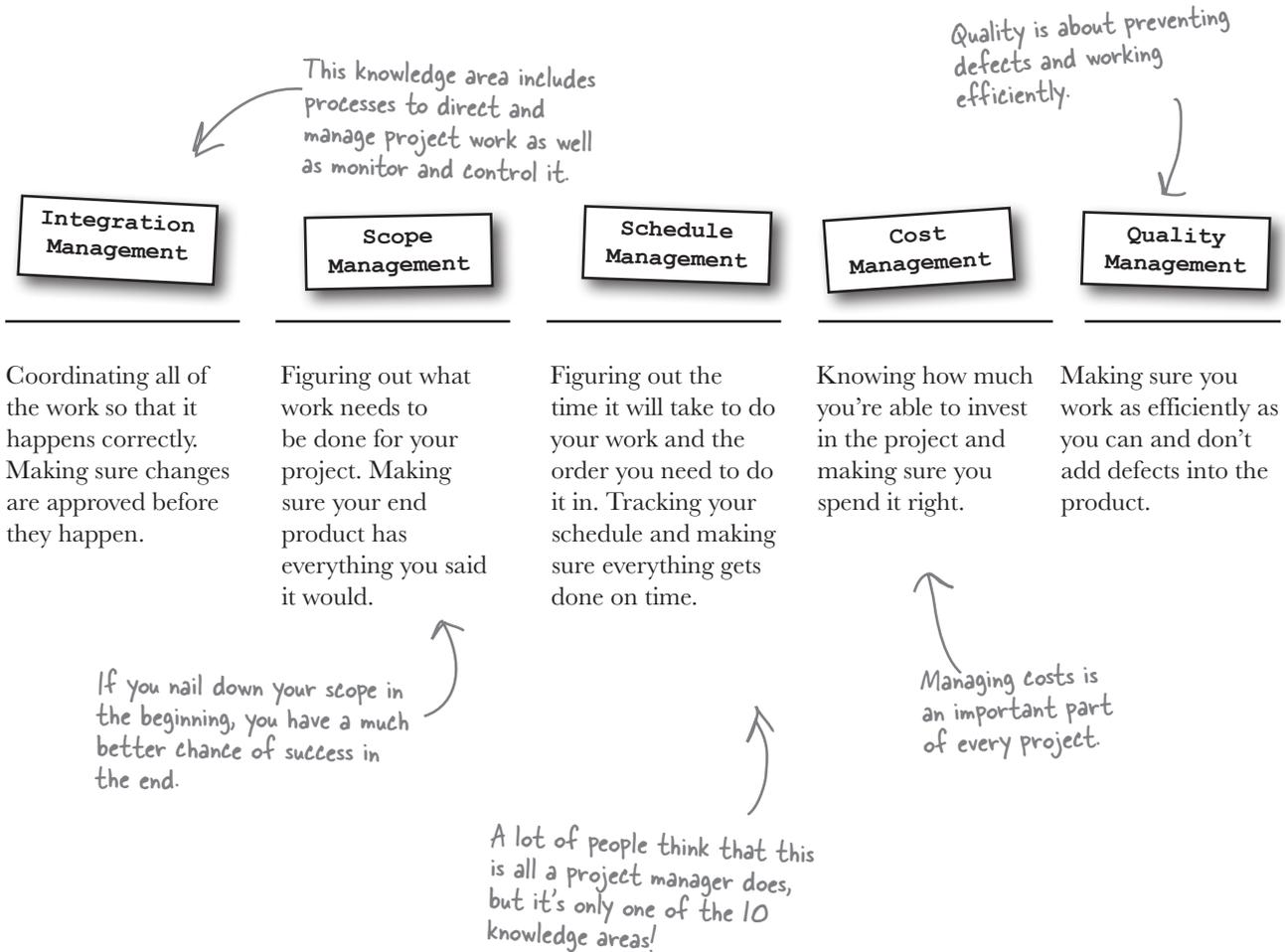
**Stakeholder Management**

**Cost Management**



# Knowledge Area Magnets Solutions

Match the knowledge areas to each description.



Since the PMBOK® Guide covers projectized organizations, it talks about actually acquiring your team as a process, too. People in most organizations don't get a chance to do that. The team is often determined by the time you get assigned to it.

This one is another area that a lot of PMs don't have much experience with. It's all about selecting suppliers, contractors, and vendors, and setting up contracts with them.



Getting the people to work on the team and helping them stay motivated. Rewarding them for a job well done and resolving conflicts that come up.

Making sure that everybody knows what they need to know to do their job right. Tracking how people talk to each other and dealing with misunderstandings or miscommunications if they happen.

Figuring out how to protect your project from anything that could happen to it. Dealing with the unexpected when it does happen.

Finding contractors to help you do the work. Setting the ground rules for their relationships with your company.

Identifying the group of people who might have an impact on your project or who your project will affect. Understanding what they need and making sure your project delivers it.

Communication is a really important part of the project manager's job.

Risk Management can also be about making sure that you are in the right position to take advantage of the opportunities that come your way.

Once you know who your stakeholders are, you can keep a constant check on how well your project is meeting their expectations.



Watch it!

**Even though all of these knowledge areas are important throughout your project, the PMBOK® Guide covers them in the order above.**

*All of the knowledge areas are used throughout every project to keep your project on track.*

## The project manager's role

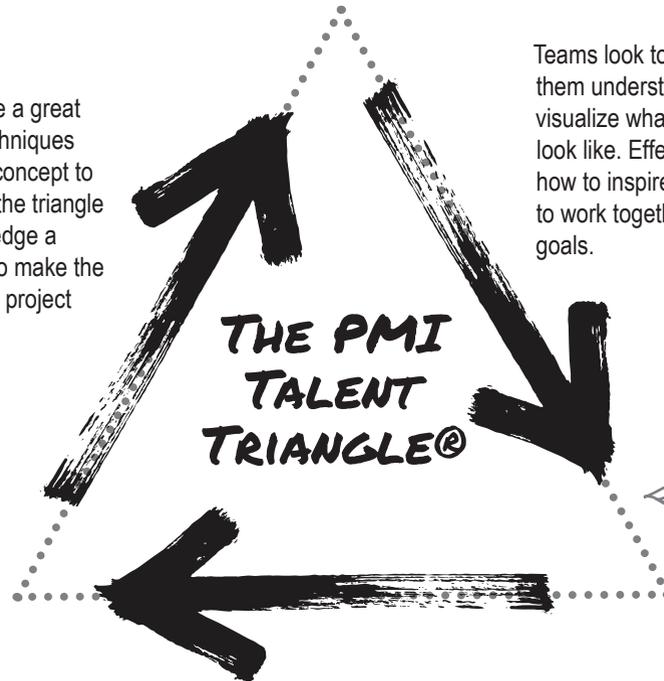
Just like a cook uses a recipe, a project manager has to keep the big picture in mind and use all of the processes and knowledge areas to achieve a goal. But just understanding the process framework that will make your project successful isn't enough. There are three major aspects to any project manager's role, and all of them are equally important to a successful project. These three components make up the **PMI Talent Triangle®**.

### Technical Project Management

Effective project managers have a great grasp on all of the tools and techniques that guide a project from initial concept to finished project. This aspect of the triangle is all about the technical knowledge a project manager needs to use to make the right decisions when directing a project team's work.

### Leadership

Teams look to project managers to help them understand the project's goals and visualize what a successful outcome will look like. Effective project managers know how to inspire the teams they work with to work together to accomplish strategic goals.



### Strategic and Business Management

Keeping a project on track means understanding the strategic purpose behind it. Successful project managers know how to interpret the environment of the organizations they work in and how to navigate that organization and position their projects for success. They constantly keep tabs on the project's direction and make sure that it's delivering as much value as possible for the organization that's sponsoring it.

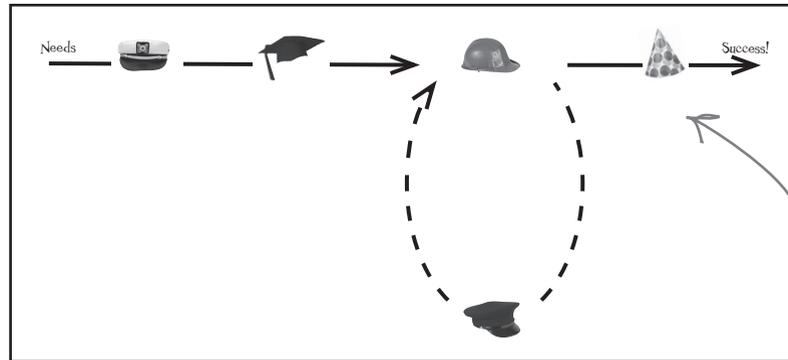
All three aspects of the PM role are related to each other. That's why it helps to think of them as a triangle.

This also ties into continuing education...which is important AFTER you pass your PMP certification exam!

**It's not enough to know processes you learn for the PMP exam. You've got to focus on leadership and strategic alignment to be a good PM!**

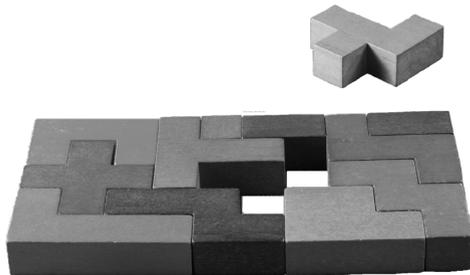
# Your technical skills make successful projects happen

Just taking a look at the *PMBOK® Guide* makes it clear that there's a lot to learn in the field of project management that can help you continuously improve your skills. Honing those skills will only help you and the project teams you work with to be more successful. But technical ability is just one part of a balanced project manager's tool set. The more you learn and improve your skills, the more aware you become of your leadership style and how your project strategically helps your organization deliver value.



Knowing the process groups, processes, and knowledge areas of the *PMBOK® Guide* will help you to develop your technical project management skills.

## How does your project fit in?



Good project managers understand the strategic goals their projects are working toward and make decisions to help keep their projects aligned. The better you understand the organization that's sponsoring your project, the more you'll be able to help your organization achieve those goals. In many cases, project teams work with a number of other teams across their organization to accomplish their work, and a good project manager has a high-level view of how all of those teams fit together and collaborate to deliver products. Maintaining this overall understanding of the sponsoring organization and its strategic goals is what the PMI Talent Triangle® calls **strategic and business management**.

The more technical skills a project manager has, the more knowledge he or she can use to keep the project on target to achieve strategic goals. Likewise, the more a project manager understands about the way an organization works and its strategic goals, the better he or she can use technical skills to get the job done.

# Leadership is different than management

Leaders inspire the teams they work with to do new and innovative things. They work with those teams to identify solutions to problems and support the team in thinking creatively. Leaders communicate the end goal and encourage their teams to find the best way to achieve it. On the other hand, managers try to control the variables that might lead to problems for their teams. Managers make decisions to maintain the team's course and guide them in a prescriptive way.

## Styles of leadership

Different styles of leadership will appeal to different teams and leaders. There are many factors that can influence which style of leadership a PM uses when working with a team, such as the organizational culture, the uncertainty of the problem the team is solving, and the interpersonal relationships on the team. Research on leadership has identified many different styles to choose from. Here are the six common leadership styles that are mentioned in the *PMBOK® Guide* because of their relevance to project management.

### Laissez faire

These leaders are “hands-off,” leaving most of the goal setting and daily leadership of the team to the team itself. They step in and make decisions only as a last resort.



### Transactional

Leaders who are transactional make goals explicit and then track progress toward completing them. When the team's actual progress deviates from the leader's plan, he or she will provide course correction.

### Charismatic

Charismatic leaders are inspiring because they hold strong convictions and have magnetic personalities. They use that inspiration to create a team culture that encourages innovation and aligns the team with those strongly held convictions and goals.



### Transformational

Like charismatic leaders, transformational leaders focus on inspiring their teams with idealized goals. But transformational leaders encourage their teams to change the environment around them. Transformational leaders work to motivate each team member to be creative and make change happen.

### Interactional

This type of leadership changes depending on the situation. Interactional leaders take whatever approach makes sense in the given situation.



### Servant leader

This type of leadership is most often discussed in relation to agile thinking and methods. Here, a leader focuses on serving the people on the team. By clearing roadblocks and helping team members get what they need to achieve the group's goal, the servant leader promotes better relationships on the team and creates a collaborative team culture.

## Project managers need to understand how power dynamics affect the team

The organization you work in has many different goals and agendas. To be a good project manager, you need to understand the goals and motivations of all of the stakeholders involved in your work. One useful tool for understanding the political playing field, and how decisions are being influenced around you, is to categorize the type of power your stakeholders are wielding.

### Types of power

It's clear that the CEO of your company has power over most of its employees just by virtue of the role he or she plays. There are many more subtle power relationships that develop in an organization that are not as easily identified. Here are some of the types of power people can exert when making decisions about your project:

- **Positional:** The kind of power a CEO has; it exists because of the position or role someone is playing.
- **Informational:** When someone knows something important that other people need.
- **Referent:** When someone is trusted or judged as credible based on past experience.
- **Situational:** When someone has skills specific to a situation that you're in and you need his help.
- **Personal or charismatic:** When someone has influence over you because you like her personality.
- **Relational:** When someone has influence because he has an alliance with someone else who is influential.
- **Expert:** When someone has influence because she's demonstrated knowledge about something that you need.
- **Reward-oriented:** When someone has influence because he can get you something you want or need.
- **Punitive or coercive:** When someone has influence over you because she can cause problems for you if you don't do what she wants.
- **Ingratiating:** When someone has influence with you because he tells you that you're great.
- **Pressure-based:** When someone can create circumstances that make you seem out of step with the rest of the organization if you don't comply with her requests.
- **Guilt-based:** When someone appeals to your sense of honor or duty to get you to do what he wants.
- **Persuasive:** When a person influences you by having a rational argument with you that changes your mind.
- **Avoiding:** When a person withdraws her involvement in an issue in order to get desired behavior.

# Who am I?

A bunch of leadership styles and types of power are playing a party game, "Who am I?" They'll give you a clue, and you try to guess who they are based on what they say. Write down their name, and what kind of thing they are (like whether they're a leadership style or type of power).



**Name**

**Kind of thing**

I'm able to tell you to do things because I flatter you. Did I mention that you're doing a great job?

\_\_\_\_\_

I change my approach based on what's going on. I draw from a number of different ways of doing things.

\_\_\_\_\_

I have influence because I can make things great for you if you do what I ask. How about that trip to the Riviera you've always wanted? Stick with me, and it's yours.

\_\_\_\_\_

Let's set a goal of getting this exercise done within the next 15 minutes. When you've completed it, let me know how long it took you.

\_\_\_\_\_

Take a look around. Everyone is studying for the PMP exam; studying for it just seems like the right thing to do.

\_\_\_\_\_

I make things happen by taking care of people. I'm always looking to get people what they need so they can be successful.

\_\_\_\_\_

I inspire people. It's what I do. Sure, you could say I work hard to get what I need, but that's because I believe in my work.

\_\_\_\_\_

I have all of the answers to these questions. I know you need them, so if you do what I need you to do, I'll tell them to you.

\_\_\_\_\_



## Personality search

Solve this word search and get these **personality traits of a good leader** to stick in your brain! These are all everyday words! How many of them can you figure out from the clues?



### Clues:

1. Is accepting of other people and open about his or her own goals and motives
2. Never rude
3. Comes up with new ideas and approaches
4. Always respectful toward other people's backgrounds and beliefs
5. Pays attention to people's feelings
6. Smart
7. Maintains control of the variables that affect project success
8. Understands the motives and agendas of all of the groups a team interacts with and can help the team to navigate them
9. Wants to help the team to accomplish their goals
10. Good at dealing with people
11. Can see the whole group of processes within which the team is working and affect it

What makes a good project manager? Personality has a lot to do with it! We hid a bunch of personality traits of good project managers in this word search. Can you use these clues to find them?

A bunch of leadership styles and types of power are playing a party game, “Who am I?” They’ll give you a clue, and you try to guess who they are based on what they say. Write down their name, and what kind of thing they are (like whether they’re a leadership style or type of power).

I’m able to tell you to do things because I flatter you. Did I mention that you’re doing a great job?

I change my approach based on what’s going on. I draw from a number of different ways of doing things.

I have influence because I can make things great for you if you do what I ask. How about that trip to the Riviera you’ve always wanted? Stick with me, and it’s yours.

Let’s set a goal of getting this exercise done within the next 15 minutes. When you’ve completed it, let me know how long it took you.

Take a look around. Everyone is studying for the PMP exam; studying for it just seems like the right thing to do.

I make things happen by taking care of people. I’m always looking to get people what they need so they can be successful.

I inspire people. It’s what I do. Sure, you could say I work hard to get what I need, but that’s because I believe in my work.

I have all of the answers to these questions. I know you need them, so if you do what I need you to do, I’ll tell them to you.

## Who am I?



### Solution

Name	Kind of thing
<u>Ingratiating</u>	<u>type of power</u>
<u>Interactional</u>	<u>leadership style</u>
<u>Reward-oriented</u>	<u>type of power</u>
<u>Transactional</u>	<u>leadership style</u>
<u>Pressure-based</u>	<u>type of power</u>
<u>Servant leader</u>	<u>leadership style</u>
<u>Charismatic</u>	<u>leadership style</u>
<u>Informational</u>	<u>type of power</u>



# Personality search

## SOLUTION

V	A	U	L	A	R	U	T	L	U	C	O	U	R	T	E	O	U	S	V
Z	Y	B	J	O	W	H	B	A	P	K	J	Y	M	M	L	A	Y	Q	M
R	R	C	U	B	U	Z	Z	K	S	Y	S	T	E	M	I	C	Y	A	S
H	G	S	E	R	V	I	C	E	O	R	I	E	N	T	E	D	N	O	V
J	V	S	Z	V	J	L	Z	C	X	L	H	R	P	G	L	A	C	Y	D
S	H	Z	N	L	H	C	Z	I	Z	A	M	W	O	J	G	I	Q	P	L
C	R	E	A	T	I	V	E	T	M	C	D	X	Y	E	A	S	E	A	V
B	X	Z	P	U	Q	G	H	N	E	I	B	I	R	L	G	C	N	E	I
C	Q	I	L	T	B	L	F	E	U	T	M	I	S	B	I	O	U	O	Q
B	Y	Z	N	M	B	R	J	H	Y	I	A	M	D	O	I	W	U	F	T
V	R	A	P	W	U	J	N	T	T	L	C	S	T	T	F	O	I	J	W
D	B	W	X	D	U	O	N	U	H	O	L	I	O	P	I	C	K	H	Z
C	W	I	U	D	Y	N	E	A	C	P	T	M	C	Q	O	F	D	V	B
M	H	I	Z	I	K	L	A	U	T	C	E	L	L	E	T	N	I	D	E

**Answers:**

1. Is accepting of other people and open about his or her own goals and motives (**Authentic**)
2. Never rude (**Courteous**)
3. Comes up with new ideas and approaches (**Creative**)
4. Always respectful toward other people's backgrounds and beliefs (**Cultural**)
5. Pays attention to people's feelings (**Emotional**)
6. Smart (**Intellectual**)
7. Maintains control of the variables that affect project success (**Managerial**)
8. Understands the motives and agendas of all of the groups a team interacts with and can help the team to navigate them (**Political**)
9. Wants to help the team to accomplish their goals (**Service-Oriented**)
10. Good at dealing with people (**Social**)
11. Can see the whole group of processes within which the team is working and affect it (**Systemic**)

## there are no Dumb Questions

**Q:** So what's the difference between process groups and knowledge areas?

**A:** The process groups divide up the processes by function. The knowledge areas divide up the same processes by subject matter. Think of the process groups as being about the *actions* you take on your project, and the knowledge areas as the things you need to *understand*.

In other words, the knowledge areas are more about helping you understand the *PMBOK® Guide* material than about running your project. But that doesn't mean that every knowledge area has a process in every process group! For example, the Initiating process group has only two processes. The Risk Management knowledge area has only Planning and Monitoring and Controlling processes. So the process groups and the knowledge areas are two different ways to think about all of the processes, but they don't really overlap.

**Q:** Is every knowledge area in only one process group?

**A:** Every process belongs to exactly one process group, and every process is in exactly one knowledge area. But a knowledge area has lots of processes in it, and they can span some, or all, of the groups. Think of the processes as the core information in the *PMBOK® Guide*, and the process groups and knowledge areas as two different ways of grouping these processes.

**Q:** It seems like the Initiating and Planning process groups would be the same. How are they different?

**A:** Initiating is everything you do when you first start a project (or project phase). You start by writing down (at a very high level) what the project is going to produce, who's in charge of it, and what tools are needed to do the work...and lots of projects never get approved and chartered (which is an important goal of Initiating!). In a lot of companies, the project manager isn't even involved in much of this. Planning just means going into more detail about all of that as you learn more about it, and writing down specifically how you're going to do the work. The Planning processes are where the project manager is really in control and does most of the work.

**Q:** Let's get back to the talent triangle for a minute. I'm a lot stronger in one of those areas than the others. What does that mean for me?

**A:** The PMI Talent Triangle® is a really valuable tool that helps you keep your own skill set in balance, and manage your professional development. Once upon a time, project management primarily involved technical skills: managing schedules, calculating costs, planning resources, managing changes, and so on. But PMI has done a lot of research in this area, and they've found that over the years—and especially over the last decade—technical skills are not enough to make a truly effective project manager in the modern enterprise. They found that the most effective project managers have a balance of technical, leadership, and strategic skills. But beyond research, the folks at PMI are committed to helping individual project managers. They developed the PMI Talent Triangle® to help you keep your own career in balance too.

**Process groups and knowledge areas are two different ways to organize the processes...but they don't really overlap each other! Don't get caught up trying to make them fit together.**

## The benefits of successful project management



**Take a moment to digest all this new knowledge, because you're going to start putting it all into practice when we take a look at Project Integration Management in Chapter 4.**



# Sharpen your pencil Solution

Think of the vacation we talked about on page 78 as a project, and each of its steps as a process. Here are some inputs, tools, and outputs that could be used in each of the vacation steps. Can you look at each of the underlined words and figure out if the words represent an input, tool, or output? (Here's a hint: some of them are an output from one process and an input for another.)

1. You log in and check your company's vacation calendar to see how much vacation time you have for your trip.

Input     Tool     Output

2. You create an itinerary on a travel website. You'll use the itinerary when you board your flight.

Input     Tool     Output

The itinerary was an output of the Develop Project Management Plan process but an input to the Direct and Manage Project Work process.

3. You have some hotel reservation documents you created on the travel website, too. You'll use those when you check in to your hotel.

Input     Tool     Output

4. You use a travel website to book the plane, hotel, and sights you'll see on your trip.

Input     Tool     Output

This one was the tool you used to book your tickets and hotel reservations.

5. You verify your bank account balance to make sure you have enough money to pay for everything.

Input     Tool     Output

You had to know this to know how much you could spend on your trip. It's an input.

6. You use a hotel feedback website to review your stay in the hotel once you get back home.

Input     Tool     Output

Here's the tool you used to give feedback about your hotel in the Close Project process.

## Exam Questions

**1. You're a project manager working on a software engineering project. Your manager is asking you to write down your performance goals for the year and measure them for your next performance evaluation. What leadership style is your manager using?**

- A. Charismatic
- B. Interactional
- C. Transactional
- D. Performance

**2. Which of the following is not a stakeholder?**

- A. The project manager who is responsible for building the project
- B. A project team member who will work on the project
- C. A customer who will use the final product
- D. A competitor whose company will lose business because of the product

**3. A project manager runs into a problem with her project's contractors, and she isn't sure if they're abiding by the terms of the contract. Which knowledge area is the BEST source of processes to help her deal with this problem?**

- A. Cost Management
- B. Risk Management
- C. Procurement Management
- D. Communications Management

**4. You're a project manager for a construction project. You've just finished creating a list of all of the people who will be directly affected by the project. What process group are you in?**

- A. Initiating
- B. Planning
- C. Executing
- D. Monitoring and Controlling

**5. You're a project manager working in a weak matrix organization. Which of the following is NOT true?**

- A. Your team members report to functional managers.
- B. You are not directly in charge of resources.
- C. Functional managers make decisions that can affect your projects.
- D. You have sole responsibility for the success or failure of the project.

## Exam Questions

6. Which of the following is NOT a project?

- A. Repairing a car
- B. Building a highway overpass
- C. Running an IT support department
- D. Filming a motion picture

7. A project manager is running a software project that is supposed to be delivered in phases. She was planning on dividing the resources into two separate teams to do the work for two phases at the same time, but one of her senior developers suggested that she use an agile methodology instead, and she agrees. Which of the following BEST describes the relationship between her project's phases?

- A. Sequential relationship
- B. Iterative relationship
- C. Constrained relationship
- D. Overlapping relationship

8. Which of the following is NOT true about overlapping phases?

- A. Each phase is typically done by a separate team.
- B. There's an increased risk of delays when a later phase can't start until an earlier one ends.
- C. There's an increased risk to the project due to potential for rework.
- D. Every phase must go through all five process groups.

9. You're the project manager for an industrial design project. Your team members report to you, and you're responsible for creating the budget, building the schedule, and assigning the tasks. When the project is complete, you release the team so they can work on other projects for the company. What kind of organization do you work in?

- A. Functional
- B. Weak matrix
- C. Strong matrix
- D. Projectized

10. Which process group contains the Develop Project Charter process and the Identify Stakeholders process?

- A. Initiating
- B. Executing
- C. Monitoring and Controlling
- D. Closing

Answers

## Exam Questions

### 1. Answer: C

Transactional leaders set goals up front and then measure their team's progress toward achieving them. Thinking about each activity that the team does as a transaction between the leader and the team is a good way to remember this leadership style.

### 2. Answer: D

One of the hardest things that a project manager has to do on a project is figure out who all the stakeholders are. The project manager, the team, the sponsor (or client), the customers and people who will use the software, the senior managers at the company—they're all stakeholders. Competitors aren't stakeholders, because even though they're affected by the project, they don't actually have any direct influence over it.

### 3. Answer: C

The Procurement Management knowledge area deals with contracts, contractors, buyers, and sellers. If you've got a question about a type of contract or how to deal with contract problems, you're being asked about a Procurement Management process.

### 4. Answer: A

People who will be directly affected by the project are stakeholders, and when you're creating a list of them you're performing the Identify Stakeholders process. That's one of the two processes in the Initiating process group.

### 5. Answer: D

In a weak matrix, project managers have very limited authority. They have to share a lot of responsibility with functional managers, and those functional managers have a lot of leeway to make decisions about how the team members are managed. In an organization like that, the project manager isn't given a lot of responsibility.

That's why you're likely to find a project expediter in a weak matrix.

## Exam Questions

### 6. Answer: C

The work of an IT support department doesn't have an end date—it's not temporary. That's why it's not a project. Now, if that support team had to work over the weekend to move the data center to a new location, then *that* would be a project!



### 7. Answer: B

Agile development is a really good example of an iterative approach to project phases. In an agile project, the team will typically break down the project into phases, where they work on the current phase while planning out the next one.

Answers

## Exam Questions

### 8. Answer: B

If there's an increased risk of a project because one phase can't start until another one ends, that means your project phases aren't overlapping. When you've got overlapping phases, that means that you typically have multiple teams that start their phases independently of each other.

Also, take another look at answer C, because it's an important point about overlapping phases. When your phases have an overlapping relationship, there's an increased risk of rework. This typically happens when one team delivers the results of their project or phase, but made assumptions about what another team is doing as part of their phase. When that other team delivers their work, it turns out that the results that both teams produced aren't quite compatible with each other, and now both teams have to go back and rework their designs. This happens a lot when your phases overlap, which is why we say overlapping phases have an increased risk of rework.

### 9. Answer: D

In a projectized organization, the project manager has the power to assign tasks, manage the budget, and release the team.

### 10. Answer: A

The first things that are created on a project are the charter (which you create in the Develop Project Charter process) and the stakeholder register (which you create in the Identify Stakeholders process). You do those things when you're initiating the project.



## 4 Project integration management

# Getting the job done

THERE I WAS WITH A BOGIE ON MY SIX AND ALMOST OUT OF FUEL, AND THAT'S WHEN I REALIZED I NEEDED TO FILL OUT A CHANGE REQUEST FOR MORE AMMO.

YOU KEEP TELLING THAT STORY, BUT WE ALL KNOW THAT YOU'RE NOT ACTUALLY A PILOT.



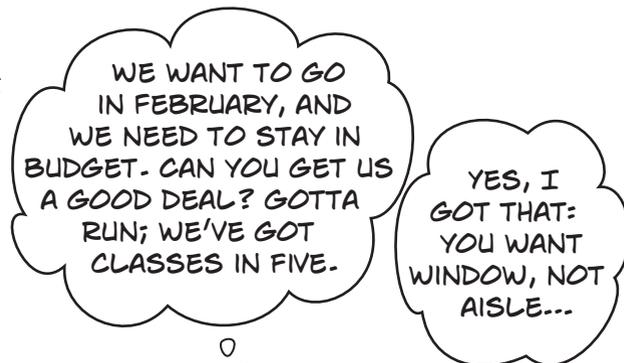
**Want to make success look easy?** It's not as hard as you think. In this chapter, you'll learn about **a few processes** you can use in your projects every day. Put these into place, and your **sponsors** and **stakeholders** will be happier than ever. Get ready for **Integration Management**.

## Time to book a trip

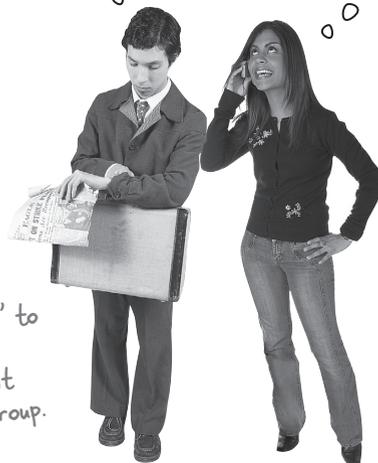
Everyone in the Midwestern Teachers' Association has gotten together and planned a trip—a tour of Asia and Europe, starting with Mumbai, India, and ending up in Paris, France.



Larry, the teachers' travel agent



Joanne and Frank were "volunteered" to organize the trip by the other eight teachers in the group.



## Larry's cutting corners

Larry wants to dive into the project and make his clients happy. When he sees an opportunity to save them money, he takes it! But sometimes the cheapest way to do things isn't the way that will end up satisfying everyone.



HMM... IF I BOOK THEIR TICKETS IN JUNE INSTEAD OF FEBRUARY, THAT'LL REDUCE THE FARE. I'LL BET THAT CONVINCES THEM TO CHANGE THEIR PLANS. WHO WOULDN'T LOVE THOSE SAVINGS?!

## The teachers are thrilled...for now

Larry convinces the teachers to travel in June because of the great price he got on tickets. But he's not really planning for the results of that decision—and neither are the teachers.

One of the keys of project management is thinking a project through *before* starting the work, so problems that could arise down the line are anticipated ahead of time. That's why so much of project management is spent **planning**.

Larry may think this itinerary is a plan, but it doesn't detail any of the problems that could arise on the teachers' vacation.

Acme  
Travel

**TRAVEL ITINERARY FOR  
MIDWESTERN TEACHERS ASSN.**

<b>Record Locator</b>	HF184-Z	<b>Agent ID</b>	Larry
<b>Trip ID</b>	189435163		Acme Travel

**Travel Details**

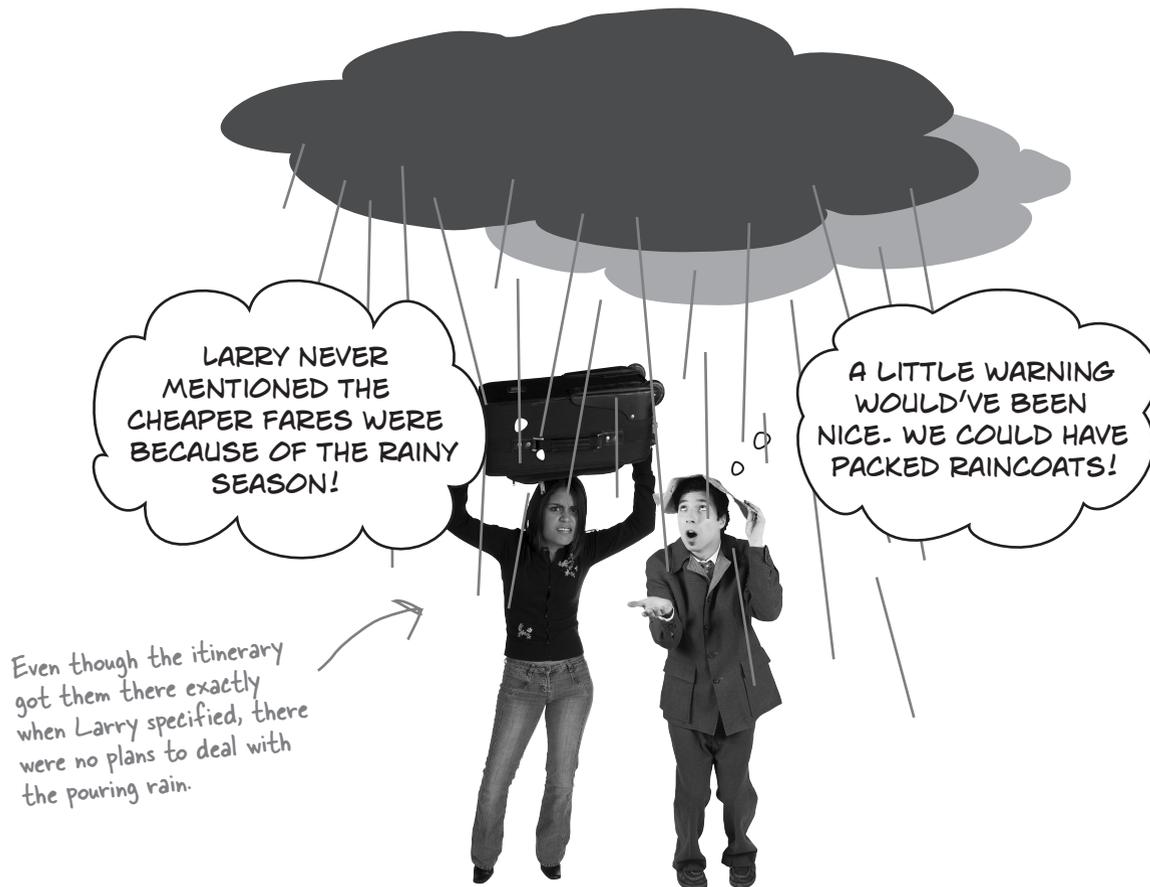
**Flight Information**

<b>Leg 1</b>		<b>Departing</b>	1:45PM
Airline	Econo Airlines	<b>Arriving</b>	1:00AM
Flight	8614	<b>Terminal</b>	1
Origin	St. Paul, MN	<b>Arriving</b>	June 13
Destination	Mumbai, INDIA	<b>Distance</b>	7942mi
Est Time	17 hours 45 Minutes		

Larry changed the date to June, and now the project's coming in way under budget.

## These clients are definitely not satisfied

When the clients arrived in Mumbai, they found out why the fare was so low: June is monsoon season in India! Larry may have saved them a bundle, but it didn't keep him from soaking his clients.



### Larry's been let go

From the minute they got off the plane, the clients were extremely unhappy. The senior managers at Acme Travel don't want to lose the teachers' business...so they've appointed YOU as the new travel agent.

It's your job to finish planning the trip, and make sure that the teachers leave their vacation satisfied.

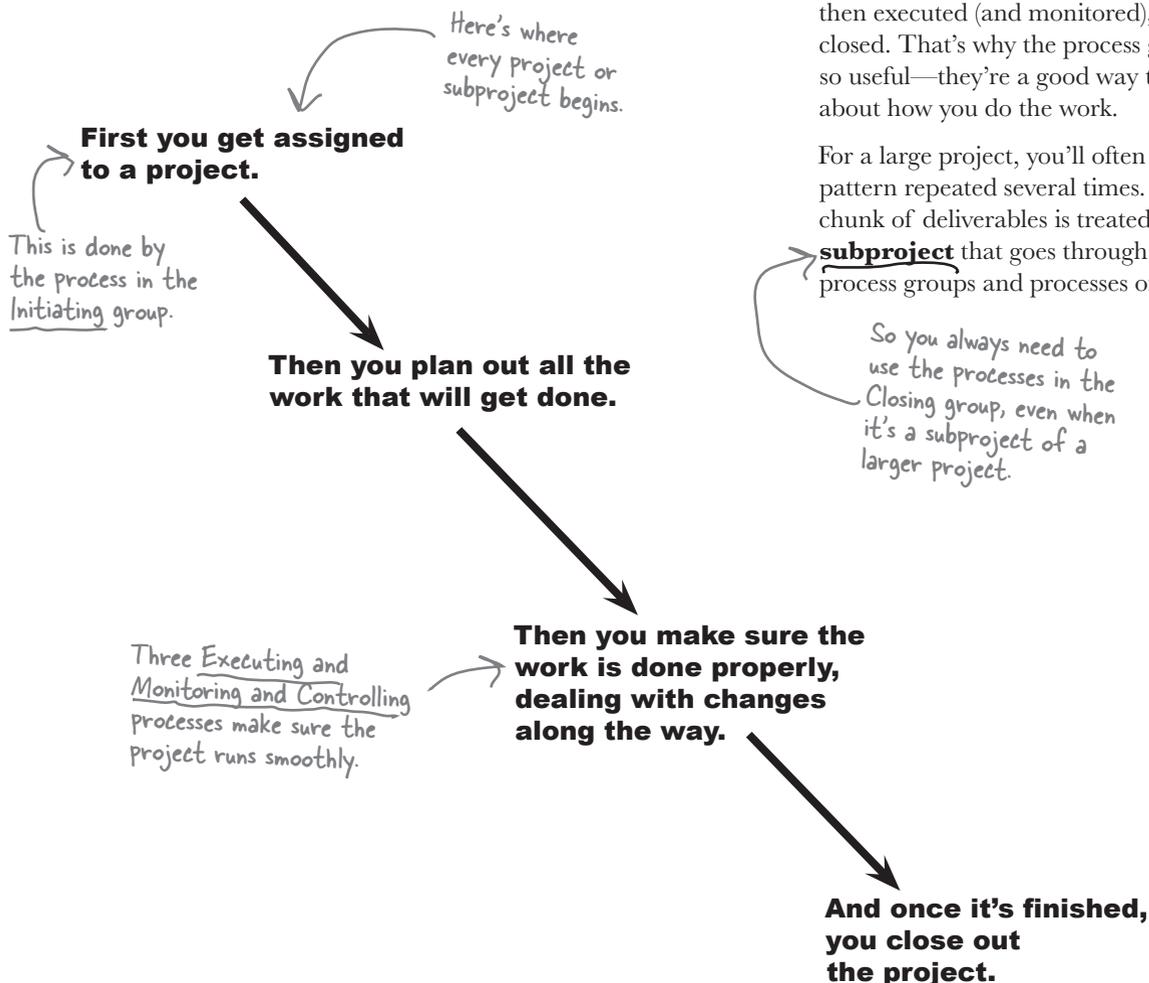
## The day-to-day work of a project manager

Project managers make projects run well. They plan for what's going to happen on the project. A big part of the job is watching closely to make sure the plan is followed, and when things go wrong, making sure they're fixed. And sometimes the plan itself turns out to be inadequate! Project managers look for those kinds of problems, and fix them too. That day-to-day work is what the **Integration Management** processes are all about.

### A bird's-eye view of a project

Every project follows the same kind of pattern. First it gets initiated, then planned, then executed (and monitored), and finally closed. That's why the process groups are so useful—they're a good way to think about how you do the work.

For a large project, you'll often see this pattern repeated several times. Each major chunk of deliverables is treated as its own **subproject** that goes through all of the process groups and processes on its own.



# The seven Integration Management processes

The *PMBOK® Guide* divides Integration Management into seven processes that you need to understand for the exam. They're what people usually think of as a project manager's "core" responsibilities.

Without the project charter, you don't have the authority to tell your team what to do and when to do it.

## 1 Develop Project Charter

The very first thing that's done on a new project is the development of the project charter. That's the document that authorizes you to do your work. But you're not always involved in making it—oftentimes it's handed to you by the sponsor.

The sponsor is the person who pays for the project.



## 2 Develop Project Management Plan

The Project Management plan is the most important document in the entire *PMBOK® Guide* because it guides everything that happens on the project. It spans all of the knowledge areas.

A big part of the Project Management plan is that it tells you how to handle changes when problems come up.



## 3 Direct and Manage Project Work

After you're done planning, it's time to do the work. Your job is to make sure that everybody is doing what they should be doing, and that the products or services your project creates meet the needs of the stakeholders.

Here's where the work gets done. It's where all of the planning you'll do in all of the other knowledge areas comes together so that you can actually make stuff. It's the day-to-day work that you help your team do, and make sure gets done.

## 4 Manage Project Knowledge

This process is all about building on the knowledge your team already has about the project and using it to solve problems as they come up. Sometimes your team will discover new information that the organization never had before. When you're managing your project's knowledge, you're helping to make sure that those new discoveries are understood throughout your organization.

It might seem like this one is focused on documentation, but sharing information doesn't always happen through documents.

## 5 Monitor and Control Project Work

A good project manager is constantly monitoring every single thing that goes on in the project. Remember, the later you find a problem, the harder and more expensive it usually is to fix.

Keep everyone satisfied by catching problems as early as possible.

## 6 Perform Integrated Change Control

Once you've found problems on your project, you've got to work with your stakeholders and sponsors to figure out how to deal with those problems. You should also update your Project Management plan to reflect any extra steps you'll need to take to complete the project. Updating the Project Management plan also makes sure everyone working on the project stays on the same page.

Once you catch problems, this is where you figure out how to fix them—or if they should be fixed at all.

Keep an eye out for potential changes. Part of your job is helping the people around you anticipate changes, and maybe even prevent them.

## 7 Close Project or Phase

The last thing you do on the project is close it out. Make sure you document everything...especially the lessons you and your team have learned along the way. You can never tell when these lessons may help you out on your *next* project.

## Sharpen your pencil



Here are a few of the things you might have to deal with in working on the teachers' vacation trip. Figure out which of the seven Integration Management processes you'd use in each situation, and write down the process name in the blank.

- 1 It turns out that one of the teachers is a vegetarian, so some of the restaurant reservations will need to be canceled, and new reservations will need to be made at restaurants that can accommodate him.

\_\_\_\_\_

*Develop Project Charter*

- 2 You come up with a detailed description of everything that you plan to do to get the teachers where they want to be.

\_\_\_\_\_

*Develop Project Management Plan*

- 3 The CEO of Acme Travel sends you a document that assigns you to the project.

\_\_\_\_\_

*Direct and Manage Project Work*

- 4 You write down some notes describing all of the teachers' needs and how you solved them.

\_\_\_\_\_

*Monitor and Control Project Work*

- 5 When the teachers get back, you write up everything you learned while handling the trip so other travel agents can learn from your experience.

\_\_\_\_\_

*Perform Integrated Change Control*

- 6 You book the tickets and hotel accommodations.

\_\_\_\_\_

*Close Project or Phase*

- 7 You check in with the teachers at each destination to make sure everything is going according to plan.

\_\_\_\_\_

*Manage Project Knowledge*

—————> **Answers on page 161.**

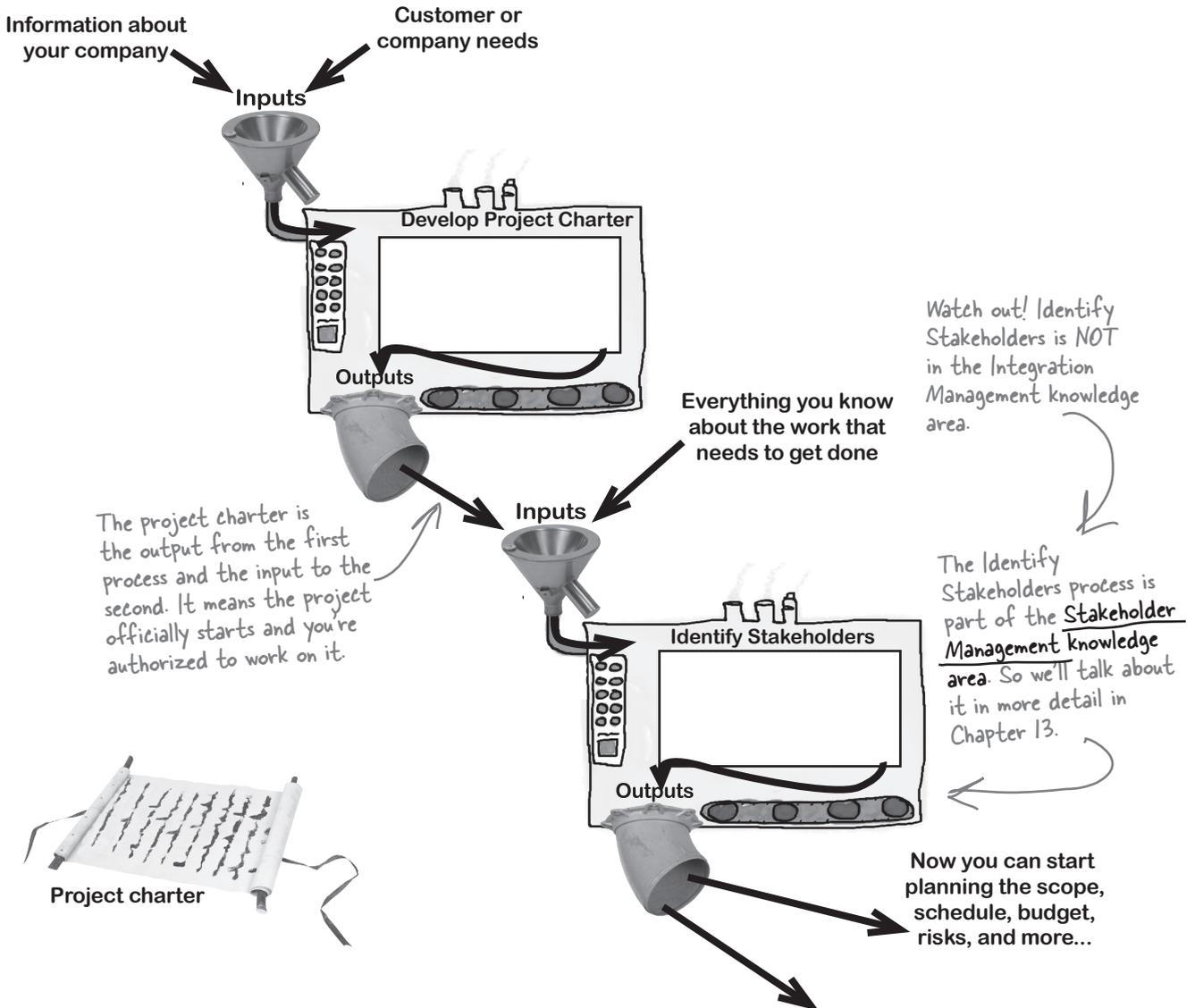
# Start your project with the Initiating processes

There **are only two processes in the Initiating process group**, and they're all you need to get your project started. First, the **Develop Project Charter** process tells everyone in the company why the project is needed, and gives you the authority you need to make it happen. Then you use the **Identify Stakeholders** process to figure out who is affected by the project and how to communicate with them.

These are the only two processes in the Initiating process group. We'll talk about one of them here, and the other in Chapter 13.

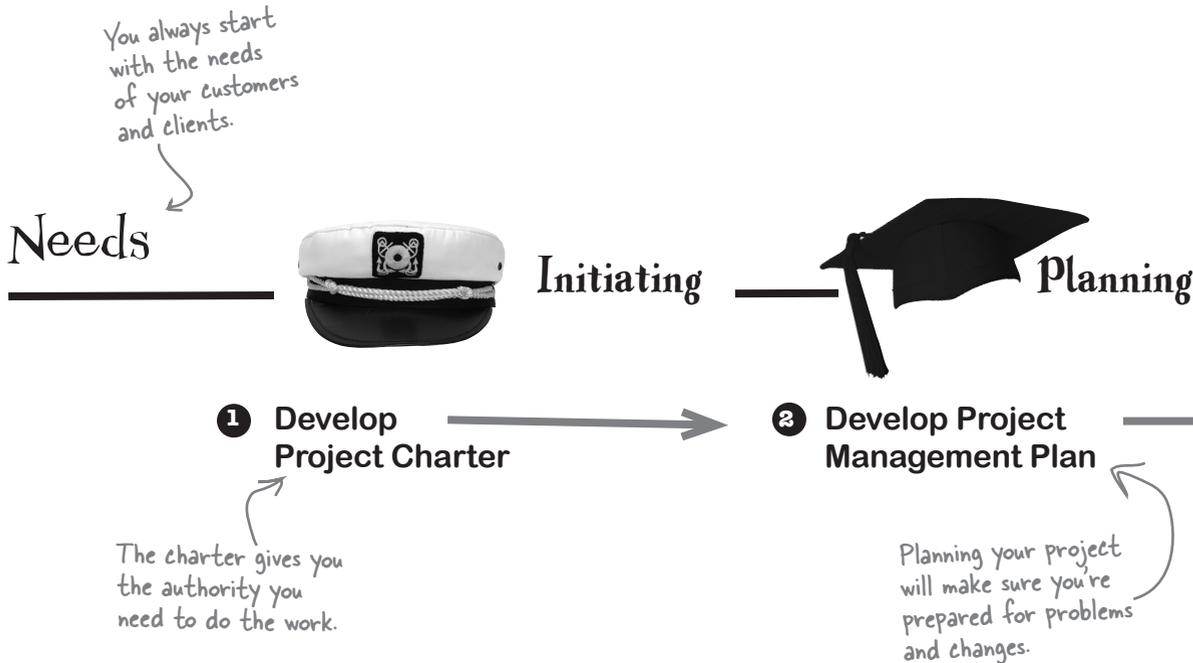


Initiating process group



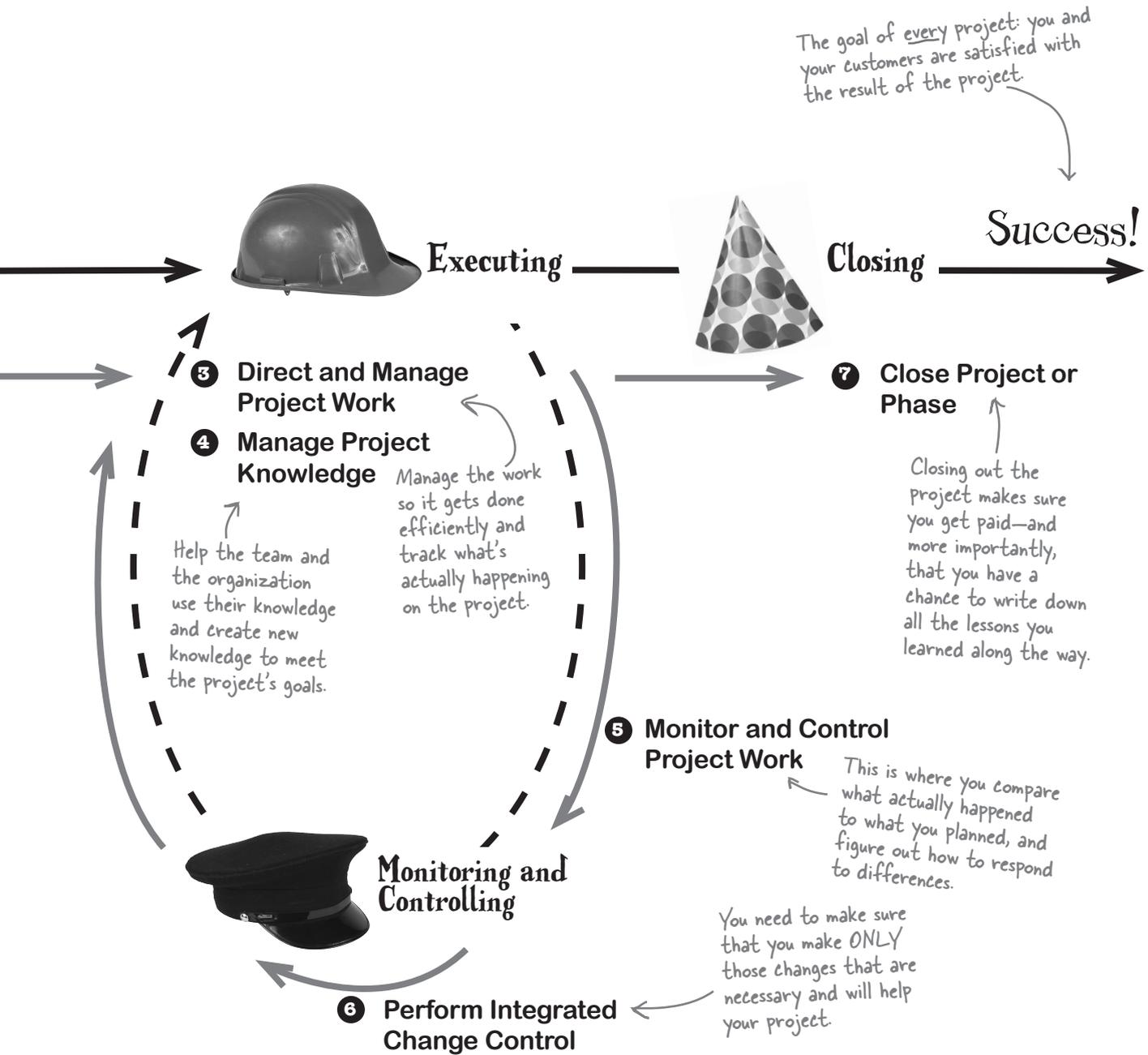
## Integration Management and the process groups

Here is how the process groups all fit into this whole Integration Management thing. The process groups show you the order in which these processes happen, and how they interact.



The Integration Management knowledge area brings all of the process groups together. A project manager has to integrate the work of everyone on the team through all of these major activities to keep the project on track:

1. Being authorized by the project charter to control the budget and assign resources
2. Planning all of the work that's going to happen throughout the project
3. Directing the work once it gets started
4. Using the information your company already knows about this project and keeping track of all of the new things you learn
5. Monitoring the way the work progresses and looking for potential problems
6. Looking out for changes, understanding their impacts, and making sure they don't derail the project
7. Closing out the project and making sure that there are no loose ends when it's over



## The Develop Project Charter process



Initiating  
process group

If you work in a matrix organization, then your team doesn't report to you. They report to functional managers, and might have other work to do. But when they're on your project, you're effectively their boss. So how do you make that happen? Well, you need some sort of **authorization**, and that's what the project charter is for. It says exactly what you're authorized to do on the project (like assign work to the team members and use the company's resources), and why you've been assigned to it. But the charter isn't just important for matrix companies. In any kind of company, it's really important to know who's in charge, and what resources you have available to you when you manage a project.

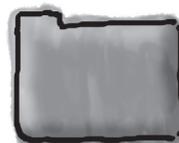
*This is a description of the business need, the scope, and how the project fits into the strategic plan.*

*The teachers' contract said that they needed to go to Asia and Europe for \$7,500 per person. You'd better make sure that shows up on the charter.*

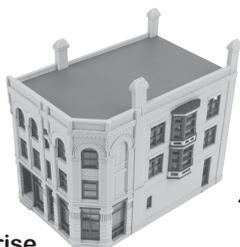
Agreements



Business documents



Enterprise  
environmental factors



Organizational  
process assets



Inputs



*Since this project will be done at Acme Travel, Acme's work culture will affect it. At Acme, everyone gets a two-hour lunch every day, so the schedule will need to take that into account.*

*While he was writing the charter, the CEO looked at lessons learned from past trips to be sure that Acme got the best airline and hotel accommodations for the teachers' trip.*

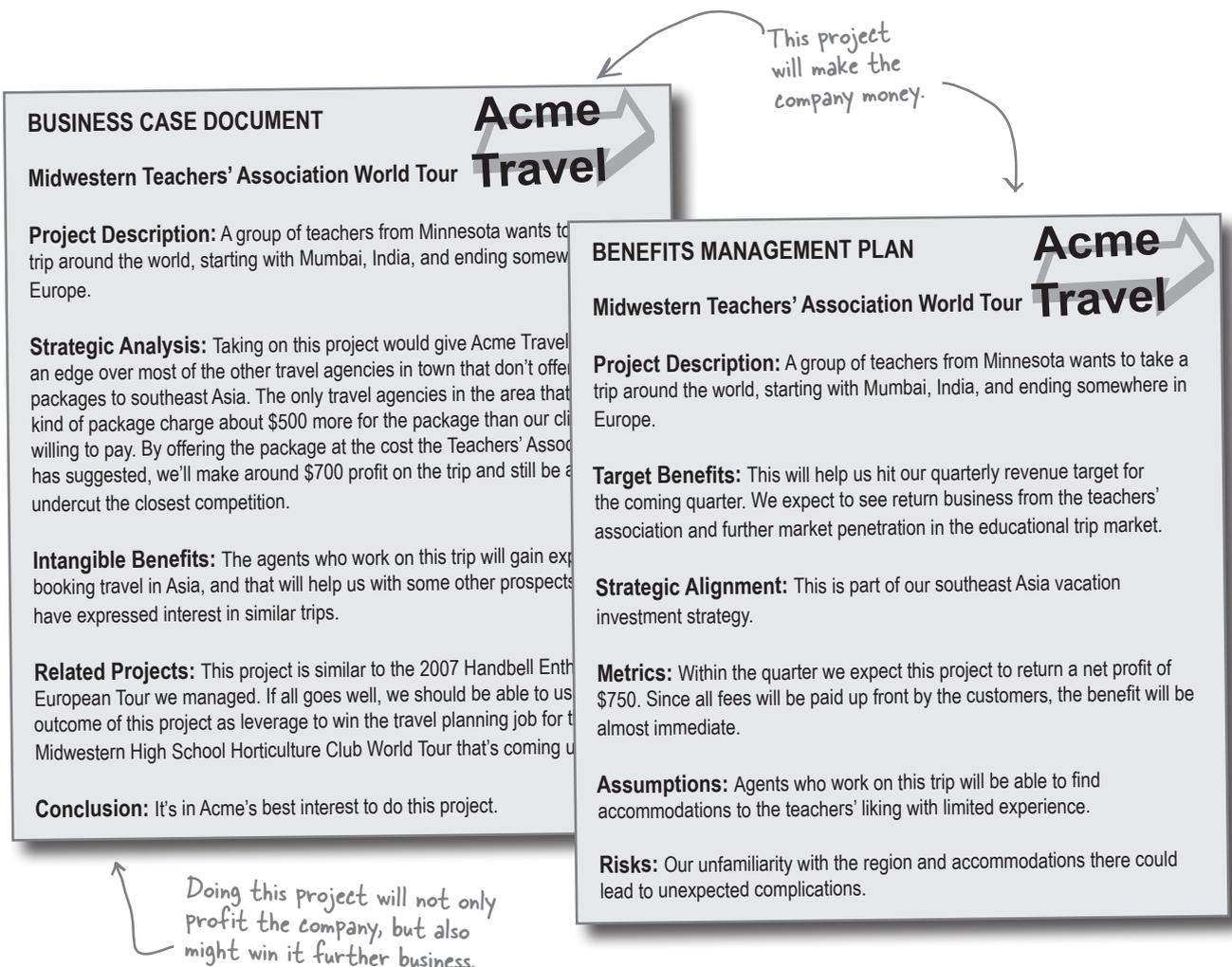
Develop Project Charter



## Make the case for your project

The Midwestern Teachers' Association contract wasn't the only one that Acme could have taken. The company's got more work than it can handle right now, and occasionally it needs to turn away a client. That's where a **business case** and **benefits management plan** come in handy. If a project is too risky, won't make enough money, isn't strategic, or isn't likely to succeed, then the senior managers at Acme could choose to pass on it.

But to figure all that out, you need to do some thinking about what makes taking on this project a good idea for Acme Travel. Preparing business documents means thinking about the value of the project to the business. Is there a big market for world travel packages that Acme can break into if it does this project? Should Acme do it just because the customer requested it? Will it help the company in other ways?





## Use expert judgment and data gathering techniques to write your project charter

When you think about it, a lot of different people's opinions can help your company come to a good decision about whether or not to start a project. Sometimes project sponsors will call on experts to help them decide which projects to do. At Acme Travel, the CEO called a meeting with the VP of Asia Travel to make sure that the teachers' trip was worth doing. The VP of Asia Travel had set up trips like this one before and knew where things could go wrong in planning them. Together, they looked at all of the project documentation to make sure that this project looked like it would make Acme enough money to be worth doing.



Your company might need to talk to subject matter experts from a bunch of different departments to decide if a project will be beneficial to it. It might rely on outside consultants or industry groups to tell it how other companies have solved the same problem. All of those different opinions are called **expert judgment**.

If the experts agree that the project's business case and contract add up to a product that's going to do good things for your company, they'll usually give the green light to write the charter.

### Data gathering techniques help everyone understand the goal of your project



When you sit down to write your project charter, you'll need to get your stakeholders on the same page about what your project team will do. You might set up meetings with your stakeholders to brainstorm project goals or work with them to resolve conflicts around how your project will run. All of the approaches you take to get everybody on the same page are called **data gathering techniques**. Unlike expert judgment, which relies on people using their past experiences to make decisions, data gathering techniques involve meetings and sessions that use hard data to reach an agreement on major project decisions.

### Interpersonal and team skills and meetings make sure everyone is on the same page



When a project is just beginning you need to think about many different perspectives. The best way to get a clear picture of how your project fits into the organization's strategic goals is to get everyone together and talk about it. You'll need to use **interpersonal and team skills** like conflict management facilitation and meeting management to help make those conversations successful. You'll also need to rely on your meeting management skills to make sure that the decisions that are made in the **meetings** are clear to everyone.



Here are a bunch of ways Acme evaluated the inputs for the Develop Project Charter process. Try to figure out which ones involve expert judgment and which are data gathering techniques.

**1. Acme Travel creates a committee to review all of the business case documents that have been submitted for possible projects and compare them to figure out which projects should be funded in the next quarter.**

- A. Expert judgment                      B. Data gathering technique

**2. Acme hires an outside consultant to help it figure out whether or not its current strategic goals are the right ones for the company.**

- A. Expert judgment                      B. Data gathering technique

**3. Acme asks the VP of Asia Travel to review the business case for the Midwest Teachers' Association trip and decide whether or not the projected costs and schedule look right.**

- A. Expert judgment                      B. Data gathering technique

**4. Acme has a focus group with all of the potential customers who might be interested in the trip to help it evaluate all of its project proposals and decide which ones are most likely to benefit the company.**

- A. Expert judgment                      B. Data gathering technique

**5. The travel agent who is assigned to the project holds a brainstorming session with all of the other travel agents to propose a new goal for the project.**

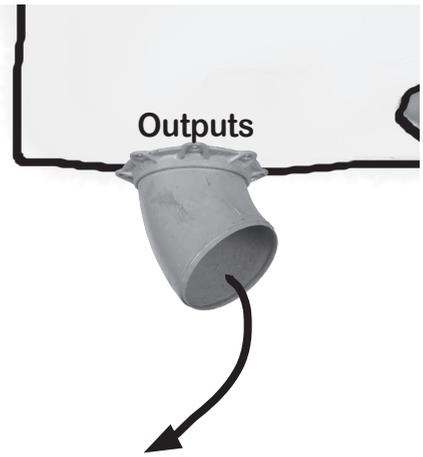
- A. Expert judgment                      B. Data gathering technique

—————▶ **Answers on page 124**

## A closer look at the project charter

The charter is the **most important** output of the Develop Project Charter process. We know that it makes sense to do the project—that's what we did with the business case. And we know that it assigns authority so that you can do your job. But what else does a charter have in it?

The only other output is the **assumption log**. During the course of building the project charter, you should keep track of the assumptions you're making as you define the project. Those assumptions will help the project team understand what was considered when the project was approved.



The charter assigns you the authority to use resources, like people on your team, computers, office equipment, conference rooms—the things you need to get the job done.

**Project Charter**

**Project Description:** World vacation in 4 weeks  
A group of teachers from Minnesota wants to take a trip around the world, starting with Mumbai, India, and ending somewhere in Europe. They have contracted Acme Travel Agency to make their dream a reality.

**Project Requirements:**

- Trip should be planned to coincide with good weather.
- Need to see famous monuments at each point of destination.
- Restaurant recommendations and nightlife information on request.
- Need assistance for missed flights, lost luggage, and other issues in transit.

**Assigned Project Manager and Authority Level:**  
You have the authority to use dedicated money and resources to accomplish this goal.

**Summary Milestone Schedule**

June 13–20—Mumbai	June 20–23—Hong Kong
June 24–29—Shanghai	June 30—July 4—Rome
July 5–8—Barcelona	July 9–14—Paris

**Business Case:**  
This project will be a sound investment for Acme. Provided it is planned and executed properly, we should receive around \$700 per person in profit.

SIGNED,  
\_\_\_\_\_  
CEO, Acme Travel

**Acme Travel**

Larry should have paid attention to this information.

As the project charter officially assigns the PM, it can be written before the PM is even involved.

This is just a summary of the important points of the business case that were used to decide to pursue the project.

This project has one sponsor, but it's OK if a project has more than one.



Assumption log

An assumption is a basis for a decision. Documenting that you expected there to be 10 teachers helps to explain the size of the van you rented.

## Sharpen your pencil

Take a look at the charter for the teachers' trip, and write down what you think each of the following sections of a typical project charter is used for.

Project Description:

Project Requirements:

Assigned Project Manager and Authority Level:

Summary Milestone Schedule:

Business Case:

## Sharpen your pencil Solution



Take a look at the charter for the teachers' trip, and write down what you think each of the following sections of a typical project charter is used for.

Project Description:

**The purpose of the project**

This is a high-level description of the goals of your project. It's usually a few sentences that describe the project's main purpose.

Project Requirements:

**Describes the product your project has to make**

Anything you know that the customer, stakeholder, or sponsor expects to get out of the project should go here.

Assigned Project Manager and Authority Level:

**Who the project manager is and what he has to do**

This is where you're assigned to the project. If it's known who is going to be the project manager, the name of that person is noted. Otherwise, you may just have a department listed that you know the PM will come from. This is also where any specific decision-making authority you might need can be described.

Summary Milestone Schedule:

**A list of dates that your project needs to meet**

Business Case:

**Why your company has decided to do this project**

This section lists the reasons why it makes sense for your business to do this project. You might note the return on investment, building infrastructure, goodwill with clients, or anything else that will help people understand why this project is important.



## Exercise

Here are a bunch of ways Acme evaluated the inputs for the Develop Project Charter process. Try to figure out which ones involve expert judgment and which are facilitation techniques.

Expert judgment always refers to people using their experience to make decisions on your project.

- |                              |                                    |
|------------------------------|------------------------------------|
| 1. <u>A. Expert judgment</u> | B. Data gathering technique        |
| 2. <u>A. Expert judgment</u> | B. Data gathering technique        |
| 3. <u>A. Expert judgment</u> | B. Data gathering technique        |
| 4. A. Expert judgment        | <u>B. Data gathering technique</u> |
| 5. A. Expert judgment        | <u>B. Data gathering technique</u> |

Data gathering techniques are the meetings and sessions that are used to get everybody to agree on major project decisions.

## Two things you'll see over and over and over...

There are two inputs that you'll see repeatedly for a bunch of different processes throughout the rest of the book. **Enterprise environmental factors** are anything that you need to know about how your company does business. And **organizational process assets** have information about your projects: how people in your company are supposed to perform them, and how past projects have gone.



**Enterprise environmental factors**

### **Enterprise environmental factors tell you about how your company does business.**

There's a lot of information about your company that will be really useful to you when you're planning your project. You need to know how each of the different departments operates, the market conditions you're working in, the company's overall strategy, any policies you need to work with, your company's culture, and all about the people who work at the company.

One of the enterprise environmental factors you'll use in the Integration Management processes is **the project management information system**, which determines how your company assigns work to people and ensures that tasks are done properly and in the right order.



**Organizational process assets**

### **Organizational process assets tell you about how your company normally runs its projects.**

Every company has standards for how to run its projects. There are guidelines and instructions for managing projects, procedures you need to follow, categories for various things you need to keep track of, and templates for all of the various documents that you need to create. These things are usually stored in some sort of library.

One of the most important organizational process assets is called **lessons learned**, which is how you keep track of valuable historical information about your project. At the end of every project, you sit down with the project team and write down everything you learned about the project. This includes both positives and negatives. That way, when you or another project manager in your company plans the next project, you can take advantage of the lessons you learned on this one.



Can you think of how these would be useful for starting and planning your project?

## there are no Dumb Questions

**Q:** I've never had a project charter. Is it really necessary?

**A:** Yes, definitely. Have you ever been on a project where you didn't feel like you had enough authority to do your job? The project charter gives you the authority to manage your project. Every project should have a charter, and writing the charter is the first thing that should happen on any project.

**Q:** Wait a minute! How can I be the one writing the charter, when it's what gives me all of my authority and I might not even be assigned to the project yet?

**A:** Right, you're not usually going to write a charter. The charter is usually handed to you. The project manager or the project sponsor can write the charter; only the sponsor approves it. And it's always easy to tell who the project sponsor is: it's the person who pays for the project, and comes up with the project's overall goals.

**Q:** I'm still not sure I get the idea behind a business case document. How's that different from the project charter?

**A:** The business case is a description of what your company is trying to get out of the project—like how much money you're planning on making from the project, how it will benefit parts of your organization, and future business you might gain from the project.

The project charter is a high-level description of your project. It tells you—and anyone else who needs to know about your project—what you'll be delivering, including a really high-level description of what it is that you'll build.

A really important difference between them is that the project charter is what authorizes the project manager to do the work, while the business case helps justify the project. You can think of the business case as the background research that had to be done in order to make sure the project was worth doing, and the project charter as the thing that formally announces the decision to do it.

**Q:** I'm still not clear on who the sponsor is. How's that different than the customer?

**A:** The sponsor is the person (or people) paying for the project. The customer is the person who uses the product of the project. Sometimes the customer is the same person as a sponsor. This is often true in consulting companies. For the teachers' project, the sponsor is the Acme Travel CEO, and the customers are the teachers. But it's possible that in another travel agency, the teachers themselves would be the sponsors. This happens a lot in contracted work.

For the exam, you'll need to be careful about this. Sometimes you'll see the word *customer* in a question that's asking you about the sponsor. You might even see the word *client*—a word that appears in the *PMBOK® Guide* only four times! (It's usually used when you're talking about procurement.) When you see this, you should assume that the question is asking you about a consulting situation, where the sponsor, customer, and client are all the same person.

The CEO and VP of Asia Travel are paying for this project in the sense that they're providing funding for the project team at the travel agency and cutting checks to the airlines, hotels, tour groups, and so on. The customers are definitely paying Acme Travel, but they're not paying out the budget for the specific work that has to be done to complete the project.

**Q:** Hold on. My project sponsors are really important people in my company. I can't imagine them actually typing up a project charter.

**A:** Good point. That's why the project sponsor will often delegate the actual creation of the charter to the project manager. For the exam, though, keep in mind that the sponsor is ultimately responsible.

**The sponsor of a project is responsible for creating the project charter.**

**The sponsor of a project pays for the project. The PM manages the project.**



## BULLET POINTS: AIMING FOR THE EXAM

In matrix organizations, your team doesn't report to you, so the charter gives you the authority to put them to work.

The project charter shouldn't be too detailed. You shouldn't have to update the charter every time you change something about your project for it to stay accurate.

Agreements are sometimes referred to as contracts on the exam.

- The **project charter** officially sanctions the project. Without a charter, the project cannot begin.
- The **sponsor** is the person (or people) responsible for paying for the project and is part of all important project decisions.
- **Develop Project Charter** is the very first process performed in a project.
- The project charter gives the project manager authority to **do the project work**, and to **assign work** or take control of project resources for the duration of the project. It also gives the project manager authority to **spend money** and **use other company resources**.
- **Data gathering techniques** (like brainstorming) are ways to get all of your stakeholders on the same page about your project goals and your approach to meeting them.
- The **business case** tells everyone why the company should do the project. It's an input to building the **project charter** that tells everyone that the project actually started, explains what it's going to deliver, and authorizes the project manager to do the work.
- The project charter does not include details about what will be produced or how. Instead, it contains the **summary milestone schedule**.
- Two additional inputs to Develop Project Charter are the **agreements** and the **benefits management plan**. The agreements are what you agreed to do, although not all projects have agreements. The benefits management plan tells everyone exactly when and how the benefits of the project will be delivered.
- **Enterprise environmental factors** tell you how your company does business. They can be either internal or external factors. An important one is the **project management information system**, which determines how work is assigned, and makes sure that tasks are done in the right order.
- **Organizational process assets** tell you how your company normally runs projects. One of the most important assets is **lessons learned**, which is where you write down all of the valuable historical information that you learn throughout the project to be used later.

At Acme, the CEO and VP of Asia Travel were the sponsors. But at another travel agency, Frank and Joanne could just as easily sponsor the project, since they're the customers.



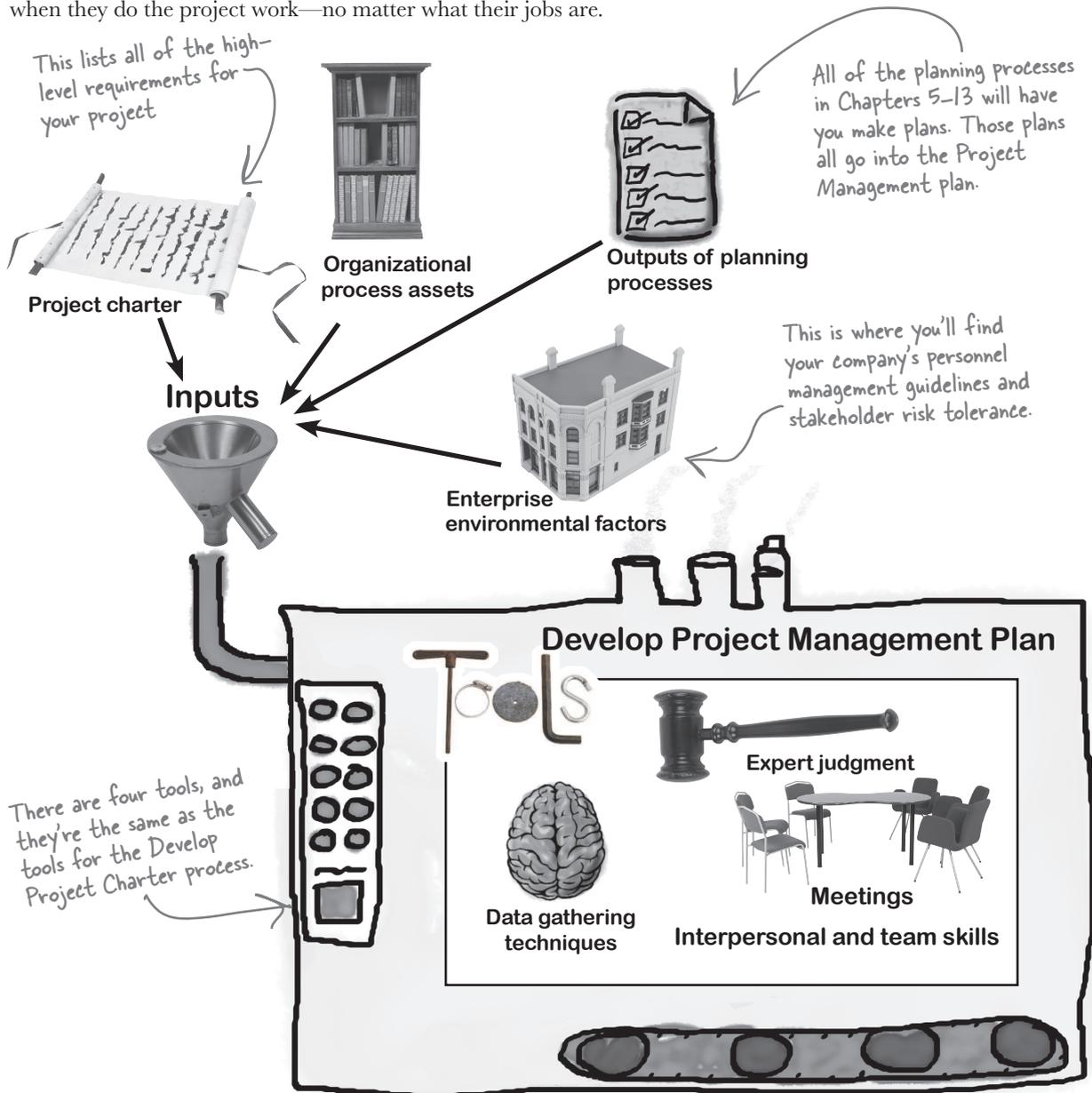
**Watch it!**

**When you're taking the PMP exam, be careful when you see a question that asks you about the customer or client.**

*There's a good chance that the question is asking you about a consulting or procurement situation where the customer or client is also the sponsor.*

# Plan your project!

Planning the project is when you really take control. You write a plan that says exactly how you're going to handle everything that goes on in the project. The **Develop Project Management Plan** process is where you organize all of the information about your project into one place, so everyone knows exactly what needs to happen when they do the project work—no matter what their jobs are.



## The Project Management plan lets you plan ahead

The **Planning** process group is where you figure out how you're going to do the project—because you need to come up with a plan before you bring the team in to do the work. This is where you think about everything that will happen on your project, and try to plot a course to complete it with as few errors as possible.

And it's where you figure out how you'll handle changes—because every project has plenty of problems, but not all of those problems mean that you need to change course. If you plan well, your project will make only the right changes.

### Outputs



The Project Management plan is the only output of the Develop Project Management Plan process.

## The Project Management plan is a collection of other plans

The Project Management plan is a single document, but it's broken into a bunch of pieces called **subsidiary plans**. There's one subsidiary plan for each of the other knowledge areas: Scope Management, Schedule Management, Cost Management, Quality Management, Resource Management, Communications Management, Risk Management, Procurement Management, and Stakeholder Management.

The Project Management plan is all about planning for problems, and having the information you need to correct those problems when they occur.

The Project Management plan is actually a whole bunch of documents called "subsidiary plans," each dedicated to a knowledge area and the specific approach to planning related to that area.

Communications Management is another knowledge area. In that plan, we've got important numbers for the trip.

If you take over a project that's already under way, but there isn't a Project Management plan or it's out of date, the first thing you need to do is get a current, accurate plan written up.



Project Management plan

There's a subplan for Risk Management. We used it when we took out traveler's insurance for the teachers' trip. That means if bags or cash are stolen, we'll have a plan for dealing with it.

The Project Management plan also has baselines. A baseline is a snapshot of the scope, schedule, or budget that you can use for planning. You'll learn all about baselines in the next three chapters!

ISN'T A PROJECT PLAN  
JUST SOMETHING I GET OUT OF  
MICROSOFT PROJECT?

**No. The Project Management plan is not the same thing as a project schedule.**

You'll use a tool like Microsoft Project when you're doing Schedule Management to build the project schedule. (It's useful for other knowledge areas as well.) But you'll use your Project Management plan as a guide to help you develop that schedule. It will tell you what tools to use when you develop it, and how changes will be handled.



Relax

**Don't worry about memorizing all of the subsidiary plans yet.**

You're going to learn about all of the knowledge areas throughout the book, so don't worry about memorizing all of these subsidiary plans right now. Just know that the Project Management plan has plans within it that map to each of the knowledge areas.

## A quick look at all those subsidiary plans

You'll be learning about each of the knowledge areas throughout this book, and you'll learn all about the subsidiary plan that goes with each area. But let's take a quick look at what each subsidiary plan focuses on.

### Project Management Plan—Subsidiary Plans and Baselines

The **Scope Management plan** describes how scope changes are handled—like what to do when someone needs to add or remove a feature for a service or product your project produces.

The **Requirements Management plan** describes how you'll gather, document, and manage the stakeholders' needs, and how you'll meet those needs with the project deliverables.

The **Schedule Management plan** shows you how to deal with changes to the schedule, like updated deadlines or milestones.

The **Cost Management plan** tells you how you'll create the budget, and what to do when your project runs into money problems.

The **Quality Management plan** deals with problems that could arise when a product doesn't live up to the customer or client's standards.

You use the **Resource Management plan** to deal with changes in your staff, and to identify and handle any additional staffing needs and constraints you might have in your specific project.

The **Communications Management plan** lists all of the ways that you communicate with your project's team, stakeholders, sponsors, and important contacts related to the project.

The **Risk Management plan** is about detailing all the bad things that might happen and coming up with a plan to address each risk when and if it occurs.

The **Procurement Management plan** focuses on dealing with vendors outside of your company.

The **Stakeholder Management plan** focuses on managing the expectations of all of the people who are affected by the project.

There are three **baselines** in the Project Management plan. The **scope baseline** is a snapshot of the scope, which helps you keep track of changes to the work that you'll be doing and the planned deliverables you'll be building. The **schedule baseline** does the same for the project schedule, and the **cost baseline** does the same for the budget.

This plan is used in Scope Management, which you'll learn about in the next chapter.

**The Project Management plan is the core of Integration Management. It's your main tool for running a project.**



Below is a whole crop of factors the project team members discovered as they executed the project. Write down which subsidiary plan you'd look in to get some help. If you're not sure, just reread the descriptions of each subsidiary plan on the previous page, and take your best guess.

1. The teachers want to go Bali, but Acme Travel doesn't book flights there so you need to subcontract one leg of the travel to another travel agency.

---

2. After reading online reviews, the teachers want to stay at better hotels. They tell you to increase their budget by 15% to do that.

---

3. Just as you're about to mail off the teachers' tickets, you notice they've been printed incorrectly.

---

4. The teachers might run into more bad weather, and you've got to figure out what contingencies you can put into place if that happens.

---

5. The teachers are concerned that they won't be able to get in touch with you when they're away.

---

6. One of the teachers realizes that he needs to come back earlier, and you want to make sure the budget reflects his lessened costs.

---

7. You find out that you need to get the tickets out earlier than expected, because the teachers' contract requires that all trips be preapproved by the superintendent of their school district.

---

—————> **Answers on page 163.**

## there are no Dumb Questions

**Q:** How far should I go when trying to anticipate every possible issue and list it in the Project Management plan?

**A:** It's really important to think about what could change on your project, so that you can have plans for what to do when things don't go as expected. An unexpected change can sometimes derail a project, and doing some planning up front can keep issues like that to a minimum. Planning can help you avoid problems in the first place, which is a lot better for everyone than reacting to them when they happen. So think of everything you can; the extra time you spend planning could be what makes your project a success.

**Q:** Does the project manager create the Project Management plan all by himself?

**A:** No, it should be a group effort between the PM and the stakeholders. Everyone on the project team and all of the stakeholders need to agree that the plan is acceptable.

**Q:** What about things that I don't think about? I'm not sure what they'll be until the project gets going. Sometimes there are uncertainties, so we base our plans on assumptions...right?

**A:** You're never going to think of everything. To help keep your plan flexible, you should add an Open Issues section to the plan. You can write down any open issues or concerns in this section, and deal with them as they come down the line. However, you have to have all your project requirements complete before starting the project—you should *never* have any requirements in your Open Issues section.

**Q:** I still don't get what enterprise environmental factors are.

**A:** Your company's enterprise environmental factors are all of the information you have about its policies, processes, departments, and people. You need to know how your company does business in order to manage a project. For example, you need to know about the different departments in your company if you're managing a project that will be used by people in them. And remember, enterprise environmental factors can also be external factors, like regulations. The important point is that you can't control them, and need to take them into account.



### BULLET POINTS: AIMING FOR THE EXAM

- Remember that the Project Management plan is **formal**—which means that it's **written down** and **distributed** to your team. This is also true for the project charter.
- You may get a question on the exam that asks what to do when you encounter a change. You **always** begin dealing with change by **consulting the Project Management plan**.
- The **project management information system** is a part of your company's enterprise environmental factors, and it's generally part of any change control system. It defines how **work is assigned to people**.
- The Project Management plan includes **baselines**: snapshots of the scope, schedule, and budget that you can use to keep track of them as they change.

## Question Clinic: The just-the-facts-ma'am question

A great way to prepare for the exam is to learn about the different kinds of questions, and then try writing your own. Each of these Question Clinics will look at a different type of question, and give you practice writing one yourself.

Take a little time out of the chapter for this Question Clinic. It's here to let your brain have a break and think about something different.

A LOT OF QUESTIONS ON THE EXAM ARE PRETTY STRAIGHTFORWARD, BUT IT'S THE ANSWERS TO THOSE QUESTIONS THAT CAN REALLY HANG YOU UP. HERE, TAKE A LOOK:

27. Which of the following can be found in the project charter?

- A. Business case document

Some answers will clearly be wrong. The business case document is one of the inputs to the Develop Project Charter process.

- B. Expert judgment

Some answers are a little misleading! This is part of the Develop Project Charter process—but it's from the tools and techniques, not a part of the project charter itself.

- C. Authorization for the project manager

Here's the right answer! The project manager's authorization is included in the project charter.

- D. Project management information system

You haven't seen this one yet—it's part of enterprise environmental factors, an input to the Develop Project Charter process, but not in the charter itself.

WHEN YOU SEE A JUST-THE-FACTS-MA'AM QUESTION, READ THE QUESTION REALLY CAREFULLY! IF YOU DON'T, IT'S EASY FOR A WRONG ANSWER TO LOOK RIGHT.



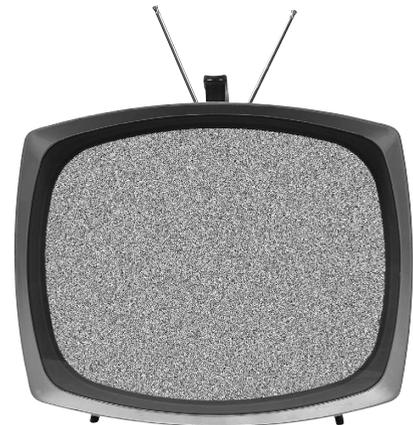
# HEAD LIBS

Fill in the blanks to come up with your own just-the-facts-ma'am question.

You are managing a \_\_\_\_\_ project. You are using  
\_\_\_\_\_ (an industry) and \_\_\_\_\_  
to create a \_\_\_\_\_ (an input) \_\_\_\_\_ (an input).  
What process are you performing?  
(an output)

- A. \_\_\_\_\_  
(the name of the wrong process)
- B. \_\_\_\_\_  
(the name of the right process)
- C. \_\_\_\_\_  
(a made-up process that sounds like a real process)
- D. \_\_\_\_\_  
(the name of a tool and technique from the right process)

**LADIES AND GENTLEMEN,  
WE NOW RETURN YOU  
TO CHAPTER FOUR**

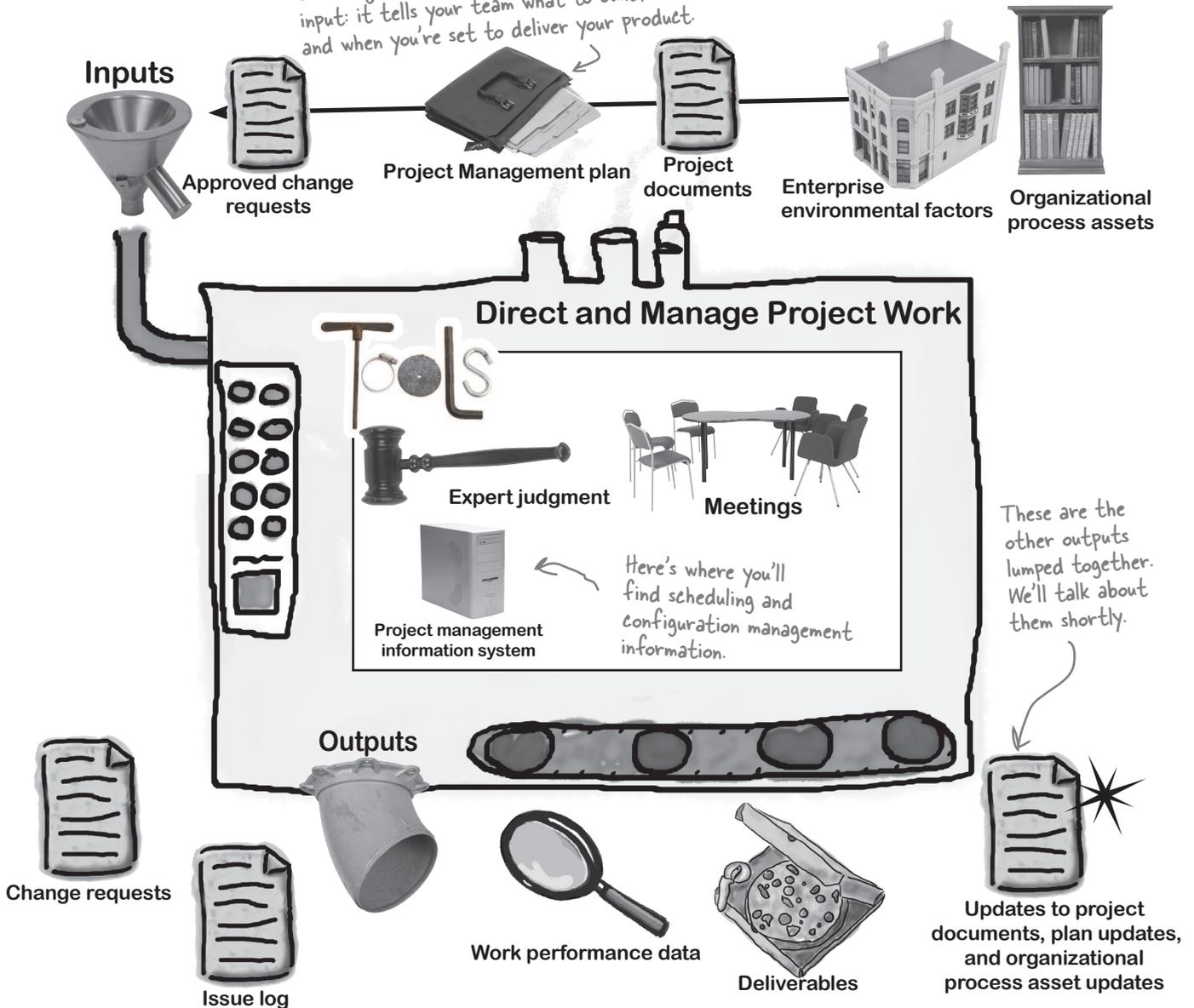


# The Direct and Manage Project Work process



Once you have a Project Management plan, your project is ready to begin. And as the project unfolds, it's your job to direct and manage each activity on the project, every step of the way. That's what happens in the **Direct and Manage Project Work** process: you simply follow the plan you've put together and handle any problems that come up.

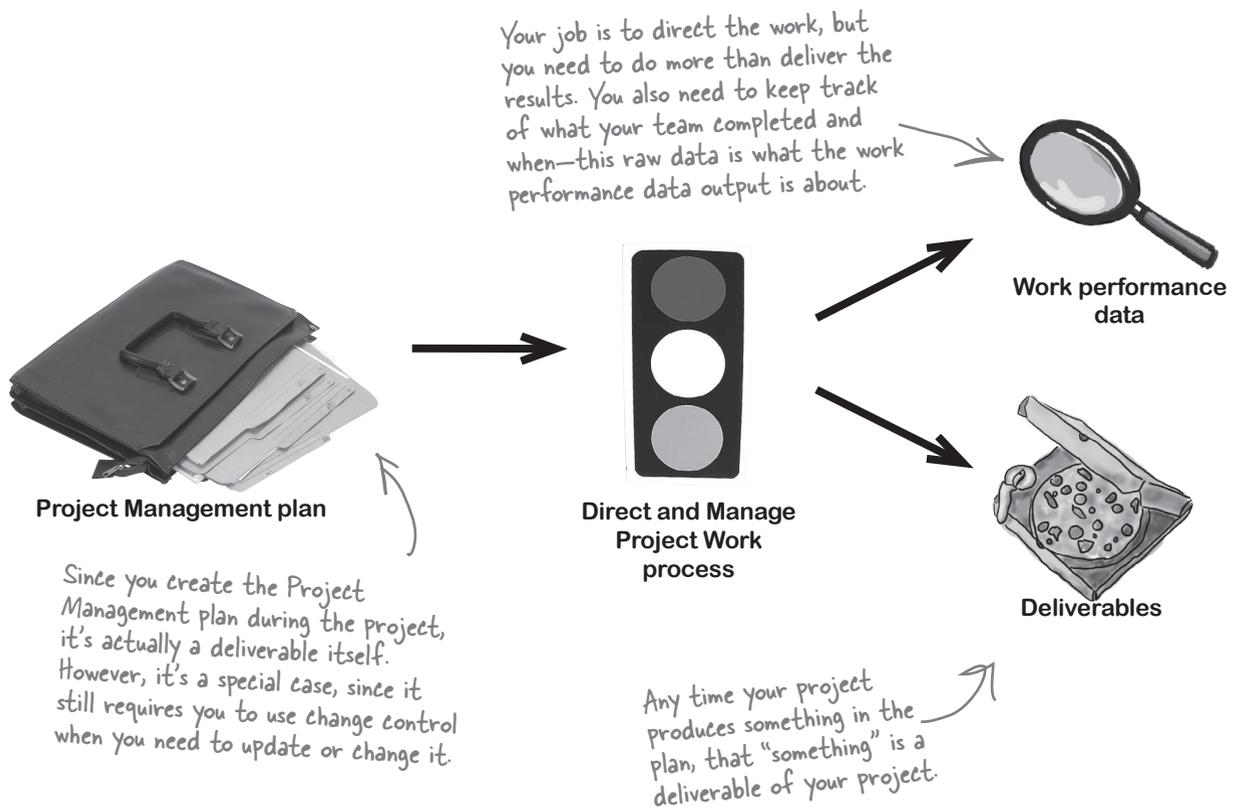
*The Project Management plan is the most important input: it tells your team what to build, how to build it, and when you're set to deliver your product.*



## The project team creates deliverables

The work you're doing on the teachers' project creates lots of things: airline reservations, hotel reservations, invoices, defect reports, and customer comments (to name a few). These things are all your **deliverables**, and they are one of the outputs of the **Direct and Manage Project Work** process.

Another output is **work performance data**, and that's what we call the reports Acme's running on the project. These reports track how many negative versus positive customer comments the project gets, and how well the project is doing at meeting its cost estimates. In fact, a project manager should figure out a way to use the work performance data that is generated from each knowledge area during the Direct and Manage Work process to understand how well the processes are being performed.



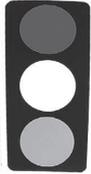
You create work performance data by measuring how and when the processes from each knowledge area are being performed.

## Executing the project includes repairing defects

The Direct and Manage Project Work process has a bunch of inputs and outputs—but most of them have to do with implementing changes, repairs, and corrective action. If there's a defect repair that's been approved, this is where it happens. Once the **defect** is repaired, the result is an implemented defect repair. The same is true for changes and corrective actions; once they're approved, they become process inputs, and then they can be implemented and become process outputs.

Any time you have to correct a mistake or make a repair in a deliverable, you're fixing a defect.

### The three components of the Direct and Manage Project Work process:



1. Use the plan to create deliverables.
2. Repair defects in deliverables.
3. As the project plan changes, make sure those changes are reflected in the deliverables.

Deliverables are anything you produce in the course of doing your project activities.

Your Quality Management plan focuses on catching defects as you go, so you can repair them as soon as possible.

This is different from fixing defects. A defect means that the plan was right, but your deliverable was built wrong.

### Deliverables include everything that you and your team produce for the project

The word **deliverable** is pretty self-explanatory. It means anything that your project **delivers**. The deliverables for your project include all of the products or services that you and your team are performing for the client, customer, or sponsor.

But deliverables include more than that. They also include every single document, plan, schedule, budget, blueprint, and anything else that gets made along the way...including all of the project management documents that you put together.

Deliverables can be either internal to your company or to the customer.



Deliverables

The Direct and Manage Project Work process is where you and your team actually do the work to produce the deliverables.

# Sharpen your pencil



Here's a list of things produced by some typical projects. Some of them are deliverables, and others are work performance data produced by running reports. There's also a list of changes, some of which affect the Project Management plan, and some of which just affect the project deliverables. It's up to you to figure out which is which.

1. The software project team builds software.

- Deliverable                       Work performance data

2. A builder hangs a door.

- Deliverable                       Work performance data

3. A wedding photographer sends the photo proofs to the client.

- Deliverable                       Work performance data

4. The cable repair technicians take an average of four hours per job.

- Deliverable                       Work performance data

5. The construction crew worked 46 hours of overtime in March.

- Deliverable                       Work performance data

6. The construction crew built the six houses required by the plan.

- Deliverable                       Work performance data

7. A software test team finds bugs in the software.

- Defect in deliverable                       Change to Project Management plan

8. A bride asks the photographer to stop asking her mother for permission to make changes.

- Defect in deliverable                       Change to Project Management plan

9. A construction crew used the wrong kind of lumber in a house.

- Defect in deliverable                       Change to Project Management plan

10. A photographer's prints are grainy.

- Defect in deliverable                       Change to Project Management plan

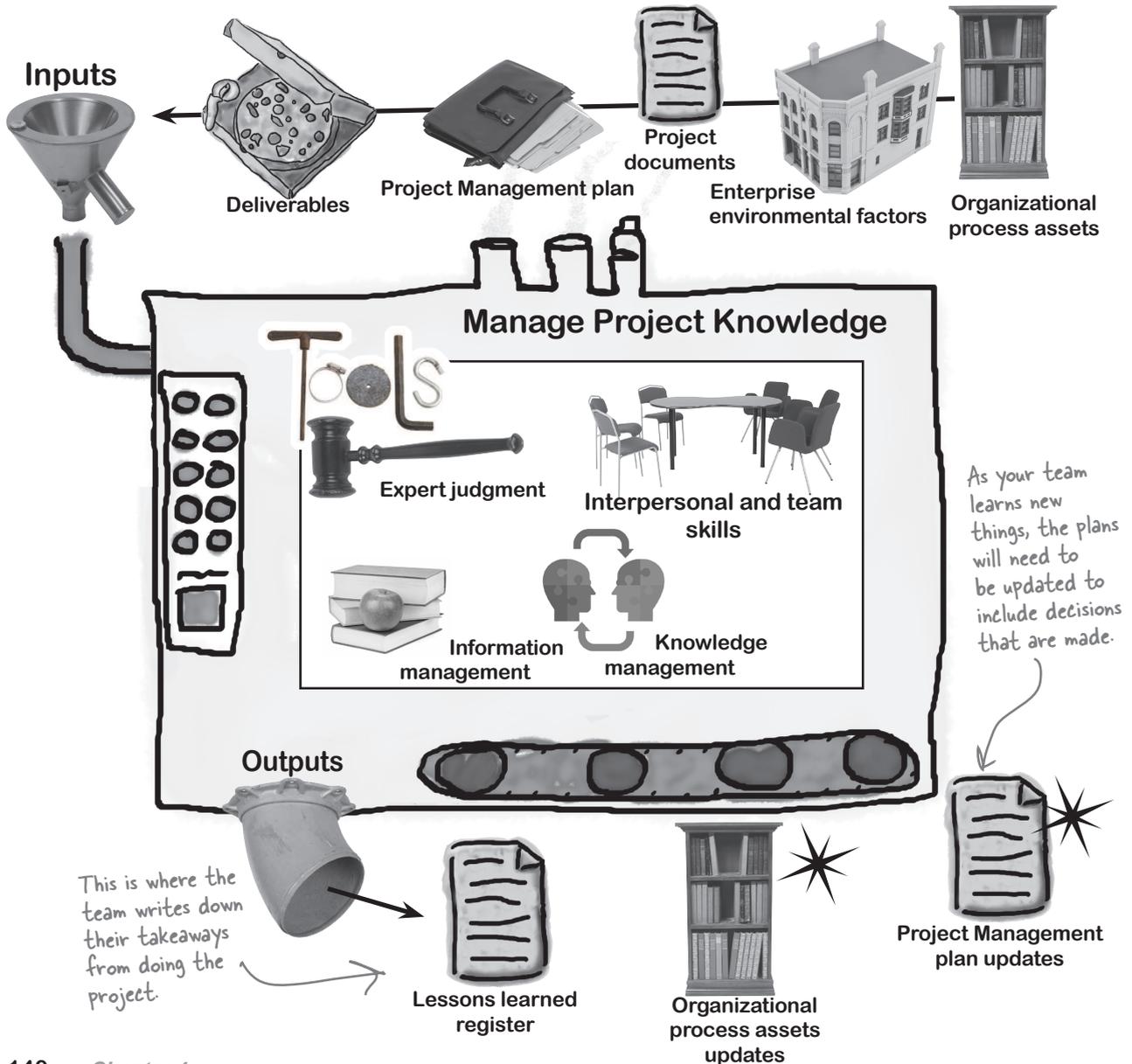
Sometimes something that looks like a defect in a deliverable is really a change that you need to make to the plan.



Answers on page 164.

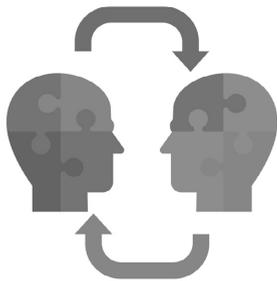
# The Manage Project Knowledge process

The whole time your project is happening, your team is solving problems and learning. The **Manage Project Knowledge** process is all about using the information your company has already learned from doing past projects and creating new information when your team learns something your company hasn't encountered before.



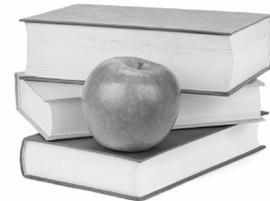
## Knowledge is the lifeblood of any project

Who would you rather have running your project: a rookie project manager who's only been managing projects for a few months, or a seasoned veteran who's got 20 years of experience? The thing that separates them, more than anything else, is **knowledge**: the experienced project manager has learned a huge number of lessons throughout her career, and she knows how to apply them to her day-to-day work to make her projects run smoothly. But it's not just the project manager who has important knowledge; it's spread across your whole team, your entire organization, and even people outside of it. Some of that knowledge is **explicit**, or written down in documents, files, data, and so on, but a lot of it is **tacit**, in people's heads or embedded in the company's culture. Getting a handle on this knowledge can be a real challenge for an organization.



That's where **knowledge management** comes in. Your team works together every day, and they're constantly reshaping their understanding of the problems that come up within your project. Knowledge management is about creating opportunities for them to share what they've learned with each other and think of new solutions together. Teams will use methods like communities of practice, message boards, distribution lists, workshops, pair programming and work shadowing, and team meetings to help keep everyone on the same page.

It's not enough for the team to have a shared understanding of the project, though—they need to share that understanding with the rest of the organization. Once the team has identified information from their project that might be useful to the rest of the organization, they need to write it down and share it. **Information management** is all about creating libraries of information that people both within and outside the project can use if they run into similar situations to the ones your team is encountering. The main document produced by teams to describe what they've learned during the project is the **lessons learned register**.



Teams use lessons learned just like the experienced PM uses her knowledge to make her project run better.

We'll dive deeper into lessons learned later in this chapter.



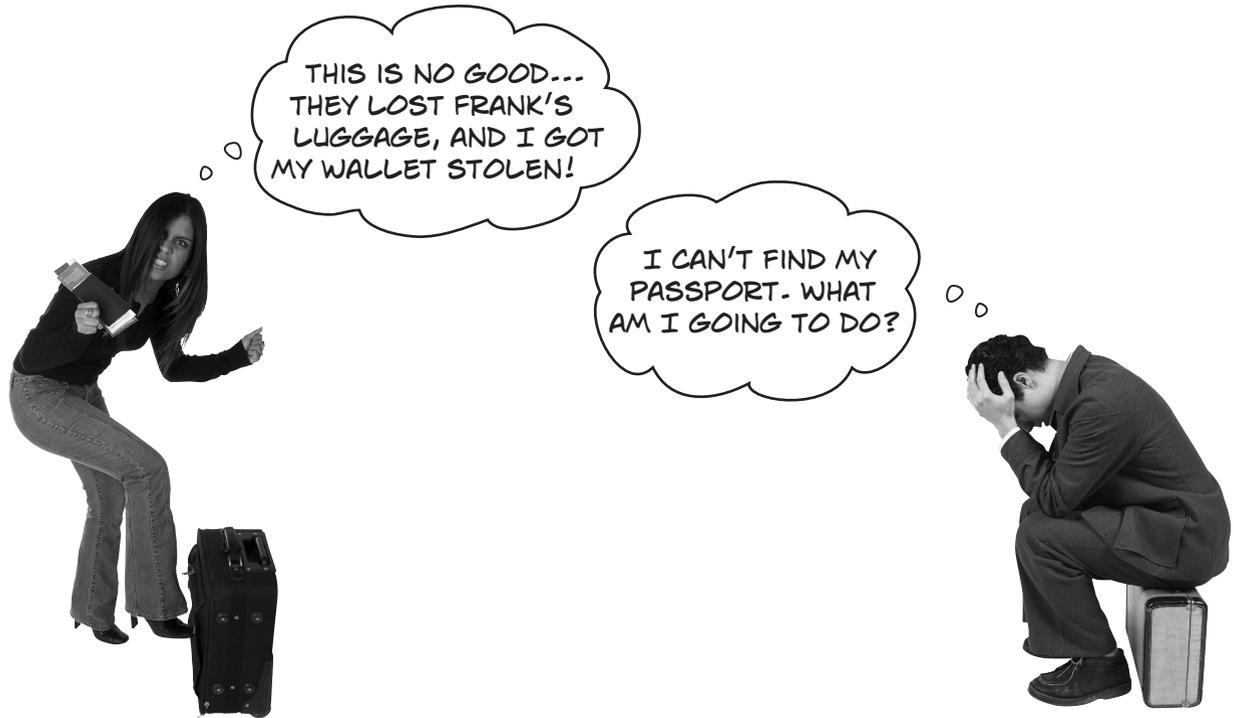
Watch it!

### Knowledge management goes beyond “just” information management.

People sometimes use the words “knowledge” and “information” interchangeably, but they're not the same thing. One way to think about it is that you process data to turn it into information, but it's only when you analyze that information that it becomes knowledge. Knowledge management goes beyond **information management**, or using IT systems to capture, store, and organize information. It also includes building a culture of collaboration and knowledge sharing.

## Eventually, things WILL go wrong...

Even if you work through all the processes you've seen so far, things can still go wrong on your project. In fact, the teachers are already letting you know about some issues they're having.



**...but if you keep an eye out for problems, you can stay on top of them!**

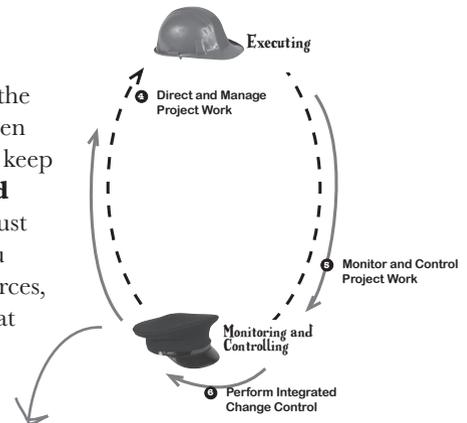
It's a good thing you've been monitoring the project. Otherwise, you might not have found out about their problems in time to help.



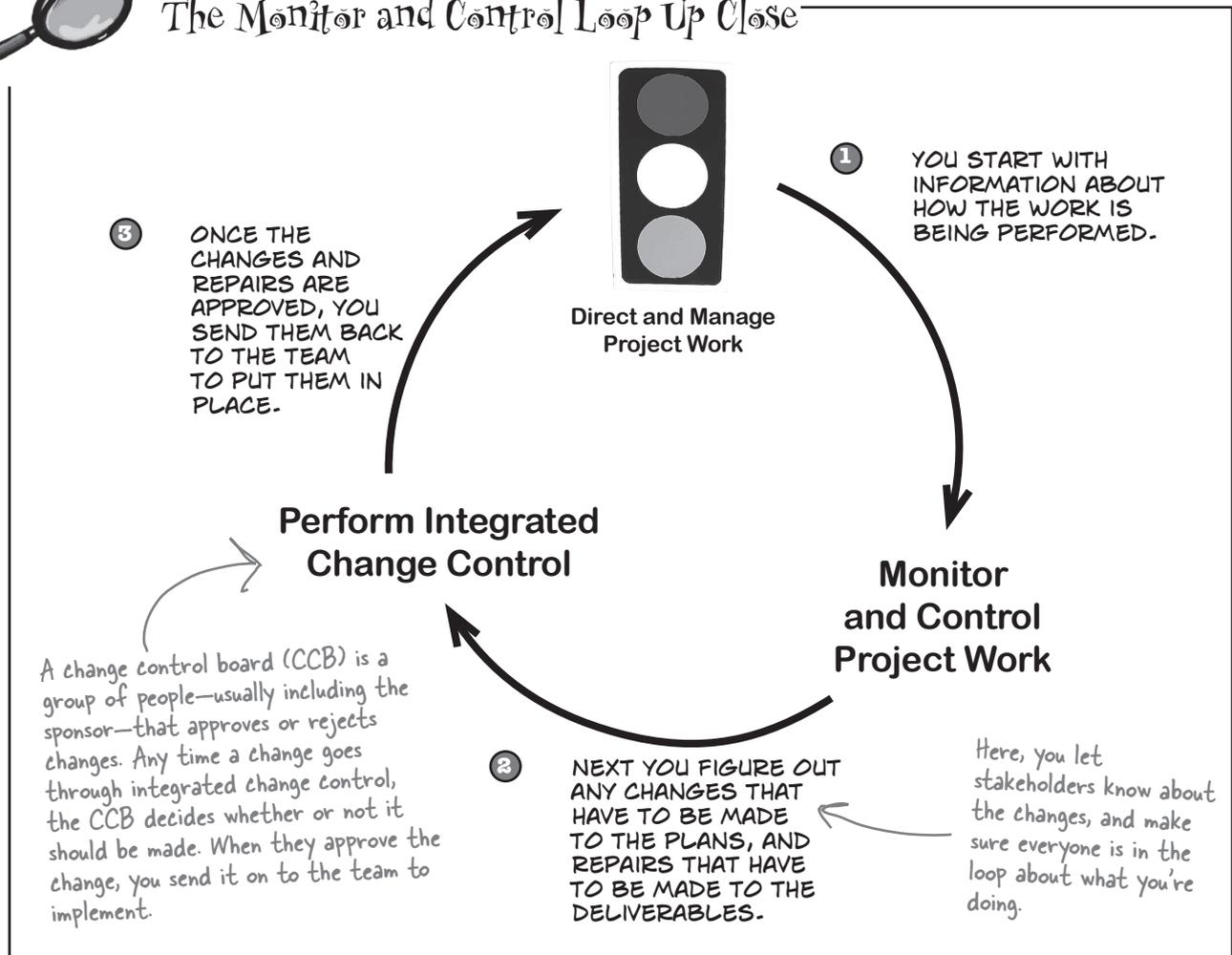
YOU CALLED JUST IN TIME! WE'VE RUN INTO SOME SERIOUS PROBLEMS. YOU CAN HELP US, RIGHT?

## Sometimes you need to change your plans

Take a minute and flip back to page 117. Notice how there's a loop between the Executing and the Monitoring and Controlling processes? That's because when your team is executing the plan and working on the deliverables, you need to keep a constant lookout for any potential problems. That's what the **Monitor and Control Project Work** process is for. When you find a problem, you can't just make a change...because what if it's too expensive, or will take too long? You need to look at how it affects the project constraints—time, cost, scope, resources, risks, and quality—and figure out if it's worth making the change. That's what you do in the **Perform Integrated Change Control** process.

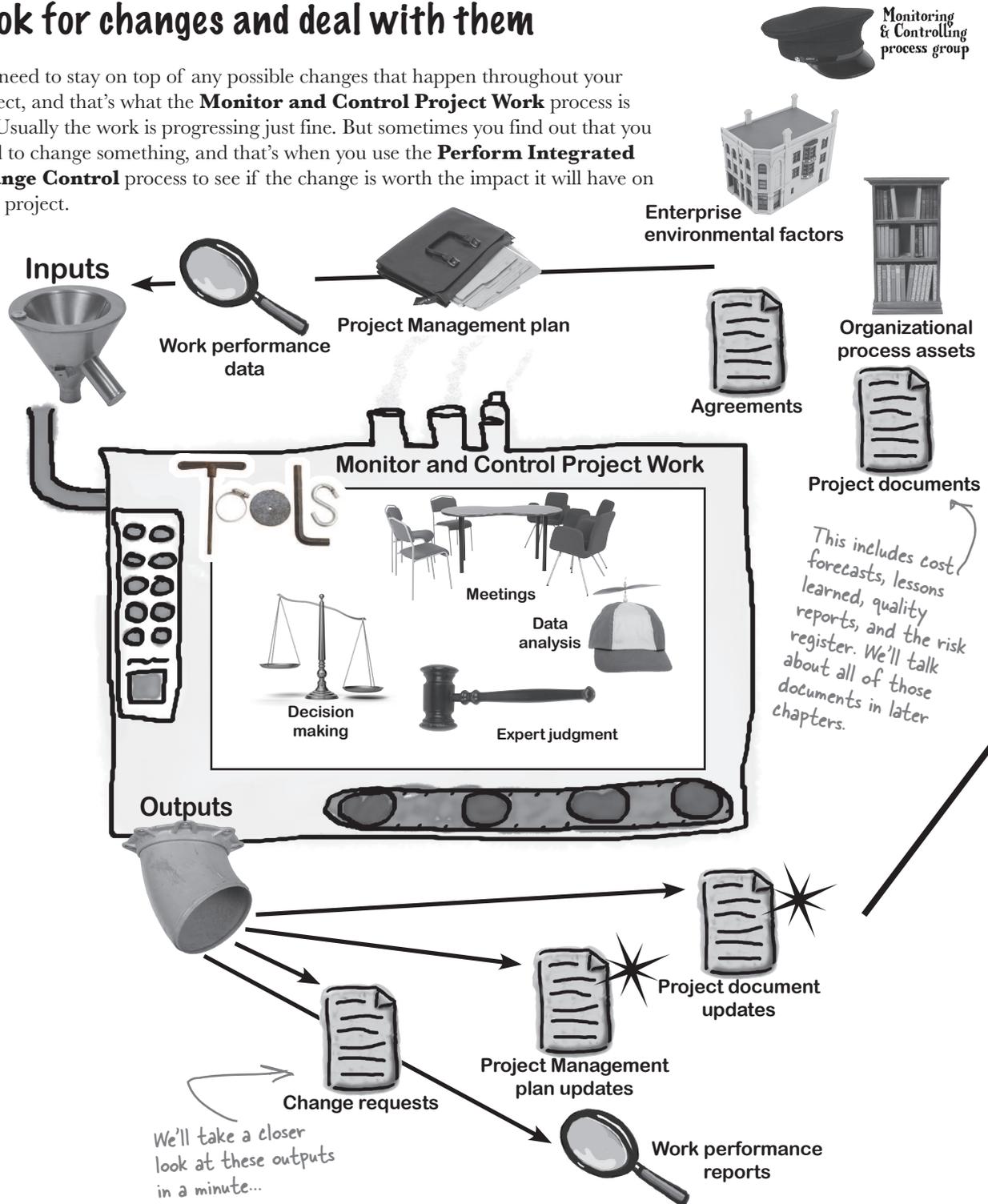


### The Monitor and Control Loop Up Close



# Look for changes and deal with them

You need to stay on top of any possible changes that happen throughout your project, and that's what the **Monitor and Control Project Work** process is for. Usually the work is progressing just fine. But sometimes you find out that you need to change something, and that's when you use the **Perform Integrated Change Control** process to see if the change is worth the impact it will have on your project.



# Make only the changes that are right for your project

The Monitor and Control Project Work process is where you find the changes that you may want to make. The **Perform Integrated Change Control** process is where you decide whether or not to make them. But you're not the one actually making that decision—a big part of Perform Integrated Change Control is that you **need to get your changes approved by the change control board**.



Monitoring & Controlling process group



Enterprise environmental factors



Project documents



Organizational process assets



Inputs



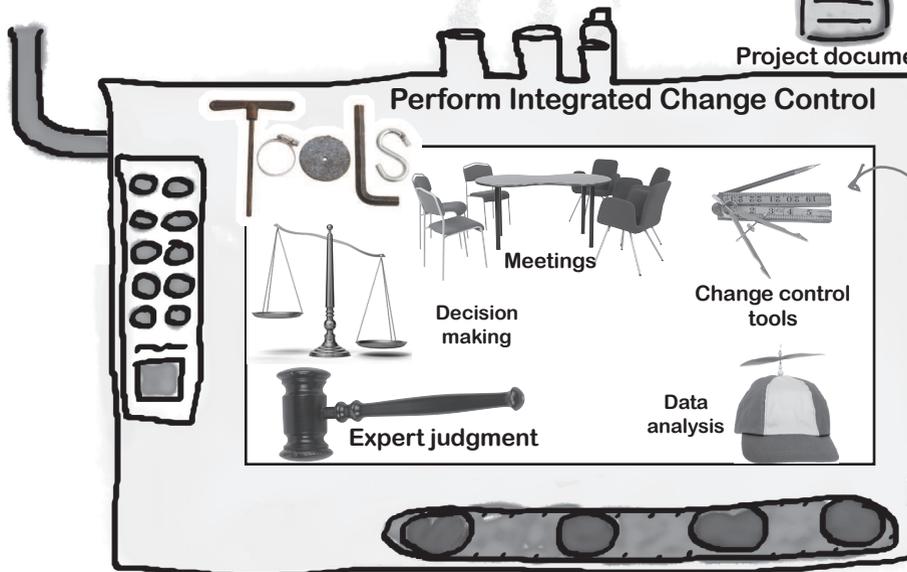
Project Management plan



Work performance reports



Change requests



Perform Integrated Change Control

Meetings

Decision making

Expert judgment

Change control tools

Data analysis

*These are any tools you might use to keep track of change requests. That could mean software, or forms you use to write them up and keep track of their status.*

**After Perform Integrated Change Control, we go back to the Direct and Manage Project Work process to put the approved changes in place.**



Approved change requests

Project Management plan updates

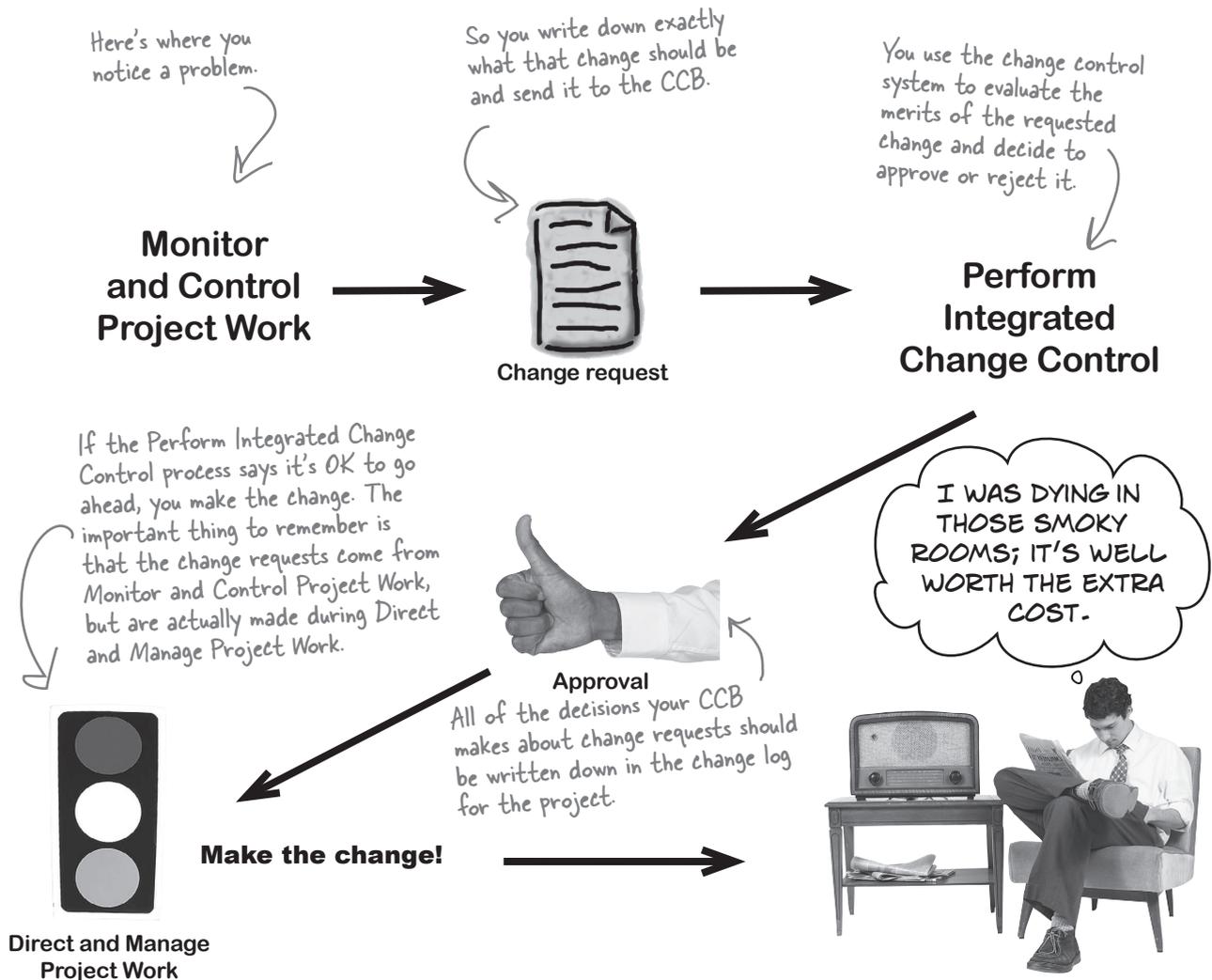
Project document updates

*All changes, even the ones that don't get approved, are written in the change log.*

## How the processes interact with one another

While monitoring the teachers' trip, you notice that they all ask for nonsmoking rooms every time they check into a hotel. But some hotels don't have enough nonsmoking rooms available, and the teachers aren't too thrilled about that.

After you talk it over with the teachers, it's clear that it's worth splitting up the group over multiple hotels to make sure they all are in nonsmoking rooms—and some hotels are more expensive than you'd planned. The cost change will put you over budget, so the Cost Management plan needs to be updated. Time to take the request to change control:



## Changes, defects, and corrections

You've already seen how a project can change as it goes along. When the teachers asked for their hotel to be upgraded, you took the request through the **Perform Integrated Change Control** process at Acme, and when the change control board approved the change, you directed the agents to make the booking for the group.

But sometimes, things go wrong with what you intended to have happen in the first place. When your quality department told you that you had booked the teachers on the flight to Rome without putting them in the same row, you quickly fixed the reservation. But you intended for the teachers to sit together in the first place, so that's not a change, it's a **defect**.

In the process, you realized that your team wasn't reading your documentation carefully, which is why they screwed up the airline reservations. To fix the way your team is working, you need to take corrective action. That's when you need to change the way you're doing the work on your project. Got all that?

**When the team is repairing defects to deliverables, they still need to go through change control.**

## Decide your changes in change control meetings



Sometimes a change you make will have a direct impact on other teams and projects, and it's a good idea to be sure that everybody who will be impacted knows that it's coming and thinks that it's worth it before you make the change. You can't always know everything that might happen as a result of a change, and that's why it's a good idea to get buy-in from key people in your company before you go through with it. And that's what a change control meeting is all about!

Usually, a change control meeting will be a regularly scheduled thing, where people representing the affected areas of the company will get together to review proposed changes and decide whether or not to make them. A change control board is never made up of just the people on your team. A change control meeting is all about getting people with different perspectives together to talk about the pros and cons of changes before deciding whether to approve or reject them.

It's your job as a project manager to know the impact of requested changes to your project and prioritize them for the change control board. Once you've done that, the change control board can make informed decisions about whether or not to approve them.

## Control your changes; use change control



Any time you need to make a change to your plan, you need to start with a **change request**. This is a document that either you or the person making the change needs to create. Any change to your project needs to be documented so you can figure out what needs to be done. Once you have a change request, that then kicks off your project's set of change control procedures.

The key here is **PROCEDURE**—change control is about how your company handles changes. You may use a computer system to monitor and document changes, but that's just one part of your change control system.

This means you need to write down exactly what needs to be changed and put it in something called a change request. That's a form that you fill out to send a change through change control.

**Change control is how you deal with changes to your Project Management plan.**

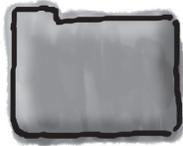
**A change control system is the set of procedures that lets you make those changes in an organized way.**

This is Acme's change control system. It's specific to the company, but it contains all of the steps you'd see in a typical change control system.

### Acme Travel Change Control System



The first thing you do with any change is to consult the proper management plan.



Cost Management plan

The teachers want to increase their budget, so you look at their Cost Management plan.



Change request

Next, you document the change, and submit it to the board that decides if the change will be implemented.



Change control meeting

A change control board is a group of people who consider changes for approval. Not every change control system has one, but most do.

Not every change gets approved, but this one did—and now the Project Management plan can be updated.



Approval



Project Management plan

At Acme, the plan is updated using the configuration management system, a part of the PMIS that tracks all of the changes.



Project management information system



## Preventing or correcting problems

When you monitor your project, you might be checking the actual time it's taking you to do scheduled work versus the amount of time you planned, or you might be gathering information on the number of defects you have found versus the number you expected. In both cases, it's possible that you might find problems. If you do, you have to change the way you do your work and keep your project from being dragged down. When you make a course change on your project, that's taking **corrective action**.

It's also possible that you might see problems that are going to occur even though they haven't happened yet. If you do, you will want to take **preventive action**, or steps that you take to avoid potential problems.

In both corrective and preventive action, you always need to submit your proposed change and put it through the Perform Integrated Change Control process—and only if it is approved will you implement it. If your recommended action makes it through, you need to change the plan and any of your **baselines** to include it.

The documented scope, schedule, and cost baselines in the Project Management plan are called the **performance measurement baseline**.

When people predict problems on projects before they happen, it's called a **forecast**. A forecast can be a good reason to make a change too!

We'll learn more about the performance measurement baseline in upcoming chapters.



### Exercise

Here is a list of actions that are recommended by a project manager. Which are preventive and which are corrective?

1. A software project is running late, so a software project manager looks to find slack time and reassign resources to get things done more quickly.

Preventive action

Corrective action

2. A caterer notices that the crudités are all gone and assigns a chef to make more.

Preventive action

Corrective action

3. A photographer brings an extra camera body to a shoot, in case one breaks down.

Preventive action

Corrective action

4. A consulting company assigns extra resources to a project to compensate for possible attrition.

Preventive action

Corrective action

→ Answers on page 162.

## there are no Dumb Questions

**Q:** Sometimes my team members come to me and tell me that the project could have problems later. What do I do with that?

**A:** For some project managers, it seems natural to dismiss these “negative Nellies” who seem concerned with problems that could go wrong in the future. But working with them instead is one of the best ways you can satisfy your stakeholders.

When someone makes an estimate or prediction of a future condition that could lead to trouble, it’s called a **forecast**, and that’s very valuable information. You should distribute it along with your work performance data, and try to think of ways to avoid the problem—which is what preventive action is all about.

A big part of your job as a project manager is to figure out how to prevent changes. This might seem a little weird—how can you prevent changes before the project is implemented? One way to do this is to plan as well as possible, because a lot of changes happen because of a lack of planning. But it also means talking to stakeholders throughout the project and keeping an eye out for potential problems. When you take the PMP exam, if you see the phrase “**influencing factors that cause change**,” this is what it’s referring to.

**Q:** Who approves changes?

**A:** Usually there’s a **change control board (CCB)** that approves changes. That’s a group of people, most often including the stakeholders and sponsor, who look at the benefits of a change and figure out if it’s worth the cost. If there’s a CCB, your change control system will include a procedure that mentions it. But not every company has a CCB, and there is no requirement in the *PMBOK® Guide* that you have one.

**Q:** What if there’s a problem outside my project, and I’m not sure it affects me?

**A:** You should still consider its potential impact when you’re monitoring your project’s work. It’s important that you’re always on the lookout for potential problems. If you’re not sure whether something could impact your project, it’s your responsibility as a project manager to bring it to the attention of your stakeholders. And if you can make a change on your own that doesn’t impact the project constraints (scope, cost, time, quality, risk, or resources), then **it’s completely within your rights as a project manager to do it**.

**Q:** Once a change is approved, what do I do with it?

**A:** You change your Project Management plan to incorporate the change. This can mean that you create a new baseline with the new Project Management plan. For example, say you forgot to add a stakeholder to the change control board, so your project plan now describes the wrong process for making changes. You’ll need to fix that, and you’ll need to go through change control to do it.

Every time a change is reviewed by the change control board, you keep a record of it in your change log. So whether the change was approved or rejected, the change request and the decision the CCB makes about it should be documented.

**Q:** What about changes that don’t affect the project constraints?

**A:** If you evaluate the impact of a change and find that it won’t have an impact on the project constraints, then you can make the change without going through change control. Sometimes you need to change resources or move tasks around, and you

can make those changes without affecting the bottom line or the end product. In these cases, change control wastes time and resources, rather than helping your project.

**Q:** Now, what’s a performance baseline again, and what do I do with it?

**A:** A performance baseline is a snapshot of your project’s scope, schedule, and cost. When you plan out the work you’ll do on a project, you write down all of the activities you’ll need to do and save that understanding as your scope baseline. You’ll do the same with your understanding of the project’s schedule and its cost. That way, you can always compare your actual performance to your plan.

Every time a change is approved, that means the plan has changed. So you have to update your baseline to include the new work (or cost, or schedule).

**You always have the authority to make changes to your project if they don’t affect cost, schedule, or scope.**

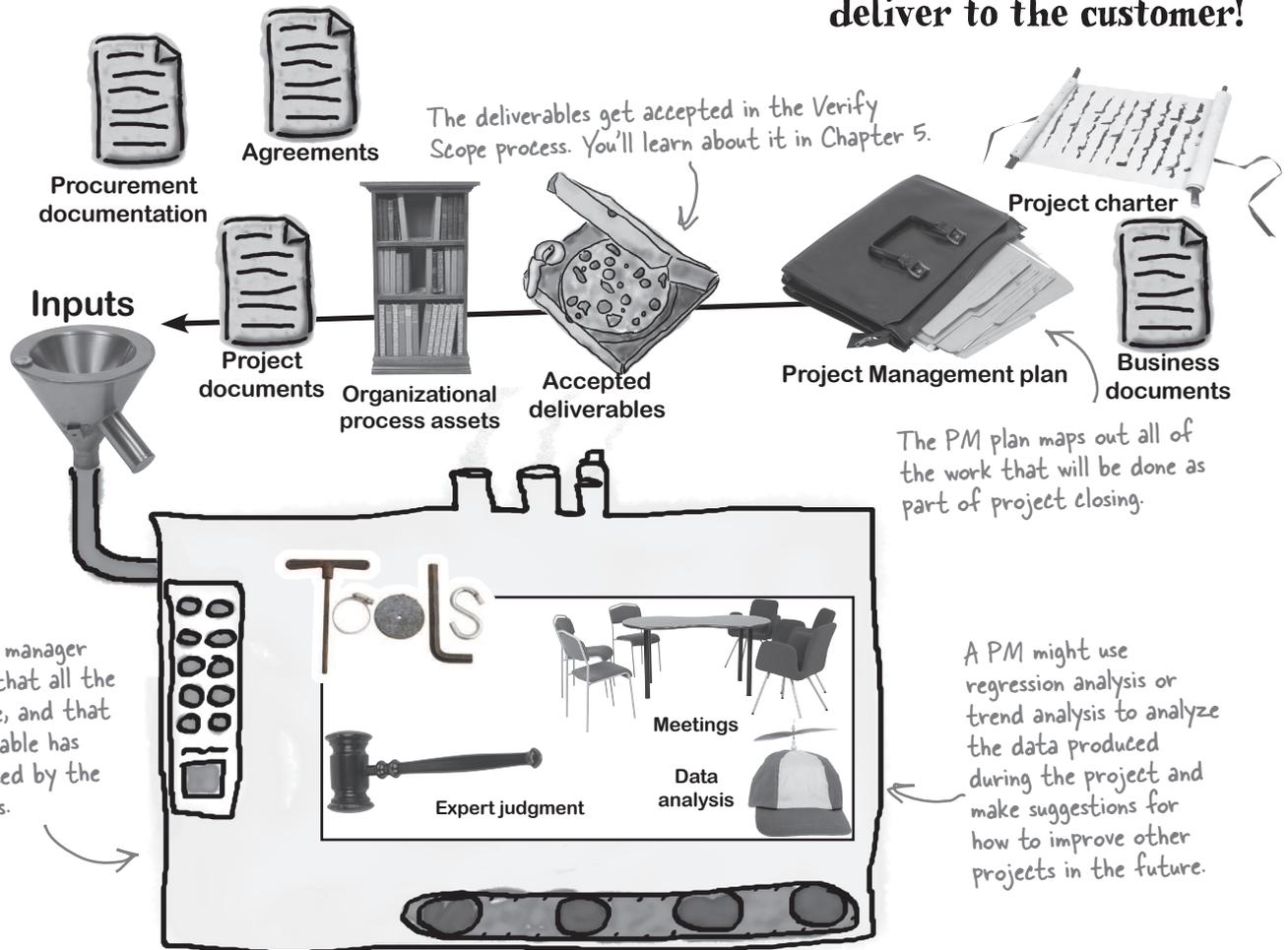
## Finish the work, close the project



Close Project or Phase

You can't finish the project until you get paid! Most projects start with contracts, and when they do you need to make sure the terms are met. Acme signed a contract with the Midwestern Teachers' Association when the project started, and now it's time to make sure all of the parts of that contract are met. And that's part of what you do in the **Close Project or Phase** process. But an even more important part of this process is that you create the **lessons learned** and add them to your company's organizational process assets. That way you and other project managers can learn from this **historical** information in the future. The inputs to the Close Project or Phase process include the project management plan, organizational process assets, and accepted deliverables. And you use the same familiar **tools and techniques** that you've seen throughout the chapter.

The most important output of the Close Project or Phase process is the final product that you deliver to the customer!





# You don't have to go home, but you can't stay here

The teachers have gone through their entire itinerary. They're now on their way to Paris, which is the final leg of their tour. They've had a great time, and now it's time for you to finish up.

Every project needs to end, and that's what the Close Project or Phase process is all about. You want other travel agents at Acme to learn from anything new you've discovered. Remember how you had to scramble with the nonsmoking room request? Maybe your friends at Acme can learn from that, and ask new clients up front what they want! That's why you write down your lessons learned, and that's a big part of closing the project.

Even if your project ends early, you still need to follow the Close Project or Phase process.



## Outputs



You've seen the organizational process assets input a bunch of times now. But where does it really come from? It turns out that it comes from other project managers just like you. Every time a project is closed, you update those assets so that you can use them later. And new project managers will be able to learn from everything that's happened on your project.

The final product of your project is the thing your customers will remember most.

The final report summarizes the project performance, including details on how well the projections were met.



Organizational process asset updates



Final product, service, or result transition



Project documents updates

Lessons learned are finished in Close Project or Phase, but written down throughout the entire project. And it's not just by the project manager—the whole team writes down lessons learned.



Final report

## BRAIN POWER

Think about a major project you've heard of that did not end well, like one that was shut down before the work was done. What lessons could have been learned from that project?

How can the project manager use the Close Project or Phase process to make sure that something good comes out of early termination?

## So why INTEGRATION Management?

The Integration Management knowledge area has all of the processes that you do in your day-to-day work as a project manager. So why are they called “Integration Management” processes? Well, think about what it takes to run a project: you need people and other resources from all around your company; knowledge about how your company does its business; standards, templates, and other assets that you’ve gathered from other projects; and the ability to put it all together—that’s what a project manager does. And that’s where the “integration” part comes in.

This is especially important when you need to work with consultants, because your job is to procure services for the project. And you need to plan for all of it at the beginning—which is when you **integrate** all of these things together into a single plan. It’s your job to make sure that every one of the 49 processes in the *PMBOK® Guide* is addressed in the plan, even if you’re not going to use it (for example, if you don’t need contractors or consultants, you won’t use Procurement processes).

**Integration Management means making sure that all of the processes work together seamlessly to make your project successful.**

I GET IT! WHEN I'M PUTTING TOGETHER MY PROJECT MANAGEMENT PLAN, I NEED TO LOOK AT EVERY SINGLE PROCESS AND FIGURE OUT HOW IT'S INTEGRATED INTO MY PROJECT. SO THAT'S WHAT **INTEGRATION MANAGEMENT MEANS.**



### What else is there?

Huh...it seems like we covered the whole project, right? You got authorized to do the work, you planned the project, you executed it, you corrected problems along the way, and you closed it out. Isn't that everything?

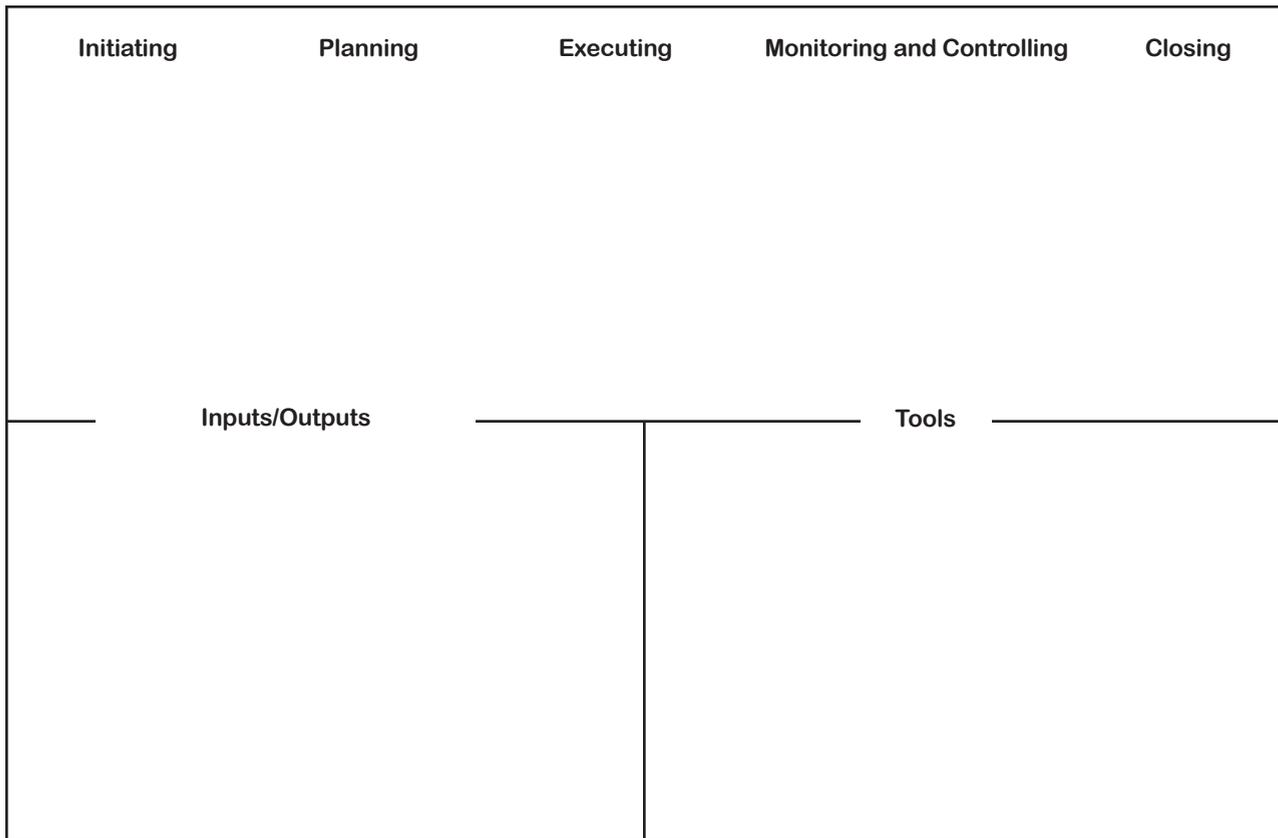
Well, of course not! There's a whole lot more planning that you have to do, and many skills that you need to have. Luckily, we've got the *PMBOK® Guide* to help us figure out exactly what we need to know to manage projects effectively.

That's what the rest of the book is about.



# Project Integration Management Magnets

These inputs, outputs, and processes are all scrambled up on the fridge. Can you reconstruct them so that the processes go under the correct process groups, and the inputs, outputs, and tools go in the right categories?



Work Performance Data

Direct and Manage Project Work

Expert Judgment

Deliverables

Develop Project Charter

Close Project or Phase

Develop Project Management Plan

Organizational Process Assets Updates

Project Documents Updates

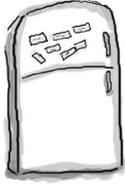
Monitor and Control Project Work

Change Control Tools

Data Analysis

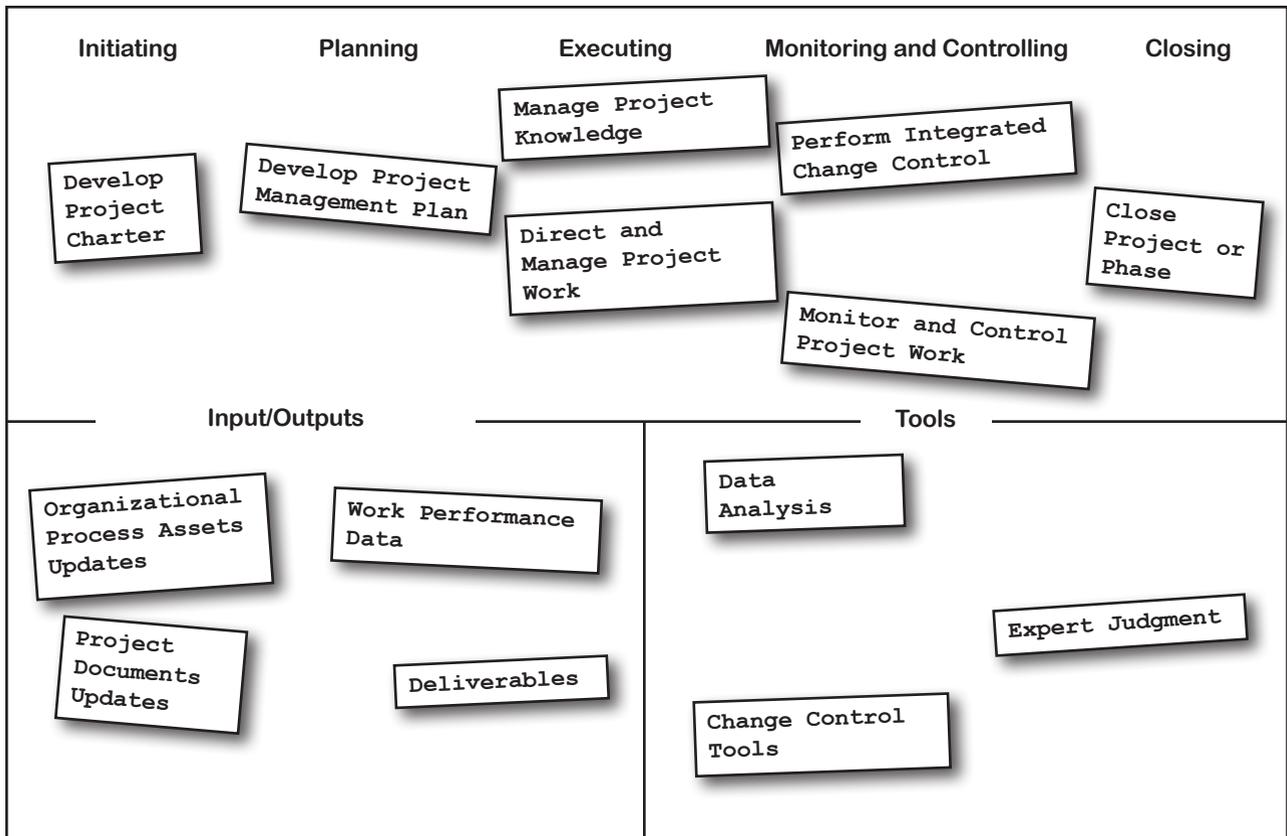
Manage Project Knowledge

Perform Integrated Change Control



## Project Integration Management Magnets Solution

These inputs, outputs, and processes are all scrambled up on the fridge. Can you reconstruct them so that the processes go under the correct process groups, and the inputs, outputs, and tools go in the right categories?



## Integration Management kept your project on track, and the teachers satisfied

By using all of the Integration Management processes, you kept the project on track. You handled all of the problems that came up, making some important changes in the process, and the teachers got to all of their destinations on time and on budget.





For project managers, Integration Management is where the magic really happens. While there might be experts on your team who are responsible for understanding scoping, cost, or quality decisions, Integration Management is something core to your responsibilities. Now that you've had a chance to think about how all of the processes in the knowledge area fit together, it's a good time to think about how you'll actually use it day-to-day on your projects.



## KEY CONCEPTS

We've covered how each of the processes works, but it's important to spend a little time thinking about why they work together. Why do you think we integrate all of the processes and knowledge areas when we work on a project?

- ★ An important reason that we do project integration is to make sure that the project stays **aligned with the benefits it's meant to bring**. The project manager is always making course corrections throughout the project to make sure that it will deliver the benefits defined in the Benefits Management plan.
- ★ The project manager **builds the plan** that keeps everyone on the project on the same page about how to work and what their goals are.
- ★ The project manager makes sure that the team learns from the organization's past experience and adds to that experience by keeping track of new **knowledge** that they create.
- ★ The project manager sees that **approved changes** are updated in the plan when the team decides to do things differently than planned, and their results are tracked and learned from.
- ★ Project managers help the team to think about the whole project when asked to **make decisions** about the way the team should act.
- ★ The project manager closes out the project when it's complete and **handles transitions between phases** when they're complete.

**THE PROJECT MANAGER USES ALL OF THE PROCESS AND KNOWLEDGE AREAS TO KEEP THE PROJECT ALIGNED WITH THE BENEFITS IT'S MEANT TO CREATE.**

## TRENDS

Project management is an evolving field. Teams are always identifying new tools and improvements to the way that project managers do their jobs. Here are a few trends in Integration Management that might help you to improve and do Integration Management more effectively.

- ★ Automated tools to collect project data and analyze trends
- ★ Visualization tools to allow for easier analysis and interpretation of project data
- ★ Knowledge tools to help the team gather and share data project data with one another
- ★ Project manager involvement up front in identifying potential project benefits and engaging business stakeholders
- ★ Hybrid methodologies or ways of incorporating agile and other iterative project management practices into the overall framework of knowledge areas and processes



## TAILORING

When you make changes to the processes your team will use during the course of your project, there are a few considerations that might influence your decisions:

- ★ What lifecycle will your project follow?
- ★ Will your project be developed with predictive methods because you know all of the requirements up front, or will it need to be adaptive because you expect to learn new requirements as you go?
- ★ How does management work in your organization? How can your project fit in to the overall culture?
- ★ How will your project handle change?
- ★ How will your organization oversee your project? How will you keep them informed of your progress?
- ★ What information should you save about your project as you go?
- ★ How will you know if your project is successful?



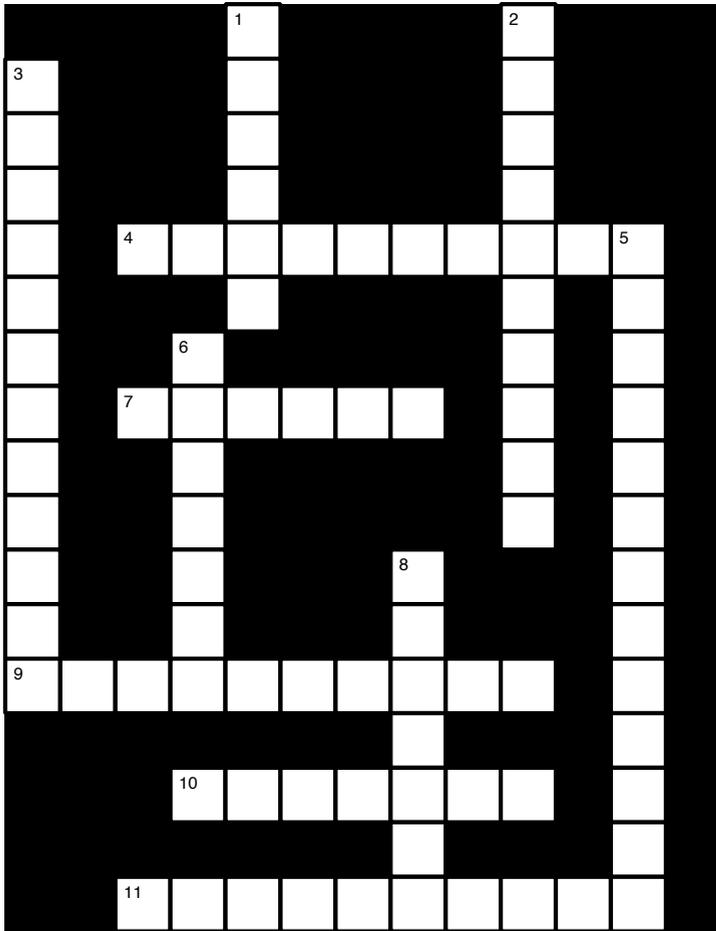
## AGILE CONSIDERATIONS

Agile teams focus on self-organization and collaboration over following a plan. If the project uses agile methods, the role of the project manager changes from defining the plan and helping the team implement it to providing a way for the team to collaboratively decide how to work and how to handle change.



# Integrationcross

Take some time to sit back and give your right brain something to do. It's your standard crossword; all of the solution words are from this chapter.



### Across

4. Fixing problems that have already happened is called \_\_\_\_\_ action.
7. A problem in a deliverable that shows that it does not do what you meant for it to do.
9. The Project Management plan is a collection of \_\_\_\_\_ plans.
10. When you watch what's happening in your project to look for changes, corrective actions, and preventive actions, you are in the \_\_\_\_\_ and Control Project Work process.
11. \_\_\_\_\_ information is an important organizational process asset that comes from documenting lessons learned.

### Down

1. When you ask someone who has experience to help you figure something out, you are using the \_\_\_\_\_ judgment tool and technique.
2. The \_\_\_\_\_ process group contains the processes that help you start your project.
3. The things your project produces.
5. Work culture and company policies are called enterprise \_\_\_\_\_ factors.
6. A record of all of the decisions you have made and their consequences that you write when you close your project is called \_\_\_\_\_ learned.
8. The project \_\_\_\_\_ is a document that gives the project manager authority over the team.

—————▶ **Answers on page 165.**

## Sharpen your pencil Solution



Here are a few of the things you might have to deal with in working on the teachers' vacation trip. Figure out which of the seven Integration Management processes you'd use in each situation, and write down the process name in the blank.

- 1 It turns out that one of the teachers is a vegetarian, so you need to change your plans to include vegetarian meals on the airlines and find restaurants that accommodate him.

Perform Integrated Change Control

- 2 You come up with a detailed description of everything that you plan to do to get the teachers where they want to be.

Develop Project Management Plan

- 3 The CEO of Acme Travel sends you a document that assigns you to the project.

Develop Project Charter

- 4 You write down some notes describing all of the teachers' needs and how you solved them

Manage Project Knowledge

- 5 When the teachers get back, you write up everything you learned while handling the trip so other travel agents can learn from your experience.

Close Project or Phase

- 6 You book the tickets and hotel accommodations.

Direct and Manage Project Work

- 7 You check in with the teachers at each destination to make sure everything is going according to plan.

Monitor and Control Project Work

Develop Project Charter

Develop Project Management Plan

Direct and Manage Project Work

Monitor and Control Project Work

Perform Integrated Change Control

Close Project or Phase

Manage Project Knowledge



## Exercise Solution

Here is a list of actions that are recommended by a project manager. Which are preventive and which are corrective?

1. A software project is running late, so a software project manager looks to find slack time and reassign resources to get things done more quickly.

Preventive action

Corrective action

2. A caterer notices that the crudités are all gone and assigns a chef to make more.

Preventive action

Corrective action

3. A photographer brings an extra camera body to a shoot, in case one breaks down.

Preventive action

Corrective action

4. A consulting company assigns extra resources to a project to compensate for possible attrition.

Preventive action

Corrective action



Below is a whole crop of factors the project team members discovered as they executed the project. Write down which subsidiary plan you'd look in to get some help. If you're not sure, just reread the descriptions of each subsidiary plan on the previous page, and take your best guess.

1. The teachers want to go Bali, but Acme Travel doesn't book flights there so you need to subcontract one leg of the travel to another travel agency.

Procurement Management plan

2. After reading online reviews, the teachers want to stay at better hotels. They tell you to increase their budget by 15% to do that.

Cost Management plan

3. Just as you're about to mail off the teachers' tickets, you notice they've been printed incorrectly.

Quality Management plan

4. The teachers might run into more bad weather, and you've got to figure out what contingencies you can put into place if that happens.

Risk Management plan

5. The teachers are concerned that they won't be able to get in touch with you when they're away.

Communications Management plan

6. One of the teachers realizes that he needs to come back earlier, and you want to make sure the budget reflects his lessened costs.

Cost Management plan

7. You find out that you need to get the tickets out earlier than expected, because the teachers' contract requires that all trips be preapproved by the superintendent of their school district.

Schedule Management plan

# Sharpen your pencil Solution



Here's a list of things produced by some typical projects. Some of them are deliverables, and others are work performance data produced by running reports. There's also a list of changes, some of which affect the Project Management plan, and some of which just affect the project deliverables. It's up to you to figure out which is which.

**1. The software project team builds software.**

Deliverable

Work performance data

**2. A builder hangs a door.**

Deliverable

Work performance data

**3. A wedding photographer sends the photo proofs to the client.**

Deliverable

Work performance data

**4. The cable repair technicians takes an average of four hours per job.**

Deliverable

Work performance data

**5. The construction crew worked 46 hours of overtime in March.**

Deliverable

Work performance data

**6. The construction crew built the six houses required by the plan.**

Deliverable

Work performance data

**7. A software test team finds bugs in the software.**

Defect in deliverable

Change to Project Management plan

**8. A bride asks the photographer to stop asking her mother for permission to make changes.**

Defect in deliverable

Change to Project Management plan

**9. A construction crew used the wrong kind of lumber in a house.**

Defect in deliverable

Change to Project Management plan

**10. A photographer's prints are grainy.**

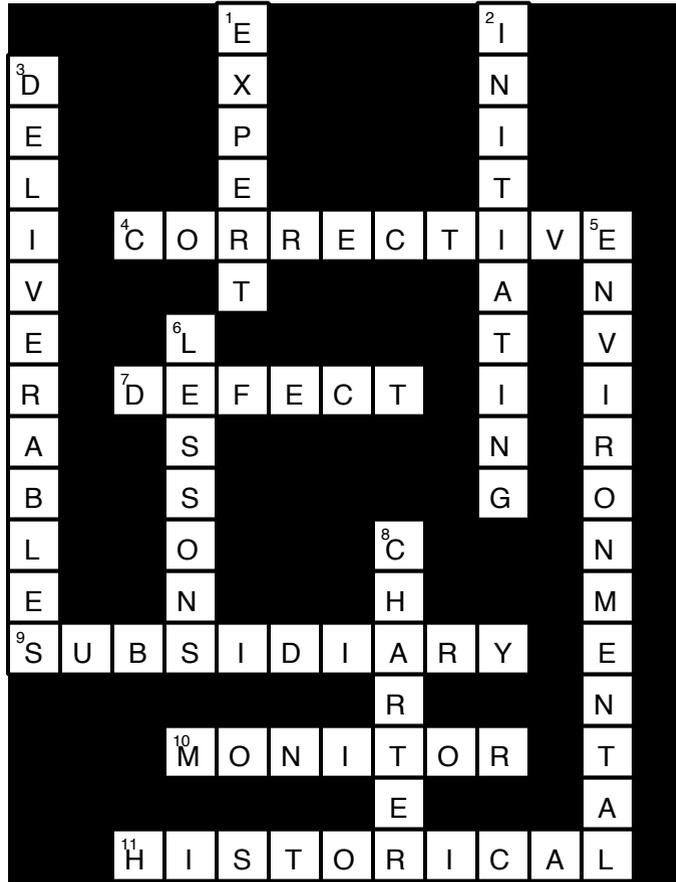
Defect in deliverable

Change to Project Management plan



# Integrationcross Solution

Take some time to sit back and give your right brain something to do. It's your standard crossword; all of the solution words are from this chapter.



## Exam Questions

**1. You've just received a change request. This means:**

- A. The project charter is complete, but the work cannot begin yet because you need to make a change to the scope baseline.
- B. You are in the Direct and Manage Project Work process, and you can implement the change now.
- C. The change needs to be approved before it can be implemented.
- D. There is a defect in a deliverable that must be repaired.

**2. Which of these is not an input to Develop Project Charter?**

- A. Enterprise environmental factors
- B. Project management plan
- C. Agreements
- D. Business documents

**3. What is the output of Direct and Manage Project Work?**

- A. Approved change requests
- B. Project Management processes
- C. Deliverables
- D. Forecasts

**4. You're managing a graphic design project. One of your team members reports that there is a serious problem, and you realize that it will cause a delay that could harm the business of the stakeholders. Even worse, it will take another two days for you to fully assess the impact—until then, you won't have the whole story. What is the BEST way to handle this situation?**

- A. Create a change request document and submit it to the change control meeting.
- B. Pull out the project charter and show them that you have authority to make decisions.
- C. Meet with the stakeholders and tell them that there's a problem, and you need two more days to get them the information they need.
- D. Update the lessons learned and add it to your organizational process assets.

**5. You're a project manager on a construction project. The electrician has started laying out the wiring, when the client comes to you with a change request. He needs additional outlets, and you think that will increase the cost of the electrical work. What is the first thing you do?**

- A. Refuse to make the change because it will increase the cost of the project and blow your budget.
- B. Refer to the Project Management plan to see how the change should be handled.
- C. Consult the contract to see if there is a clause.
- D. Make the change, since the client requested it.

## Exam Questions

### 6. The work authorization system:

- A. Ensures that every work package is performed at the right time and in the proper sequence
- B. Authorizes the project manager to spend money on work
- C. Is a set of processes and tools that aids the project manager in effectively guiding the project to completion
- D. Is a formalized, written description of how to carry out an activity

### 7. You're the project manager at a telecommunications company. You recently had stakeholders approach you with changes. You figured out that the changes would cost additional time and money. The stakeholders agreed, you were given additional time and budget, and the changes were approved. Now you have to incorporate the changes into the project. What do you do next?

- A. Modify the project charter to include the changes.
- B. Use the project management information system to make sure the work is performed.
- C. Make sure to track your changes against the project's baseline so you know how much they eventually cost.
- D. Incorporate the changes into the baseline so you can track the project properly.

### 8. You are a project manager on a software project. When you planned the project, your enterprise environmental factors included a policy that all changes that cost over 2% of the budget need to be approved by the CFO, but smaller changes could be paid for by a management contingency fund. One of your stakeholders submitted a change request that requires a 3% increase in the budget. Your company has an outsourcing effort, and you believe that a small change to the way that the change is requested could allow you to take advantage of it and cut your costs in half. What is the BEST way to handle this situation?

- A. Work with the stakeholder to figure out how to reduce the cost of the change by a third.
- B. Request approval from the CFO.
- C. Refuse the change because it is over 2% of the budget.
- D. Document the change request, since all changes must be documented.

### 9. You're on the project selection committee. You're reviewing a document that describes the strategic value of a potential project and its benefits to the company. What's this document called?

- A. Project charter
- B. Business case
- C. Benefit measurement method
- D. Contract

## Exam Questions

**10. One of your team members has discovered a defect in a deliverable and has recommended that it be repaired. Which of the following is NOT true:**

- A. The project charter has authorized you to perform the work.
- B. Your project is in Monitor and Control Project Work process.
- C. The defect repair must be approved before the deliverable can be repaired.
- D. You must update the Project Management plan to document the defect.

**11. You are holding a formal, approved document that defines how the project is executed, monitored, and controlled. You are holding:**

- A. The Project Management plan
- B. The performance measurement baseline
- C. The project charter
- D. The work breakdown structure

**12. You are the project manager for a software project, when the sponsor pulls the plug and cancels the project. What do you do?**

- A. Give the team the day off to recuperate from the bad news.
- B. Create a budget summary for the remaining unspent budget.
- C. Follow project closure procedures to close the project and update lessons learned.
- D. Find new assignments for any people previously assigned to your project.

**13. You are managing a software project, when you find out that a programming team whom you were supposed to have access to has been reassigned to another project. What is the first thing that you should do?**

- A. Figure out the impact that this will have on your project.
- B. Bring a copy of your project's charter to the other manager, and explain that you need that team for your own project.
- C. Go to your sponsor and demand the team.
- D. Figure out a way to compress the project schedule so that you can work with the team if they become available.

**14. You are a project manager on a software project. There are several changes that need to be made, and you need to decide how to apply project resources in order to implement them. What do you do?**

- A. Decide the priority of the changes and announce them to the team.
- B. Call a team meeting and invite the stakeholders, so that everyone can reach a consensus on the priority.
- C. Deny the changes because they will delay the project.
- D. Consult the Change Prioritization plan for guidance on prioritizing new changes.

## Exam Questions

**15. You're a project manager on a software project. Your team is busy executing the project and creating the deliverables, but there have been several changes requested by stakeholders over the past few weeks. Each time you got one of these changes, you called a meeting with your team and the stakeholders to discuss it. Why did you do this?**

- A. Every change needs to be evaluated by a change control board.
- B. You're delegating the work of evaluating changes.
- C. You do not have a good change control system in place.
- D. You are using a project management information system to assign the work.

**16. You are the project manager on a construction project, and you have just received a change request. You consulted the Project Management plan, and followed the procedures laid out in the change control system. You are in the process of reviewing the change and documenting its impact. Your manager asks you why you are doing this. Which process are you doing by reviewing the change and documenting its impact?**

- A. Perform Integrated Change Control
- B. Monitor and Control Project Work
- C. Manage Requested Changes
- D. Direct and Manage Project Work

**17. Which of the following is NOT true about the project charter?**

- A. The project charter defines the requirements that satisfy customer needs.
- B. The project charter defines the work authorization system.
- C. The project charter makes the business case that justifies the project.
- D. The project charter includes the milestone schedule.

**18. You have just verified that all of the work on your project is completed. Which of these things is NOT part of the Closing process?**

- A. Update historical information by documenting lessons learned.
- B. Document the work performance data to show the deliverables that have been completed and record the lessons learned.
- C. Verify that all of the deliverables have been accepted by the stakeholders.
- D. Follow the project closure procedure.

**19. Which of the following is NOT true about the Project Management Plan?**

- A. The Project Management plan contains the Scope Management plan.
- B. The Project Management plan gives authority to the project manager.
- C. The Project Management plan contains the schedule baseline.
- D. The Project Management plan contains the performance baseline.

## Exam Questions

**20. Which of the following is NOT an output of the Direct and Manage Project Work process?**

- A. Work performance data
- B. Deliverables
- C. Project documents updates
- D. Forecasts

**21. You are a project manager starting a new project. Your manager warns you that previous projects ran into trouble. Which of the following would be BEST for you to rely on to help plan your project:**

- A. Our project management expertise
- B. Historical information
- C. The change control system
- D. Forecasts

**22. Which is NOT true about the project charter:**

- A. The project manager must be consulted before the charter is finalized.
- B. The charter is issued by the project sponsor.
- C. The project manager's authority to manage the project is granted by the charter.
- D. The charter gives a summary milestone schedule.

**23. Which of the following is NOT an input to the Develop Project Management Plan process?**

- A. Outputs of the planning processes
- B. Project charter
- C. Expert judgment
- D. Enterprise environmental factors

**24. You are the project manager on a network engineering project. Two weeks ago, your team began executing the project. The work has been going well, and you are now a day ahead of schedule. Two stakeholders just approached you to tell you that they have an important change that needs to be made. That change will put you behind schedule. What do you do?**

- A. Implement the change because you're ahead of schedule.
- B. Refuse to make the change because the stakeholders did not take it to the change control board.
- C. Refuse to make the change until the stakeholders document it in a change request.
- D. Make sure the stakeholders know that you're open to change, and tell them to talk to the project sponsor.

## Exam Questions

25. Diane is a project manager at a software company. She just got a change request from one of her stakeholders, but is concerned that it will cause a serious problem with her schedule. She called a meeting with the project team, and decided that there was a real change, and now they need to start change control. Which of the following is NOT an output of the Perform Integrated Change Control process?

- A. Project document updates
- B. Approved change requests
- C. Project Management plan updates
- D. Change requests

Start thinking about the kinds of questions you're seeing. Some have extraneous details—we call them "red herrings." Others are about inputs and outputs. That will definitely make the exam more familiar and easier.

OH, I SEE. SOMETIMES THE DETAILS OF THE QUESTION DON'T MATTER. THEY'RE JUST THERE TO THROW YOU OFF TRACK.

### Watch out for those red herrings.

Take some time to go over the answers to these questions and if they did throw you off track, reread the question to understand why.

**Just remember...if you get something wrong now, that means you're actually MORE likely to remember it on the exam! That's why practice exams are so useful.**



## Answers

~~Exam Questions~~**1. Answer: C**

This is really a question about inputs and outputs. There's only one process that takes "change requests" as an input, and that's Perform Integrated Change Control. That's where your changes get approved. The other answers all refer to other processes: A is about building a baseline (which is part of Develop Project Management Plan), while B and D are both about Direct and Manage Project Work.

**2. Answer: B**

The Project Management plan is created in the Develop Project Management Plan process, which happens after Develop Project Charter. Develop Project Charter is the very first process on any project, and the inputs in answers A, C, and D exist before the project started. The Project Management plan is created during the project.

This is a "which-is-not" question. When you see a question asking you to choose which input or output is not associated with a process, one good strategy is to try to think of what it is that process does.

**3. Answer: C**

The whole reason for the Direct and Manage Project Work process is to actually do the project work, and the deliverables are the products or services that are created by the project. Don't get fooled by answer D—even though the work is performed in Direct and Manage Project Work, the information about how that work is performed is turned into forecasts in Monitor and Control Project Work.

That makes sense. You need to monitor the work to figure out how well it's being performed.

**4. Answer: C**

When you get a question about communication, look for the answer that provides the most complete, honest, and up-front information, even if that information won't necessarily solve the problem or make everyone happy.

**5. Answer: B**

All changes must be handled using the change control system, which is a set of procedures that is contained in the Project Management plan. There is no way to tell from the question what specific steps will be in that change control system—answers A, C, and D are all possible ways to deal with changes, depending on the situation. The only way to know for sure what to do is to follow the change control procedures in the Project Management plan.

## Answers

~~Exam Questions~~**6. Answer: A**

This is a just-the-facts-ma'am question, and answer A is the actual definition of the work authorization system. (This term is used in the *PMBOK® Guide*—technically it's not specifically defined there, but you might still see it on the exam.)

**7. Answer: D**

The first thing you do after a change is approved is to update the baseline. If you chose answer C, don't feel bad—it's easy to get a little mixed up about what a baseline is used for. The whole purpose of the baseline is to figure out whether your project has deviated from the plan. But a change isn't a deviation from the plan! A deviation is accidental, while a change is done on purpose. That's why it's so important to get the change approved: that way, everyone knows about it, which means that you can plan for it. And updating the baseline is how you do that planning.

**8. Answer: B**

When your company has a policy, you need to follow it and not try to work around it. Also, don't get fooled by answer D—the question said that a change request was submitted, so it's already documented. The exam could contain tricks like that!

You use the baseline to protect yourself from nasty surprises...and an approved change is not a surprise.

**9. Answer: B**

This is a business case—it describes the benefits of doing a project and can be used to decide whether it's worth it for your company to do the work. Sometimes the benefits will be about gaining capabilities, not just money.

The important stuff in this question is all in the second and third sentences. The outsourcing detail is a red herring.

**10. Answer: D**

Defects do not need to be documented in the Project Management plan. Take a look at the other answers—do you understand why they are correct? Answer A is simply the definition of the project charter; it doesn't have anything to do with the defect, but it's still true. When you're performing the Monitor and Control Project Work process, you need to make sure defect repairs are approved before you change the deliverables, so answer B is true as well. And as far as answer C goes, that's the whole purpose of the Perform Integrated Change Control process: to approve defect repairs, changes, and preventive and corrective actions!

There will be questions on the exam where there are two valid answers but only one BEST answer.

# Answers

## Exam Questions

11. Answer: A

This is the definition of the Project Management plan!

12. Answer: C

Even when a project is terminated, you still need to close it out.

*A question like this needs you to actually think about what you'd do—it's not just about applying a rule that you've learned.*

13. Answer: A

If a resource is not available to you, it doesn't matter what's in your project charter or what your sponsors and stakeholders want. You need to figure out how to move forward from here, and the first step in doing that is evaluating the impact that this new problem will have on your project.



*There's no such thing as a Change Prioritization plan! Keep an eye out for fake artifacts and processes.*

14. Answer: A

The project manager must decide the priority of the changes. If the changes need to be made, that means that they were approved. So you can't simply deny them. And you can't call the team in for a meeting, because they need to do the work. Some people may think that the stakeholders need to be involved—but since the change was already approved, you've gotten their buy-in. Now it's up to you to decide the order in which they're implemented.



*This is NOT a good change control board because a change control meeting doesn't usually include the whole team!*

15. Answer: C

When you get a change request, you need to consult the Project Management plan and follow the procedures defined in the change control system. It is generally not a good idea to involve the entire team in evaluating each change that comes in—there may be many changes, and if you pull your team off the job for each one, they'll never get their job done!



*Doesn't C seem like the right answer? Too bad it's not a real process!*

16. Answer: A

Once a change is requested, all of the work that you do with it falls under Perform Integrated Change Control, right up until it's approved and you can implement it.



## Answers

~~Exam Questions~~**17. Answer: B**

The work authorization system is defined by the company, and it's external to the project. You can think about it as the rules that you are told to follow in order to assign work in your company. They are part of the enterprise environmental factors, an input to Develop Project Charter.

Remember that lessons learned are documented throughout the project, not just at the end! That's why they're part of work performance data.

When you close a process or phase, you need to make sure each deliverable has been accepted by the stakeholders.

**18. Answer: B**

The work performance data is documented as part of Direct and Manage Project Work. By the time the project closes, it's too late to use the work performance data! That's why it's an input to Monitor and Control Project Work—so you can take corrective action if the work is not being performed well.

We'll learn about Scope Management in the next chapter.

**19. Answer: B**

The project charter authorizes the project manager.

IT SEEMS LIKE HISTORICAL INFORMATION IS AN IMPORTANT CONCEPT. I'LL BET THERE WILL BE A QUESTION OR TWO ABOUT IT ON THE EXAM.

**20. Answer: D**

You'll learn about forecasts in Chapter 7—they're used to help predict whether the project will come in on time and within budget. If not, preventive or corrective actions will be needed! But you don't need to know that to know they're not an output of Direct and Manage Project Work.

**21. Answer: B**

Historical information is an important input into Develop Project Charter, which is the first process that you perform when you start a new project. Historical information is very important, because it's how you learn about past projects' successes and failures. It's not actually listed as its own input. It's a part of organizational process assets—and it really is a huge asset to any organization!

When you add lessons learned to your organizational process assets, you're recording important historical information that other project managers can use later.



Answers

~~Exam Questions~~

22. Answer: A

The project manager may be consulted when the project charter is created, but that's not always the case. It's possible that the project manager for a project is not even known when the charter is created!

23. Answer: C

While you may employ good judgment in developing your Project Management plan, expert judgment is not an input. It's a tool/technique used in the various processes.

← Didn't D look like a good answer?

24. Answer: C

The first step in handling any change is to document it. That's why change requests are an input to Perform Integrated Change Control: the change control process cannot begin until the change is written down!

25. Answer: D

If you're having trouble remembering what the inputs and outputs are for Monitor and Control Project Work and Perform Integrated Change Control, one way to think about it is that change control is all about deciding whether or not to do something. Monitor and Control Project Work is where you spot the problems—that's why all of the *requested* changes are outputs of it, and inputs into Perform Integrated Change Control.

Perform Integrated Change Control is where those recommendations get evaluated and turned into *approved* actions and changes. The ones that are not approved are rejected. Then they go back to Direct and Manage Project Work, where they are implemented, because that's project work and all project work happens in that process.

REJECTING CHANGES MEANS THAT SOMETIMES YOU NEED TO SAY NO TO PEOPLE TO MAKE THEM HAPPY IN THE END. THEY MIGHT NOT LIKE IT, BUT THEY'LL END UP SATISFIED WHEN THE PROJECT GOES WELL.



Remember, this is how you handle changes: Find it...evaluate it...fix it.



So how did you do?

## 5 Scope management

# Doing the right stuff



### Confused about exactly what you should be working on?

Once you have a good idea of what needs to be done, you need to **track your scope** as the project work is happening. As each goal is accomplished, you confirm that all of the work has been done and make sure that the people who asked for it are **satisfied with the result**. In this chapter, you'll learn the tools that help your project team **set its goals** and keep everybody on track.

## Out of the frying pan...

The people at Ranch Hand Games have been working hard for over a year on the sequel to their most successful title, *Cows Gone Wild*. It seemed like the project would never end...



Amy's the creative director. She's in charge of the story and the artwork.



Brian's the development manager. His job is managing the team that builds and tests the software.

## ...and right back into the fire

Since it took so long to get this version out, it's already time to start working on the next version. But nobody wants to see that project spin out of control the way it did last time.



### **BRAIN POWER**

The *Cows Gone Wild II* team ran into a lot of changes throughout the project. Could they have done something to avoid that problem?

## Cubicle conversation



IT TOOK WAY TOO LONG  
TO GET COWS GONE WILD II  
OUT THE DOOR.

**Brian:** The project rocked in the beginning. We brought in some really talented programmers so that we could handle all of the technical challenges that might come up. We spent all that time whiteboarding and working our way through the technical issues in design. It really felt like this game was going to be amazing and fun to build. What went wrong?

**Amy:** We got sidetracked all over the place. Remember what happened with the website? We spent months making that site look just like the game. It got to the point where it actually looked a lot better than the game did.

**Brian:** Yeah, you're right. And there were all these changes along the way—the story got updated like a thousand times. It was nuts.

**Amy:** I remember that. What a mess.

**Brian:** Totally. Oh man, and that time we realized you had to redraw all the artwork for the Haymaker level? We all slept in the office for like a week!

**Amy:** Right...um, so what's gonna keep that from happening this time?

↑  
Maybe the Cows Gone Wild II project  
would have gone better if they'd had a  
project manager on board...



### Exercise

How would you solve these problems that happened in *Cows Gone Wild II* so they don't cause the same kind of trouble on *CGW III*?

Just write down a short sentence for each of these.



1. The website got larger and larger and took almost as much time to build as the game itself.

.....

The team had to rework a bunch of artwork because the game story changed.



2. There were lots of last-minute story changes. ....

.....

3. Artwork changes caused rewrites at the last minute. ....

.....

4. The game was over a year late. ....

.....



## Exercise Solution

Here are some answers that are good for dealing with these scenarios.

1. The website got larger and larger and took almost as much time to build as the game itself.

### Keep the team from doing unnecessary work.

You can't depend on the team to figure out what to do along the way. You need to scope out the work from the very beginning.

Luckily, if you nail down the scope up front, your team won't waste time doing unnecessary work later.

2. There were lots of last-minute story changes. **Plan ahead and avoid late-breaking changes.**

Writing down all of the work and the effort required to do it will help everyone understand the impact of their changes.

If the creative team figured out earlier that they'd need to make changes, the programmers could have worked on parts that weren't going to change. That would have been a lot more efficient.

3. Artwork changes caused rewrites at the last minute.

### Get started on the artwork changes sooner.

It's easier to figure out what's going to have to change if everyone is in sync on the scope.

Sounds like this game was late because the scope kept changing. Better planning could have fixed this.

4. The game was over a year late. **Start planning sooner. Figure out what the team is going to do before they start.**

Knowing what you're going to build BEFORE you build it means you can do a better job predicting how long it will take.

Doing more planning at the start of the project helps you prioritize so that the most important work gets done efficiently.

## It looks like we have a scope problem

All of the major problems on *Cows Gone Wild II* were **scope problems**. The website was bloated with features that were added on late in the project. The creative team kept realizing that they had to do a lot more work. These are classic scope problems.

The product scope is all about the final product—its features, components, pieces.

When people talk about scoping out their products, a lot of times they're talking about figuring out the features of the product, not the work that goes into it.

**Product scope** means the features and functions of the product or service that you and your team are building.

When we talk about scoping out a project, we mean figuring out all of the work that needs to be done to make the product.

**Project scope** is all of the work that needs to be done to make the product.

THIS is a big part of what the project manager is concerned with...the work the team has to do.

This means changes that just went in without anyone bothering to figure out what effect they'd have on the project's time, cost, scope, quality, risk, or resources.

**Scope creep** means uncontrolled changes that cause the team to do extra work.

**For the exam, you need to understand both product and project scope.**

## Sharpen your pencil



Here are some attributes of *Cows Gone Wild III*. Which are project scope and which are product scope?

**1. Programming**

Project scope

Product scope

**2. 34 levels in the game**

Project scope

Product scope

**3. Graphic design**

Project scope

Product scope

**4. Four playable characters**

Project scope

Product scope

**5. Great graphics**

Project scope

Product scope

**6. Testing**

Project scope

Product scope

**7. Mac and PC compatible**

Project scope

Product scope

**8. A “boss battle” milk fight level at the end**

Project scope

Product scope

—————> **Answers on page 244.**

## there are no Dumb Questions

**Q:** Does the scope include all of the stuff that I make, like a project schedule or a budget? What about things that are used to build the product but not actually delivered to the people who use it?

**A:** Yes, the project scope includes every single thing made by you and the team, and that includes the project plan and other project management documents. There are plenty of things on a project that are deliverables, but which the people who use the product will never see...like a project schedule, specifications, blueprints, and budgets. And while some of these things are made by the project manager, there are a lot of them that aren't, and it's not your job to figure out what goes into them. You just need to make sure they get done.

**Q:** Won't the team care more about what they are making than how they are making it?

**A:** Yes, definitely. It's your job as project manager to worry about all of the work the team does to build the product, so that they can focus on actually building it. But that doesn't mean you don't need their cooperation to make sure you've written down all of the work, and nothing else.

**Q:** Does that mean the project manager doesn't care about the product scope at all, just the project scope?

**A:** No, you still need to think about your project's final product. You can never ignore product scope, because most projects have

changes to the product scope along the way. You'll have to change your project scope to include the work that's caused by product scope changes. Changes like that will probably have an impact on time and cost, too.

Here's an example: if somebody asks for a new feature in *Cows Gone Wild III*, the first thing the team needs to do is understand how much work is involved to accommodate it, and what that scope change will do to the cost and schedule.

As a project manager, your main concern is understanding that impact, and making sure everyone is OK with it before the change gets made. It's not your job to decide which is the best feature for the product, just to help everybody involved keep their priorities in mind and do what's best for the project.

## You've got to know what (and how) you will build before you build it

You always want to know exactly what work has to be done to finish your project *before* you start it. You've got a bunch of team members, and you need to know exactly what they're going to do to build your product. So how do you write down the scope?

That's the goal of the **six Scope Management processes**. They're about figuring out how you will identify all of the work your team will do during the project, coming up with a way to make sure that you've written down what work will be done (and nothing else!), and making sure that when things change on your project, you keep its scope up to date so that your team is always building the right product.

Scope Management means figuring out what's **OUT OF** scope, not just what's part of it.

CAN'T I JUST HAVE MY TEAM SPEND A DAY BRAINSTORMING A LIST OF EVERY POSSIBLE THING THEY MIGHT HAVE TO DO?



### That's a good idea. But what happens if they miss something?

It often seems like you should just be able to get everyone in the same room when the project starts and just hash all this stuff out. But it's really easy to miss something, and it's even easier for a team to get sidetracked.

It's way too easy for people to go off track and start doing things that don't really contribute to the project—like building the website for a video game instead of building the game itself.



Scope Management plan

You need to write down exactly how you're going to do all of those things in the Scope Management plan.

This is why the Scope Management plan needs to say how you're going to keep unnecessary work out of the project.

**The Scope Management plan describes how you write down the scope, make sure it's right, and keep it up to date.**

## The power of Scope Management

When you take control of your project's scope, you're doing more than just planning. It turns out that when projects have scope problems, the results are actually pretty predictable. Take a look at these problems that the Ranch Hand team ran into. Do any of these sound familiar to you? Many project managers run into similar problems on their own projects.

**1 The team had trouble getting the project off the ground.**

Everyone on the team was good at their individual jobs, but it seemed like nobody knew how to get the project started.

They'd sit around in meetings talking about what they wanted to build, but it seemed like weeks before anything started getting done.

**2 There were a lot of false starts.** Just when they thought they were getting the project under way, it seemed like something would shift and they'd be back to square one.

**3 The sponsor and stakeholders were unpredictable.** There were three different times that Amy and Brian thought they were done. But each time, a stakeholder found a problem that sent them back to the drawing board.

The worst part about this was that there was no way to know when they were done with the project without asking for the sponsor's opinion...and it seemed like that opinion was always changing.

**4 There were a whole lot of changes.** They were always scrambling to keep up with shifting priorities and ideas, and they never knew for sure what they'd be working on each week.

The team was tempted to lay down the law and forbid any changes...but a lot of those changes were necessary, and good ideas.

# The six Scope Management processes

Each of the Scope Management processes was designed to help you avoid the kinds of scope problems that cause a lot of projects to go off track. One of the best ways to remember these processes for the exam is to understand why they're useful, and how they solve the kinds of problems that you've seen on your own projects.



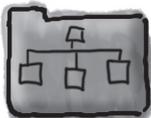
Project Management plan



Requirements documentation



Project scope statement



Work breakdown structure



Change requests



Accepted deliverables

## Plan Scope Management

Here's where you write down the subsidiary plan for the Project Management plan that we talked about in the last chapter. You plan out all of the work you'll do to define your scope, make sure the team is planning to do the right work, and control it.

## Collect Requirements

In this process, you find out all of the stakeholders' needs and write them down so that you know what to build and your requirements can be measured and tracked.

## Define Scope

Here's where you write down a detailed description of the work you'll do and what you'll produce.

*When you do this right, the stakeholders are never unpredictable because you already understand their needs.*

## Create WBS

The work breakdown structure (WBS) organizes all of your team's work into work packages—or discrete pieces of work that team members do—so that you can keep the momentum of the project going from the start.

*Pay attention to the WBS—there will be a lot of questions about it on the exam.*

## Control Scope

We already know how important it is to control changes on your project. When scope changes aren't controlled, it leads to the most frustrating sort of project problems. Luckily, you already know about change control, and now you can use it to manage your project's scope.

*Remember integrated change control from Chapter 4? Now you'll see it in action.*

## Validate Scope

Once the work is complete, you need to make sure that what you're delivering matches what you wrote down in the project scope statement. That way, the team never delivers the wrong product to the customer.

*On the exam, "customer" can mean the same thing as "client" and "sponsor."*

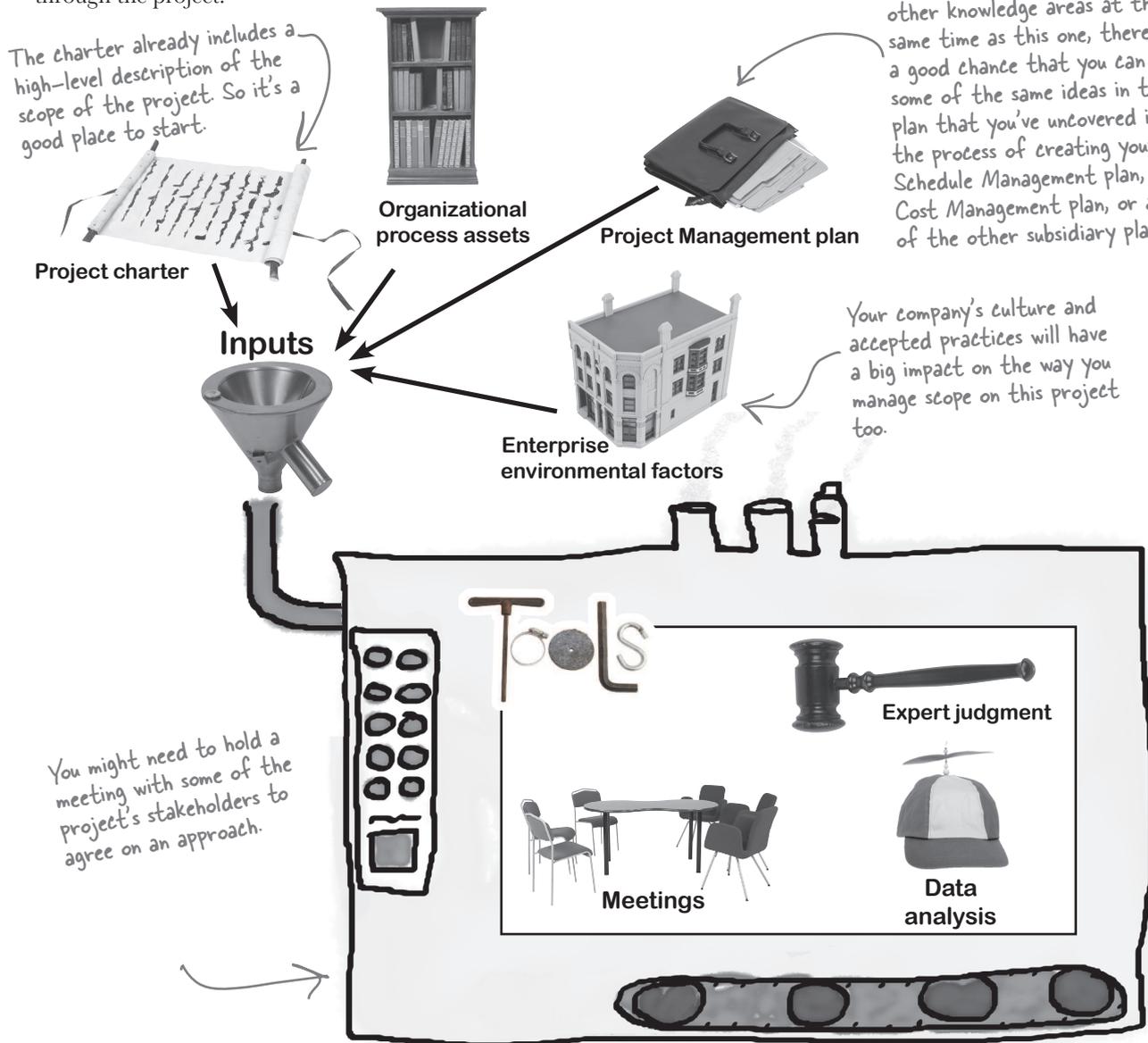
# Plan your scoping processes

Here's where you figure out how you'll approach defining and validating the scope of your project. The **Plan Scope Management** process is where you lay out your approach to figuring out what work you'll do and what's out of scope. All of the other processes in the Scope Management knowledge area are defined and described in this document. It's the blueprint you'll use for everything else you'll do to manage scope through the project.



Since you're in the process of creating these plans for the other knowledge areas at the same time as this one, there's a good chance that you can use some of the same ideas in this plan that you've uncovered in the process of creating your Schedule Management plan, your Cost Management plan, or any of the other subsidiary plans.

The charter already includes a high-level description of the scope of the project. So it's a good place to start.



Your company's culture and accepted practices will have a big impact on the way you manage scope on this project too.

You might need to hold a meeting with some of the project's stakeholders to agree on an approach.

## Now you've got a roadmap for managing scope

There are two outputs of the Plan Scope Management process: the Scope Management plan and the Requirements Management plan. Both of them help you define the scope of your project and make sure that you and your team are focused on only the work that will help you satisfy your customers' needs. The Scope Management plan keeps you on track by detailing the processes you and your team will follow as you document your scope, figure out your work breakdown structures, and validate and control your scope for the rest of the project. The Requirements Management plan details the process you'll use to collect requirements and how you'll manage them once they've been written down.

### Outputs



Your Requirements Management plan will describe all of the processes your team will use to document your requirements and maintain that document throughout the project.

### Requirements Management plan

Here's where you'll find a description of the approach the team will take to planning, tracking, and reporting on requirements. You'll use this document to describe the prioritization process for requirements, and how you'll build a traceability matrix for your requirements as well.



The Scope Management plan isn't just about writing a scope document; it details the process you use to come up with your work breakdown structure too.

### Scope Management plan

Here's where you write down the subsidiary plan for the Project Management plan that we talked about in Chapter 4. You plan out all of the work you'll do to define your scope, with the right work planned for the team, and control it.

**The Plan Scope Management process helps you think through everything you'll need to do to keep your project focused on the right work from beginning to end.**

## Cubicle conversation

Meet Mike, the new project manager at Ranch Hand Games.



IT LOOKS LIKE I GOT  
HERE JUST IN TIME.

**Brian:** So we finally hired a project manager. Welcome aboard!

**Amy:** I'm glad they brought you in to help fix this mess.

**Brian:** So what are you gonna do to help us? Because I don't see what you can really change.

**Mike:** Thanks for the vote of confidence. Look, I might not be able to fix everything, but we should be able to keep this scope under control.

**Brian:** Sure, you say that now. But we all thought the last project would go fine too, and that one was a real pain!

**Mike:** Well, did you gather the requirements for your last project?

**Amy:** No, but we've built video games before and we knew basically what we needed to do when we started out.

**Mike:** It sounds like that wasn't enough.

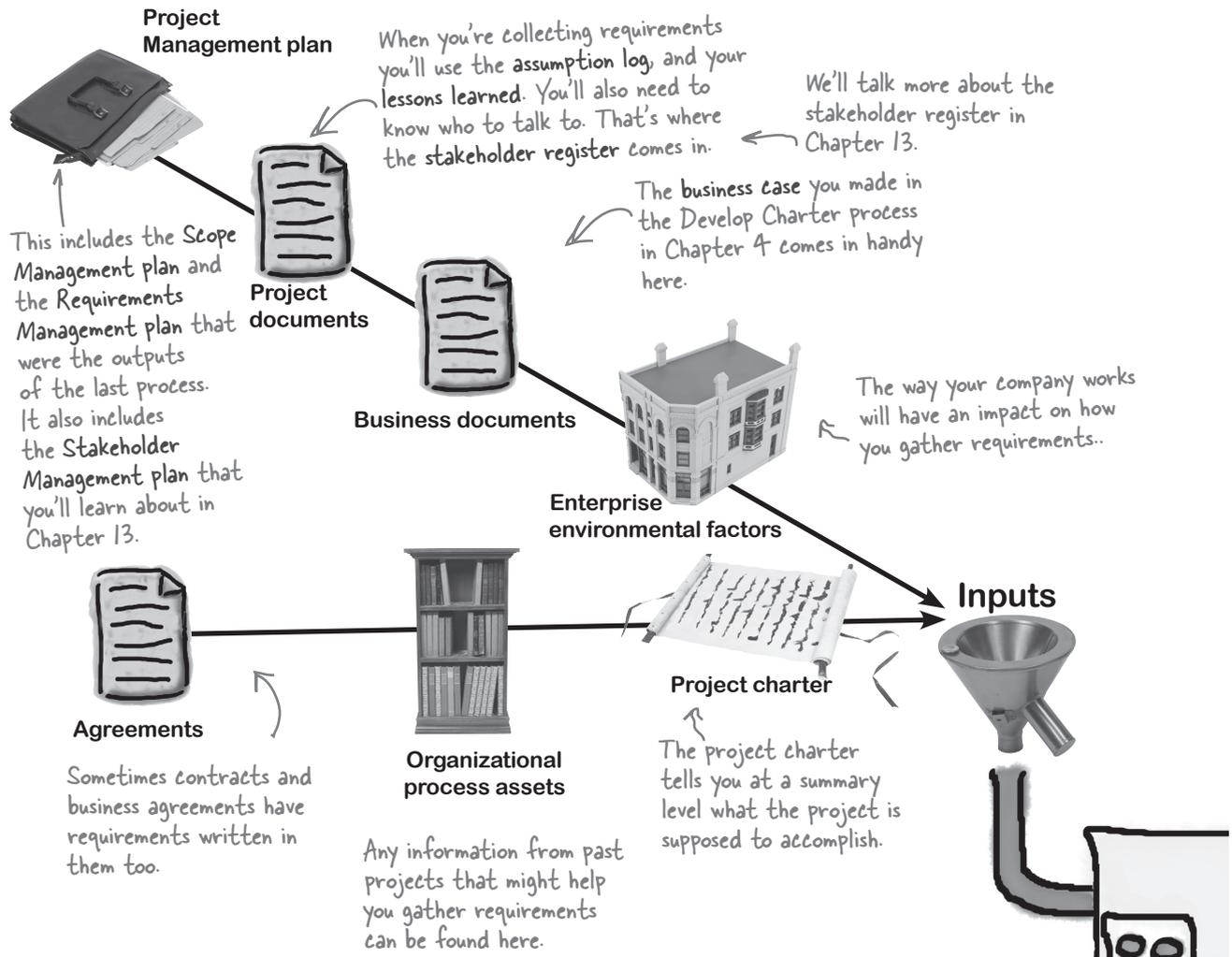


What's the first thing Mike should do to make sure that *Cows Gone Wild III* goes well?

# Collect requirements for your project



Gathering requirements is all about sitting down with all of the stakeholders for your project and working out what their needs are, and that's what you do in the **Collect Requirements** process. If your project is going to be successful, you need to know what it will take for all of your stakeholders to agree that your project has met its goals. You need to have a good idea of what's required of your project up front, or you'll have a tough time knowing whether or not you're doing a good job as you go. That's why you need to write down all of your project and product requirements with enough detail that you can measure your team's progress.



## Talk to your stakeholders



The **Collect Requirements** process involves talking to the people who are affected by your project to find out what they need. All of the tools in this process are focused on getting your stakeholders to tell you about the problem that the project is going to solve. Sometimes that means sitting down with each of them one-on-one, and other times you can do it in a group setting. One of the most important things to understand about requirements is that every requirement fulfills a specific stakeholder need. Lucky for you, a lot of those needs are already written down—in your business case document.

But that's not the only place you'll find requirements, so here are a few really useful **data gathering** tools and techniques to help you gather requirements:

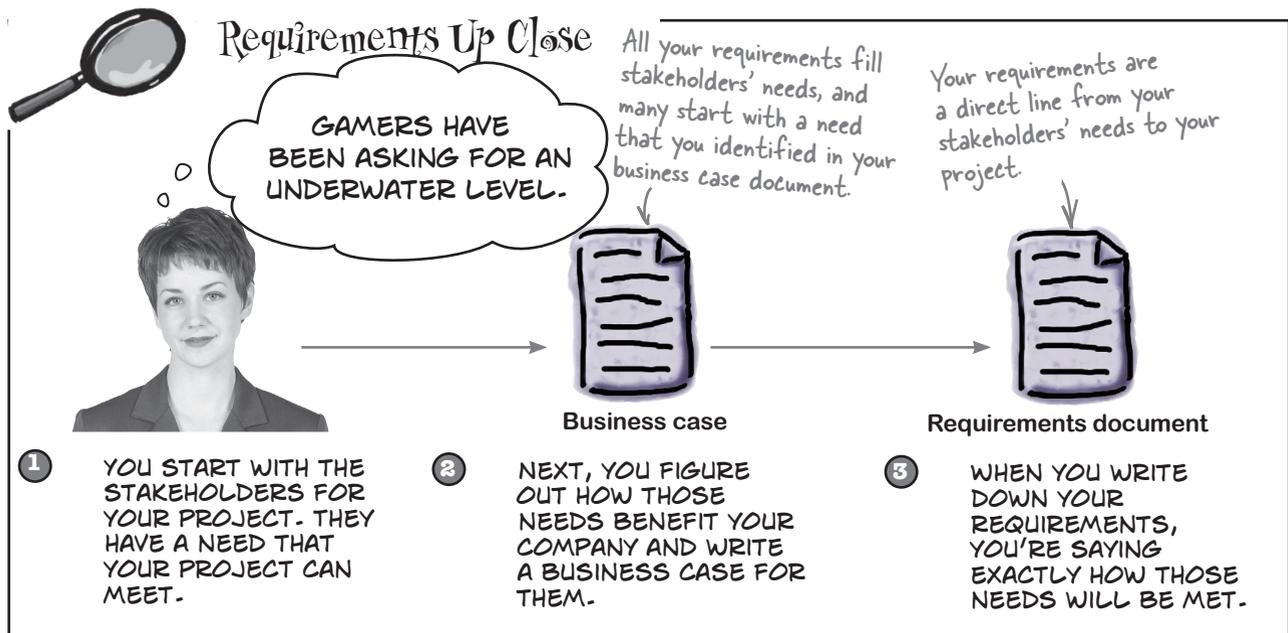
**Interviews** are important ways to get your stakeholders to explain how they'll use the product or service your project is creating. By talking to people one-on-one, you can get them to explain exactly what they need so that you can be sure that your project can meet its goals.

**Questionnaires and surveys** are a way of writing down the questions you want to ask the people who will benefit from the software and reviewing their responses all together.

**Focus groups** are another way to get a group of people to discuss their needs with you. By letting a group discuss the end product together, you can get them to tell you requirements that they might not have thought of by themselves.

**Brainstorming** is one of the most commonly used ways of collecting requirements. Whenever you sit a group of people down to think of new ideas, you're brainstorming.

**Benchmarking** is a way of comparing the processes and practices used in building your software with the practices and processes in other organizations so you can figure out the best ideas for improvement.





## Make decisions about requirements

A big project usually has a lot of stakeholders, and that means a lot of opinions. You'll need to find a way of making decisions when those opinions conflict with each other. There are four major decision-making options you can choose from. These are referred to as **decision-making techniques** on the test.

**Unanimity** means everyone agrees on the decision.

**Majority** means that more than half the people in the group agree on the decision.

**Plurality** means that the idea that gets the most votes wins.

**Autocratic** decision making is when one person makes the decision for the whole group.

**Multicriteria decision analysis** is when teams use numbers to help them map out decisions. Teams might compare optional decisions based on numeric values they've given for uncertainty, risk, business value, time criticality, or other important factors.



### Exercise

You'll need to know the difference between the different decision-making techniques for the exam. Here are the minutes from a facilitated workshop that the CGW team held with all of its stakeholders. Identify which decision-making technique was used in each case.

1. The group voted on the CCG (cud-chewer gun) five times, but decided not to include it because they couldn't get everyone to agree to it.

Unanimity     Plurality

Majority     Autocratic

2. The VP of Engineering told everyone that they had to come up with a new character for Team Guernsey. Since he's the highest-ranking person in the room, nobody argued with him.

Unanimity     Plurality

Majority     Autocratic

3. There were 10 new scenery suggestions up for approval, but only 5 could make it into the game. The team chose the top 5 in a general vote.

Unanimity     Plurality

Majority     Autocratic

4. Over half the group wanted to see a new story that involved Farmer Ted. So that requirement was recorded as an absolute necessity.

Unanimity     Plurality

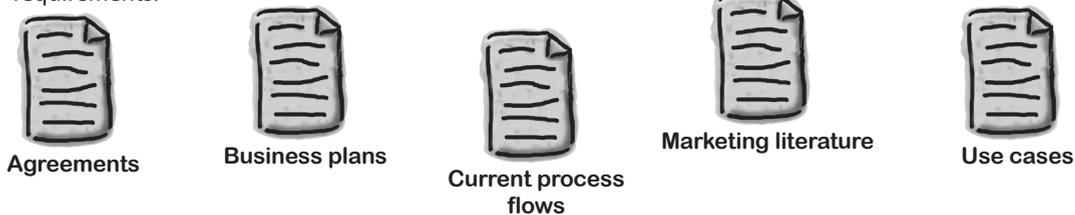
Majority     Autocratic

Answers: 1. Unanimity 2. Autocratic 3. Plurality 4. Majority

## Understand your requirements

Understanding all of the documents that have been created in the initial discussions about your project will help you to get a better handle on what your project will create. That's why the Collect Requirements process includes a tool called **data analysis**.

**Document analysis** is a way of collecting requirements by reading through all of the existing documents for your product. Here are some of the documents you will draw from when you're collecting requirements:



## The stakeholders know a lot about the project already

Requirements are all about people's needs, so it shouldn't be a surprise that you'll need to use your **interpersonal and team skills** to get everyone on the same page about what the project needs to accomplish.

**The nominal group technique** is a form of brainstorming where you write down the ideas as you find them and have the group vote on which ones they like the best. You then use the votes to rank all of the ideas and separate the ones that aren't important from the ones you want to delve into deeper.

**Facilitation** of requirements discussions means using collaborative techniques to get everybody together to talk about what they think the project needs to accomplish and how to achieve it. Here are some of the kinds of group requirements discussions you might use to collect project requirements.

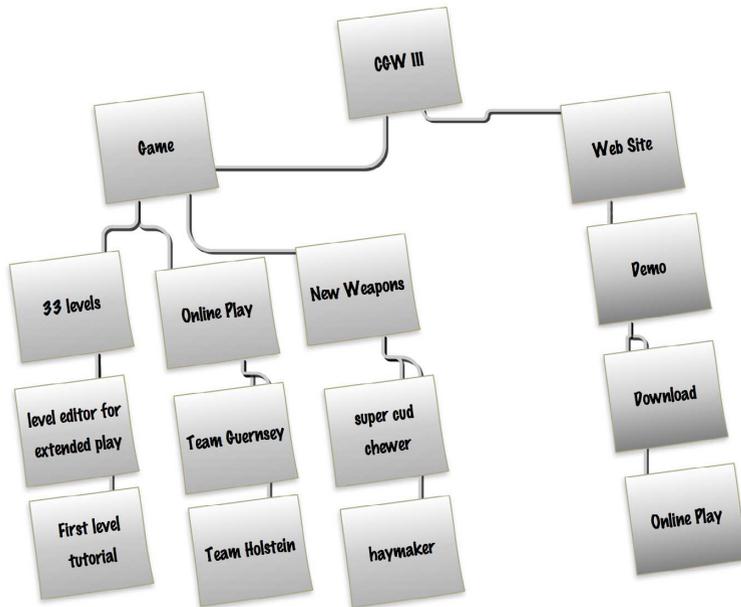
- ★ **Joint application design** is a facilitated workshop where users and the development team work together to define requirements. It's sometimes called a JAD Session.
- ★ **Quality function deployment** is a workshop often used in manufacturing projects where the team identifies customer needs, prioritizes them, and then figures out goals for the team to meet to deliver those requirements.
- ★ **User stories** are short descriptions of functionality that end users need. Often teams collaborate to write user stories and use the actual story they write as a reminder of the discussion they had together. User stories are often written using this format:

*As a <type of user>, I want to <specific action I'm taking> so that <the benefit from the action I've just taken>.*

## See your ideas better

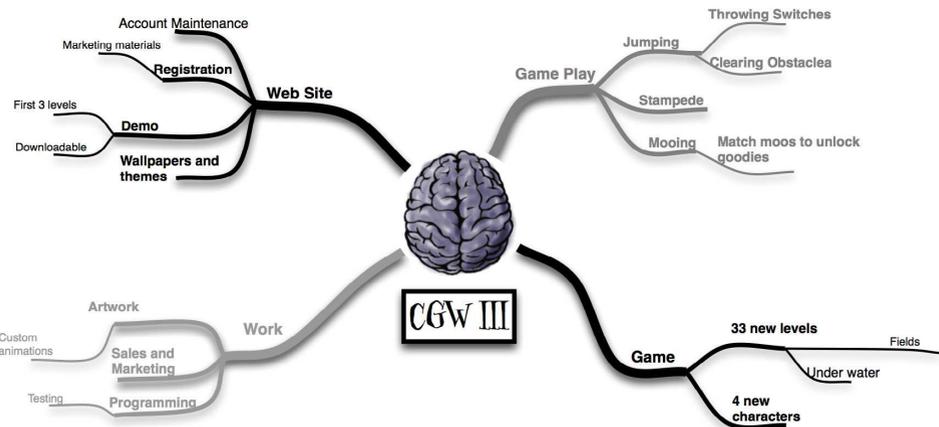


Getting your team to think creatively can help you create a better product from the start. **Data representation** is all about visualizing your ideas so that everyone can see how they relate to each other.



**Affinity diagrams** are great when you have a lot of ideas and you need to group them so you can do something with them. A lot of people make affinity diagrams using Post-it notes on walls. That way, you can move the ideas around and change the groupings when you think of new areas to explore. Sometimes just putting requirements in categories will help you to find new ones.

**Idea/mind maps** are a good way to visualize the way your ideas relate to each other. When you've finished working through an idea, it sometimes helps to create a map of how you got there and show which ideas can be grouped together.



**Context diagrams** help your team show the way all of the processes and features in your product scope relate to each other. It's a picture of the scope of your product that shows how users will interact with it.

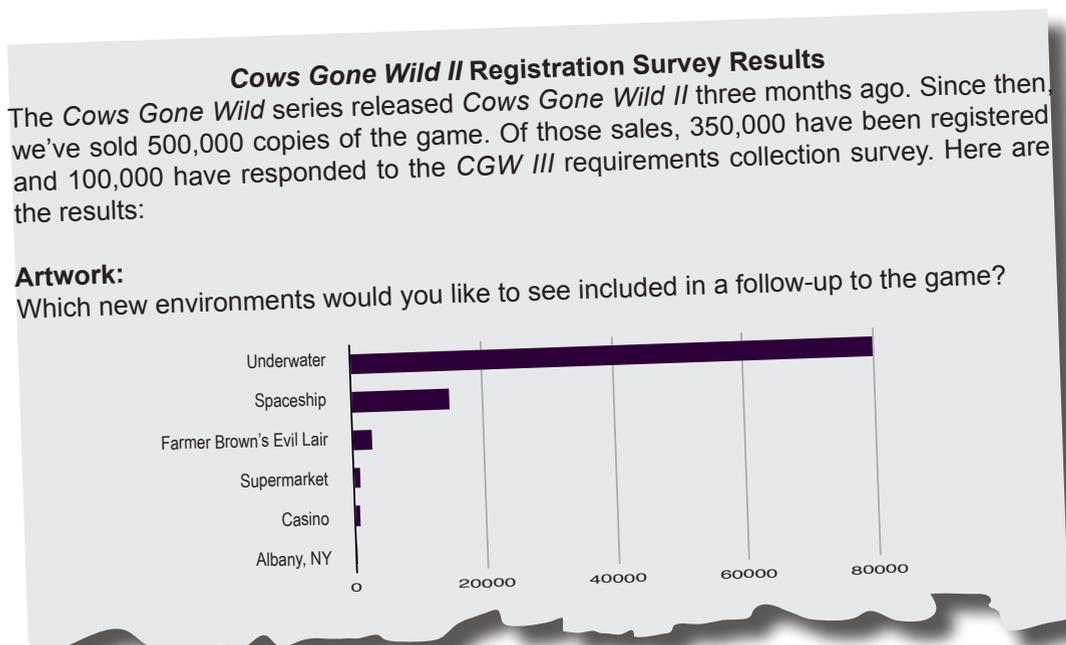
## Use a questionnaire to get requirements from a bigger group of people



The *Cows Gone Wild* development team needed to talk to the people who play their games to figure out what would make the gamers happy in the next version. The team obviously couldn't go around to every customer's house asking questions, so they wrote a questionnaire about new possible features for the game that they sent to gamers who had registered the game.

When it was time to start collecting requirements for the new version, the team started with all of the data they'd gathered from those surveys and did some analysis to figure out which features were most important to the gaming community. Here's an excerpt from their survey results:

Questionnaires are considered data gathering techniques when you're studying for the exam.



## Observation can help you see things from a different point of view

Sometimes observing the people who will use your product while they work with it will give you a better idea of how to solve their problems. People don't always know what to say when you ask them for requirements, so watching them deal with the problem your product is going to address can help you to find requirements that they might not tell you about on their own.

Observation is one of the interpersonal and team skills tools you'll use to collect requirements.



Expert judgment is another tool used in requirements gathering.



## A prototype shows users what your product will be like

Sometimes the best way to get your stakeholders to give you an opinion on what your product should be is to show it to them in a **prototype**. Prototypes are models of the product that you're going to build that give your stakeholders a better idea of what your team is thinking. Sometimes users who are experimenting with a prototype will come up with a brand new requirement that they never thought of before. If you can get them to find it in the prototype, it's a lot easier to deal with than if you wait until the end of the project to show to them. When you're making a really complicated product, it can make sense to prototype it as part of the requirements collection process so that you can find changes that your users will ask for early on.

Prototypes are a great tool if you're developing your project using iterative techniques. If you're using agile software development processes or defining requirements in phases, prototypes are a great way to keep your stakeholders involved in the project and get their feedback on changes that might be needed.



### there are no Dumb Questions

**Q:** In my company, business analysts collect the requirements, not project managers. Why do I need to know all this stuff?

**A:** Good point. A lot of project teams will have a business analyst who will work on gathering requirements for the project and writing specifications for it. As the project manager, though, you are responsible for making sure that the needs of all of the stakeholders are met. So it's a good idea for you to stay on top of the requirements collection process, and be an active participant in it.

Some organizations even divide up the requirements-gathering activities into project requirements and product requirements. The project requirements would be things like staying within the budget, meeting specific deadlines, and using a certain number of resources, while product requirements would be about features of the product. Even if you are lucky enough to have a business analyst on your project to help you gather requirements, you'd better understand both the project and product requirements if you're going to keep your project on track.

**Q:** Can I just skip these requirements-gathering tools and jump straight into code? We do iterative development where I work. That means I can jump right in and plan the work as it's happening, right?

**A:** The short answer is no. The more you know up front, the easier it's going to be for you to plan out your project. Even iterative projects must plan out their requirements for each phase up front. Now, it's true that you should be able to get through the Collect Requirements process more quickly if you're only gathering requirements for a small phase of your project, but it doesn't mean that you can skip requirements altogether.

**Q:** How do I know when I'm done collecting requirements?

**A:** That's a good question. Your requirements need to be measurable to be complete. So it's not enough to write down that you want good performance in your product. You need to be able to tell people what measurement counts as good performance for you. You have to be able to confirm that all of your requirements are met when you close out your project, so you can't leave requirements up to interpretation.

**You know your requirements are complete when you've got a way to verify each of them once they're built.**

## Now you're ready to write a requirements document

The outputs of the Collect Requirements process are the **requirements documentation** and a requirements traceability matrix, which allows you to follow the requirements from the document through implementation and verification.

### Outputs



This requirement is measurable. If the end product has puzzles that involve swimming, the requirement will pass its test. If not, it will fail.

Here, you can load the levels and time it to figure out if the product meets its requirements.

### CGW III Requirements Document

#### 1. Introduction

CGW II was a huge hit. We've done some market research and some internal brainstorming and compiled these requirements for *Cows Gone Wild III: The Milkening*, which will be released next year in time for the holidays.

#### 2. Organizational impact

This product will have an impact on many departments at Ranch Hand Games, including Research and Development, Marketing, Distribution, Shipping, Administration, Finance, and Customer Service.

#### 3. Functional requirements

Name	RU001—Include Underwater levels.
Summary	The cows will need to be able to move around underwater.
Rationale	Underwater environment was the single biggest request from polled gamers.
Requirement	Cows will need to be able to swim, and underwater puzzles will need to be developed that require swimming.

#### 4. Nonfunctional requirements

Name	RNF001—Performance as good or better than CGW II.
Summary	The new functionality cannot slow down gameplay.
Rationale	Gamers were very happy with the performance upgrades in CGW II. We cannot be seen as losing that improvement in the next version.
Requirement	All levels must load in under 15 seconds. All online levels must load in under 25 seconds over a cable connection at 256K.

The requirements document needs to list all of the functional and nonfunctional requirements of your product.

**Functional requirements** are most of the kinds of things that you think of right away: new features, bug fixes, and new or different behavior. **Nonfunctional requirements** are sometimes called *quality attributes* because they're things that you expect from your deliverables, but aren't specific features. Some examples of nonfunctional requirements are performance, reliability, error handling, and ease of use.

### CGW III Requirements Traceability Matrix

**Origin codes:** Business case: BC, Survey: S1, Internal: I  
**Requirement nos:** Cross-reference with requirements document  
**Work module:** Where implemented, cross-reference with WBS  
**Test:** Where verified, cross-reference with design of experiments

#### Requirements for Underwater Levels

Origin	Requirement	Module	Test
S1	RU001	3.3.1	TC01–TC57
BC1	RU002	3.4.1	TC101–TC350
S3	RU003	3.6.2, 3.7.1	TC2

This document shows where the requirements come from, where they get implemented, and how they get verified. It's a great way to take a quick high-level look at all your requirements and make sure they're mapped to specific test cases.

We'll be talking more about what a WBS is and how to build one in just a few pages.

### CGW II Requirements Management

#### The Requirements Collection Process:

The following techniques will be used for requirements elicitation:

1. Questionnaires and surveys
2. Facilitated workshops
3. Delphi technique
4. Focus groups
5. Interviews
6. Observation

They will be prioritized based on strategic alignment with CGW III's business case document.

**Requirements will be managed as part of integrated change control once approved.**

The Requirements Management plan tells how requirements will be gathered and analyzed.

Once the requirements document is approved by the stakeholders, any changes to it need to be approved using integrated change control.



## BULLET POINTS AIMING FOR THE EXAM

- **Product scope** means the features and functions of the product or service being built. **Project scope** means the work that's needed to build the product.
- **Functional requirements** are the behavior of the product. **Nonfunctional requirements** are implicit expectations about the product.
- **Scope Management** is about figuring out all of the work that's going to be needed for the project, and making sure only that work is done—and nothing else.
- The **Scope Management plan** is created as part of the Project Management plan. It defines the process you'll use for defining scope and managing changes to it.
- You'll need to know the **order of processes** for the exam. A good way to remember them is to understand how the output of one process is used as the input for another.



Write down the Collect Requirements tool or technique that's being used in each one of these scenarios.

1. The team got together to come up with ideas for the game. As they thought of them, they grouped them on different-colored index cards and used thumb tacks to arrange them on a bulletin board by type.

.....

2. Ranch Hand Games listed questions for people visiting the website to answer in exchange for a game promo coupon.

.....

3. The team got together to brainstorm and periodically voted to rank requirements and separate the least important from the most important.

.....

Answers: 1. Affinity diagram, 2. Questionnaire, 3. Nominal group technique

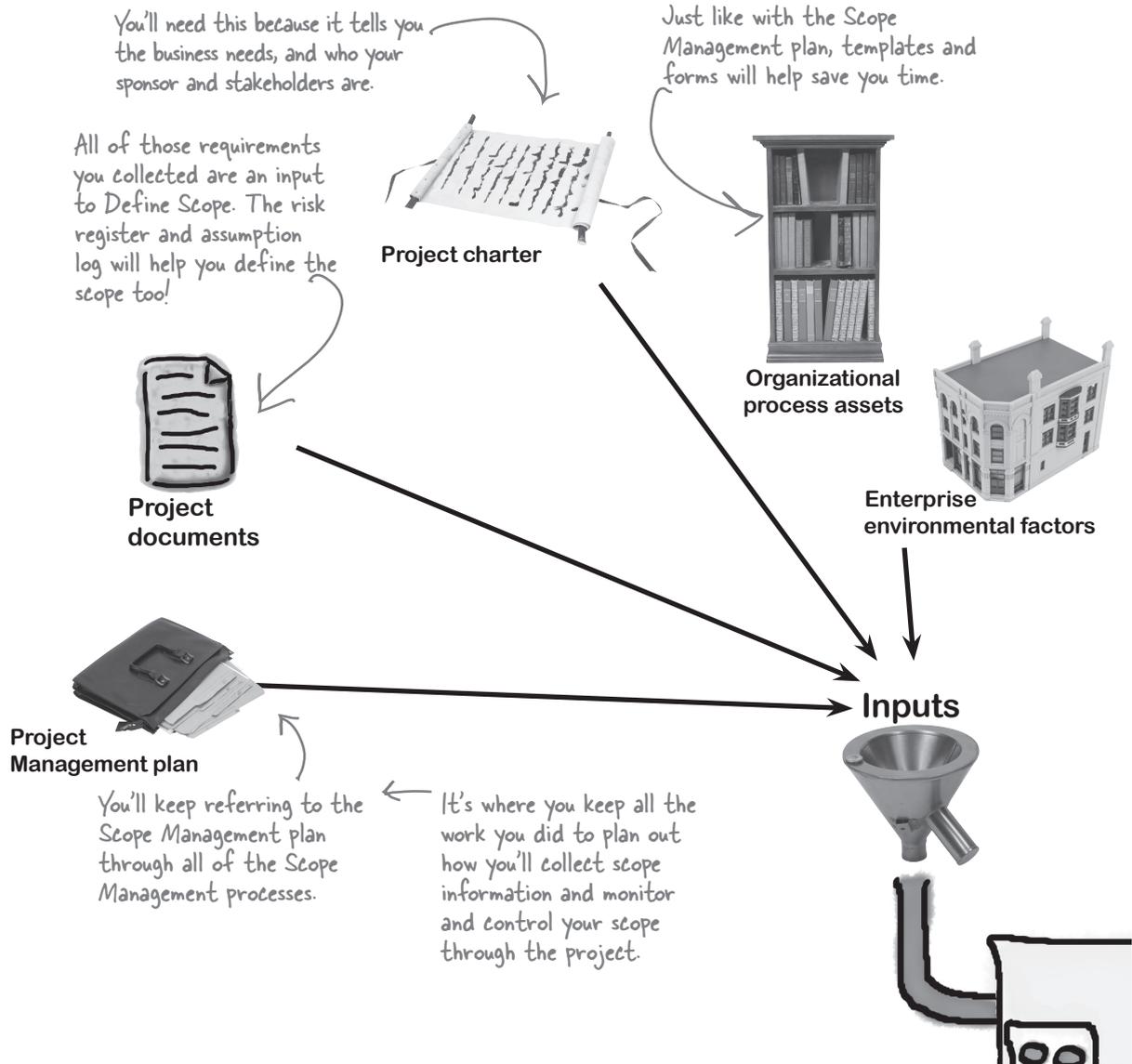


Now that Mike's gathered the requirements, what do you think he should do with them? How can he make sure they actually get implemented in the game?

# Define the scope of the project



Now that the Ranch Hand team has a project manager, everything will go smoothly, right? Well, not exactly. Just assigning a project manager isn't enough to get the scope under control. That's why you need the **Define Scope** process. Even the best project managers need to rely on things from the company and the people around them. That's why the inputs to Define Scope are so important. They contain everything you need to know before you can begin to break the project down into the work that the team members will do.



## How do you define the scope?

You already got a head start on defining the project scope when you wrote down the requirements. But now you need to go a lot further and write down all of the work that you and your team are going to do over the course of the project. Luckily, the **Define Scope process tools and techniques** are there to help guide you through creating the project scope statement (which you'll learn about in a minute).

These are the five tools and techniques of Define Scope.



You need to figure out what the stakeholders need so you can deliver it to them.

### Interpersonal and team skills

When you do facilitated workshops with your stakeholders, figure out what they need, and write it all down. The reason you do this is because you need to make sure that what you're delivering really meets the needs of the stakeholders. This keeps the team from delivering a poor product.

An important part of stakeholder analysis is doing your best to set **quantifiable goals**. That means writing down specific project goals that you can measure, which makes it a lot easier for the team to plan for the work they have to do.



That's a great goal, but it's not quantifiable.



VS.



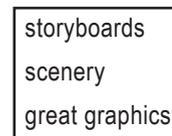
Everybody can shoot for that.



### Product analysis

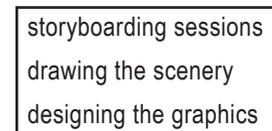
Remember product versus project scope? People naturally think about the product they are making when they start to define the scope. This tool is all about turning those things into project work that needs to be done.

Once the work is complete, you're going to have to make sure that what you're delivering matches what you put in your requirements. The better your product analysis is at the start of the project, the happier your stakeholders will be with the product, and the less likely it is that you'll discover painful, last-minute problems at the end.



The game needs this...

...so Amy does this.



## Data analysis

Think of other ways that you could do the work. Exploring different ways to do the work will help you find the one that is most efficient for the project. It's always possible that you might find a better way of doing things and need to change your original plan. Teams will often spend time performing **alternatives analysis** as part of the data analysis work they do when they define the scope of a project.

## Designing the graphics: alternatives

**A.**  Hire a graphic designer

**B.**  Send the design work to an outside studio

**C.**  License artwork that already exists

## Expert judgment

You've seen this one before! Bring in an expert to help you figure out what work needs to be done.



## Decision making

Here you identify the criteria that will help you make a good decision about what to include and exclude from scope in your project and assign numeric values to them so you can figure out which requirements are most important in terms of business value to your stakeholders.

### *there are no* Dumb Questions

**Q:** Is product analysis the same as requirements gathering?

**A:** Not exactly. When people gather requirements, they're trying to understand what needs the product should fill. Requirements are the contents of the product. When you use product analysis to define the scope of the work to be done, you're figuring out what deliverables the team needs to work on in order to build your project scope statement. So product analysis is concerned with how the work will be done, not what's in it.

**Q:** What if there is only one way to do something? Do I still need to do alternatives analysis?

**A:** There aren't too many things out there that can only be done one way, but if you happen across one, then you don't have to spend much time on alternative analysis because there aren't any alternatives to identify.

**Q:** What if a stakeholder can't tell me how to measure his needs?

**A:** That can get kind of tricky. Sometimes stakeholders know that they want things to get better, but they don't know how to tell when they've succeeded. You need to work with them to find something that can be measured in their ideas about project success. Without a way to measure your success, you won't know whether or not you are accomplishing your goals.

## The project scope statement tells you what you have to do

After you have done your scope planning, figured out as much as you could using stakeholder and product analysis, and identified all of the possible ways of doing the work, you should be ready to add any new findings to the project scope statement.



### Outputs

**Cows Gone Wild III: The Milkening**  
Project Scope Statement

**Product Scope Description:** The product must contain 34 levels and 4 playable characters, and must be created for both Mac and PC platforms.

**Project Exclusions:** This project does not include a companion website. That will need to be done by another project team.

**Project Deliverables:** The deliverables for this project are:

Game	Test plan	Source code	Schedule
Design documents	Test reports	Defect reports	Change requests
Contract	Budget	Project Management plan	

**Project Acceptance Criteria:** The product must not have an adverse impact on existing systems. All defects found must be judged of low enough priority and severity to be acceptable to all stakeholders.

This means looking for all the work the project **DOESN'T** include.

The deliverables listed here are **EVERYTHING** the project creates, including project management stuff.

This is the other output of the process, and it has to do with change control. We'll get to that when we talk about the Control Scope process.



Project documents updates

## \* WHAT'S MY PURPOSE \*

Here are a few things that Mike left out of the *CGW III* project scope statement. Can you figure out where each of them should go?

1. The game must have fewer than 15 defects per 10,000 lines of code.

A. Project exclusions

2. There will be four graphic designers reporting to the art director, and six programmers and four testers reporting to the development manager.

B. Project deliverables

3. No more than 15 people can be allocated to work on the game at any time.

C. Project constraints

4. Scenery artwork.

D. Project assumptions

5. The product will not include bug fixes for the previous version.

E. Project requirements

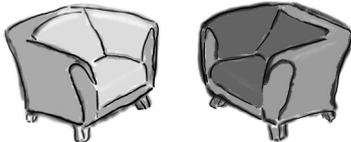
6. The game needs to run on a machine with 1 GB of memory or less.

F. Acceptance criteria

—————▶ **Answers on page 245.**

**The project scope statement tells what work you are—and are not—going to do in the project.**

## Fireside Chats



Tonight's talk: **Requirements Documentation and Project Scope Statement spar over what's important in Scope Management**

### **Requirements Documentation:**

I'm glad we're finally getting a chance to chat in person.

I wouldn't say that! It's just that, well, I think it's not hard to see why I'm such a critical part of Scope Management.

Well, it ought to be. I mean, you wouldn't even exist if it weren't for me.

There's no work to do if there's no product and without me, nobody knows what to build. So without me, really, who needs you?

But they still need me to tell them what to build. I tell everybody what the product needs to be.

That's true. And it's no wonder that so many projects have problems. But the more you know up front, the easier it is to plan for what might happen along the way.

### **Project Scope Statement:**

Really? I never got the impression that you had much respect for me.

Typical. Everything's about you.

How do you figure?

Now that's just not fair. You think that just because people get together and talk about you in focus groups and brainstorming sessions, you're something special. Without me, people would be arguing over your requirements forever. I'm the one who puts limits on all of this stuff.

That may be true, but think about it for a minute. Your requirements almost always change from the time you start the project until it ends. You're so high-maintenance. You hardly ever hear of a project where the team gets all of the requirements right from the beginning. And when you change, I have to change too. It's so obnoxious.

**Requirements Documentation:**

I guess that means that knowing the project scope up front is pretty important too, now that I think about it.

But you're so broad. I mean, if you really want to know what's getting done on a project, you have to look at me. I represent the need the project is filling; without me, it never would've happened in the first place.

That seems almost as important as my job to me.

**Project Scope Statement:**

That's exactly my point. We're both useful, but I'm the one everyone thinks of first when they think about managing scope.

Here we go again with your attitude. Trust me, without me, no one would know how those needs were going to be met. I'm just as important as you are.

I guess we're never going to see eye-to-eye on this.



You'll need to know the difference between defining the scope and collecting the project's requirements for the exam. Which of these things is part of the project scope statement, and which is part of the requirements document?

**1. The work required to create the graphics**

Requirements document  Project scope statement

**2. New characters in the game**

Requirements document  Project scope statement

**3. 33 new levels**

Requirements document  Project scope statement

**4. The performance requirements for the product**

Requirements document  Project scope statement

**5. A description of how the WBS is created**

Requirements document  Project scope statement

**6. How the software will be tested**

Requirements document  Project scope statement

**7. How the stakeholders will verify the deliverables**

Requirements document  Project scope statement

**8. A list of all artwork that will be created**

Requirements document  Project scope statement

Answers: Requirements doc: 2, 3, 4, 8 Project scope statement: 1, 5, 6, 7

## Question Clinic: The which-is-BEST question

WHEN YOU'RE TAKING ANY SORT OF EXAM, THE MORE FAMILIAR YOU ARE WITH IT, THE MORE RELAXED YOU'LL BE. AND ONE WAY TO GET FAMILIAR WITH THE PMP EXAM IS TO GET TO KNOW THE DIFFERENT KINDS OF QUESTIONS YOU'LL SEE. ONE IMPORTANT SORT IS THE WHICH-IS-BEST QUESTION.

The which-is-BEST question sometimes starts with a sentence or two talking about a particular situation.

This is one of those questions where "customer" is used in place of "sponsor."

OK, now you have enough information to answer the question. What do you do when you find out that certain deliverables need to change?

36. You are the project manager for a building contracting project. You schedule a meeting with your customer and stakeholders to give them an update on the progress of the project. At that meeting, they tell you that certain deliverables need to be changed before they can be accepted. Which is the BEST way for you to proceed?

- A. Inform the stakeholders that they have no authority to decide what deliverables are acceptable.
- B. Consult the project charter and use it to show the stakeholders that you are the authorized project manager.
- C. Figure out what needs to be fixed so that you can tell the team how to make the deliverables acceptable.
- D. Document the requested changes so that you can put them through change control.

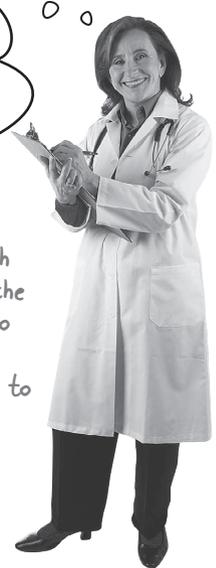
Some of the answers will simply be wrong. You should be able to eliminate them first.

This one sounds good... That's what the project charter is for, right? But wait a minute! What does the charter have to do with the scope of the work?

OK, this actually seems right—you do need to do that. But is it really the BEST answer?

THE WHICH-IS-BEST QUESTION MAY HAVE MORE THAN ONE GOOD ANSWER, BUT IT ONLY HAS ONE BEST ANSWER.

Aha! Here's the BEST answer! Even though C was technically correct, D is a much better description of how change control actually works.



# HEAD LIBS



Fill in the blanks to come up with your own which-is-BEST question.

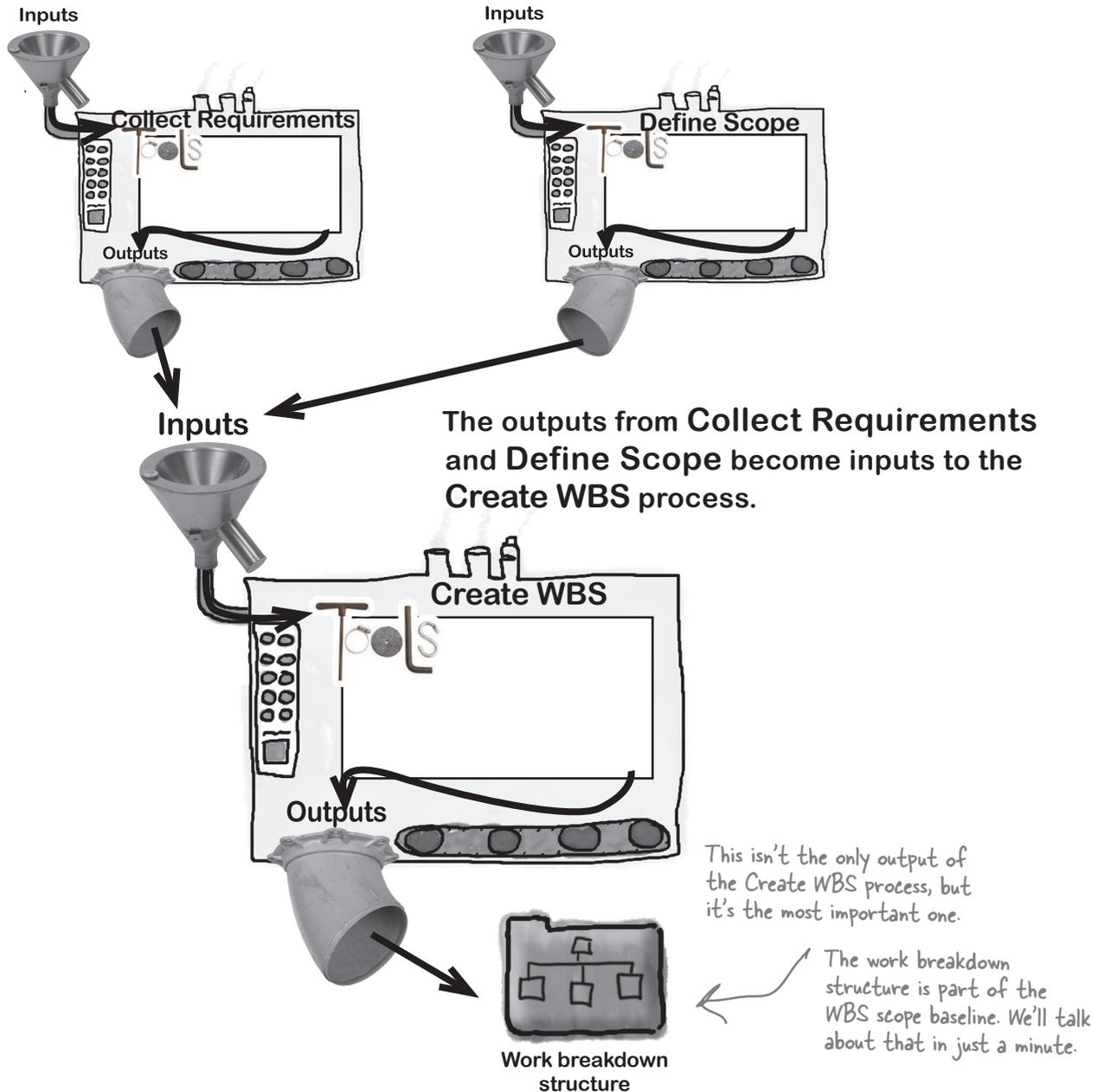
You are the project manager for \_\_\_\_\_ . At the end  
*(an industry or the name of a project)*  
of \_\_\_\_\_ , you ran into a problem. You find  
*(a Scope Management process)*  
out that \_\_\_\_\_ was not performed by  
*(a tool or technique that is part of that process)*  
\_\_\_\_\_ correctly. Which is the BEST way for you to proceed?  
*(the team member or person who is supposed to do that tool or technique)*

- A. \_\_\_\_\_  
*(an obviously wrong answer where the person or project manager uses the tool or technique incorrectly)*
- B. \_\_\_\_\_  
*(an answer that sounds correct, but isn't the BEST answer)*
- C. \_\_\_\_\_  
*(the BEST answer that describes exactly how to use the process properly)*
- D. \_\_\_\_\_  
*(an answer that says something that's true about an irrelevant process, like one from Chapter 4)*

## Create the work breakdown structure



The **Create WBS** process is the most important process in the Scope Management knowledge area because it's where you actually figure out all the work you're going to do. It's where you create the **work breakdown structure** (or WBS), which is the main Scope Management output. Every single thing that anyone on the project team—including you—will do is written down in the WBS somewhere.

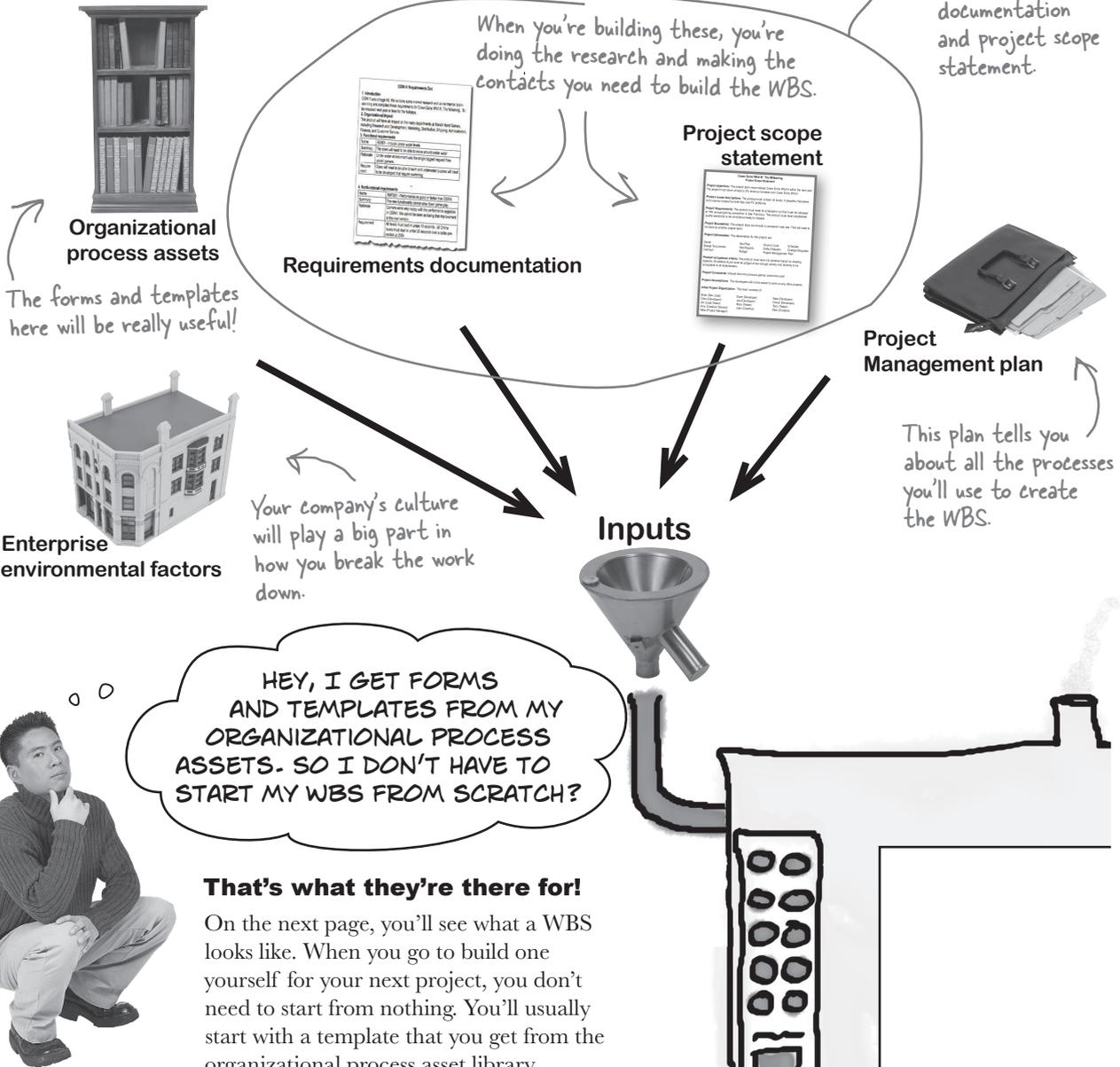


# The inputs for the WBS come from other processes

You've already seen all of the inputs that you need to create the WBS. It shouldn't be too surprising that you need the requirements document, project scope statement, and organizational process assets before you create the WBS. When you're developing these things, you're learning what you need to know in order to decompose the project work.

When you see "project documents," that includes the requirements documentation and project scope statement.

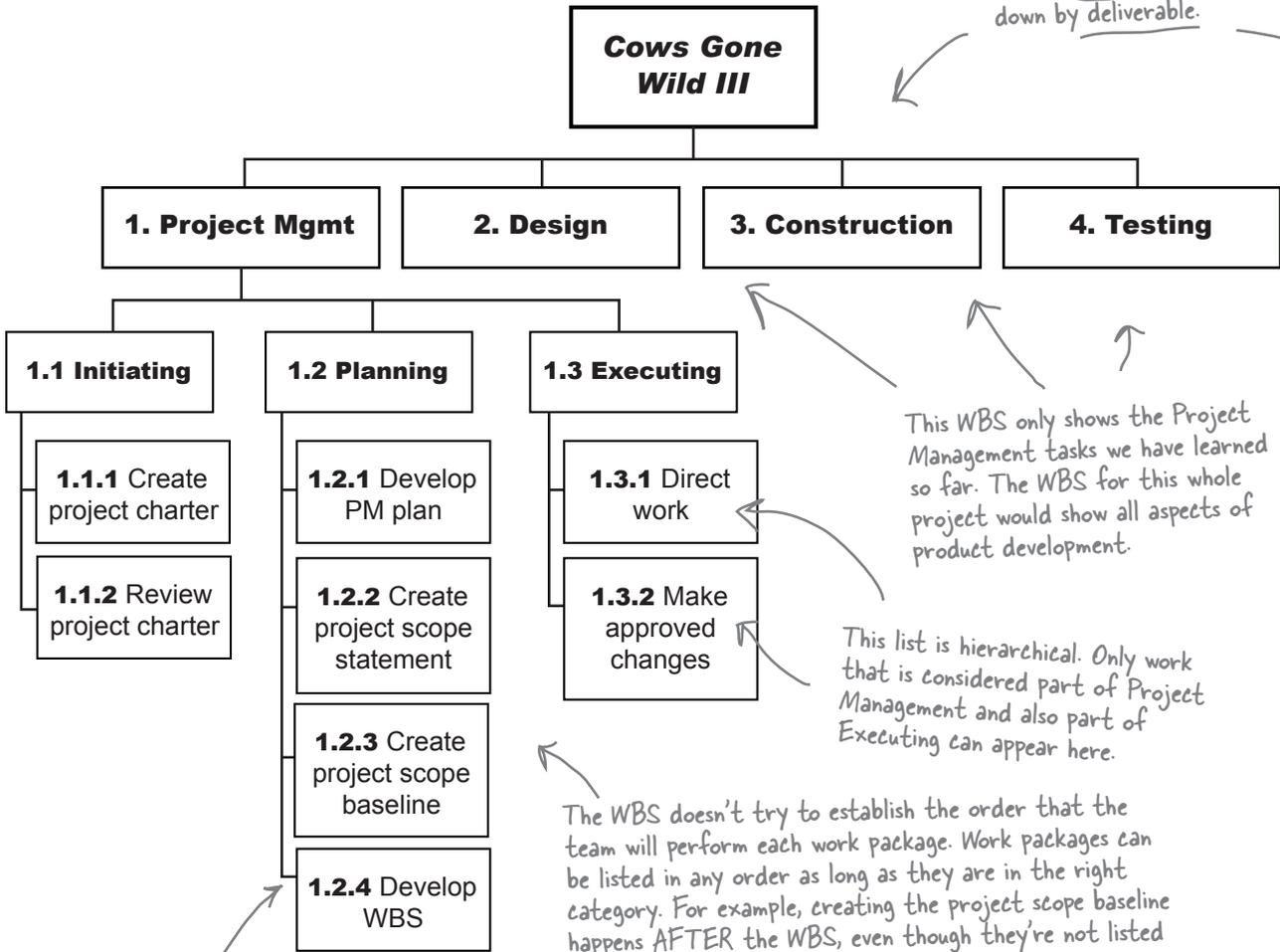
When you're building these, you're doing the research and making the contacts you need to build the WBS.



# Breaking down the work

One way to get a clear picture of all of the work that needs to be done on a project is to create a work breakdown structure. The WBS doesn't show the order of the work packages or any dependencies between them. Its only goal is to show the work involved in creating the product.

This WBS breaks the project work down by phase; the one on the right breaks them down by deliverable.



This WBS only shows the Project Management tasks we have learned so far. The WBS for this whole project would show all aspects of product development.

This list is hierarchical. Only work that is considered part of Project Management and also part of Executing can appear here.

The WBS doesn't try to establish the order that the team will perform each work package. Work packages can be listed in any order as long as they are in the right category. For example, creating the project scope baseline happens AFTER the WBS, even though they're not listed here in that order.

This picture helps everybody to see the magnitude of the work that needs to be done, and sometimes catches work packages that you might not find in a document.

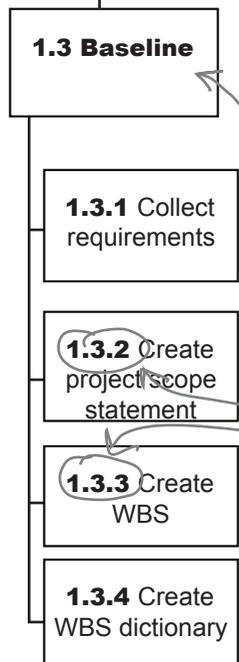
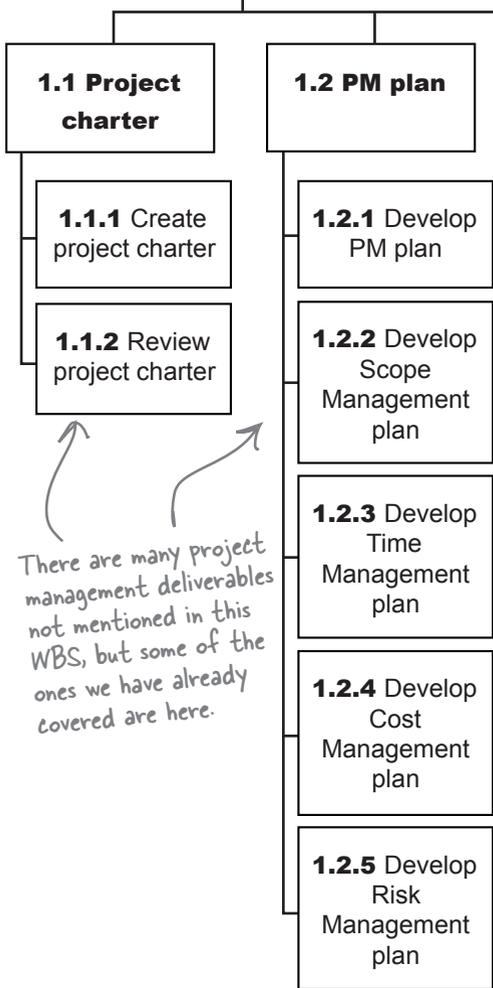
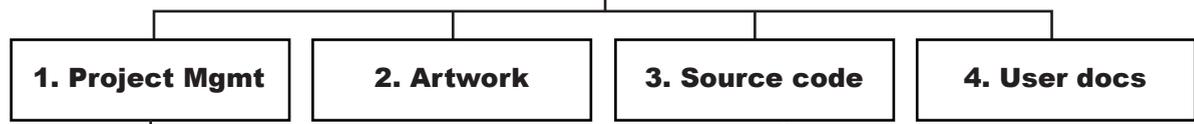


Why would you break the project down by phase rather than deliverable? Why would you want to break it down by deliverable?

# Break it down by project or phase

A WBS can be structured any way it makes the most sense to you and your project team. The two most common ways of visualizing the work are by deliverable or by phase. Breaking down the work makes it easier to manage, because it means you are less likely to forget work packages that need to be included. This is the same project as the one on the left, but this time, it's broken down by deliverable.

← These are the same phases we talked about in Chapter 3.



← This WBS isn't done—it doesn't show any of the work related to creating the product. Those would need to be filled out before this chart could be finished.

← We haven't talked about this one yet. But it's coming up next.

← Every work package in the WBS has a unique number, usually an outline number like in your word processor. You use the number to identify each work package and its category.

← There are many project management deliverables not mentioned in this WBS, but some of the ones we have already covered are here.

**Each of these things is called a work package.**

It's a unit of work that you and your team use to organize the stuff you're going to have to do to get the project done. The work package is the lowest level on a WBS; the higher levels are used to categorize the work packages. When you roll them all up into one big WBS, you get a complete picture of everything that the team will do over the course of the project.

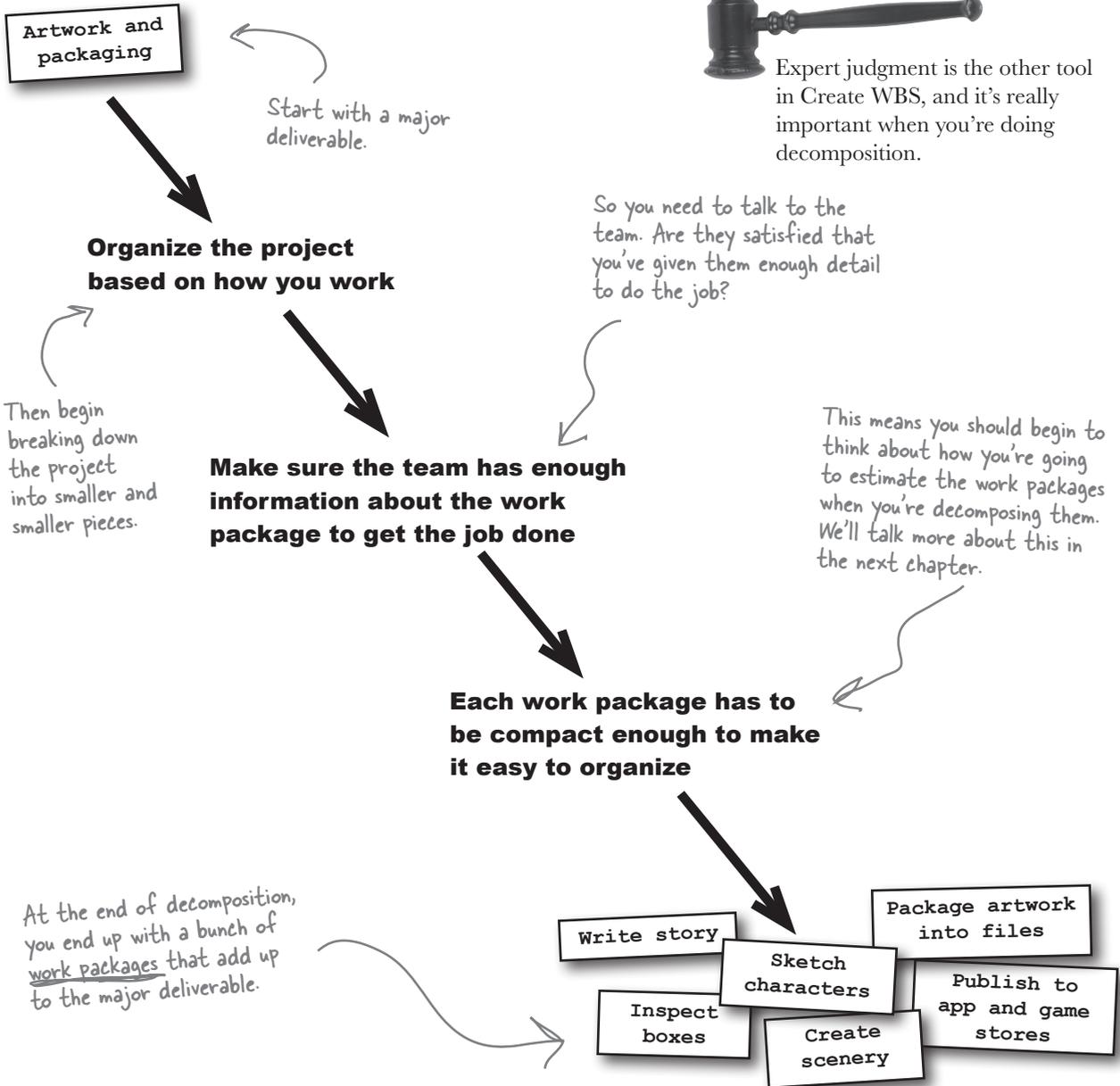
# Decompose deliverables into work packages



Creating the WBS is all about taking deliverables and coming up with work packages that will create them. When you do that, it's called **decomposition**, and it's the main tool you use to create a WBS.



Expert judgment is the other tool in Create WBS, and it's really important when you're doing decomposition.



You won't find any solutions for this, because there aren't any right or wrong answers! It's your chance to take a minute to think things through—that'll get it into your brain.



You'll need to understand decomposition for the exam. Here are a few deliverables from *Cows Gone Wild III*. Based on what you've seen so far, decompose them into work packages. There are no right or wrong answers—this is practice for thinking about decomposition.

Software .....

.....

.....

Artwork .....

.....

.....

Marketing materials .....

.....

.....

Throwing a party for the team .....

.....

.....

.....

Online play promotional events .....

.....

.....

.....

Game add-ons .....

.....

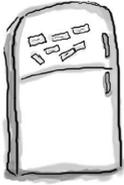
.....

Support forums and message boards .....

.....

.....

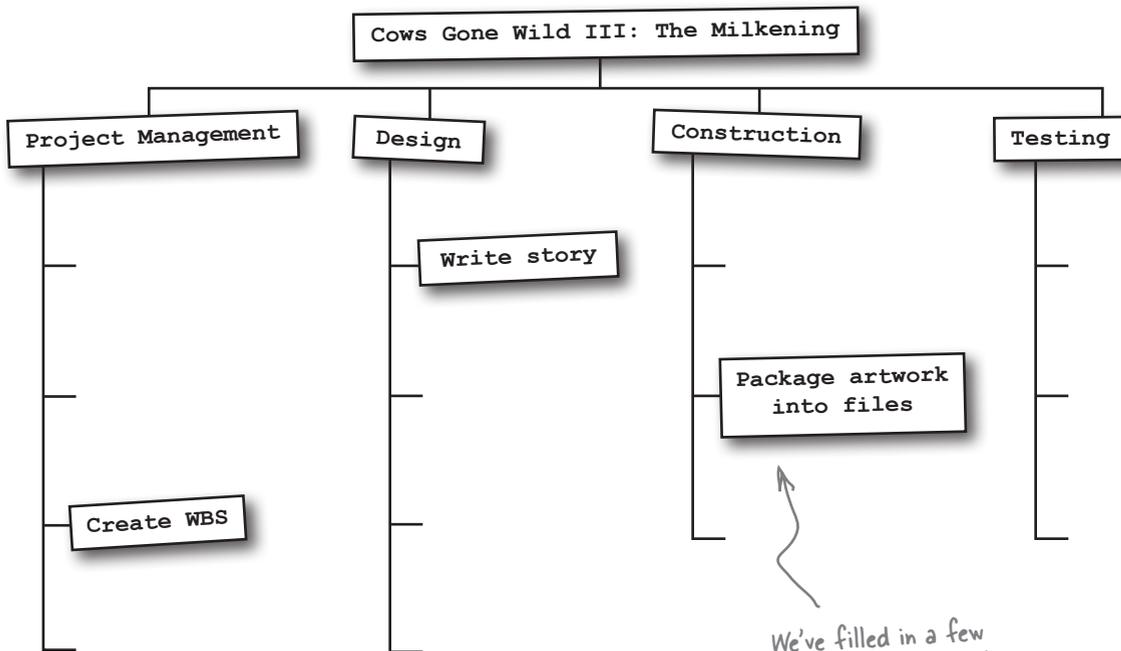
.....



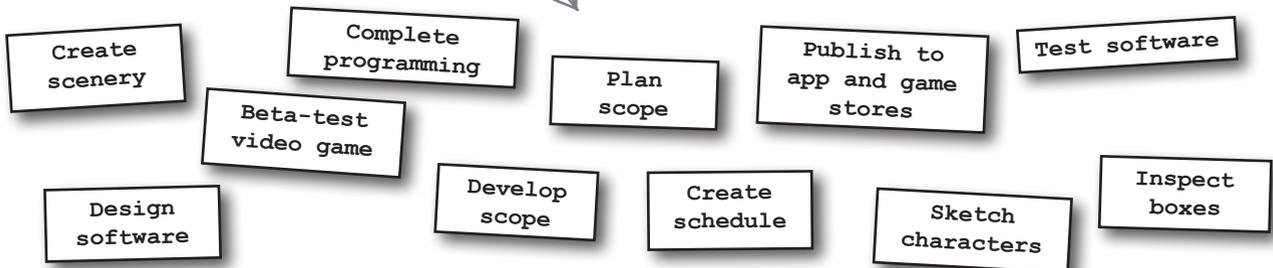
## Project Scope Management Magnets

Understanding how to build a work breakdown structure is very important for the exam—it's one of the most important parts of the Scope Management knowledge area. Here's your chance to create a WBS for *Cows Gone Wild III: The Milkening*. There are two ways you can break down the work. See if you can use decomposition to do it!

**On this page, create a work breakdown structure broken down by project phase.**



Use these magnets to fill in the blank WBS.

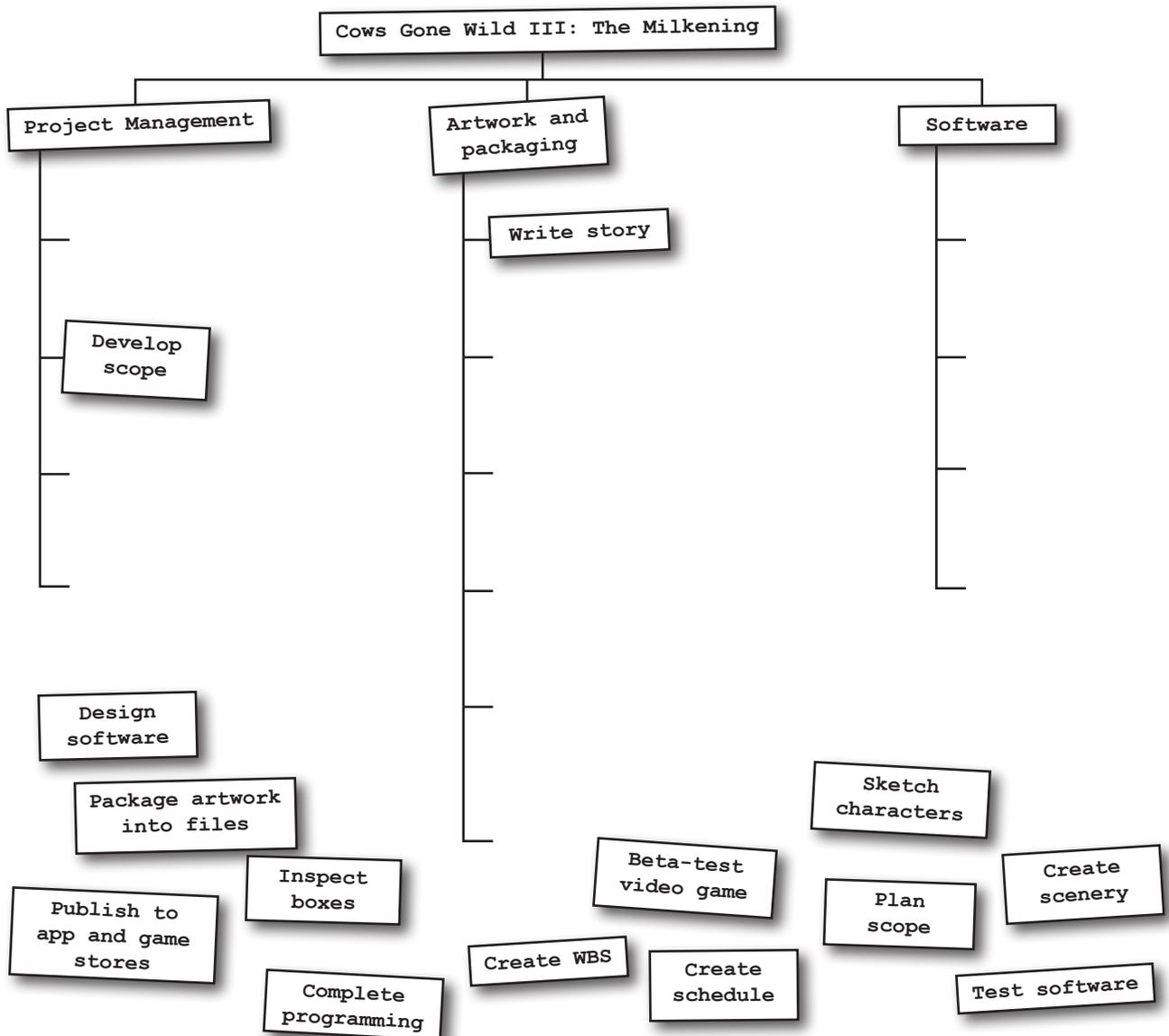


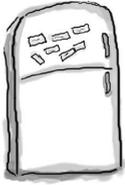


## More Magnets

Oops! Looks like the magnets fell off the fridge. Here's your chance to practice breaking down the work to create a different WBS using the same magnets as before. But this time, instead of decomposing project phases into work packages, break the project down by deliverable.

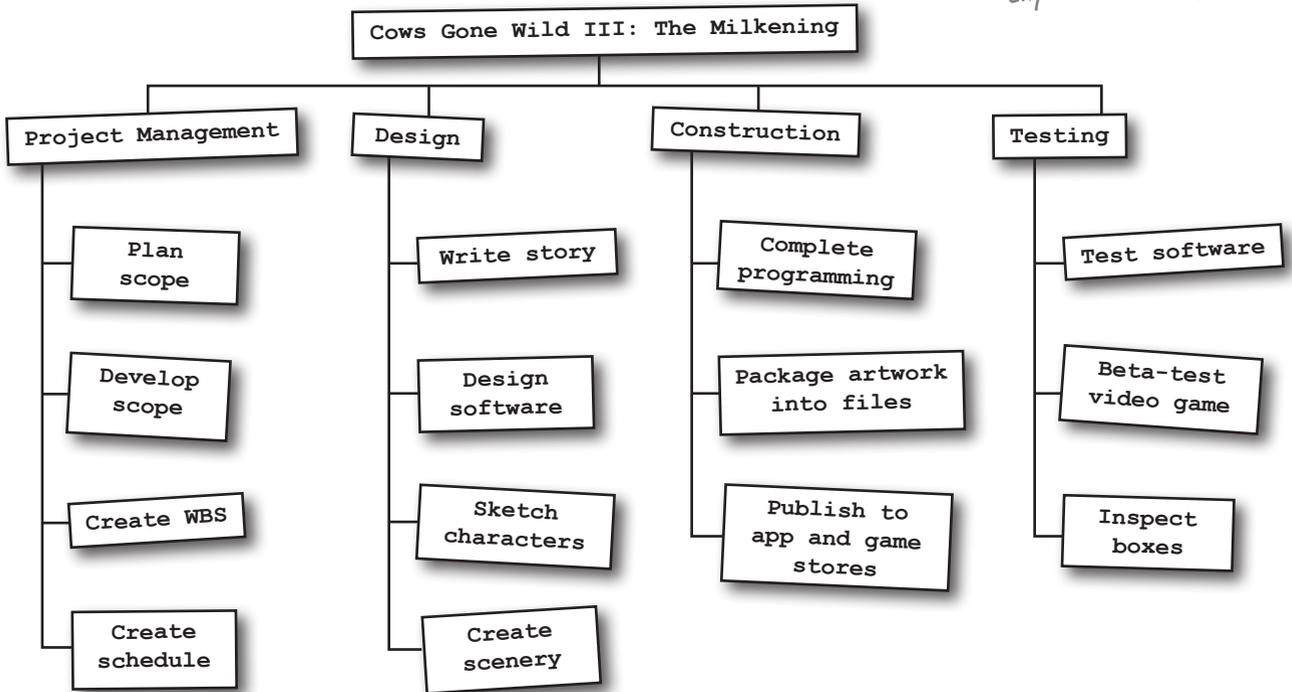
**On this page, create a work breakdown structure broken down by deliverable.**





# Project Scope Management Magnets Solutions

You can break down the work for a project in any number of ways.

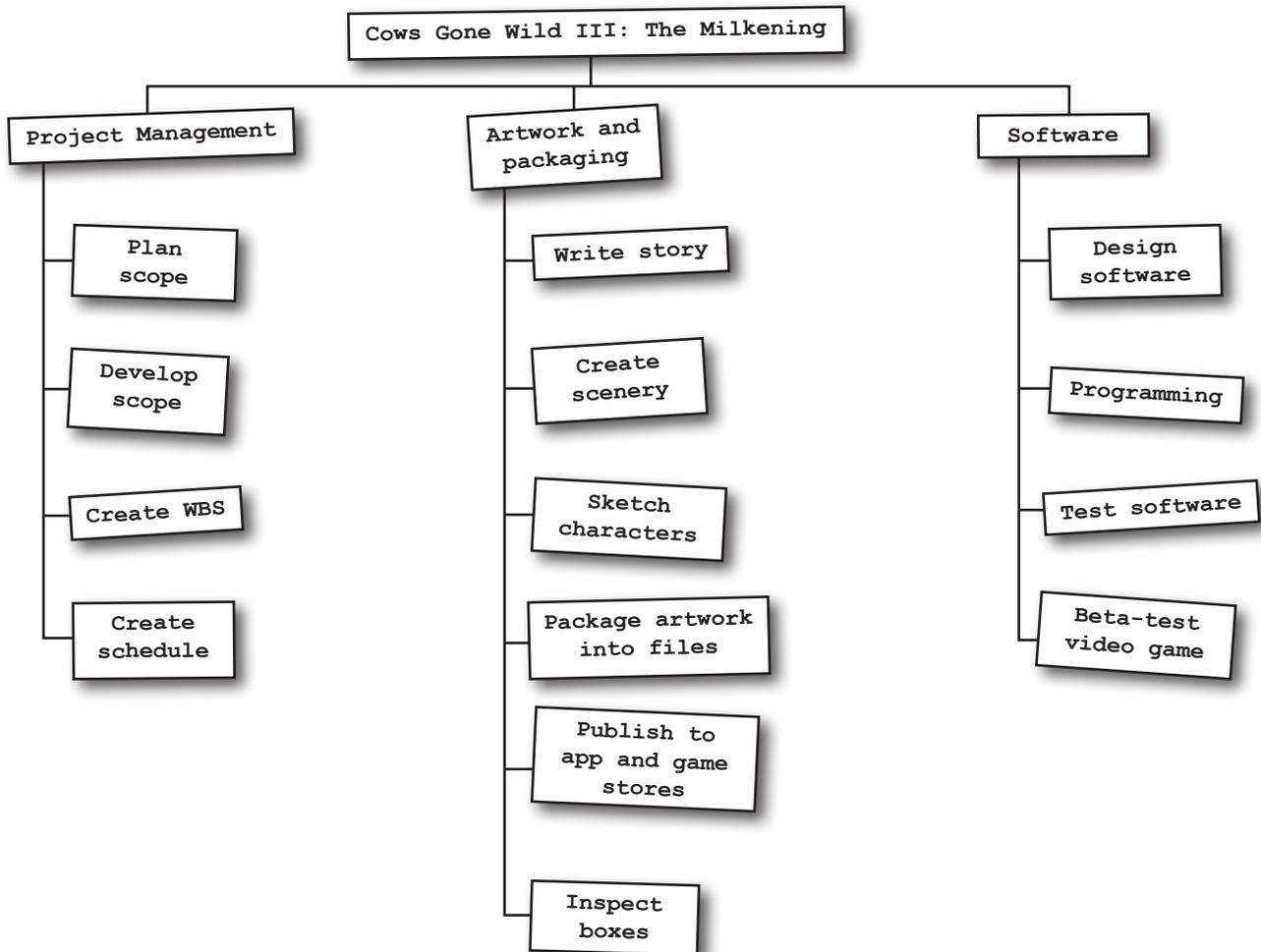


It's OK if you decided that, say, creating scenery is a work package under construction, not design. The important thing here is to learn about the WBS, not video game design.



Can you think of a reason that Mike would break down *Cows Gone Wild III* work by phase?  
Can you think of why he'd break it down by deliverable?

This WBS has the same work packages, but they're broken down differently.



Did you notice how the project management work packages are the same in both WBSes? You could break them down into more detailed project management deliverables, and then you'd see a difference.

## Inside the work package

You've probably noticed that the work breakdown structure only shows you the name of each work package. That's not enough to do the work! You and your team need to know a lot more about the work that has to be done. That's where the **WBS dictionary** comes in handy. It brings along all of the details you need to do the project work. The WBS dictionary is an important output of the Create WBS process—the WBS wouldn't be nearly as useful without it.

This is one of the WBS Dictionary entries for the Cows Gone Wild III project. It goes with the Test Software work package in the WBS.

The WBS dictionary contains the details of every work package. It's a separate output of the Create WBS process.

Each work package has a name, and in many WBSes the work packages will also have ID numbers.

Here's what the WBS entry would look like with this ID number.

3.2.4 – Test Software

Each work package should be small enough to make cost and resource estimates.

\*This account identifier is important—it's how you hook your WBS into your company's accounting system. That way, you can make sure all of the work is paid for.

This is just a description of the work that needs to be done.

Don't forget that the WBS doesn't show dependencies among work packages.

**Test Software**  
WBS Dictionary Entry

**Work Package ID and Name:** 3.2.4 – Test Software

**Statement of Work:**  
The goal of software testing is to verify that the *Cows Gone Wild III* software implements all of the requirements. Each requirement will be fully tested by a team of quality engineers.

**Responsible Organization:** Ranch Hand Games QA Team

**Schedule Milestones:**

- 4/26 – Programming team delivers software
- 6/18 – Functional testing and graphics testing completed
- 8/10 – QA approves software for beta testing

**Quality Requirements:**  
The software must meet the requirements defined by the Ranch Hand Games QA team's quality standards document ("RHG QA Standards.doc")

**Code of Account Identifier:** RHG-236

**Required Resources and Cost Estimate:**

- Test planning – One QA lead and two QA analysts (\$8,500)
- Functional testing – 2 leads, 3 analysts, 11 testers (\$36,000)
- Monitor beta testing – 2 leads, 1 analyst (\$6,000)

Here's another chance for you to think things through. Putting it down on paper helps the cognitive process.



## Sharpen your pencil

It will help you on the exam to know why all of the outputs are important, and the WBS is one of the most important ones. Write down as many reasons for using a WBS as you can think of.

.....

.....

.....

.....

.....

.....

## there are no Dumb Questions

**Q:** Does the work breakdown structure need to be graphical? It looks like a lot of work. Can't I just write out a list of tasks?

**A:** The WBS has to be hierarchical: it needs to show all of the work packages, and how they decompose into phases or deliverables. A graphical WBS happens to be a good way to show hierarchy. When you look at a simple WBS, it might seem like you could manage your work packages just as efficiently using a simple list. But what if you have a large team with dozens, hundreds, or even thousands of work packages? That's when you'll be really happy that you know how to decompose deliverables into a hierarchy.

**Q:** What if one work package depends on another one?

**A:** There are definitely dependencies among work packages. For example, the Ranch Hand QA team can't begin to test the software until the programming team has finished building it. But while this information is important, the WBS isn't where you figure out the dependencies.

The reason is that you need to figure out what work needs to be done before you start to figure out how the work packages depend on each other.

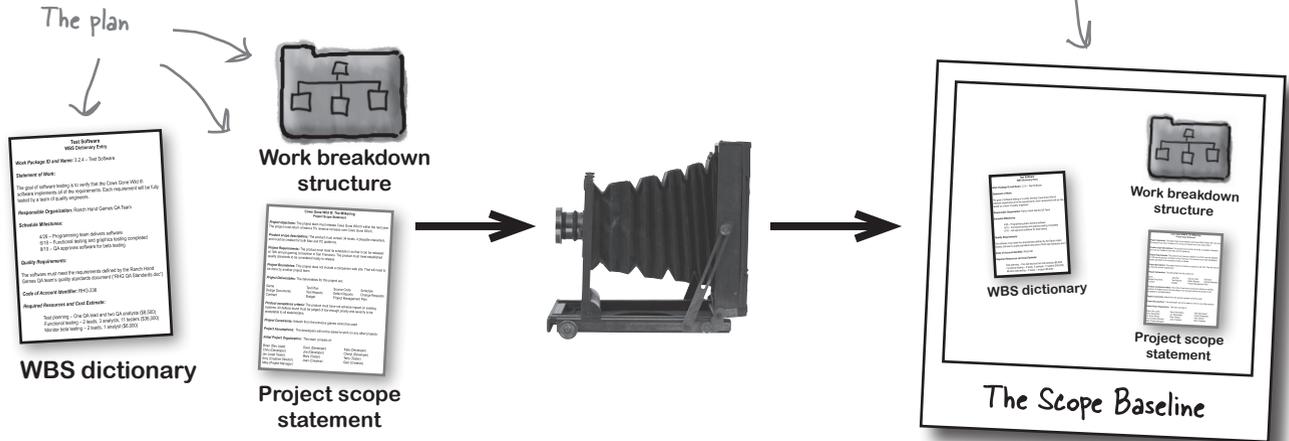
**Q:** What if I don't know enough to estimate the cost of a work package? What do I add to the WBS dictionary?

**A:** The WBS dictionary should contain only information that you can fill in when you create it. A lot of the time, you'll know all of the information that needs to go into it. If you have an estimate and know the resources that should be used, then put it in. But if all you have is a statement of work and an account code, then that's all the information you'll be able to add to the entry.

# The project scope baseline is a snapshot of the plan

As the project goes on, you will want to compare how you are doing to what you planned for. So, the **project scope baseline** is there to compare against. It's made up of the project scope statement, the WBS, and the WBS dictionary. When work gets added to the scope through change control, you need to change the baseline to include the new work packages for that work, so you can always track yourself against the plan.

The project scope baseline is a snapshot of the plan, and it's an important output of Create WBS.



SO, IF SOMEONE WANTS TO ADD OR REMOVE WORK PACKAGES, THAT'S A CHANGE?



**Yes. When there's a change you need to take a new snapshot.**

Whenever a change is approved through change control, the project scope baseline needs to be updated. Approved changes are changes to the Scope Management plan also, so it's important that you re-baseline your project when they are approved. That way, you'll always be comparing your performance to the most updated plan.

## there are no Dumb Questions

**Q:** What happens if I need to change the scope after I created the baseline?

**A:** You need to put it through change control—just like a change to the product scope. As you're building the product, it's always possible that some work will pop up in an unexpected place.

It could be that the initial technical design is inadequate or buggy. Or maybe you just think of a better way to do things while you're working. In either case, you have to determine the impact to the schedule, the budget, the scope, and the quality of the product, and put the proposed change through change control. That's what it means to look at the project constraints every time there's a change.

Once everyone understands the impact and approves the change, you need to go back and adjust your project scope baseline to include the new work. If your budget or schedule is affected, you'll need to change those baselines too and integrate all of them into the Project Management plan. But we'll talk more about that in later chapters.

**Q:** Do I really need to create a project scope baseline?

**A:** Yes. It might seem like a formality in the beginning, but the baseline is a really useful tool. As you are building your project, you will need to refer back to the baseline if you want to know how you are tracking against stakeholders' expectations.

Let's say you said it would take you 12 months to build *Cows Gone Wild III*, and a wrong technical decision creates a two-week delay. You can use the project scope baseline to figure out the impact of that change to all of the different plans you have made, and then explain to everybody the impact of the change.

You can think of the baseline as a way of keeping track of the project team's understanding of their goals and how they are going to meet them. If the goals change, then the understanding of them needs to change too. By telling everyone who needs to approve the two-week delay about it, you make sure that the goals change for the team as well. Then you change the baseline, so you can measure your team against the new deadline of 12 and a half months.

**Q:** Wait a minute. Doesn't that mean I need to do change control and update the baseline every time I make any change to the document while I'm writing it? That's going to make it really hard to write the first version of anything!

**A:** Don't worry, you don't have to go through change control until the baseline is approved. And that goes for ANY document or deliverable. Once it's accepted and approved by all of the stakeholders, only then do the changes need to go through change control. Until it's approved, you can make any changes you want. That's the whole reason for change control—to make sure that once a deliverable is approved, you

run all of the changes by a change control board to make sure that they don't cause an unacceptable impact to the schedule, scope, cost, or quality.

**Q:** How can you know all of this up front?

**A:** You can't. Even the best planned projects have a few surprises. That's why the scope planning cycle is iterative. As you find out something new about your scope of work, you put it through change control. When it's approved, you need to add it to your Scope Management plan, your project scope statement, your WBS, and your WBS dictionary.

It's also possible that you might find new things that the team should do when you're making your WBS or your project scope statement. So all of the scope planning documents are closely linked and need to be kept in sync with one another.

**Q:** What if I come up with new work for the team later on?

**A:** You use change control to update the baseline. Your project can change at any time, but before you make a change you need to figure out how it will affect the project constraints—and make sure your sponsors and stakeholders are OK with that impact. That's what change control does for you.

**Once you've created the baseline, any time you make a change, you need to get it approved, and then update the baseline.**

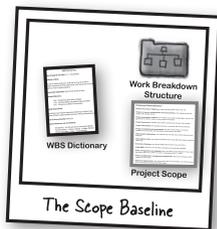
## The outputs of the Create WBS process

The Create WBS process has three major outputs: the **work breakdown structure**, the **WBS dictionary**, and the **baseline**. But there are others as well. When you create the WBS, you usually figure out that there are pieces of the scope that you missed, and you may realize that you need to change your plan. That's what the project document updates are for.

### Outputs



We've already seen the most important ones.



Baseline

When you're creating the WBS, you often discover missing pieces of the scope. You'll need to go back and plan for them. That kicks off the planning cycle again.



Project document updates

This means changes to the Project Management plan and other project documents.

### Make sure you finalize the WBS

Before your WBS is done, you need to finalize it. You do this by establishing a set of **control accounts** for the work packages. A control account is a tool that your company's management and accountants use to track the individual work packages. For example, Mike gets a list of control accounts from Ranch Hand Games' accounting department, so they know how to categorize the work for tax purposes.

## BULLET POINTS: AIMING FOR THE EXAM

- The **Create WBS** process is a really important process on the PMP exam.
- You create the WBS by **decomposing** large work products into **work packages**.
- To finalize the WBS, **control accounts** are established for the work packages.
- The **WBS dictionary** is a description of each work package listed in the WBS.
- The inputs to WBS creation are the outputs to the Define Scope and Collect Requirements processes: the requirements document and the project scope statement.
- As you decompose the work, you find new information that needs to be added to the requirements document and the project scope statement. That information is treated as a change and goes through change control. Once it's approved, it can be added into the document, and that kicks off the planning cycle again.

## there are no Dumb Questions

**Q:** How do I know if I should use phases or deliverables for my WBS?

**A:** It really depends on the project. You want to present the information so that it enables the management in your organization to visualize and control your project. So, if most people in your organization divide it by phases, then you should, too.

If people do it different ways from project to project where you work, then you might make your decision based on how people think about the work you are about to do.

The point of the WBS is to help other people see the work that is necessary to get the project done, so if your management thinks of projects in terms of phases and understands them best that way, then it's better to divide your project work along those lines.

It could be that the work you are doing is anxiously awaited by a lot of people who will look at the WBS to understand the project, and, in that case, it probably makes sense to divide your work up by deliverable.

WE'VE PLANNED THE SCOPE AND WE'VE BROKEN DOWN THE WORK FOR COWS GONE WILD III. NOW WE'RE READY TO BEGIN THE PROJECT!



**Q:** How do I know when I have decomposed the work to a small enough work package?

**A:** The short answer is that you should decompose the work until it is manageable.

You need to be careful when you come up with the work packages for your WBS. If you decompose to the most granular level, you could end up wasting everybody's time trying to figure out exactly how much effort goes into, say, writing up meeting minutes for each and every meeting in your project.

So, you should break down the work into small enough packages that everybody can understand what's being done and describe it in the dictionary...and no further.

**Q:** I know how to make scope changes during Planning. What do I do if I run into scope changes during Execution?

**A:** Any time you run into a change to your scope, regardless of where you are in the process, you put it through change control. Only after examining the impact and having the change approved can you incorporate the change.

**Q:** Can you back up a minute and go over the difference between the Scope Management plan and the Project Management plan one more time?

**A:** Remember how the Project Management plan was divided into subsidiary plans? The Project Management plan tells you how to manage all of the different knowledge areas, and it has baselines for the scope, schedule, and budget.

The Scope Management plan is one of those subsidiary plans. It has really specific procedures for managing scope. For example, Mike's Scope Management plan tells him which stakeholders he needs to talk to when he's gathering requirements. It lists what tools and techniques he's planning to use when he uses scope definition to define the scope (for example, it says that he needs to consult with specific experts when he does alternatives analysis). And when there's an inevitable change—because even the best project manager can't prevent every change—it gives him procedures for doing Scope Management. So even though the Scope Management plan is created in the Develop Project Management Plan process, it's used throughout all of the Scope Management processes. So definitely expect questions about it on the exam!

## Cubicle conversation

Everything is great. The project is rolling along, and there are no problems with the scope...until something goes wrong.



**Brian:** At first I thought we could use the same five backgrounds over and over, but it's starting to look really stale.

**Amy:** Huh, I guess you're right. It looks like we need to create more scenery.

**Mike:** Why were we trying to limit the backgrounds in the first place?

**Amy:** I think they were worried about disk space.

**Brian:** Yeah, but that's not so much a concern right now.

**Amy:** Great! Let's just change the artwork, then.

**Mike:** Not so fast, Amy. There are a couple of things we need to do first...

*This is work that was not planned for, and isn't in the WBS. That means it's a scope change.*



What homework do you need to do before you make a change to the scope by adding or removing project work? Why?

## Why scope changes

Sometimes something completely unexpected happens. Say, a really important customer asks for a new feature that nobody saw coming and demands it right away. Or a design for a feature just isn't working, and you need to rethink it. Or new stakeholders come on board and ask for changes.

The scope can change while you are working for a lot of reasons. Some changes are good for your project, while others will definitely reduce your chance of success. Change control is there to help you to see which is which.



### Good change

A good change makes the product better with very little downside. It doesn't cost more time in the schedule or more money from the budget, and it doesn't destabilize the product or otherwise threaten its quality.

Good changes happen pretty rarely, and nearly EVERY change has some impact that should be fully explored before you go forward.



### Bad change

A bad change is one that might seem from the outside like a good idea but ends up having an impact on the project constraints. Here are a couple of examples:

#### Scope creep

This happens when you think you know the impact of a change so you go ahead, but it turns out that *that* change leads to another one, and since you are already making the first change, you go with the next. Then another change comes up, and another, and another, until it's hard to tell what the scope of the project is.

The way to avoid scope creep is to plan your changes completely.

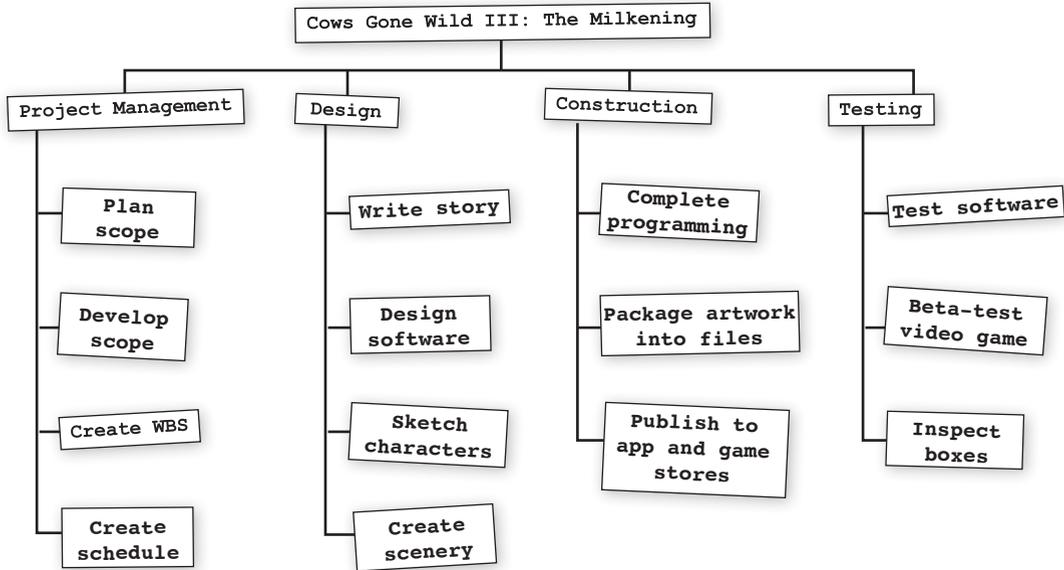
Be on the lookout for examples of scope creep and gold plating on the exam. Both are considered very bad and should never be done.

#### Gold plating

Sometimes people think of a really great improvement to the product and go ahead and make it without even checking the impact. In software, this can happen pretty easily. A programmer thinks of a way to make a feature better, for example, and just implements it, without talking it over with anybody. This may sound good, but it's not—because now you have to pay for these features you never asked for.



Here's the WBS that you created for the *Cows Gone Wild III* project, and below that are some changes that the team has asked Mike to make since the work started. All of them are bad changes. Check either scope creep or gold plating for each one.



1. We need to create a screensaver to market the game. Let's kill two birds with one stone and test out a brand new graphics engine on it. Oh, and we'll need a story for the screensaver, so we should write that too. Of course we have to recruit some killer voice talent for the screensaver. Memorable names sell more games.

Scope creep     Gold plating

2. Testing the most recent build, I just noticed that if the player presses x-x-z-a-Shift-Shift-Space in that order, Bessie does the Charleston—it's a really funny easter egg the developer just added at random.

Scope creep     Gold plating

3. We should add a calculator for tracking gallons of milk collected in the game. It will be really easy. We could even release the calculator as a separate add-in, and we could probably make it full-featured enough for the folks developing the game down the hall to use it too.

Scope creep     Gold plating

4. The printer just told us that she could also do silk screen T-shirts for everybody as a ship gift. Let's get our design team to do some special artwork for them. We can have everybody's names written in cows!!! Then we could use the same artwork on posters that we put around the office—oh, and coffee mugs for new people, too

Scope creep     Gold plating

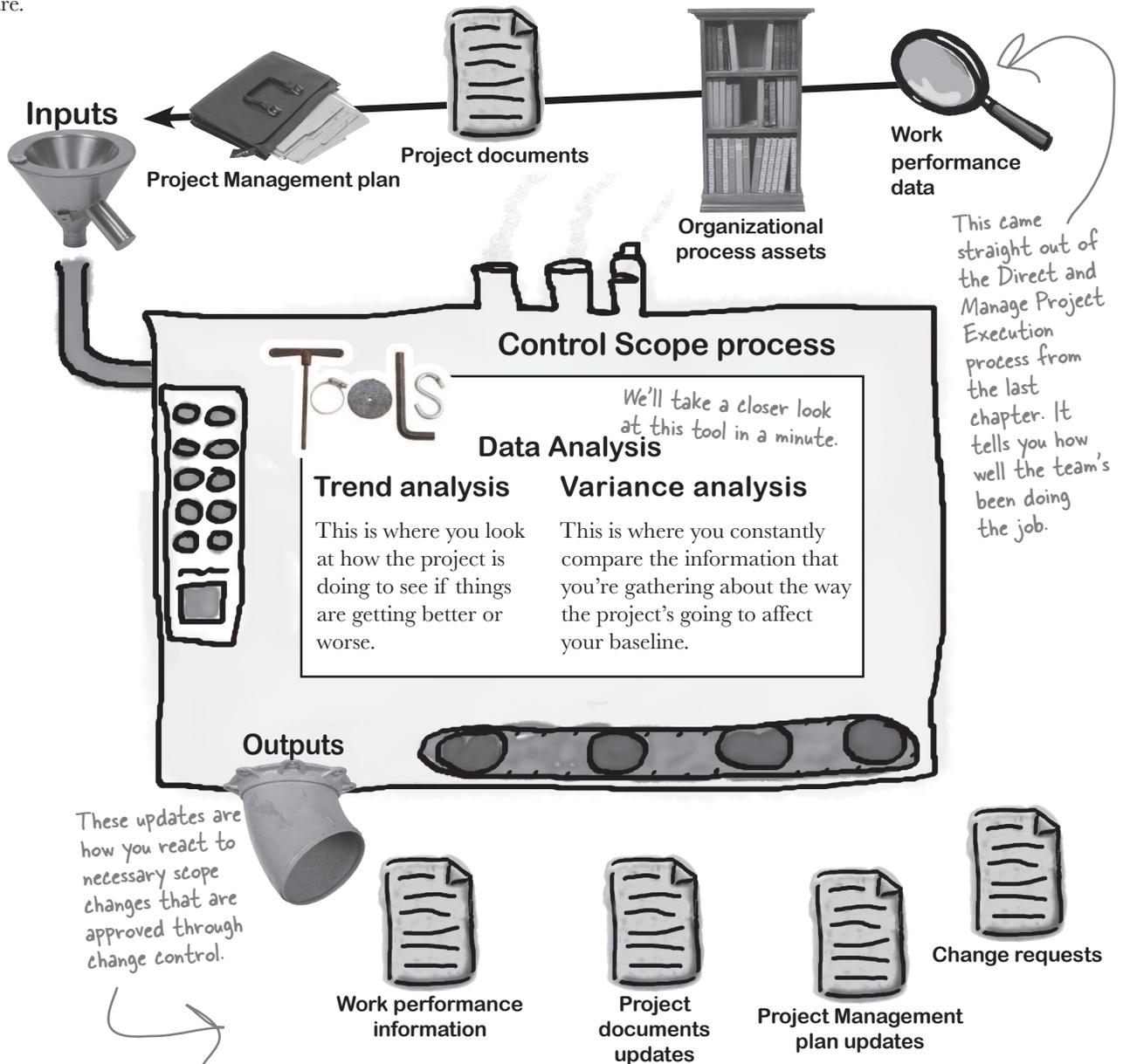
Answers: 1, 3, and 4 are scope creep. 2 is gold plating

# The Control Scope process



You'll also use organizational process assets as an input here.

There's no way to predict every possible piece of work that you and your team are going to do in the project. Somewhere along the way, you or someone else will realize that a change needs to happen, and that change will affect the baseline. That's why you need the **Control Scope** process. It's how you make sure that you make only those changes to the scope that you need to make, and that everyone is clear on what the consequences of those changes are.



## Anatomy of a change



Let's take a closer look at what happens when you need to make a change. You can't just go and change the project whenever you want—the whole reason that you have a baseline is so you can always know what work the team is supposed to do. If you make changes, then you need to change the baseline...which means you need to make sure that the change is **really** necessary. Luckily, you have some powerful tools to help you manage changes:

### 1 A change is needed.

Every change starts the same way. Someone realizes that if the project sticks with the plan, then the outcome will lead to problems.



I KNOW WE'RE UNDER PRESSURE TO GET THE GAME OUT THE DOOR, BUT WE NEED TO MAKE A CHANGE. WE ONLY PLANNED ON MAKING FOUR MEADOWS ON LEVEL 3 AND REUSING THEM FOR LEVEL 6, BUT IT'S JUST NOT WORKING FOR US. WE'VE GOT TO CHANGE THIS IF WE WANT THE GAME TO SELL.

A change can come from anywhere—the project manager, a team member, even a stakeholder!

### 2 Create a change request.

Before a change can be made, it needs to be approved. That means that it needs to be documented as a requested change. The only way to get a handle on a change is to write it down and make sure everyone understands it.



WE'LL WRITE UP A CHANGE REQUEST, AND THEN PUT IT THROUGH INTEGRATED CHANGE CONTROL TO GET IT APPROVED.

### 3 Do impact analysis.

When you do impact analysis, you evaluate the effect the change will have on the project. This is where you decide whether you need to take some sort of corrective action. You compare the baseline against the change that you want to make, and figure out just how big the change really is.

You're weighing the change against the baseline to see if it's going to require a big change to your plan.

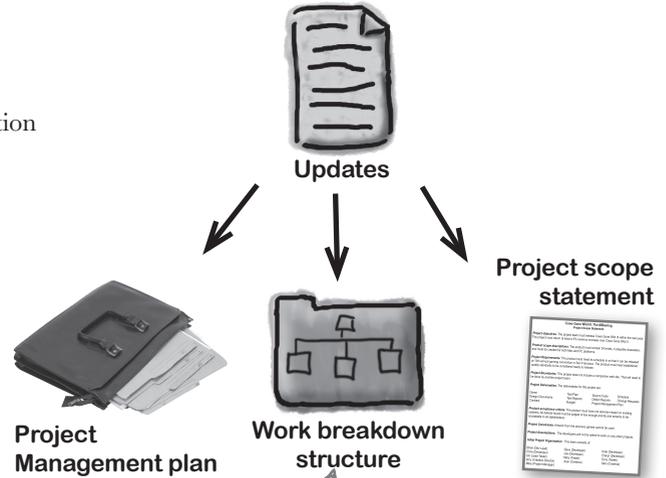


- 4 Get the change approved.**  
Remember integrated change control from Chapter 4? That's the process where the project manager takes a requested change and works with the sponsor and stakeholders to get approval to put it in place.

Think of integrated change control as a kind of machine that converts requested changes into approved changes.



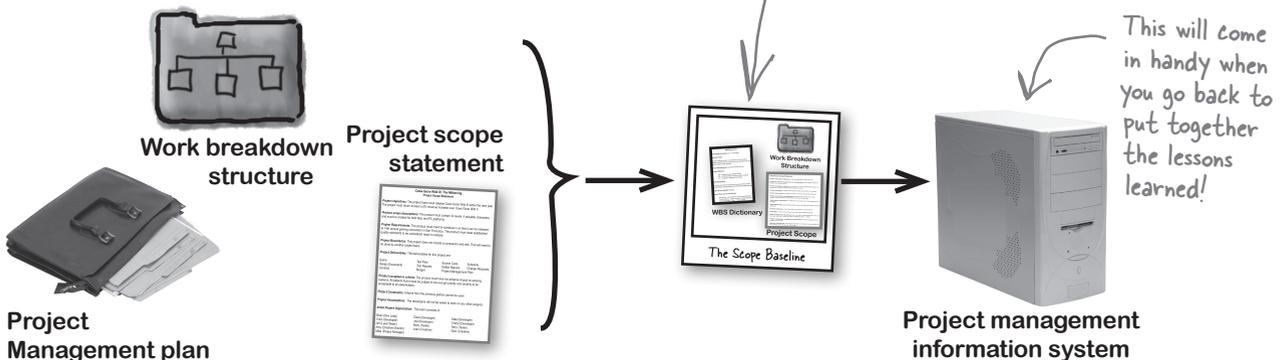
- 5 Replan the work.**  
Now it's time to go back to the scope documentation and update it to reflect the change.



- 6 Create a new baseline.**  
Now that you've figured out that you need to change the scope, it's time to update the baseline. Go back to the scope statement, WBS, and WBS dictionary, and update them so that they reflect the change that needs to be made.

Don't forget to update the WBS dictionary, too.

**The change is done!**  
Now you can move on with the project using the new baseline that you saved and distributed to the team.



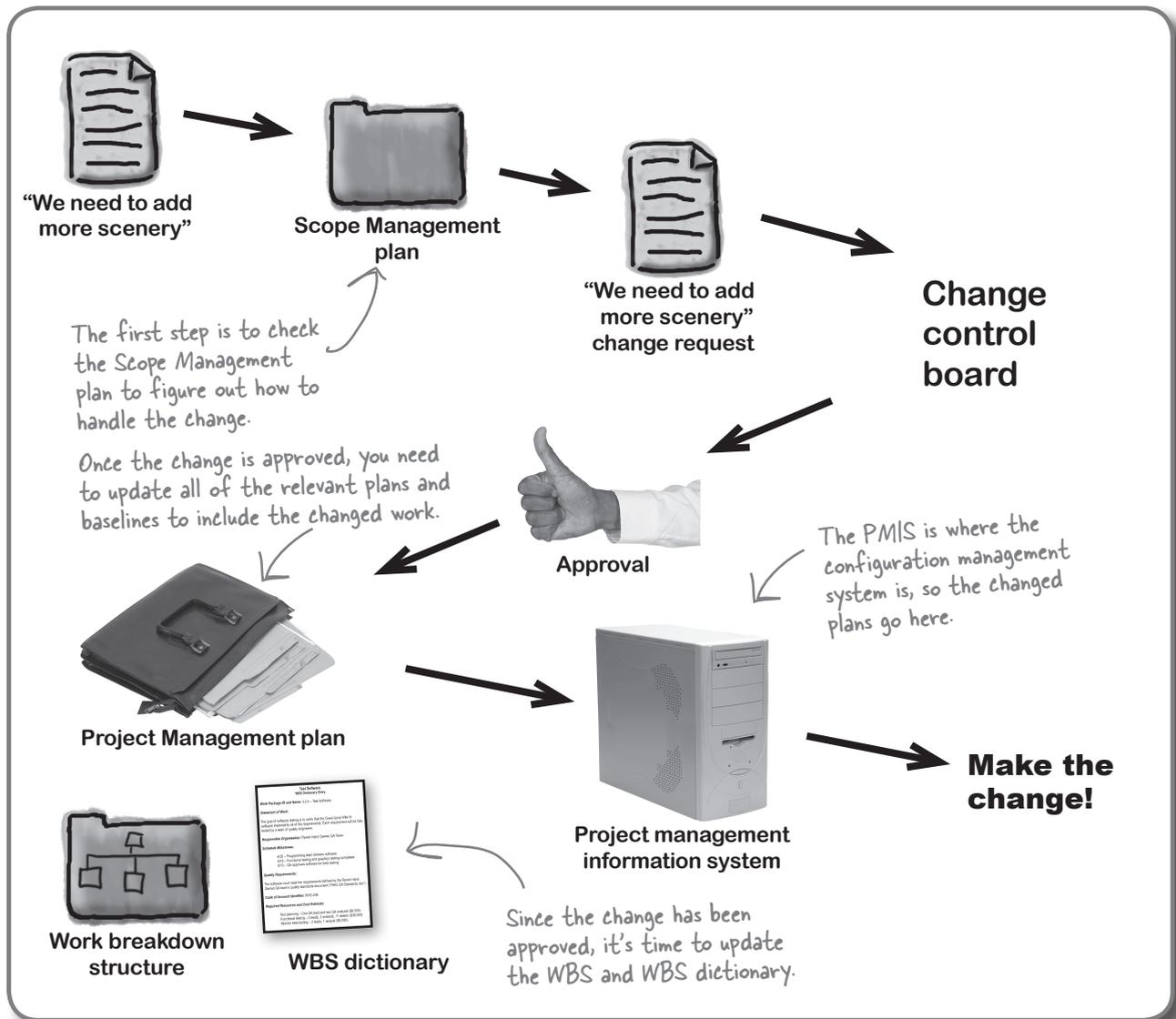
## A closer look at the change control system



One of the most important tools in any Monitoring and Controlling process is the **change control system**. Let's take a closer look at how it works.

Since the folks at Ranch Hand need a change to add more scenery to *Cows Gone Wild III*, Mike takes a look at the Scope Management plan to understand the impact before forwarding it to the change control board. Once they approve the change, he updates the Project Management plan, checks it into the **configuration management system**, and changes the WBS and WBS dictionary to include the new work packages.

Remember this from Chapter 4? It's exactly the same change control system tool that we already learned about.



## Just two Control Scope tools and techniques

There are only two tools and techniques in the Control Scope process. They're pretty intuitive: take a minute and think of what you would need to do if you had to make a change to your project's scope. You'd need to figure out how big the change is, and what needs to change. And when you do that, it's called **variance analysis**. While you're thinking about how big the change is, you probably want to pay attention to the way the project has been going so far and whether the project is performing better or worse than planned. That's where **trend analysis** comes in.

### Variance analysis

This means comparing the data that can be collected about the work being done to the baseline. When there is a difference between the two, that's variance.

This tool of Control Scope is all about analyzing the difference between the baseline and the actual work to figure out if the plan needs to be corrected. If so, then you recommend a corrective action and put that recommendation through change control.

**The goal of Control Scope is updating the scope, plan, baseline, and WBS info.**

## There's no "right order" for the Control Scope and Validate Scope processes

If you've got a copy of the *PMBOK® Guide* handy, take a look at how it presents the Scope Management processes. Did you notice how the section on the Validate Scope process comes before Control Scope? We're putting these processes in this book in a different order (but don't worry, we don't do this often—you'll see it again in Chapter 8). That's not because the *PMBOK® Guide* is wrong—it isn't! We could do this because there is no "right" order: Control Scope can happen at any time, because project changes can happen at any time. Validate Scope (the next process you'll learn about) is *usually* the last Scope Management process that you'll do in a project. The trick is that sometimes you'll find a scope problem while you're verifying the scope, and you'll need to do Control Scope and then go back and gather new requirements, rebuild the WBS, and so on. So the Control Scope process can happen **either before or after** Validate Scope.

So why did we change the order? Because thinking about how the two processes relate to each other will help you remember this for the exam!



A lot of things can happen along the way during a project, especially when you have a lot of changes. What happens if the deliverables you and the team build don't quite match up to what your stakeholders expect?

## there are no Dumb Questions

**Q:** Is Control Scope always about work and project scope? Can it ever be about deliverables and product scope?

**A:** No. As a project manager, you manage the work that the team is doing, not the things that they're making. Now, that doesn't mean you should never pay attention to deliverables. You still need to pay attention to the scope of the product, too, since the two are pretty closely related. For example, in the *CGW III* project, any time somebody wants to add a new feature to the game, a programmer will need to program it, an artist will need to make new artwork, and a tester will have to test it. Any time you make changes to the project scope, it affects the product scope, and vice versa.

**Q:** What if a change is really small? Do I still have to go through all of this?

**A:** Yes. Sometimes what seems like a really small change to the scope—like just adding one tiny work package—turns out to be really complex when you take a closer look at it. It could have a whole lot of dependencies, or cause a lot of trouble in other work packages. If you don't give it careful consideration, you could find yourself watching your scope creep out of control. Each and every change needs to be evaluated in terms of impact. If there is any impact to the project constraints—time, cost, scope, quality, resources, or risk—you HAVE to put it through change control.

**Q:** How can you do variance analysis without knowing all of the changes that are going to happen?

**A:** You do variance analysis as an ongoing thing. As information comes in about your project, you constantly compare it to how you planned. If you're running a month behind, that's a good indication that there are some work packages that took longer than your team estimated—or that you missed a few altogether. Either way, you need to take corrective action if you hope to meet your project objectives.

Waiting until all possible changes are known will be too late for you to actually meet your goals. So you need to constantly check your actuals versus your baseline and correct where necessary (after putting your recommended actions through change control, of course!).

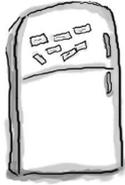
**Q:** I thought the configuration management system was part of the project management information system from Chapter 4. What does that have to do with change control?

**A:** When you write and modify documents throughout your project, you need to make sure that everybody is working with the same version of them. So you check them into a configuration management system, and that way everybody always knows where to go for the latest version.

Since you are checking all of your documents in, that's where you will keep your work performance information also. The most recent version of the schedule, any reports you have gathered on defects, and individual work performance should all be there. So, when you want to figure out what's going on in your project, you look there first.

It follows that you would modify your documents and check them back into the CMS after any change has been approved too.

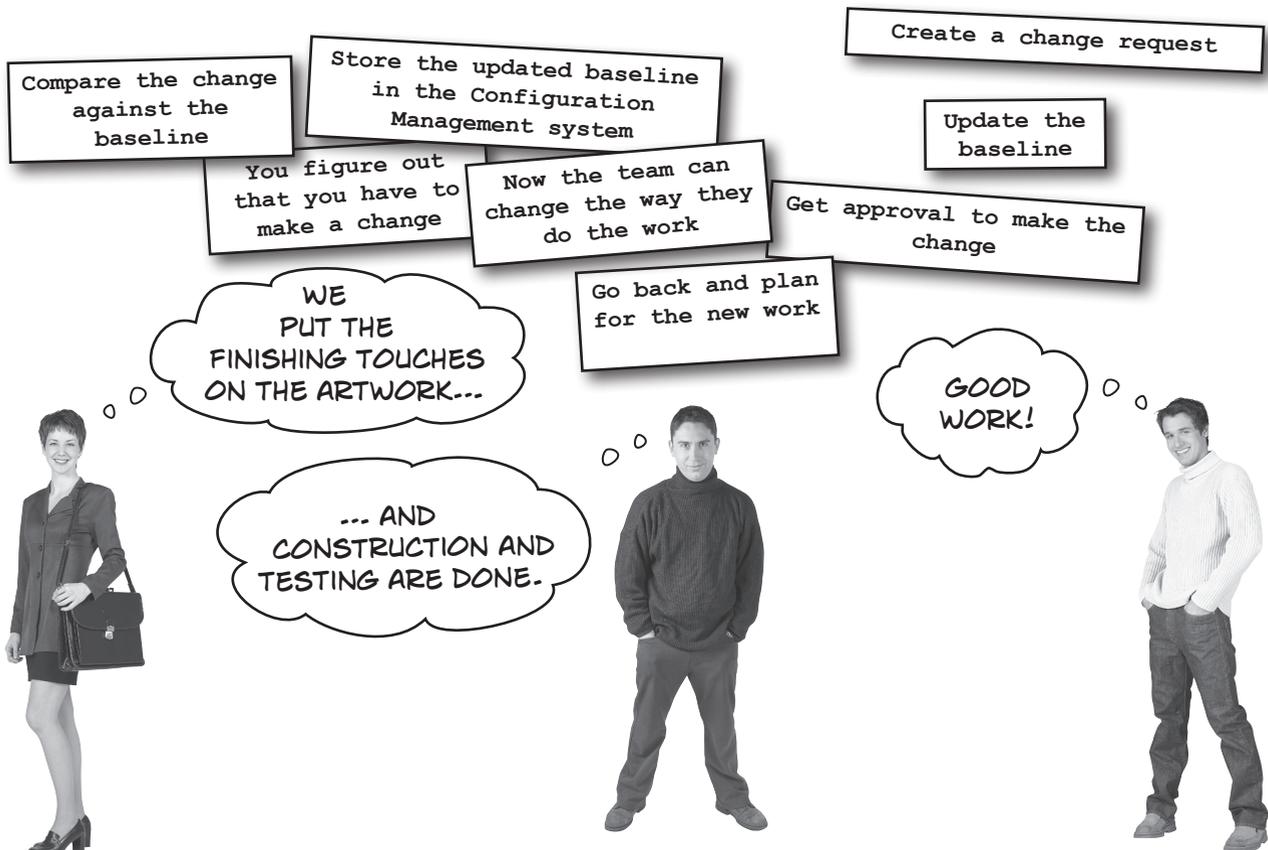
**Every scope change goes through the Control Scope process.**



## Control Scope Process Magnets

Whenever you make a scope change, you need to go through all of the steps of change control. So what are those steps? Arrange the magnets to show the order that you handle changes to the scope.

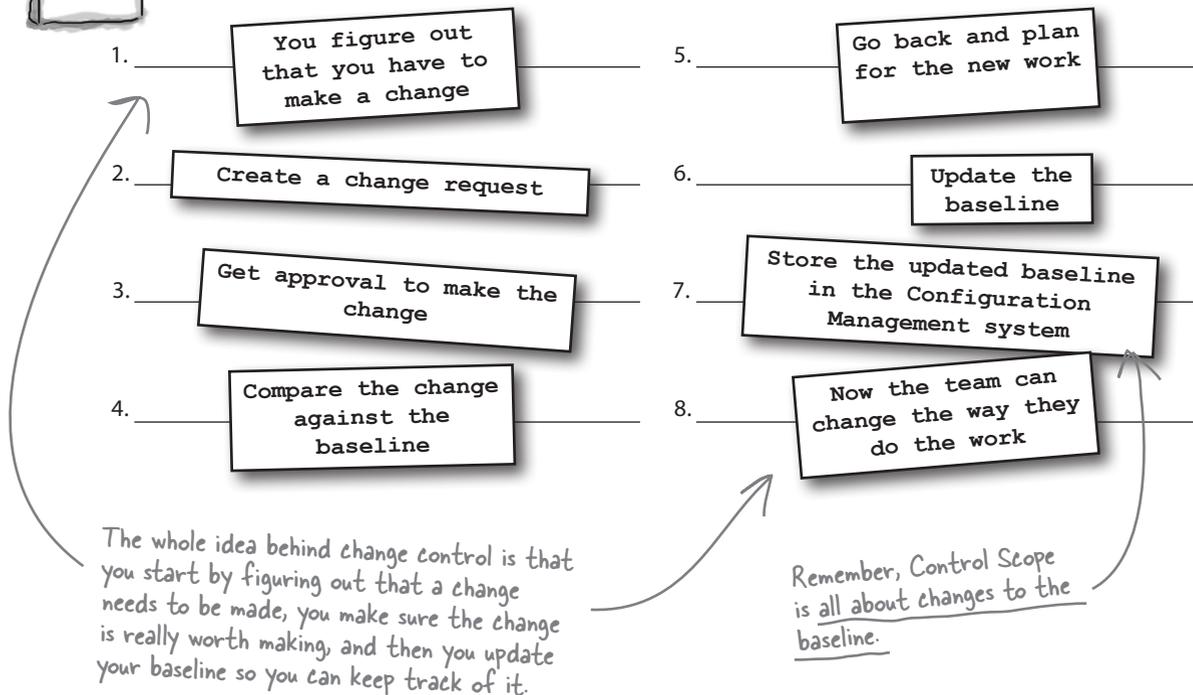
1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_
6. \_\_\_\_\_
7. \_\_\_\_\_
8. \_\_\_\_\_





## Control Scope Process Magnets Solutions

Arrange all of the activities you do to control scope in the right order.



HOLD ON, IT SEEMS LIKE WE KEEP GOING AROUND IN CIRCLES WITH ALL OF THESE CHANGES. HOW DO I KNOW WHEN THE PROJECT IS DONE?

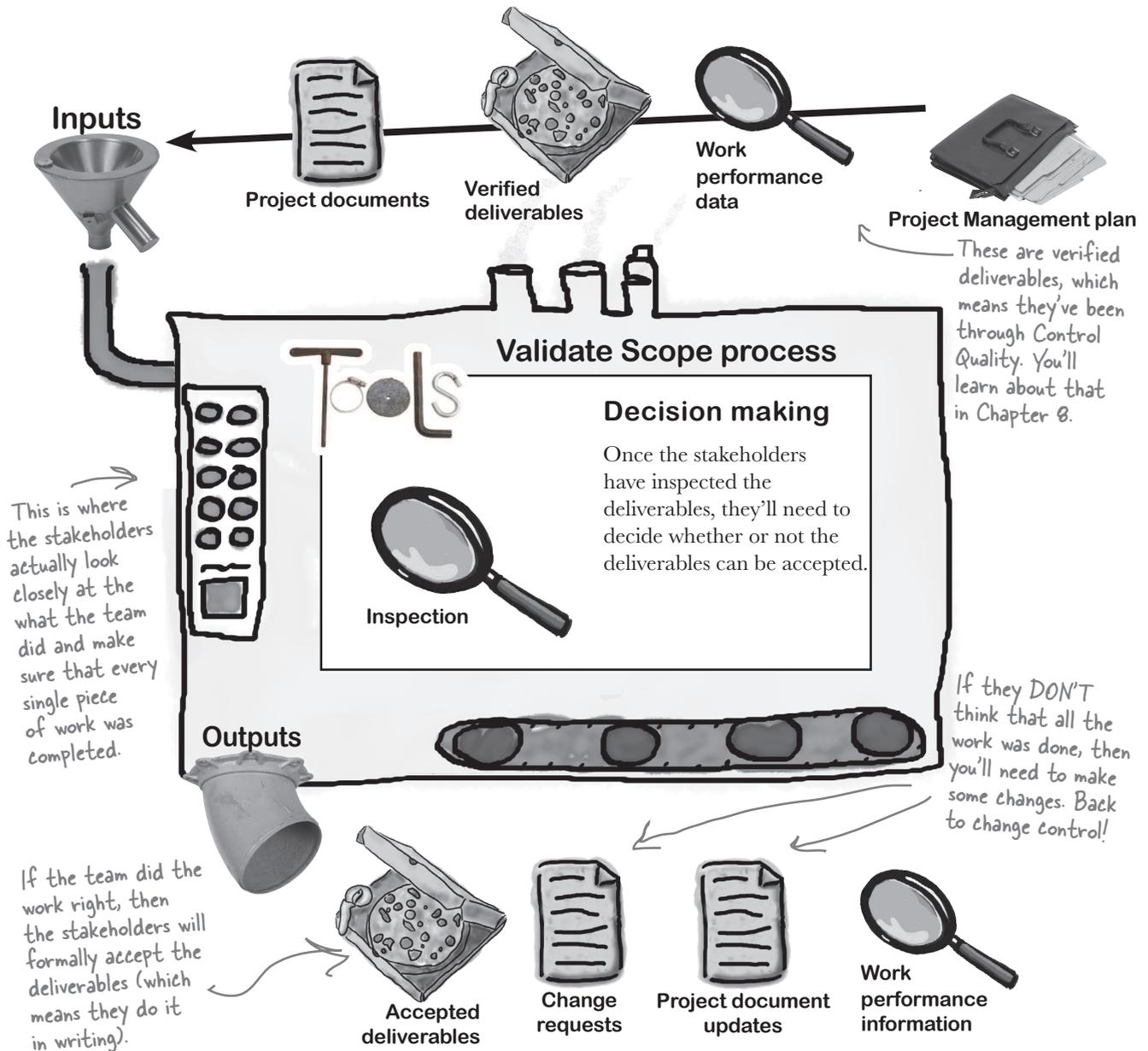
### Ask the stakeholders.

You need to go back to the stakeholders and get formal acceptance. That's what the Validate Scope process is for, and it's coming up next.



# Make sure the team delivered the right product

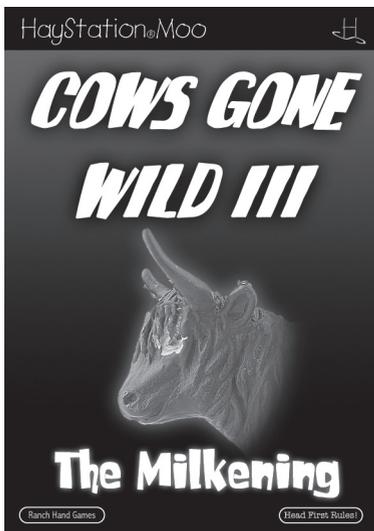
When the team is done, what happens? You still have one more thing you need to do before you can declare victory. You need to gather all the stakeholders together and have them make sure that all the work really was done. We call that the **Validate Scope** process.



## The stakeholders give you criteria for deciding when you're done

As you deliver the features in your scope statement, you need to make sure that each of the deliverables has everything in it that you listed in the scope statement. You inspect all of your deliverables versus the scope statement, the WBS, and the Scope Management plan. If your deliverables have everything in those documents, then they should be acceptable to stakeholders. When all of the deliverables in the scope are done to their satisfaction, *then* you're done.

Check this...



...against these



Requirements documentation

CGW III Requirements Traceability

Origin codes: Business Case - BC, Survey S1, Internal I  
Requirement Nos: Cross-reference with Requirements Document  
Work Module: Where implemented, cross-reference with WBS  
Test: Where verified, cross-reference with design of experiments

Requirements for Under Water Levels

Origin	Requirement	Module	Test
S1	RU001	3.3.1	TC01-TC57
BC1	RU002	3.4.1	TC101-TC350
S3	RU003	3.6.2, 3.7.1	TC2

using this →



Inspection

Why do you think you need the requirements documentation and the traceability matrix to verify your scope?

Inspect the deliverables and confirm that each of the acceptance criteria in the scope statement is met.

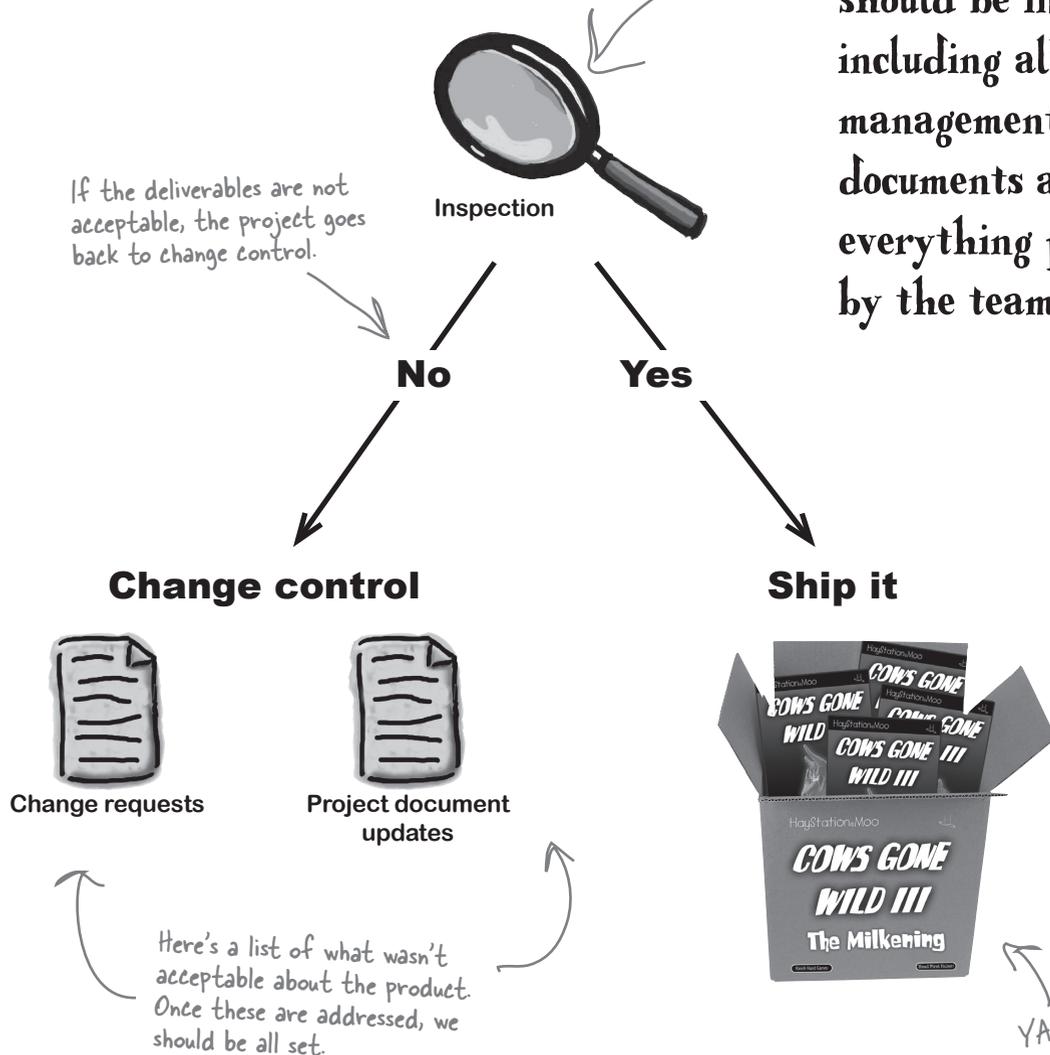
Formal acceptance means that you have written confirmation from all of the stakeholders that the deliverables match the requirements and the Project Management plan.

## Is the product ready to go?

Once the deliverables are ready for prime time, you inspect them with the stakeholders to make sure that they meet acceptance criteria. The purpose of Validate Scope is to obtain formal, written acceptance of the work products. If they are found to be unsatisfactory, the specific changes requested by the stakeholders get sent to change control so that the right changes can be made.

Inspection just means sitting down with the stakeholders and looking at each deliverable to see if it's acceptable.

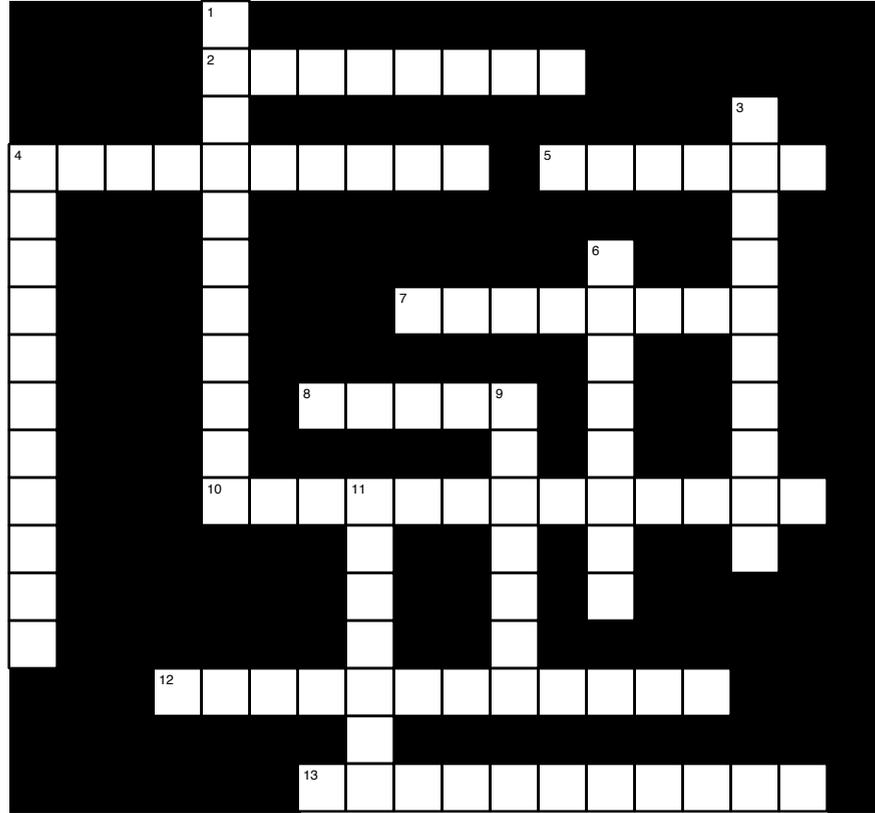
**EVERY** deliverable should be inspected, including all project management documents and everything produced by the team.





# Scopecross

Take some time to sit back and give your right brain something to do. It's your standard crossword; all of the solution words are from this chapter.



## Across

2. Bob used an \_\_\_\_\_ diagram to get a handle on all of the ideas he collected from stakeholders.
4. The details of every work package in the WBS are stored in the WBS \_\_\_\_\_.
5. The process where you write the project scope statement is called \_\_\_\_\_ Scope.
7. Figuring out how big a change is by comparing it to the baseline is called \_\_\_\_\_ analysis.
8. When one change leads to another and another and another, it's called scope \_\_\_\_\_.
10. Getting work packages out of deliverables.
12. Exploring all of the ways that you can do the work so that you can find the best way to do the work in your project is called \_\_\_\_\_ identification.
13. A quantified and documented need or expectation of a sponsor, customer, or other stakeholder.

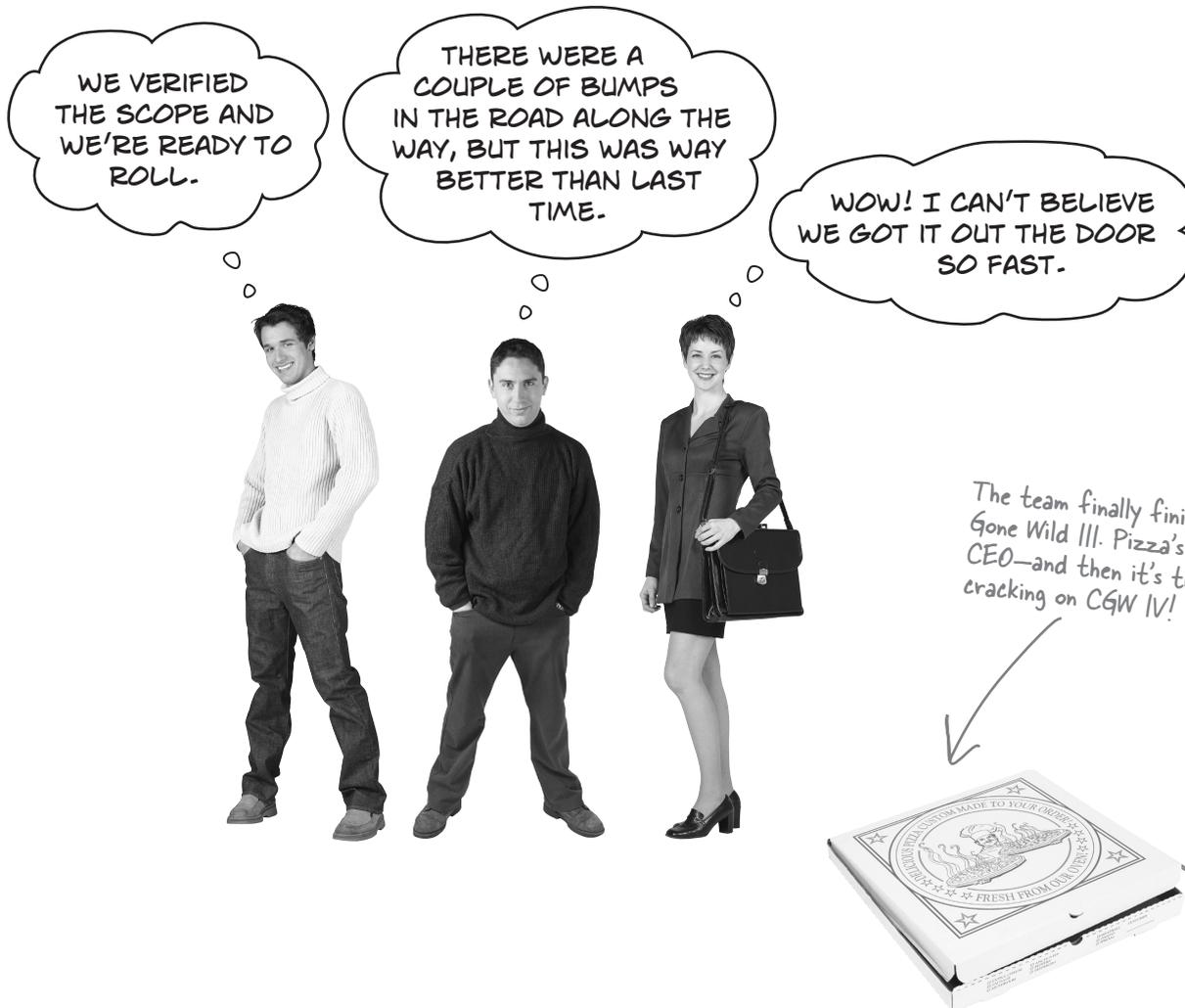
## Down

1. A JAD session is an example of a \_\_\_\_\_ workshop.
3. Looking closely at the product to see if you completed all of the work is called \_\_\_\_\_.
4. When you're making a WBS, you can break the work down by phase or \_\_\_\_\_.
6. A version of the Scope Management plan, work breakdown structure, and product scope that you will compare your project to is called the scope \_\_\_\_\_.
9. \_\_\_\_\_ scope means the features or functions of the thing or service that you are building.
11. A good way to gather requirements is to \_\_\_\_\_ how the people who will use your deliverables perform their jobs.

Answers on page 246.

## The project is ready to ship!

There were a few unexpected changes to the scope along the way. But, for the most part, everything went according to plan. The stakeholders and the CEO got together with the team and went through everything they did—and it's ready to go. Great job, guys!





How your team defines the scope of the work they do says a lot about how they'll run their project. Whether you're talking about the scope of the product you're creating or the scope of project you're managing, the practices your team uses to identify scope and stay on top of scope changes are the difference between an end product that realizes the benefits it set out to achieve and one that doesn't.



## KEY CONCEPTS

We've talked about the processes you and your team will use when identifying and managing scope, but it's worth taking a minute to think about how scope management impacts your project as a whole.

- ★ You need to be concerned with the overall **scope of the product** your team is creating and that's where product requirements come in. During the Collect Requirements process, you and the team work to define all of the requirements of the product your project will produce.
- ★ Understanding the scope of product is only part of the story. Most of the processes in the Scope Management knowledge area are about figuring out the scope of the work that you and your team will do. The **scope of the project** is all of the work that will happen as you create the product that satisfies all of the requirements you've collected.
- ★ In predictive projects, the team tries to nail down the scope of product at the beginning of the project. They save that initial understanding of the scope as the **scope baseline**, and then manage changes to the baseline as an ongoing process of validation and control.
- ★ Adaptive or agile processes treat both the product and project scope as variable and focus on prioritizing the work they do rather than controlling changes to a scope baseline.

**SCOPE MANAGEMENT IS ABOUT GETTING A HANDLE ON WHAT THE TEAM WILL DO AND HOW THEY'LL DO IT.**

## TRENDS

Here are a few trends in Scope Management that might help you to improve and manage the scope of work on your projects more effectively.

- ★ Collaborating with business analysts as they define product scope by working with stakeholders to elicit and document them.
- ★ Helping the team to understand the business needs for your project.
- ★ Understanding the needs that all of the stakeholders for your project represent.
- ★ Beginning requirements analysis as early as possible.



## TAILORING

When you make changes to the processes your team will use during the course of your project, there are a few considerations that might influence your decisions:

- ★ What development lifecycle will your project follow? Should you focus on understanding requirements up front, or will they emerge throughout the project?
- ★ Does your team need to manage the requirements of your project as part of a larger knowledge management strategy within your company?
- ★ Once you identify requirements, are they likely to remain unchanged?
- ★ Does your organization require documentation of product or project scope because of regulatory or governance concerns?



## AGILE CONSIDERATIONS

Agile teams focus on frequent collaboration and feedback to understand the requirements of the projects they work on. Instead of investing time in understanding all of the project scope up front, agile teams identify high-level goals for the project they work on and decompose those goals into smaller pieces that can be delivered in short increments. As each increment is created, it is reviewed by the whole team as a collaboration. New requirements are identified through this feedback loop and the requirements of the project emerge as the team iterates on the incremental deliverables together.

# Sharpen your pencil Solution



Here are some attributes of *Cows Gone Wild III*. Which are project scope and which are product scope?

### 1. Programming

Project scope

Product scope

### 2. 34 levels in the game

Project scope

Product scope

### 3. Graphic design

Project scope

Product scope

### 4. Four playable characters

Project scope

Product scope

### 5. Great graphics

Project scope

Product scope

### 6. Testing

Project scope

Product scope

### 7. Mac and PC compatible

Project scope

Product scope

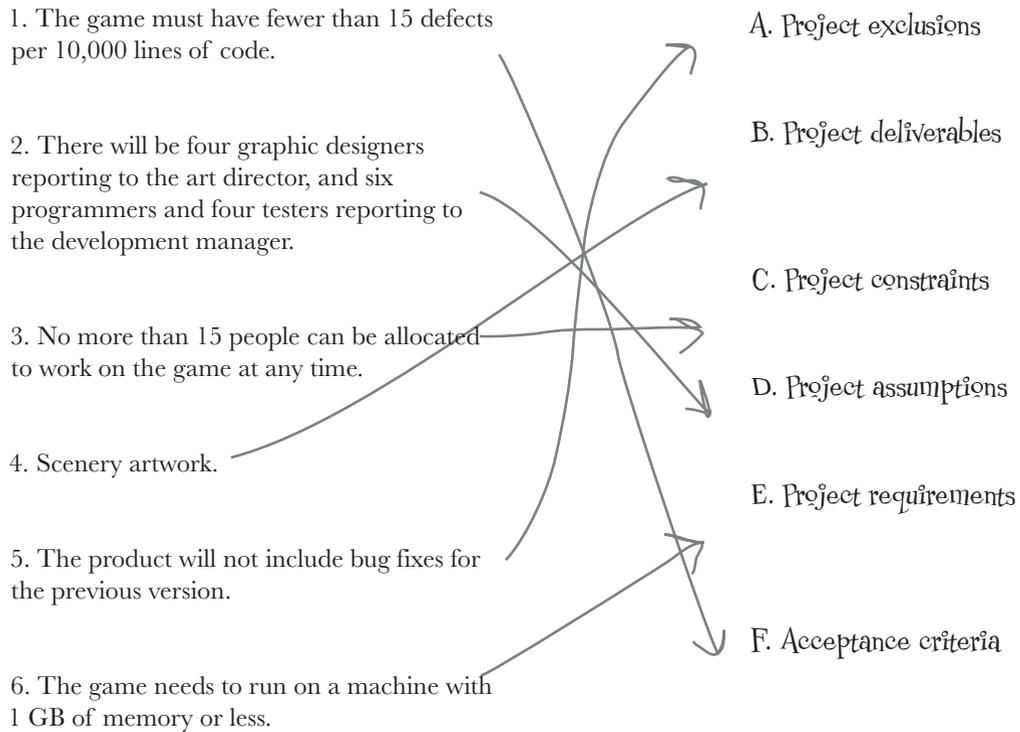
### 8. A "boss battle" milk fight level at the end

Project scope

Product scope

# WHAT'S MY PURPOSE

Here are a few things that Mike left out of the *CGVIII* project scope statement. Can you figure out where each of them should go?





## Exam Questions

### 1. Which of the following is TRUE about a work breakdown structure?

- A. It contains work packages that are described in a linear, unstructured list.
- B. Each item in the WBS represents a feature in the product scope.
- C. The WBS represents all of the work that must be done on the project.
- D. The WBS is created by the product sponsor and stakeholders.

### 2. Which is NOT an output of a Scope Management process?

- A. Business case
- B. WBS dictionary
- C. Change requests
- D. Accepted deliverables

### 3. Which of the following is NOT TRUE about a work breakdown structure?

- A. It describes procedures to define the scope, verify work, and manage scope changes.
- B. It contains a graphical, hierarchical list of all work to be performed.
- C. It can be broken down by project phase or deliverable.
- D. It is an important element of the baseline.

### 4. What is the correct order of the Scope Management processes?

- A. Plan Scope Management, Define Scope, Create WBS, Collect Requirements, Validate Scope, Control Scope
- B. Plan Scope Management, Collect Requirements, Control Scope, Create WBS, Validate Scope
- C. Plan Scope Management, Collect Requirements, Define Scope, Create WBS, Validate Scope, Control Scope
- D. Plan Scope Management, Collect Requirements, Baseline, Define Scope, Control Scope, Validate Scope

**5. You are managing a software project. Your team has been working for eight weeks, and so far the project is on track. The lead programmer comes to you with a problem: there is a work package that is causing trouble. Nobody seems to know who is responsible for it, the accounting department does not know what cost center to bill it against, and it's not even clear exactly what work should be performed. Which of the following would BEST help this situation?**

- A. Alternatives analysis
- B. WBS dictionary
- C. Scope Management plan
- D. Scope validation

## Exam Questions

**6. The goal of Validate Scope is:**

- A. To inspect the scope statement for defects so that it is correct
- B. To gain formal acceptance of the project deliverables from the sponsor and stakeholders
- C. To get everyone in the project working together toward a common goal
- D. To verify that all *PMBOK® Guide* processes are complied with

**7. Historical information and lessons learned are part of:**

- A. Organizational process assets
- B. Enterprise environmental factors
- C. Project management information system (PMIS)
- D. Work performance information

**8. You've taken over as a project manager on a highway construction project, and the execution is already under way. Your sponsor tells you that moving forward, all asphalt should be laid down with a 12" thickness. The scope statement and the WBS call for 9" thick asphalt. What is the BEST course of action?**

- A. Look for a cheaper supplier so the cost impact is minimized.
- B. Tell the sponsor that the work is already under way, so you can't accommodate his request.
- C. Refuse to alter the plans until the change control system has been used.
- D. Tell the team to accommodate the request immediately.

**9. Which of the following BEST describes the purpose of a requirements traceability matrix?**

- A. It describes how WBS dictionary entries are traced to work packages, and how work packages are decomposed from deliverables.
- B. It's used to make sure that all of the subplans of the Project Management plan have been created.
- C. It helps you understand the source of each requirement, and how that requirement was verified in a later deliverable.
- D. It's used to trace the source of every change, so that you can keep track of them through the entire Control Scope process and verify that the change was properly implemented.

**10. It's the end of execution for a large highway construction project. The work has been done, and the workers are ready to pack up their equipment. The project manager and project sponsor have come by with specialists to check that each requirement has been met, and that all of the work in the WBS has been performed. What process is being done?**

- A. Control Scope
- B. Validate Scope
- C. Scope Testing
- D. Define Scope

## Exam Questions

**11. You have just been put in charge of a project that is already executing. While reviewing the project documentation, you discover that there is no WBS. You check the Scope Management plan and discover that there should be one for this project. What is the BEST thing for you to do:**

- A. Immediately alert the sponsor and make sure the project work doesn't stop.
- B. Stop project work and create the WBS, and don't let work continue until it's created.
- C. Make sure you closely manage communications to ensure the team doesn't miss any undocumented work.
- D. Mark it down in the lessons learned so it doesn't happen on future projects.

**12. A project manager on an industrial design project finds that the sponsor wants to make a change to the scope after it has been added to the baseline, and needs to know the procedure for managing changes. What is the BEST place to look for this information?**

- A. WBS
- B. Scope Management plan
- C. Change request form template
- D. Business case

**13. You have just started work on the project scope statement. You are analyzing the expected deliverables when you discover that one of them could be delivered in three different ways. You select the best method for creating that deliverable. What is the BEST way to describe what you are doing?**

- A. Alternatives analysis
- B. Decomposition
- C. Define scope process
- D. Stakeholder analysis

**14. You're the project manager on a software project. Your team has only completed half of the work when the sponsor informs you that the project has been terminated. What is the BEST action for you to take?**

- A. Verify the deliverables produced by the team against the scope, and document any place they do not match.
- B. Call a team meeting to figure out how to spend the rest of the budget.
- C. Work with the sponsor to see if there is any way to bring the project back.
- D. Tell the team to stop working immediately.

**15. You are managing an industrial design project. One of your team members comes to you with a suggestion that will let you do more work while at the same time saving the project 15% of the budget. What is the BEST way for you to proceed?**

- A. Tell the team to make the change because it will deliver more work for less money.
- B. Refuse to make the change until a change request is documented and change control is performed.
- C. Refuse to consider the change because it will affect the baseline.
- D. Do a cost-benefit analysis and then make sure to inform the sponsor that the project scope changed.

## Exam Questions

**16. You are the project manager for a telecommunications project. You are working on the project scope statement. Which of the following is NOT included in this document?**

- A. Authorization for the project manager to work on the project
- B. Requirements that the deliverables must meet
- C. A description of the project objectives
- D. The list of deliverables that must be created

**17. Which of the following is NOT an input to Control Scope?**

- A. Work performance data
- B. Project management plan
- C. Requested changes
- D. Organizational process assets

**18. Which of these processes is not a part of Scope Management?**

- A. Scope Identification
- B. Collect Requirements
- C. Control Scope
- D. Validate Scope

**19. You are the project manager for a new project, and you want to save time creating the WBS. Which is the BEST way to do this?**

- A. Make decomposition go faster by cutting down the number of deliverables.
- B. Use a WBS from a previous project as a template.
- C. Don't create the WBS dictionary.
- D. Ask the sponsor to provide the work packages for each deliverable.

**20. The project manager for a design project is using the Define Scope process. Which BEST describes this?**

- A. Creating a document that lists all of the features of the product
- B. Creating a plan for managing changes to the baseline
- C. Creating a document that describes all of the work the team does to make the deliverables
- D. Creating a graphical representation of how the phases or deliverables decompose into work packages

**21. You are the project manager for a construction project. You have completed project initiation activities, and you are now creating a document that describes processes to document the scope, decompose deliverables into work packages, verify that all work is complete, and manage changes to the baseline. What process are you performing?**

- A. Develop Project Management plan
- B. Define Scope
- C. Create WBS
- D. Develop Project Charter

## Exam Questions

**22. You are a project manager working on a project. Your sponsor wants to know who a certain work package is assigned to, what control account to bill it against, and what work is involved. What document do you refer her to?**

- A. Scope Management plan
- B. WBS
- C. WBS dictionary
- D. Scope statement

**23. You are the project manager for a software project. One of the teams discovers that if they deviate from the plan, they can actually skip one of the deliverables because it's no longer necessary. They do the calculations, and realize they can save the customer 10% of the cost of the project without compromising the features in the product. They take this approach, and inform you the following week what they did during the status meeting. What is the BEST way to describe this situation?**

- A. The project team has taken initiative and saved the customer money.
- B. A dispute is resolved in favor of the customer.
- C. The team informed the project manager of the change, but they should have informed the customer, too.
- D. The team did not follow the Control Scope process.

**24. Which of the following BEST describes the purpose of the project scope statement?**

- A. It describes the features of the product of the project.
- B. It is created before the Scope Management plan.
- C. It decomposes deliverables into work packages.
- D. It describes the objectives, requirements, and deliverables of the project, and the work needed to create them.

**25. A project manager at a cable and networking company is gathering requirements for a project to build a new version of their telecommunications equipment. Which of the following is NOT something that she will use?**

- A. Specific descriptions of work packages that will be developed
- B. One-on-one interviews with the senior executives who need the new equipment for their teams
- C. An early working model of the telecommunications equipment to help get feedback from stakeholders
- D. Results from a focus group that she ran when starting the project

**26. Which of the following is NOT an output of Collect Requirements?**

- A. Requirements observations
- B. Requirements traceability matrix
- C. Requirements documentation
- D. Requirements Management plan

~~Exam Questions~~**1. Answer: C**

The work breakdown structure is all about breaking down the work that your team needs to do. The WBS is hierarchical, not linear and unstructured. Did you notice that answer B was about *product* scope, not *project* scope?

**2. Answer: A**

There are two ways you can get to the right answer for this question. You can recognize that the WBS dictionary, change requests, and accepted deliverables are all Scope Management process outputs. (You'll see change requests in every knowledge area!) But you can also recognize that the business case is used in the Develop Project Charter process, which is part of the Initiating process group.

**3. Answer: A**

Did you recognize that answer A was describing the Scope Management plan? Once you know what the WBS is used for and how to make one, questions like this make sense.

**4. Answer: C**

You'll need to know what order processes come in, and one good way to do that is to think about how the outputs of some processes are used as inputs for another. For example, you can't create the WBS until the scope is defined, which is why A is wrong. And you can't do change control until you have a baseline WBS, which is why B is wrong.

Take a minute and think about how there's no "right" order for Validate Scope and Control Scope. You could have a scope change at the beginning of the project, so Control Scope would come first. But a change could happen late in the project, too! If there's a major change to the project after the scope's verified, you need to redo it.

**5. Answer: B**

An important tactic for a lot of exam questions is to be able to recognize a particular tool, technique, input, or output from a description. What have you learned about that tells you who is responsible for a work package, tells what control account to associate with it, and describes the work associated with it? That's a good description of the WBS dictionary.

**6. Answer: B**

Inspection isn't just done at the end of the project. You do Validate Scope on every single deliverable made by you and the team.

There are some questions where you'll just have to know what a process is all about, and this is one of them. That's why it's really helpful to know why Validate Scope is so helpful to you on a project. You use Validate Scope to check that all of the work packages were completed, and get the stakeholders and sponsor to formally accept the deliverables.

## Answers

~~Exam Questions~~

## 7. Answer: A

It's easy to forget that organizational process assets is more than just an input. It's a real thing that's part of your company. Take a second and think about what **assets** are in your **organization** that help you carry out each **process**. Get it? Good! So what is historical information, anyway? It's stuff like reports and data that you or another project manager wrote down on a previous project and stored in a file cabinet or a database. That's an asset you can use now! What are lessons learned? Those are lessons you wrote down at the end of a previous project and stuck in a file cabinet or a database. And now those lessons are another asset you can use.



THESE INPUTS AND OUTPUTS MAKE SENSE WHEN I THINK ABOUT HOW I'D USE THEM ON A PROJECT. ORGANIZATIONAL PROCESS ASSETS ARE JUST THINGS THAT MY ORGANIZATION KEEPS TRACK OF TO HELP ME DO MY JOB, LIKE INFORMATION FROM OLD PROJECTS AND PROCEDURES.

The PMBOK® Guide says this stuff is stored in a "corporate knowledge base," but that can be as simple as a file cabinet or a folder on your network.

But PMOs are increasingly relying on advanced knowledge management tools, practices, and procedures.

## 8. Answer: C

One thing to remember about change control is that if you want to make the sponsor and stakeholders happy with the project in the end, sometimes you have to tell them "no" right now. When you're doing Control Scope, the most important tool you use is the change control system. It tells you how to take an approved change and put it in place on a project, and there's no other way that you should ever make a change to any part of the baseline. That means that once everyone has approved the scope statement and WBS, if you want to make any change to them, then you need to get that change approved and put it through the change control system.

## 9. Answer: C

The requirements traceability matrix is a tool that you use to trace each requirement back to a specific business case, and then forward to the rest of the scope deliverables (like specific WBS work packages), as well as other parts of the project: the product design (like specific levels in *Cows Gone Wild*) or test strategy (like test plans that the Ranch Hand Games testers use to make sure that the game works).

The idea is that you're tracing a deliverable from its initial description all the way through the project to testing, so that you can make sure that every single deliverable meets all of its requirements.

## Answers

~~Exam Questions~~

## 10. Answer: B

When you're getting the sponsor and stakeholders to formally accept the results of the project, you're doing Validate Scope. This involves an important too: inspection. That means carefully checking the deliverables (in this case, what the workers built on the highway) to make sure they match the WBS.



Answer D is a good idea, but it's not as important as creating a new WBS.

## 11. Answer: B

This question is a little tricky. The most important thing about a WBS is that if your Scope Management plan says it should be there, then your project absolutely cannot be done without it. And a general rule is that if you ever find that there is no WBS, you should always check the Scope Management plan to find out why.

## 12. Answer: B

This is another question that is testing you on the definition of a specific document, in this case the Scope Management plan, which is one of the subsidiary plans of the Project Management plan. Think about what you use a Scope Management plan for. It gives you specific procedures for defining the scope, breaking down the work, verifying the deliverables, and **managing scope changes**—which is what this question is asking. All of the other answers don't have anything to do with managing changes.

## 13. Answer: A

Here's another example of how there are two correct answers but only one BEST one. Answer C is true—you are doing scope definition. But is that really the best way to describe this situation? Alternatives analysis is part of scope definition, and it's a more accurate way to describe what's going on here.



When you look at a few ways to create a deliverable and then decide on the best one, that's alternatives analysis.

## 14. Answer: A

This question is an example of how you need to rely on more than just common sense to pass the PMP exam. All four of these answers could be good ways to handle a terminated project, but there's only one of those answers that corresponds to what the *PMBOK® Guide* says. When a project is terminated, you still need to complete the Validate Scope process. That way, you can document all of the work that has been completed, and the work that has not been completed.

THAT WAY, IF I NEED TO RESTART THE PROJECT LATER OR REUSE SOME OF ITS DELIVERABLES, I'LL KNOW EXACTLY WHERE MY TEAM LEFT OFF WHEN IT ENDED.



## Answers

~~Exam Questions~~

## 15. Answer: B

Are you starting to get the hang of how this change control stuff works? The baseline isn't etched in stone, and you need to be able to change it, but you can't just go ahead and make changes whenever you want. You need to document the change request and then put that request through change control. If it's approved, then you can update the baseline so that it incorporates the change.

You definitely can't just make the change and inform the sponsor later. All changes need to be approved.

## 16. Answer: A

When a question asks you about what a particular document, input, or output contains, be on the lookout for answers that talk about a different document. What document do you know about that gives the project manager authorization to do the work? That's what the project charter is for.

## 17. Answer: C

Sometimes Control Scope is easiest to think about as a kind of machine that turns approved changes into updates. It sucks in the approved changes and all of the other Scope Management stuff (the Scope Management Plan, Requirements Management Plan, and Scope Baseline), does all the stuff that it needs to do to update those things, and then spits out updates. And sometimes it spits out new requested changes because when you're making changes to the WBS or scope statement you realize that you need to make even more changes.

## 18. Answer: A

Scope Identification is a made-up process. It didn't appear in this chapter, and even though it sounds real, it's wrong.

I THINK OF PERFORM INTEGRATED CHANGE CONTROL AS A MACHINE THAT TURNS CHANGE REQUESTS INTO APPROVED CHANGES, AND CONTROL SCOPE AS THE MACHINE THAT TURNS APPROVED CHANGES INTO UPDATES TO THE BASELINE.

## 19. Answer: B

WBS templates are a great way to speed up creating the WBS, and the easiest way to create a template is to use one from a previous project. It is **not** a good idea to cut out deliverables, skip important outputs like the WBS dictionary, or make the sponsor do your job for you.

You can also use a template for the Scope Management plan.



Answers

~~Exam Questions~~

20. Answer: C

This question asked you about the Define Scope process, but all of the answers describe various outputs. Which of these outputs matches Define Scope? Well, the main output of Define Scope is the scope statement, and answer C is a good description of the scope statement.

21. Answer: A

Did you guess "Create WBS" because it was a Scope Management process and the question mentioned decomposing deliverables into work packages?

This question asked you where you defined the procedures for doing all of the Scope Management processes. Where do you find those procedures? You find them in the Project Management plan—specifically, the Scope Management subplan. And you build that in the Develop Project Management Plan process.

22. Answer: C

There's only one document you've seen that shows you details of individual work packages and contains a control account, a statement of work, and a resource assignment. It's the WBS dictionary.

Did you notice how the question made it sound like the team did a good thing by ignoring Control Scope and making changes that were never approved?

23. Answer: D

When you read the question, it looks like the team really helped the project, right? But think about what happened: the team abandoned the plan, and then they made a change to the project without getting approval from the sponsor or stakeholders. Maybe they discovered a useful shortcut. But isn't it possible that the shortcut the team found was already considered and rejected by the sponsor? That's why change control is so important.

HEY, I'LL BET A GOOD WAY TO STUDY FOR THE EXAM IS TO LOOK AT ANSWERS A, B, AND C IN QUESTION 23 AND FIGURE OUT WHAT EACH OF THEM IS DESCRIBING. IT'LL BE GREAT PRACTICE IDENTIFYING AN OUTPUT FROM A DESCRIPTION!



## Answers

**Exam Questions****24. Answer: D**

Some questions are just definition questions. When that definition is a which-is-BEST question, there could be an answer that makes some sense, and it's tempting to stop with it. In this case, answer A sounds like it might be right. But if you read answer D, it's much more accurate.

**25. Answer: A**

The question asked about the tools and techniques for Collect Requirements, and answer A is the only answer that has to do with the Create WBS process. The rest of the answers were descriptions of Collect Requirements tools and techniques: interviews (answer B), prototypes (answer C), and observations (answer D).

**26. Answer: A**

The outputs of Collect Requirements are requirements documentation and the requirements traceability matrix. "Requirements Observations" isn't really an output.

 The easiest way to make sure you get questions like this right is to think about how each of those outputs is actually used later in the project.

**Keep an eye out for questions that describe an input or output and then ask you to name it. Look at each answer and think up your own descriptions for them—one of them will match the question.**



## 6 Project schedule management

# Getting it done on time

WE USED PROJECT SCHEDULE MANAGEMENT TO MAKE SURE WE HAVE PLENTY OF TIME TO DO OUR HOMEWORK AFTER WE GO TO THE PLAYGROUND!



**Project schedule management is what most people think of when they think of project managers.** It's where the deadlines are set and met. It starts with **figuring out what work** you need to do, how you will do it, what **resources you'll use**, and how long it will take. From there, it's all about developing and controlling that **schedule**.

## Reality sets in for the happy couple

Rob and Rebecca have decided to tie the knot, but they don't have much time to plan their wedding. They want the big day to be unforgettable. They want to invite a lot of people and show them all a great time.

But just thinking about all of the details involved is overwhelming. Somewhere around picking the paper for the invitations, the couple realize they need help...

They've always dreamed of a June wedding, but it's already January.



EVERYTHING HAS TO BE PERFECT! BUT IT SEEMS SO HUGE. I DON'T KNOW WHERE TO START.



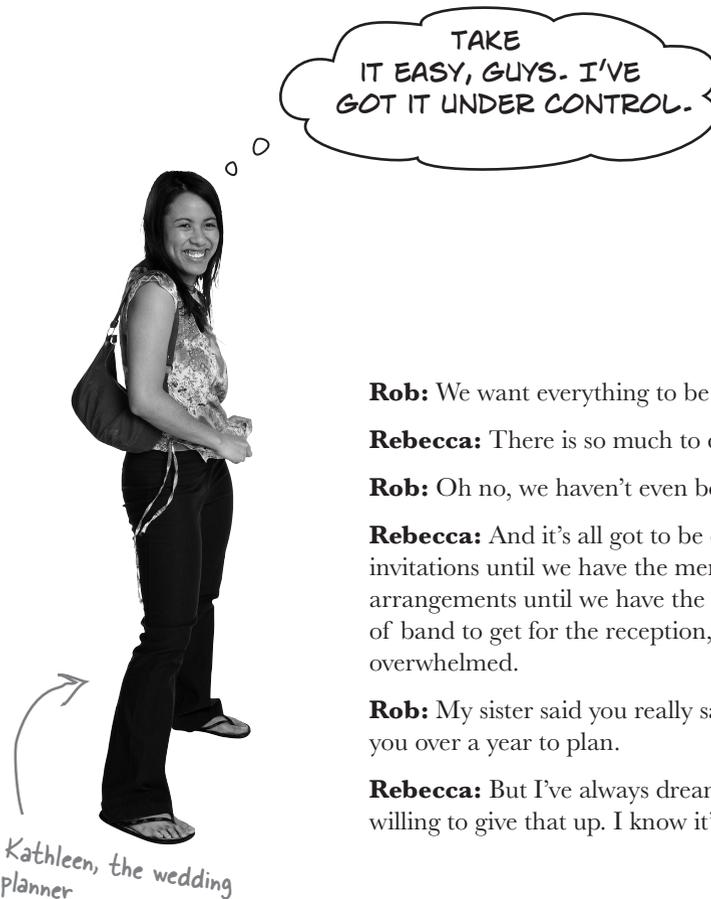
Rebecca's been dreaming of the big day since she was 12, but it seems like there's so little time to do it all. She needs some help.

She's super-nervous about the wedding plans! Can they find someone to help take the pressure off and make the day perfect?

DON'T WORRY. MY SISTER'S WEDDING PLANNER WAS GREAT. LET ME GIVE HER A CALL.



## Meet the wedding planner



**Rob:** We want everything to be perfect.

**Rebecca:** There is so much to do! Invitations, food, guests, music...

**Rob:** Oh no, we haven't even booked the place.

**Rebecca:** And it's all got to be done right. We can't print the invitations until we have the menu planned. We can't do the seating arrangements until we have the RSVPs. We aren't sure what kind of band to get for the reception, or should it be a DJ? We're just overwhelmed.

**Rob:** My sister said you really saved her wedding. I know she gave you over a year to plan.

**Rebecca:** But I've always dreamed of a June wedding, and I'm not willing to give that up. I know it's late, but can you help us?

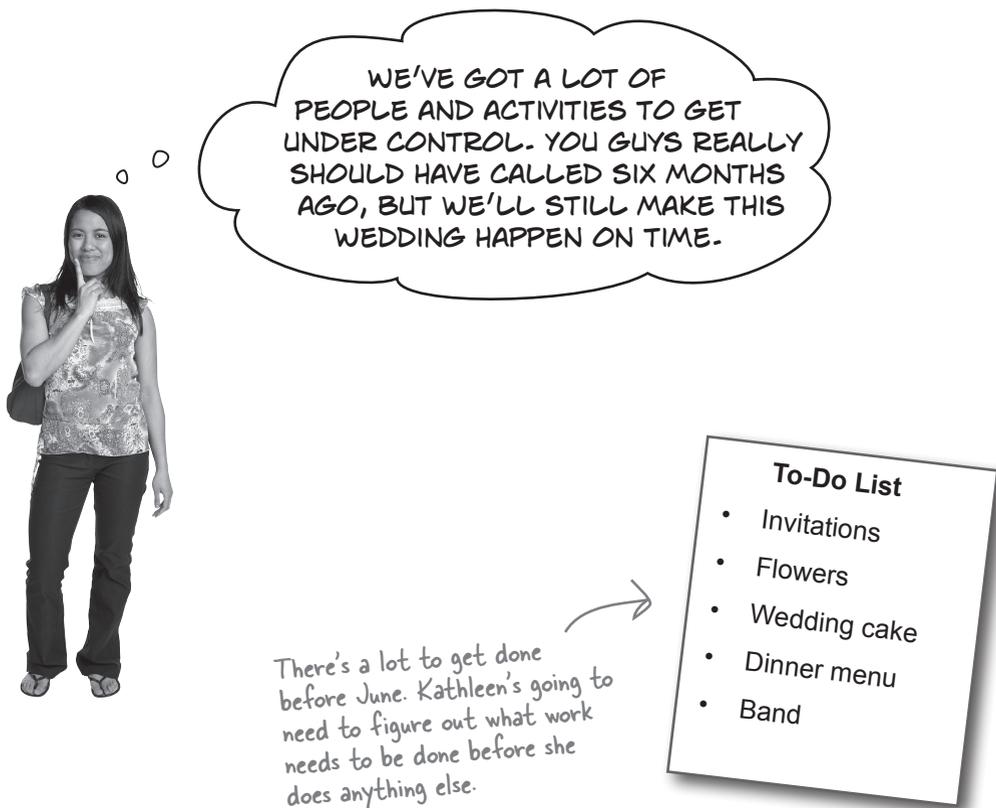


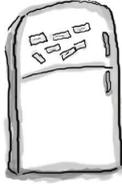
What should Kathleen do first to make sure they have time to get everything done?

## Schedule management helps with aggressive timelines

Since there are so many different people involved in making the wedding go smoothly, it takes a lot of planning to make sure that all of the work happens in the right order, gets done by the right people, and doesn't take too long. That's what the **Project Schedule Management** knowledge area is all about.

Initially, Kathleen was worried that she didn't have enough time to make sure everything was done properly. But she knew that she had some powerful time management tools on her side when she took the job, and they'll help her make sure that everything will work out fine.





# Project Schedule Management Magnets

You need to know the order of the Project Schedule Management processes for the exam. Luckily, they are pretty intuitive. Can you figure out the order?

1
2
3
4
5
6

Control Schedule

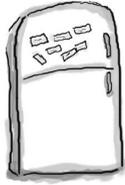
Estimate Activity Durations

Develop Schedule

Sequence Activities

Define Activities

Plan Schedule Management



# Project Schedule Management Magnets Solution

Here are the correct order and the main output for each of the Project Schedule Management processes.

1

## Plan Schedule Management



Schedule Management plan

First you define the processes you'll use to plan and control your schedule.

2

## Define Activities



Activity list

Next you come up with a list of all of the activities that will need to be completed.

The activity list is the basis for the network diagram that you create in the next process.

3

## Sequence Activities



Project schedule network diagram

Next, you figure out which activities need to come before others, and put them in the right order. The main output here is a **project schedule network diagram**, a picture of how activities are related.

Knowing the stuff that needs to happen and the sequence is half the battle. Now you need to figure out who will do the work.

4

## Estimate Activity Durations



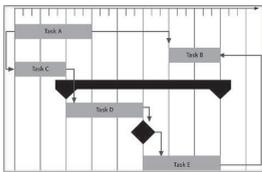
Activity duration estimates

...and then estimate the time it will take to do each activity.

You can use lots of different estimation techniques to determine how long the project will take.

5

**Develop Schedule**

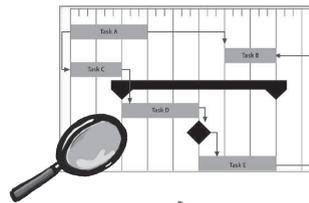


Then you build a schedule from all of the estimates and the resource and activity information you've created.

The schedule pulls all of the information together to predict the project end date.

6

**Control Schedule**



Finally, you monitor and control changes to the schedule to make sure that it is kept up to date.

Keeping track of the issues that require schedule changes and dealing with them is as important in Schedule Management as it was in Scope Management.

The last process, Control Schedule, is in the Monitoring and Controlling process group.



The first five Project Schedule Management processes are in the Planning process group because they're all about coming up with the schedule—and you need that before you can start executing your project.

**BRAIN POWER**

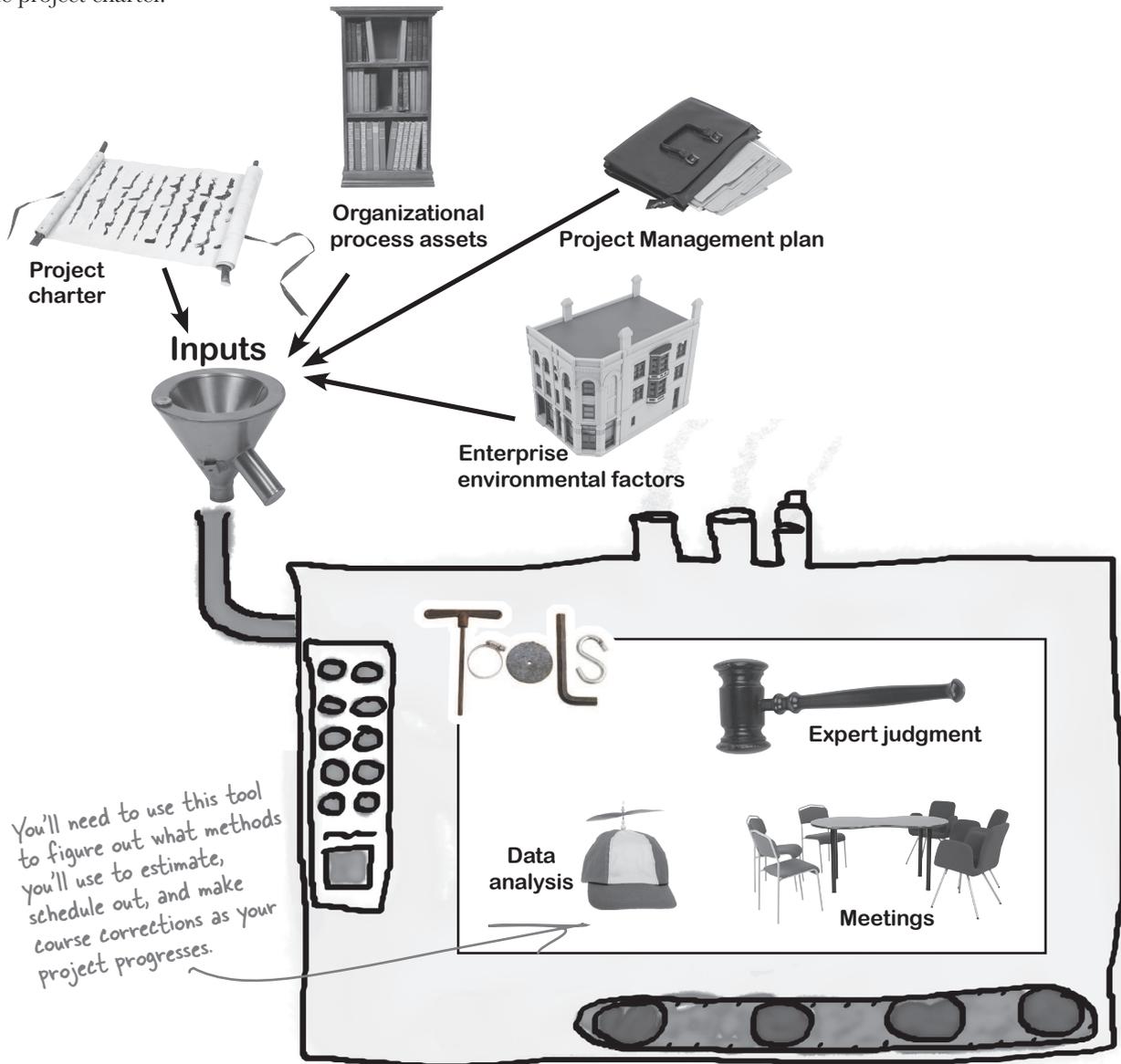
Project Schedule Management is all about breaking the work down into activities, so you can put them in order and come up with estimates for each of them.

What do you need to know before you can figure out what activities are needed for a project?

## Plan your scheduling processes



The **Plan Schedule Management** process is just like all of the other planning processes you've seen so far. In fact, you've already seen all of the inputs and tools that are used to create it in previous processes. Just like with the Plan Scope Management process from Chapter 5, your goal is to build a Schedule Management plan from the other project management plans, your company's culture and existing documents, and the project charter.



## Now you know how you'll track your schedule

The only output of the Plan Schedule Management process is the Schedule Management plan. It describes the way you'll estimate your work, track your progress, and report on it.

### Outputs



#### Rob and Rebecca's Wedding Schedule Management Plan

**Project Schedule Model Development:** Kathleen will create a schedule model for the wedding using Microsoft Project. It will be stored in an open document repository and updated on a weekly basis. The initial schedule will be based on high-level estimates that will be refined at set intervals as requirements are defined for the project. The schedule will be baselined whenever a change request is approved, and also at the following milestones:

- Scope Statement Complete
- Venue Booked
- Invitations Sent
- RSVPs Received
- Bridesmaids

**Level of Accuracy:** The initial schedule model is expected to be accurate by +/- 10%. As each week passes, the schedule update increases the level of accuracy because the team knows more and more about the project. At the time of RSVPs received, the schedule model will be +/- 3% accurate. This possible 15% overage will be included in the team's overall estimate as a contingency to assist in risk mitigation.

**Units of Measure:** All estimates will be provided in calendar days.

**Organizational Procedures Links:** The project schedule model will follow the organizational outline provided by the WBS. All schedule status reports will follow the format provided in the WBS as well.

**Project Schedule Model Maintenance:** On a weekly basis, Kathleen will update the project schedule model with individual % complete numbers on tasks to keep the schedule up to date.

**Reporting Formats:** Every Thursday, Kathleen will host a weekly status meeting to discuss how the project is tracking to its estimates with Rob and Rebecca. The status report for this meeting will follow the standard wedding planning status report template.

## Use the Define Activities process to break down the work

Define Activities uses everything we already know about the project to divide the work into activities that can be estimated. The inputs for this process all come from the processes in the Integration Management knowledge areas. The first step in Project Schedule Management is figuring out how the project work breaks down into activities—and that's what the **Define Activities** process is for.



The Schedule Management plan was the output of the last process. It tells you the methods to use when you define the activities in your schedule.



Project Management plan

The Project Management plan includes the scope baseline that we covered in Chapter 5. The WBS and WBS dictionary are important considerations when you're defining the activities you'll do in your project

You might want to look at all of the lessons from similar projects your company has done to get a good idea of what you need to do on the current one.



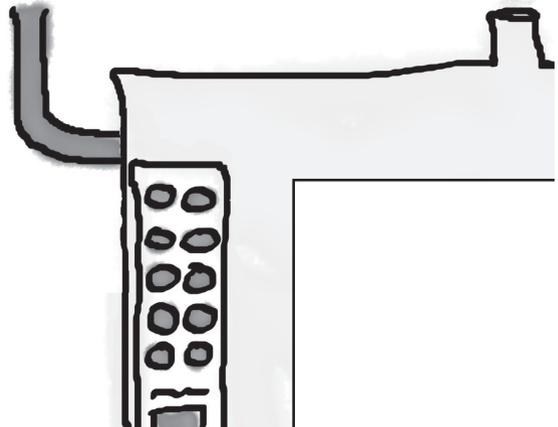
Organizational process assets



Enterprise environmental factors

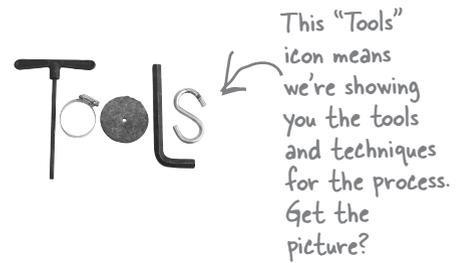
You'll need the project management information system (PMIS), because that's where you store information about your activities. But that's not the only thing you need to know about your working environment. Can you think of other environmental factors that influence the way you break down the work?

Inputs



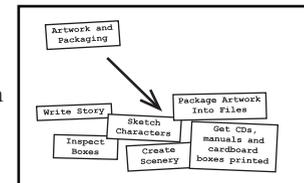
# Tools and techniques for Define Activities

Kathleen wrote down everything she knew about the project. She used the activity list from her last wedding as a guide and then thought about the things that Rob and Rebecca wanted that were different from her past projects. She broke those things down into activities and pulled everything together into an activity list.



## Decomposition

This means taking the work packages you defined in the Scope Management processes and breaking them down even further into activities that can be estimated.



## Expert judgment

Ask somebody who has done this before to give an opinion on what activities will be needed to get the job done.



## Rolling wave planning

When you plan this way, you decompose only the activities that you need to plan for because they're coming up soon. You leave everything else planned at the milestone level until it gets closer to the time when you'll do it.



Flip the page for an example of this tool!

## Meetings

You'll need to talk to the team to figure out what they think they need to do to achieve your project's goals. Getting the team together to discuss the plan will be a useful tool when you're defining the activities in your schedule.



## Rolling wave planning lets you plan as you go

Sometimes you start a project without knowing a lot about the work that you'll be doing later. **Rolling wave planning** lets you plan and schedule only the stuff that you know enough about to plan well.

If Kathleen were using rolling wave planning, she might write a schedule for only the tasks it takes to do the invitations, and leave the planning for the menu and the seating up in the air until she knows who will RSVP.

Rob and Rebecca probably wouldn't be happy hearing that Kathleen was only going to plan for the invitations to be sent, though. They want to know that their wedding is going to happen on time. That's why rolling wave planning should be used only in cases where it's not possible to plan any other way.

Think back to the definition of a project in Chapter 2. Remember how projects are **progressively elaborated**? Rolling wave planning takes advantage of the fact that you know more about the project as you go to make plans more accurate.



---

### there are no Dumb Questions

---

**Q:** How would you use experts to help you define tasks?

**A:** A wedding is something that a lot of people have experience with, but some projects are not as easy to get a handle on. If you were asked to manage a project in a new domain, you might want to ask an expert in that field to help you understand what activities were going to be involved.

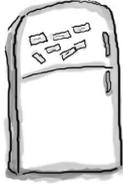
Even in Kathleen's case, access to a catering expert might help her think of some activities that she wouldn't have planned for on her own.

It could be that you create an activity list and then have the expert review it and suggest changes. Or, you could involve the expert from the very beginning and ask to have a Define Activities conversation with him before even making your first draft of the activity list.

**Q:** I still don't get rolling wave planning.

**A:** One way to develop a project is to divide it up into phases of work, and gather requirements for each phase as the previous one is completed. Sometimes projects are done iteratively, where you divide the work up into phases and then plan out each phase before you execute on it. Rolling wave planning is all about committing to planning out one portion of the work that you'll do, executing it, and then moving on to the next portion.

Software projects using **agile methodologies** use a form of rolling wave planning to make sure that everything they sign on to do gets done. They might do user stories for a release of the software up front, build it, and deliver it, and then gather more requirements based on the users' ideas after working with the released version.



# Activity Magnets

Here is part of a WBS. Arrange the activities underneath the WBS to show how the work items decompose into activities.

This is one work package from the wedding WBS. How does it decompose into activities?

This is part of the WBS that Kathleen made for the wedding project.



1. ....

1. ....

1. ....

2. ....

2. ....

2. ....

3. ....

3. ....

3. ....

4. ....

4. ....

Shop for shoes

Create the guest list

Arrange tailoring and fitting

Shop for dress

Find caterer

Wait for the RSVPs

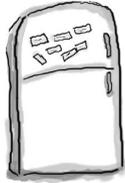
Mail the invitations

Cater the wedding

Finalize the menu

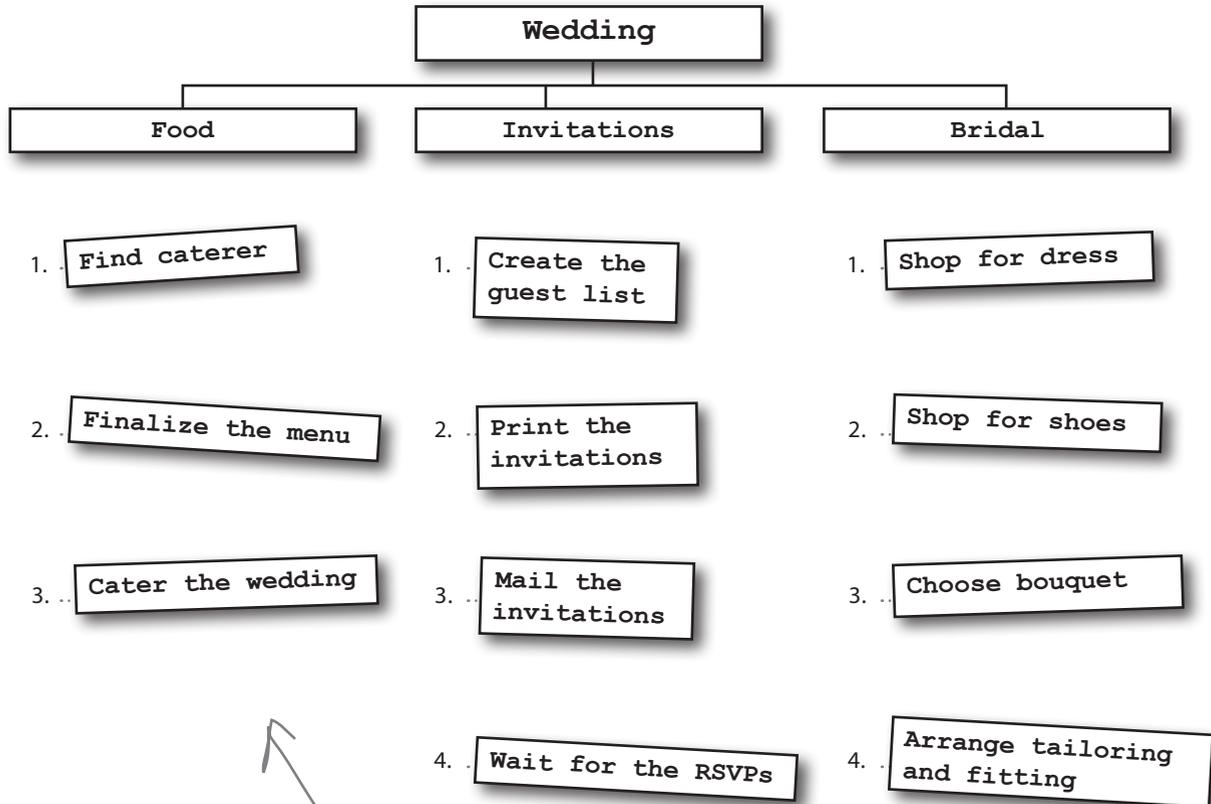
Print the invitations

Choose bouquet



## Activity Magnets Solution

Here is part of a WBS. Arrange the activities underneath the WBS to show how the work items decompose into activities.



There are lots of other activities that could be defined for the three work packages in Kathleen's WBS.

The important thing to remember about activities, though, is that they are broken down to the level at which they can be estimated accurately.

## Define activities outputs

The main output of this process is the **activity list**. It's the basis for all of the estimation and scheduling tasks you will do next. But there are a few other outputs that go along with it, and help to make the estimates more detailed and accurate.

### Outputs



### Activity list

This is a list of everything that needs to be done to complete your project. This list is lower-level than the WBS. It's all the activities that must be accomplished to deliver the work packages.



Activity list

### Activity attributes

Here's where the description of each activity is kept. All of the information you need to figure out the order of the work should be here, too. So any predecessor activities, successor activities, or constraints should be listed in the attributes, along with descriptions and any other information about resources or time that you need for planning.



Activity attributes

### Milestone list

All of the important checkpoints of your project are tracked as milestones. Some of them could be listed in your contract as requirements of successful completion; some could just be significant points in the project that you want to keep track of. The milestone list needs to let everybody know which are required and which are not.



Milestone list

### Change requests

As the team is working through the work they'll do, they sometimes find new information about the scope or requirements of the project. When that happens, they'll need to create a change request to update the scope of the project.



Change requests

### Project Management plan updates

When the team identifies new activities there will likely be changes to both the **schedule baseline** and the **cost baseline**. You'll need to put those changes through change control and then update the Project Management plan to include the new activities.



Project Management plan updates

Some milestones for the wedding:

- \* Invitations sent
- \* Menu finalized
- \* Church booked
- \* Bridesmaids' dresses fitted



WE JUST GOT THE  
PROGRAMS BACK FROM THE  
PRINTER, AND THEY'RE ALL  
WRONG!

**Rob:** The quartet cancelled. They had another wedding that day.

**Rebecca:** Aunt Laura is supposed to do the reading at the service, but after what happened at Uncle Stu's funeral, I think I want someone else to do it.

**Rob:** Should we really have a pan flute player? I'm beginning to think it might be overkill.

**Rebecca:** Maybe we should hold off printing the invitations until this stuff is worked out.

**Kathleen:** OK, let's think about exactly how we want to do this. We need to be sure about how we want the service to go before we do any more printing.

# The Sequence Activities process puts everything in order

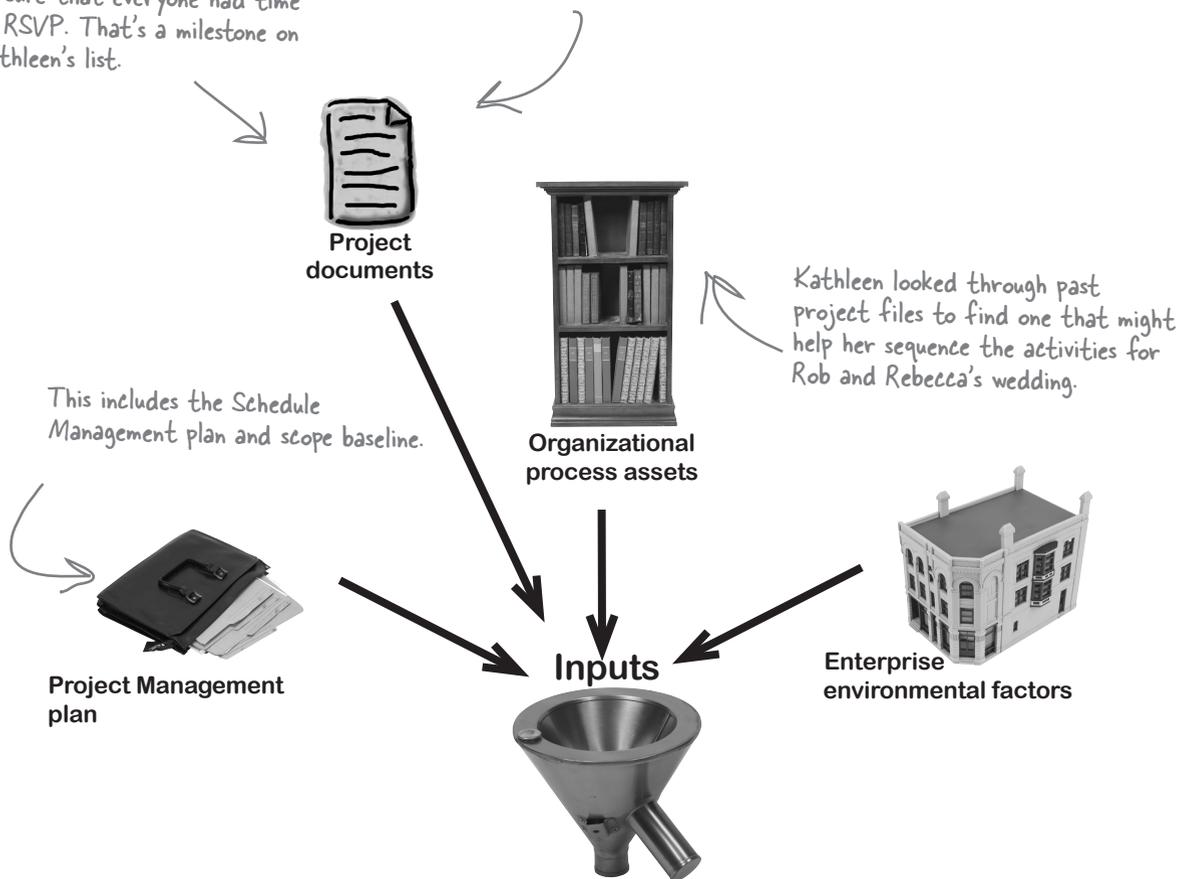
Now that we know what we have to do to make the wedding a success, we need to focus on the order of the work. Kathleen sat down with all of the activities she had defined for the wedding and decided to figure out exactly how they needed to happen. That's where she used the **Sequence Activities** process.

The **activity attributes** and the **activity list** she had created had most of the predecessors and successors written in them. Her **milestone list** had major pieces of work written down, and there were a couple of changes to the scope she had discovered along the way that were approved and ready to go.



Rob and Rebecca had asked that the invitations be printed at least three months in advance to be sure that everyone had time to RSVP. That's a milestone on Kathleen's list.

This includes information about each activity, including known predecessors and successors, the milestone list, and activity attributes.



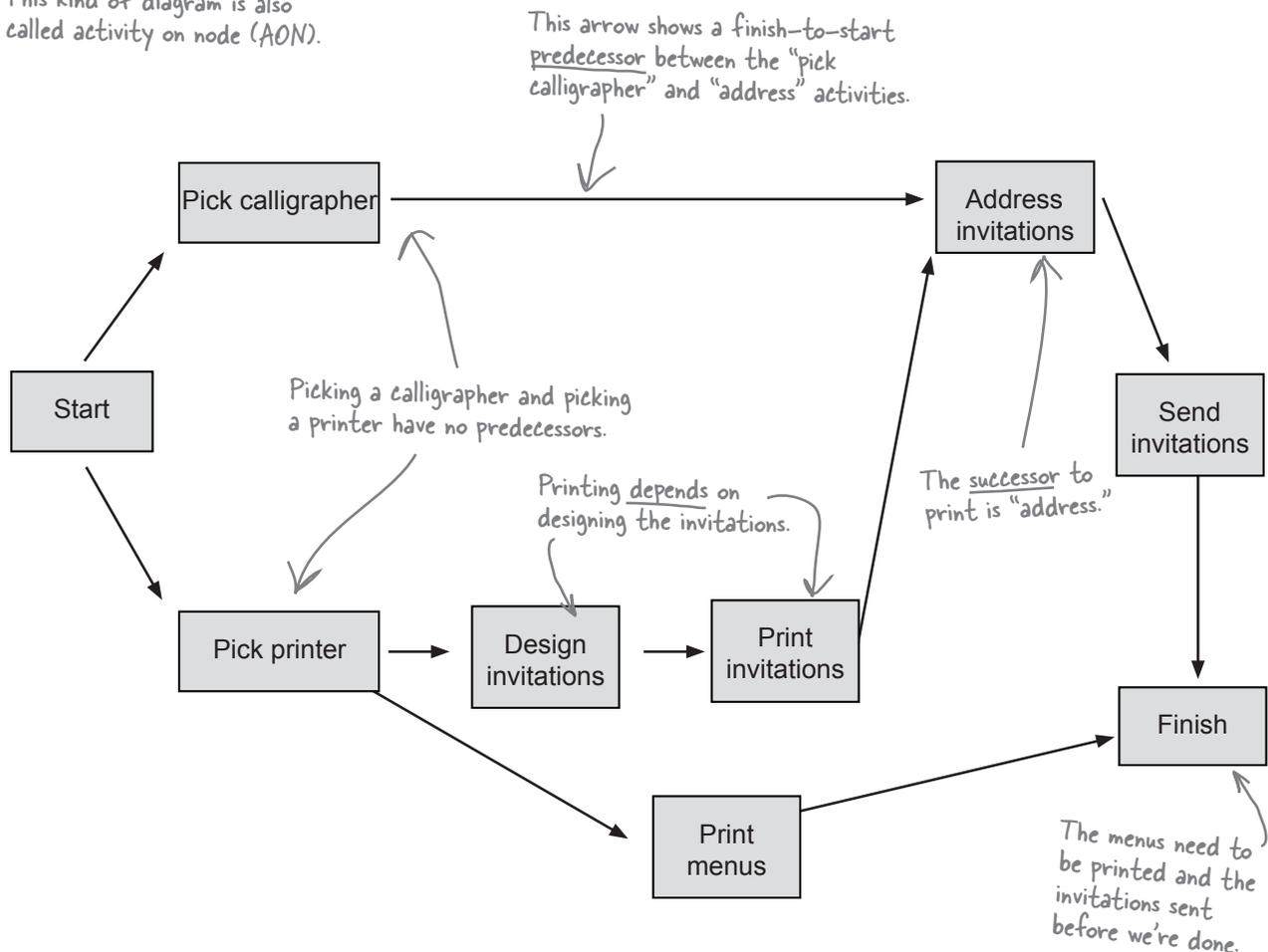
## Diagram the relationship between activities

One way to visualize the way activities relate is to create a **network diagram**. Kathleen created this one to show how the activities involved in producing the invitations depend on one another.

For example, the calligrapher is the person who's hired to write the addresses on the invitations, so Rob and Rebecca need to pick one before the invitations can be addressed. But the invitations also need to be printed before they can be addressed, because otherwise the calligrapher won't have anything to write on! See how predecessors can get all complicated? Luckily, a diagram makes sense of them!

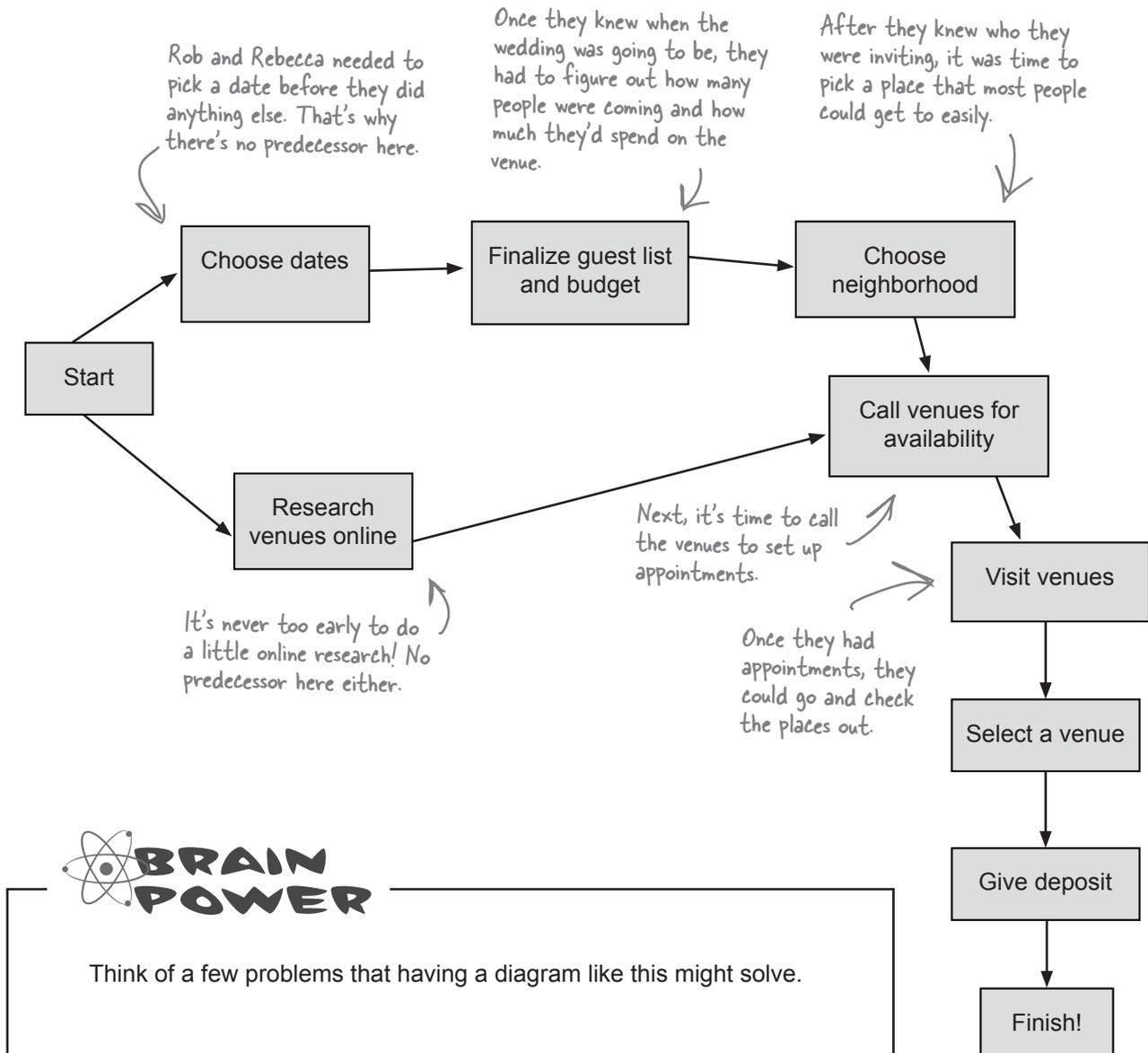
Showing the activities in rectangles and their relationships as arrows is called a **precedence diagramming method (PDM)**.

This kind of diagram is also called activity on node (AON).



## Network diagrams put your tasks in perspective

Just looking at the way all of these tasks relate to one another can help you figure out what's important at any time in the project. Once Rob and Rebecca looked at the network diagram below, they realized they needed to get online and start looking for a venue for their wedding right away, even before they'd figured out their budget and guest list.



 **Sharpen your pencil**

You'll need to know how to turn a table of nodes into a network diagram, so here's your chance to get some practice! Here's a list of nodes for a PDM network diagram. Try drawing the diagram based on it:

Name	Predecessor
Start	—
A	Start
B	A
C	B
D	Start
E	D
F	B
G	C
H	D
I	E, H
Finish	F, G, I

Now try another one!

Name	Predecessor
Start	—
1	Start
2	1
3	2
4	Start
5	3
6	Start
7	6
Finish	7, 4, 5

—————▶ Answers on page 336.

## Dependencies help you sequence your activities

The most common kind of dependency is the Finish to Start. It means that one task needs to be completed before another one can start. There are a few other kinds of dependencies, though. They can all be used in network diagrams to show the order of activities. The three main kinds of dependency are **Finish to Start (FS)**, **Start to Start (SS)**, and **Finish to Finish (FF)**. This tool is called **dependency determination and integration** in the Sequence Activities process.

When you think of dependencies, this is what you usually think of—one thing needs to end before the next can begin.

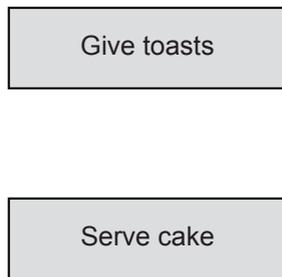
It's called Finish to Start because the first activity's finish leads into the second activity's start.

### Finish to Start (FS)



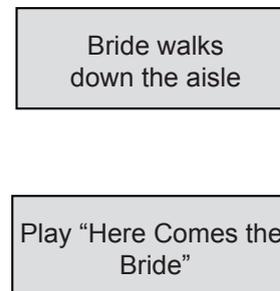
### Start to Start (SS)

This is a little less common, but sometimes you need to coordinate activities so they begin at the same time.



### Finish to Finish (FF)

In the PMP exam, you might see this two-letter abbreviation.



These two finish at the same time.

## External dependencies

Sometimes your project will depend on things outside the work you are doing. For the wedding, we are depending on the wedding party before us to be out of the reception hall in time for us to decorate. The decoration of the reception hall then depends on that as an external dependency.

## Discretionary dependencies

Rob and Rebecca really want the bridesmaids to arrive at the reception before the couple. There's no necessity there—it's just a matter of preference. For the exam, know that you should set discretionary dependencies based on your knowledge of the best practices for getting the job done.

## Mandatory dependencies

You can't address an invitation that hasn't been printed yet. So, printing invitations is a mandatory dependency for addressing them. Mandatory dependencies are the kind that have to exist just because of the nature of the work.

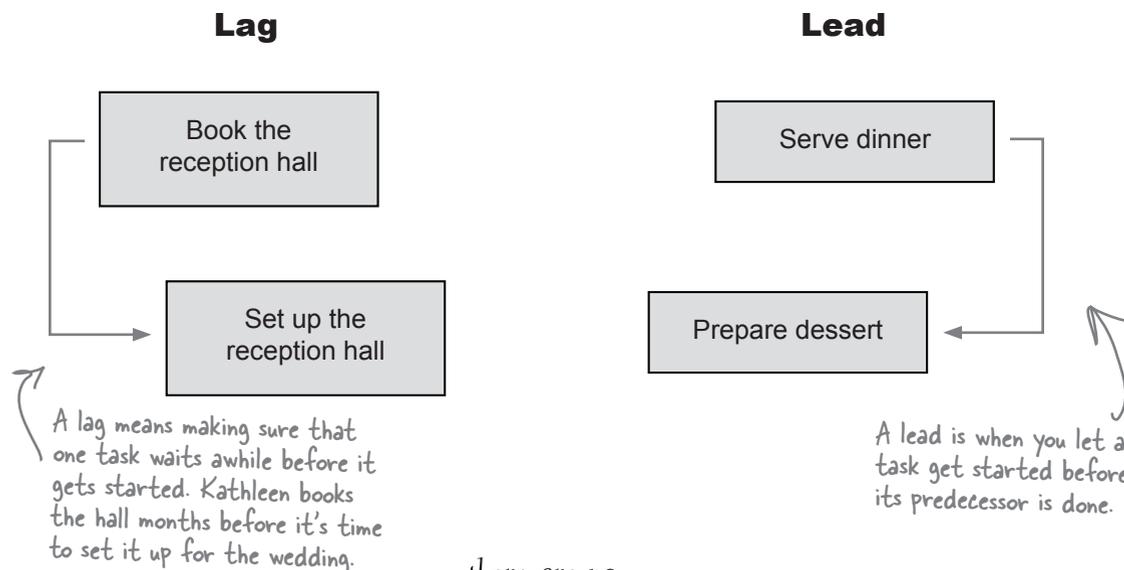
## Internal dependencies

The rehearsal dinner can't begin until the happy couple leaves the church. Some dependencies are completely within the team's control.

## Leads and lags add time between activities

Sometimes you need to give some extra time between activities. **Lag time** is when you purposefully put a delay between the predecessor task and the successor. For example, when the bride and her father dance, the guests wait awhile before they join them.

**Lead time** is when you give a successor task some time to get started before the predecessor finishes. So you might want the caterer preparing dessert an hour before everybody is eating dinner.



### there are no Dumb Questions

**Q:** Where do you get the dependency information to figure out your network diagram?

**A:** Your **activity attributes** should list the predecessors and successors for each activity. As you build the network diagram, you might discover new dependencies as well. Your project team will determine the dependencies necessary for each of the activities.

**Q:** What about Start to Finish dependencies?

**A:** It's possible for activities to require that a task has been started before it can finish. An example might be that singing couldn't start until after the music had started. But tasks like that are pretty rare and almost never show up in network diagrams.

**Q:** My scheduling software makes network diagrams for me. Why do I need to know this?

**A:** Most scheduling software does create one of these diagrams automatically. But spending the time to think through your dependencies and examine them visually can really help you find places where you might need to give some tasks more priority if you want to get your project done on time. So you should know how to make them too.

## Scheduling software can help you see the sequence of activities

Many people use applications like Microsoft Project to visualize their activity list and organize their dependencies. Taking the time to really understand the best sequence of activities can have a real impact on your project's deadlines, so using software like that as part of your company's **project management information system** is a good way to get a handle on just the right sequence for your project to run efficiently.



BUT I DO ALL THIS STUFF  
AT THE SAME TIME. WHY DO  
I NEED ALL THESE SEQUENCE  
DIAGRAMS?



### **You should still think of things in sequence.**

For the test, it's important to know the order of these processes. And even though you might do it all at once, you probably spend some time thinking about each of these things.

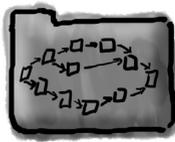


What's the advantage of thinking about Define Activities and Sequence Activities separately?

# Create the network diagram

As you sequence the activities, you will find new activities that need to be added and new attributes for activities that you didn't know about. So, while the main product of this process is the network diagram, you also produce updates to some of the Define Activities documents and outputs of other processes, too.

## Outputs



### Project schedule network diagrams

Here's where you work out how all of the tasks fit together based on their predecessors and determine the critical path through the project.

For the test, you won't need to know exactly which documents change as an output to this process. All you need to know is that project document updates are an output.



### Project documents updates

When you've sequenced your activities, you might find that some of the documents you've created as part of other processes need to be updated. The *PMBOK® Guide* calls documents like these "project document updates." The pictures to the right are some examples, but there could be other documents that require updates as well.



### Activity attributes updates

Sometimes sequencing will show that two tasks rely on each other. If you find new predecessors or successors, their attributes will need to be changed.



### Assumption log

When you sequence your activities, you might find that the assumptions you made when you initiated the project have proven incorrect. That's why you would want to update the assumption log once you've made a decision about the order of activities.



### Activity list updates

If you find a new activity while sequencing, updates need to be made to the activity list.

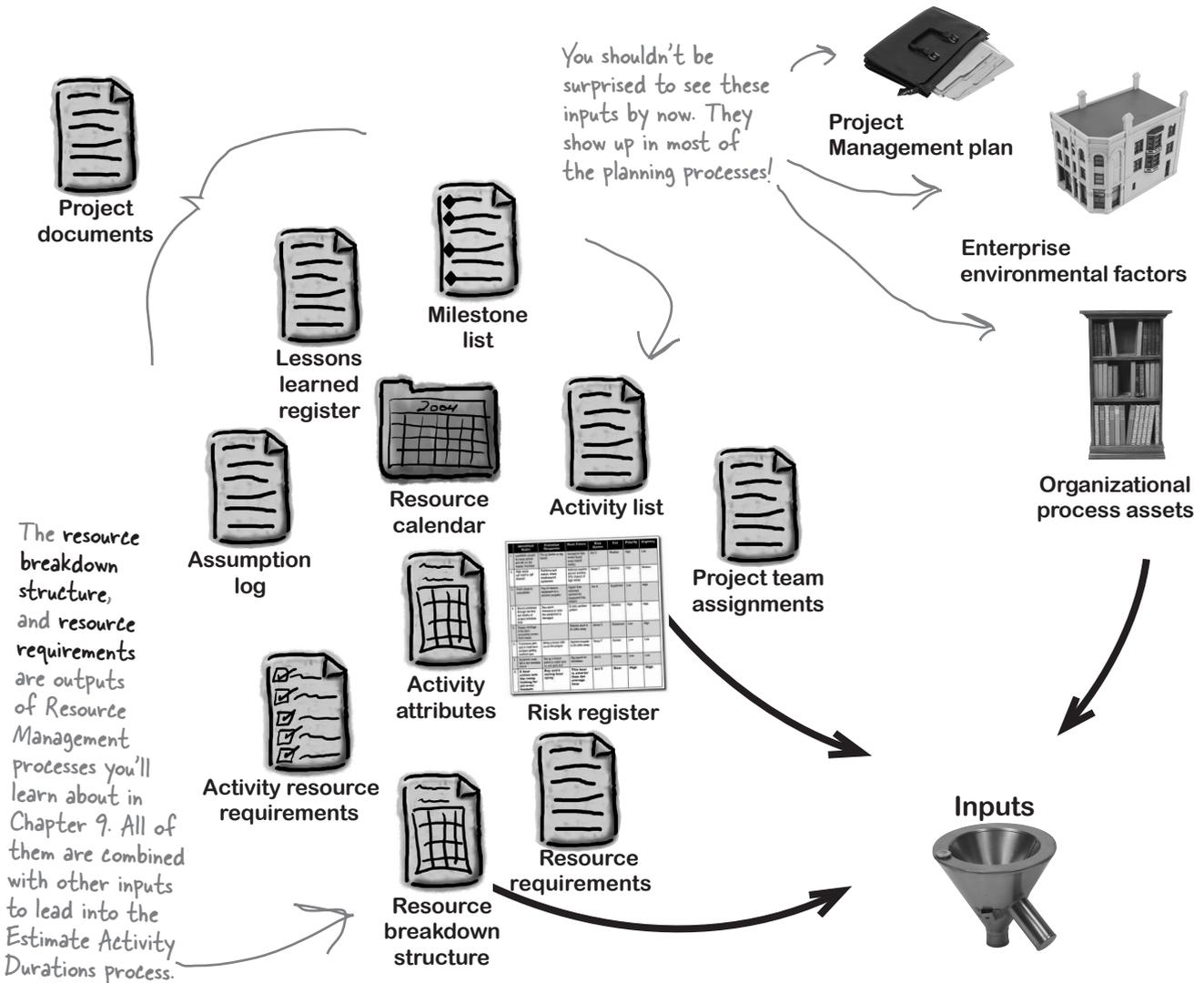


### Milestone list

When you sequence your activities, you can find new milestones that you can use to measure interim progress.

# Figuring out how long the project will take

Once you're done with Sequence Activities, you've got everything you need to figure out how long each activity will take. That's done in a process called **Estimate Activity Durations**. This is where you look at each activity in the activity list, consider the scope and the resources, and estimate how long it will take to perform.





You'll need to understand the various inputs and outputs for each process for the exam. Here's a list of some of the project documents and other inputs for Estimate Activity Durations. Write down what you think each of them will be used for when you actually sit down and estimate how long each activity will take.

1. Activity list and activity attributes

2. Activity resource requirements

3. Project scope statement

4. Enterprise environmental factors

5. Organizational process assets



## Exercise

You'll need to understand the various inputs and outputs for each process for the exam. Here's a list of some of the inputs for Estimate Activity Durations. Write down what you think each of them will be used for when you actually sit down and estimate how long each activity will take.

1. Activity list and activity attributes

**Contains information about the activities that are being estimated**

You need these because the goal of this process is to estimate the duration of each activity.

2. Activity resource requirements

**Shows which resources are assigned to each activity**

The more resources you add to an activity, the less time it takes.

But sometimes adding people won't get the job done any faster! Remember, nine women can't have a baby in one month.

3. Project scope statement

**Lists constraints and assumptions for each activity**

You're probably not the first person in your company to do this sort of project. Information from people around you will be very valuable when you're creating estimates.

This input is always about looking elsewhere in your organization for information.

4. Enterprise environmental factors

**Other people or databases in my company can help with estimation**

Any time you see this, think about historical information and project records!

The more you know about how past projects went, the more accurate your estimates will be.

5. Organizational process assets

**Contains historical information and records from past projects**

# Estimation tools and techniques



Estimating the duration of an activity means starting with the information you have about that activity and the resources that are assigned to it, and then working with the project team to come up with an estimate. Most of the time you'll start with a rough estimate and then refine it (maybe a few times!) to make it more accurate. You'll use these tools and techniques to create the most accurate estimates.

**Expert judgment** will come from your project team members who are familiar with the work that has to be done. If you don't get their opinion, then there's a huge risk that your estimates will be wrong!

**Parametric estimating** means plugging data about your project into a formula, spreadsheet, database, or computer program that comes up with an estimate. The software or formula that you use for parametric estimating is built on a database of actual durations from past projects.

**Bottom-up estimating** means building your estimates up based on individual estimates from the people who will do the work.

**Data analysis** means using **reserve analysis** to add extra time to the schedule (called a *contingency reserve* or a *buffer*) to account for extra risk. It can also mean using **alternatives analysis** to think through all of the possible options to find the most efficient path for delivery.

**Analogous estimating** is when you look at activities from previous projects that were similar to this one and see how long it took to do similar work for them. But this only works if the activities and the project team are similar!

**Three-point estimates** are when you come up with three numbers: a **most likely** estimate that probably will happen, an **optimistic** one that represents the best-case scenario, and a **pessimistic** one that represents the worst-case scenario. The final estimate is the average.

**Decision-making** techniques help the team decide on the best estimates for the activities they've defined.

**Meetings** help teams to work together when they estimate the work.



## Exercise

Each of these scenarios describes a different tool or technique from Estimate Activity Durations. Write down which tool or technique is being described.

1. Kathleen comes up with three estimates (one where everything goes wrong, one where some things go wrong, and one where nothing goes wrong) for printing invitations, and averages them together to come up with a final number. ....
2. There will be two different catering companies at the wedding. Kathleen asks the head chef at each of them to give her an estimate of how long it will take to do the job. ....
3. There's a spreadsheet Kathleen always uses to figure out how long it takes guests to RSVP. She enters the number of guests and their zip codes, and it calculates an estimate for her. ....
4. Kathleen's done four weddings that are very similar to Rob and Rebecca's, and in all four of them it took exactly the same amount of time for the caterers to set up the reception hall. ....

Answers on page 333.





## Three-Point Estimates Up Close



**PERT (Program Evaluation Review Technique)** is the most common form of three-point estimation. It's a technique that was developed in the 1960s by consulting firms working with the US government as a way of getting more accurate project duration predictions up front. To do a PERT estimate, you start with three estimates—pessimistic, most likely, and optimistic estimates. (The formula used for PERT estimates is called *beta distribution*.) Since the pessimistic and optimistic estimates are less likely to happen than the normal estimate, the normal estimate is weighted (multiplied by 4) and added to the optimistic and pessimistic estimates, and then the whole thing is divided by 6 to give an expected duration. The formula looks like this:

$$\left( \text{Optimistic duration} + 4 \text{ Most likely duration} + \text{Pessimistic duration} \right) \div 6 = \text{Expected duration}$$

Kathleen used a PERT estimate for all of the wedding planning activities to make sure that she could get it all done in time for Rob and Rebecca's big day. They only have six months until the wedding, so all of the planning needs to be done within the month to leave enough time to actually finish everything. She wrote down the **assumptions** she made for each estimate, coming up with all of the reasons she could think of that she took into account when coming up with her estimates.

When Kathleen assumed the best-case scenario, these assumptions led her to her 9-day estimate.

$$(9 + 4(15) + 30) \div 6 = 16.5$$

An assumption is a decision that you make to account for things you don't know when you make an estimate.

Optimistic = 9 days	Most likely = 15 days	Pessimistic = 30 days
All guests RSVP early.	Half of the guests won't RSVP until the very last week; a few won't RSVP at all but will still show up.	Nobody RSVPs and many bring guests unannounced.
The couple settles on the first venue they visit.	They'll visit four or five and spend weeks negotiating with venue operators.	They'll comb the neighborhood and visit every possible place for weeks.
The printer can get the invitations done in two weeks.	They'll want to talk to a few printers and most of them will ask for at least a month.	All the printers will be booked, so we'll have to use somebody from out of town and it'll take six work weeks (30 business days).



## Exercise

Here are some examples of three-point estimates. Use the formula to figure out the expected time for each of these.

1. A software team gathered estimates for all of the work they'd have to do to build the next major release of their flagship product. Last time it took them around 45 days, but they're hoping that the lessons learned from the past release could bring the time down to 30 days. However, the infrastructure team needs to upgrade their servers, and they are concerned that procurement delays could potentially extend the project out to 90 days.

Expected duration = \_\_\_\_\_      Optimistic duration = \_\_\_\_\_      Most likely duration = \_\_\_\_\_  
Pessimistic duration = \_\_\_\_\_

2. A construction team gathered estimates for all of the work they'd have to do to build a garage. In general, they can build a garage in 20 days, but rain or cooler temperatures could stretch the project out to 30 days. If, however, the forecast is correct, warm, sunny weather might bring the duration down to just 12 days.

Expected duration = \_\_\_\_\_      Optimistic duration = \_\_\_\_\_      Most likely duration = \_\_\_\_\_  
Pessimistic duration = \_\_\_\_\_

3. A project manager used data from past projects to come up with an estimate for an upcoming software system replacement project. She felt confident about a 25-day duration, but also noted that adding an extra resource could bring the schedule down to 10 days. The test team felt that the complexity of some completely new features would add additional test cases, adding a few weeks for a 40-day estimate.

Expected duration = \_\_\_\_\_      Optimistic duration = \_\_\_\_\_      Most likely duration = \_\_\_\_\_  
Pessimistic duration = \_\_\_\_\_

4. A project manager in charge of a big civil engineering project came up with an estimate for a highway repaving project. The worst-case scenario was 82 days, but the team felt more certain based on past experience that they could get it done in 49 days. If all went well with their equipment and materials, it might be done in 33 days instead.

Expected duration = \_\_\_\_\_      Optimistic duration = \_\_\_\_\_      Most likely duration = \_\_\_\_\_  
Pessimistic duration = \_\_\_\_\_

Answers on page 333

## Create the duration estimate

You've got a list of activities, you know what resources are needed to actually do each activity, and you've got your estimation tools and techniques...now you have enough to create the estimates! That's the whole point of the **Estimate Activity Durations** process, and it's also the main output.



Outputs

You don't always know exactly how long an activity will take, so you might end up using a range (like 3 weeks +/- 2 days).

The activity **duration estimates** are estimates of how long each activity in the activity list will take. The estimate can be in hours, days, weeks...any work period is fine, and you'll use different work periods for different jobs. A small job (like booking a DJ) may just take a few hours; a bigger job (like catering—including deciding on a menu, ordering ingredients, cooking food, and serving guests on the big day) could take days. You'll also produce a **basis of estimates** document that describes your approach, the assumptions you made, and factors you considered.

You'll also learn more about the specific activities while you're estimating them. That's something that always happens—you have to really think through all of the aspects of a task in order to estimate it. So the other output of Estimate Activity Durations is **updates to the project documents**.

You may have guessed from the name that the activity duration estimates are always **duration estimates**, not effort estimates, so they show you calendar time and not just person-hours.



Duration estimates



Project document updates



Basis of estimates

The activity duration estimate consists of estimates for each activity. It's the main output of the Estimate Activity Durations process.

---

### there are no Dumb Questions

**Q:** When you use parametric estimation, how does the program or formula know how much to estimate?

**A:** When people design a system for parametric estimation, they collect a lot of data from past projects and condense it into a table or a database. And then they come up with a **heuristic** (like a rule of thumb) that lets you boil your estimation down into just a few parameters that you need to enter. Most successful parametric estimation systems need a lot of time to develop.

**Q:** Since reserve analysis lets me use buffers, why can't I just put everything I don't know about into the reserve?

**A:** The idea behind reserve analysis is that there are always unknowns on any project, but you can account for these unknowns by taking your best guess at what's going to go wrong and inserting a buffer. But you can't just make an enormous reserve, because then there's no reason to ever do any estimation! The entire project becomes one big unknown, and that's not particularly useful to anyone.

**Q:** Wait a minute! I don't quite get the difference between a duration estimate and an effort estimate. Can you explain?

**A:** Duration is the amount of time that an activity takes, while effort is the total number of person-hours expended. If it takes two people six hours to carve the ice sculpture for the centerpiece of a wedding, the duration is six hours. But since two people worked on it for the whole time, it took 12 person-hours of effort to create!

## Back to the wedding

Kathleen's really got a handle on how long things are going to take, but that's not enough to get the job done. She's still got some work to do before she's got the whole project under control.

**Rob and Rebecca know where they want to get married, and they've got the place booked now.**



**But what about the caterer? They have no idea who's going to be providing the food.**



**And what about the band that they want? Will the timing with their schedule work out?**



o o

Rebecca just can't stop thinking about everything happening in exactly the right order. What can Kathleen do to make sure it all works out?



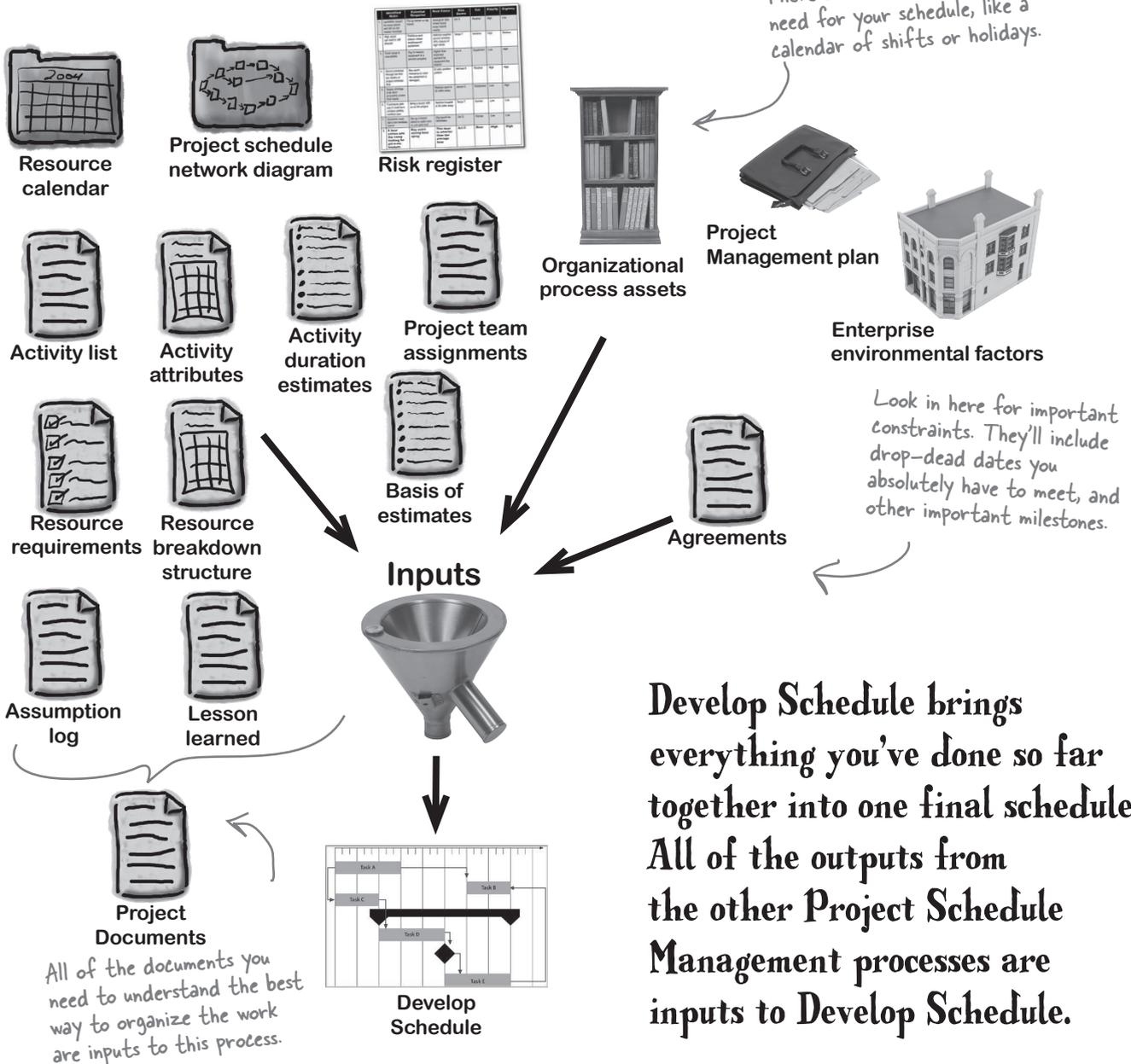
### BRAIN POWER

It's not easy to plan for a lot of resources when they have tight time restrictions and overlapping constraints. How would you figure out a schedule that makes everything fit together?

## Bringing it all together



The **Develop Schedule process** is the core of Project Schedule Management. It's the process where you put it all together—where you take everything you've done so far and combine it into one final schedule for the whole project. A lot of project managers consider this the most important part of their job. The schedule is your most important tool for managing a project.



**Develop Schedule brings everything you've done so far together into one final schedule. All of the outputs from the other Project Schedule Management processes are inputs to Develop Schedule.**

HOLD ON! I DON'T REALLY WORK LIKE THAT ALL THE TIME WHEN I'M MANAGING PROJECTS! I FIGURE SOME THINGS OUT, THEN GO BACK AND MAKE CHANGES. LIKE WHAT IF I'M WORKING ON THE SCHEDULE AND I REALIZE I NEED TO CHANGE MY RESOURCES? THIS SAYS I SHOULD HAVE FIGURED THAT ALL OUT BY NOW, RIGHT?



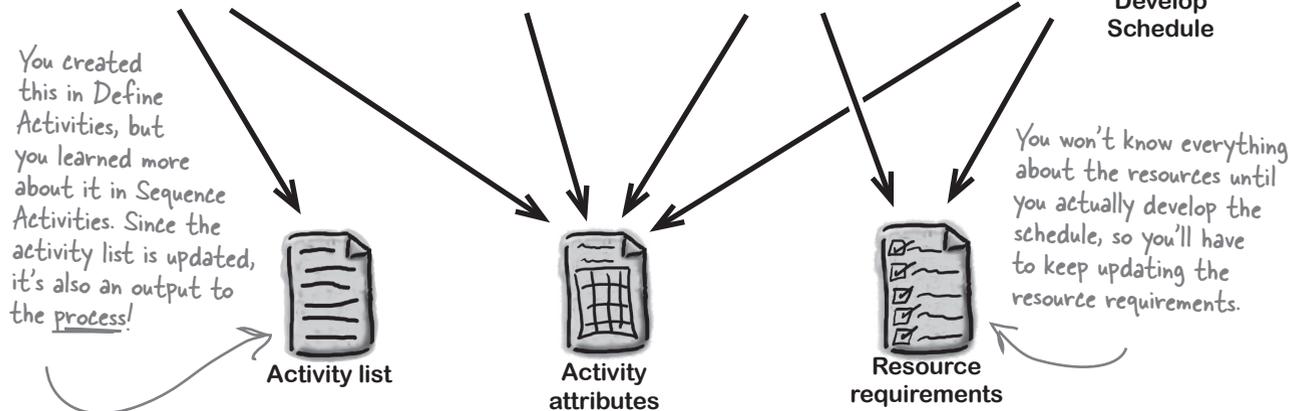
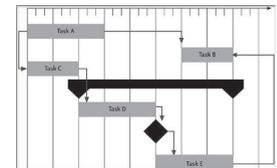
**Don't worry, even though you're done with the Estimate Activity Durations process, you're not done with the resources.**

You're never going to have the complete resource picture until you're done building the schedule. And the same goes for your activity list and duration estimates, too! It's only when you lay out the schedule that you'll figure out that some of your activities and durations didn't quite work. We'll go in depth about resources when we talk about Project Resource Management in Chapter 9.

Each of the processes allows updates to an output from a previous one, so when you discover changes, you can include them in the schedule.

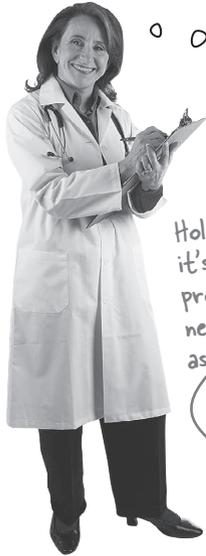
You're not done with activity attributes yet. When you estimate resources, you'll learn more about some activities and update their attributes.

That's why the processes have the word "Estimating" in their names! Because you're taking an educated guess, but you won't know for sure until you've actually developed the schedule.



## Question Clinic: The which-comes-next question

IF YOU WANT TO PASS THE PMP EXAM, YOU'LL NEED TO HAVE A GOOD FEEL FOR THE ORDER THAT THE PROCESSES ARE PERFORMED IN, BECAUSE YOU'LL BE ASKED A LOT OF WHICH-COMES-NEXT QUESTIONS! THESE ARE QUESTIONS THAT QUIZ YOU ON HOW THE PROCESSES FIT TOGETHER INTO ONE BIG FRAMEWORK. THESE QUESTIONS AREN'T HARD, BUT THEY CAN BE A LITTLE MISLEADING.



Hold on—this question doesn't look like it's asking about the order of the processes! But a lot of which-comes-next questions describe a situation and ask you what you'd do.

Don't be thrown if the question asks about an industry you don't know much about. All projects follow the same processes.

In other words, you've used decomposition and created an activity list. These are part of the Define Activities process.

27. You're the project manager for a highway construction project. You've analyzed the work that has to be done and come up with a list of activities. You consulted with the project sponsor in order to find out any important milestones that you need to meet. What's the next thing that you do?

- A. Create the project schedule.
- B. Perform the Define Activities process.
- C. Consult your Project Management plan to figure out how to handle any schedule changes.
- D. Figure out the dependencies between activities and create a diagram of the activity network.

The milestone list is an input that you've seen before.

The Develop Schedule process needs more than an activity list and resource availability.

The question described the Define Activities process, so you've already performed it.

You only do this during Control Schedule, but since there's no schedule yet, there's nothing to control.

Did you notice the question said "diagram of the activity network" and not "project network diagram"? The exam might not use the exact same phrasing as the PMBOK® Guide. That's why you're learning how these things are used, not just memorizing their names.

This answer describes Sequence Activities, which happens after Define Activities and takes the activity list and milestone list as inputs. That's the right answer.

THE WHICH-COMES-NEXT QUESTION DOESN'T ALWAYS LOOK LIKE IT'S ASKING ABOUT THE ORDER OF THE PROCESSES! KEEP AN EYE OUT FOR QUESTIONS THAT DESCRIBE INPUTS, OUTPUTS, TOOLS, OR TECHNIQUES AND ASK YOU WHAT YOU'RE SUPPOSED TO DO NEXT.



# HEAD LIBS

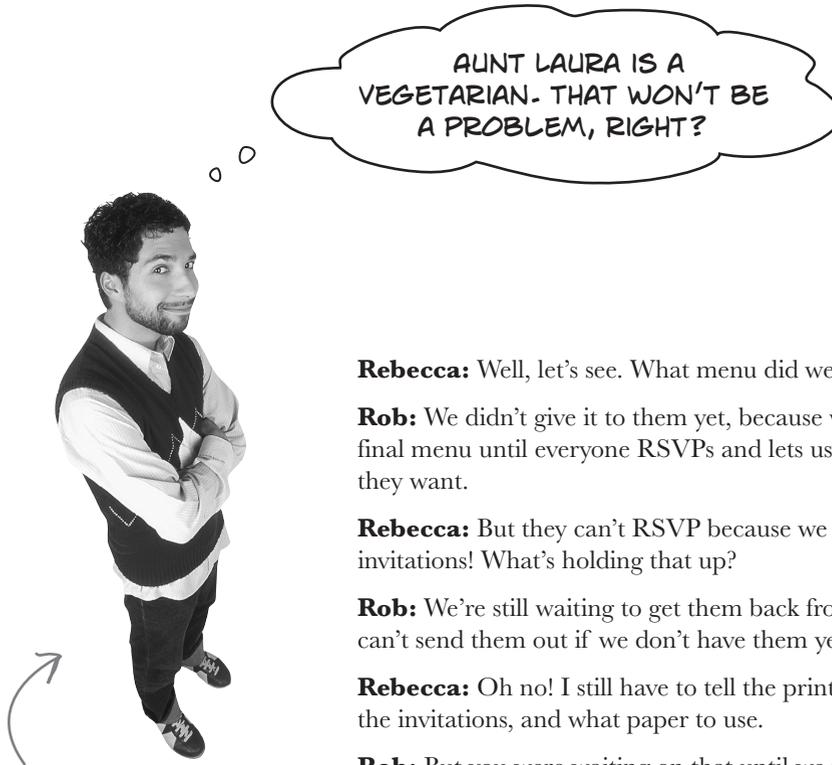


Fill in the blanks to come up with your own which-comes-next question! Start by thinking of a process to be the correct answer, and then figure out which process came right before it—that's the one you'll describe in the question!

You are managing a \_\_\_\_\_ (an industry or the name of a project). You've finished creating the \_\_\_\_\_ (an output from the previous process), you've come up with \_\_\_\_\_ (another output from the previous process) and you've just finished \_\_\_\_\_ (a tool or technique from the previous process). What's the next thing you do?

- A. \_\_\_\_\_ (the correct answer—a brief description of what happens during the process)
- B. \_\_\_\_\_ (a description of a different process)
- C. \_\_\_\_\_ (the name of a tool or technique that's part of a totally different process)
- D. \_\_\_\_\_ (the name of an irrelevant process)

## One thing leads to another



Rob thought this was just a little problem...

AUNT LAURA IS A VEGETARIAN. THAT WON'T BE A PROBLEM, RIGHT?

**Rebecca:** Well, let's see. What menu did we give to the caterers?

**Rob:** We didn't give it to them yet, because we won't have the final menu until everyone RSVPs and lets us know which entrée they want.

**Rebecca:** But they can't RSVP because we haven't sent out the invitations! What's holding that up?

**Rob:** We're still waiting to get them back from the printer. We can't send them out if we don't have them yet!

**Rebecca:** Oh no! I still have to tell the printer what to print on the invitations, and what paper to use.

**Rob:** But you were waiting on that until we finished the guest list.

**Rebecca:** What a mess!

...but it turns out to be a lot bigger than either Rob or Rebecca realized at first! How'd a question about one guest's meal lead to such a huge mess?

### BRAIN POWER

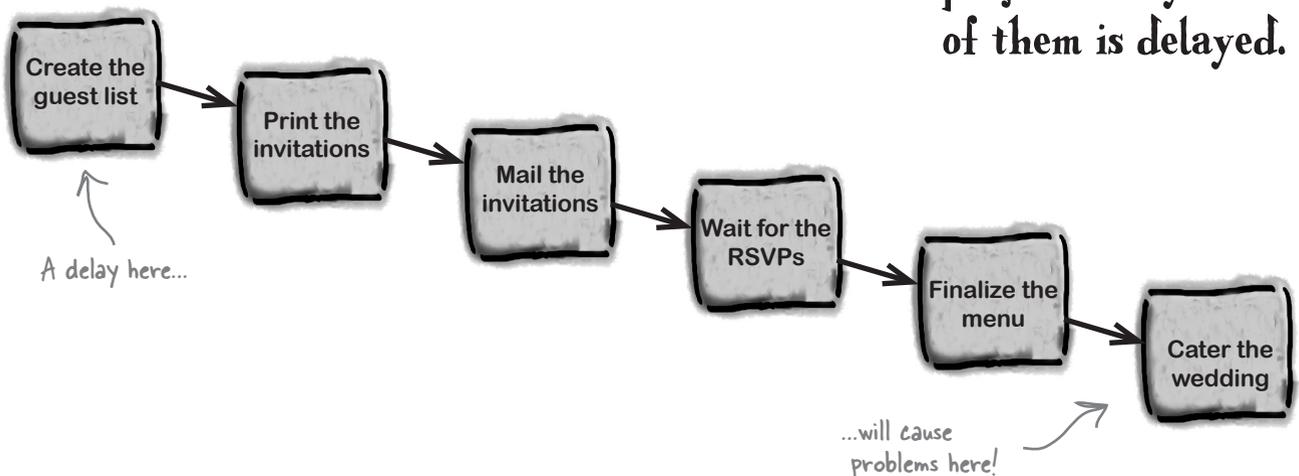
Can you think of a situation where a delay in an activity early on in a project can lead to a problem in a later activity, which leads to another problem in another activity, leading to a cascade of problems that makes the project late?

## Use the critical path method to avoid big problems

The **critical path method** is an important tool for keeping your projects on track. Every network diagram has something called the **critical path**. It's the string of activities that, if you add up all of the durations, is longer than any other path through the network. It usually starts with the first activity in the network and usually ends with the last one.

The reason that the critical path is, well, *critical*, is that every single activity on the path must finish on time in order for the project to come in on time. A **delay in any one of the critical path activities** will cause the **entire project to be delayed**.

The critical path is the string of activities that will delay the whole project if any one of them is delayed.



### How does knowing your critical path help?

Knowing where your critical path is can give you a lot of freedom. If you know an activity is *not* on the critical path, then you know a delay in that activity may not *necessarily* delay the project.

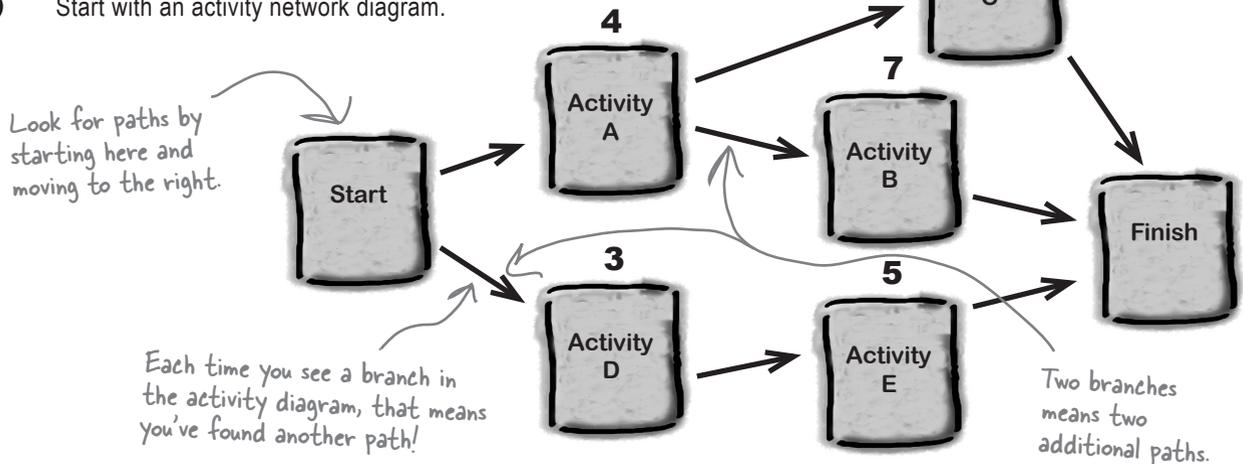
This can really help you handle emergency situations. Even better, it means that if you need to bring your project in earlier, you know that adding resources to the critical path will be much more effective than adding them elsewhere.

# How to find the critical path

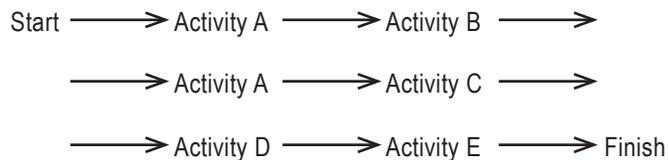
It's easy to find the critical path in any project! With a little practice, you'll get the hang of it. Of course, on a large project with dozens or hundreds of tasks, you'll probably use software like Microsoft Project to find the critical path for you. But when it does, it's following the same exact steps that you'll follow here.

You'll usually write the duration above each node in the diagram.

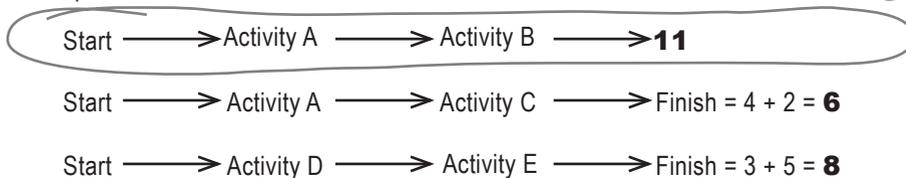
- 1 Start with an activity network diagram.



- 2 Find all of the paths in the diagram. A path is any string of activities that goes from the start of the project to the end.



- 3 Find the duration of each path by adding up the durations of each of the activities on the path.



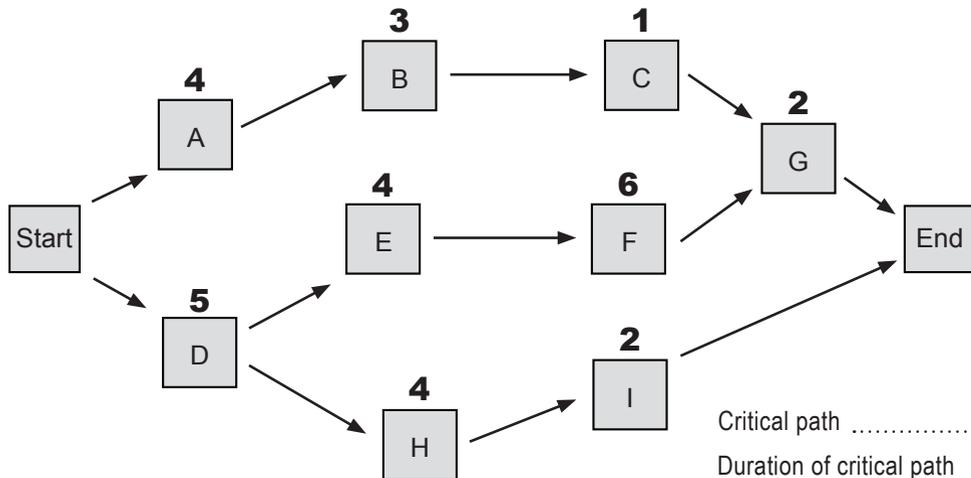
This path has a duration of 11, which is longer than the other two (6 and 8). So it's the critical path!

**The critical path is the one with the longest duration!**



**Exercise**

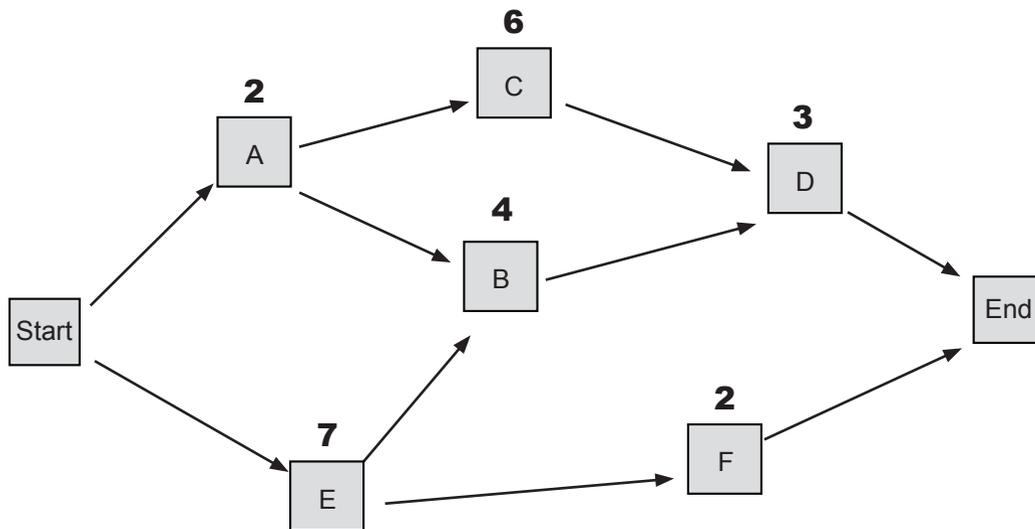
You may get questions on the exam asking you to identify the critical path in a network diagram. Here's some practice for doing that! Find the critical path and duration for these PDMs.



Critical path .....

Duration of critical path .....

Total number of paths .....



Critical path .....

Duration of critical path .....

Total number of paths .....

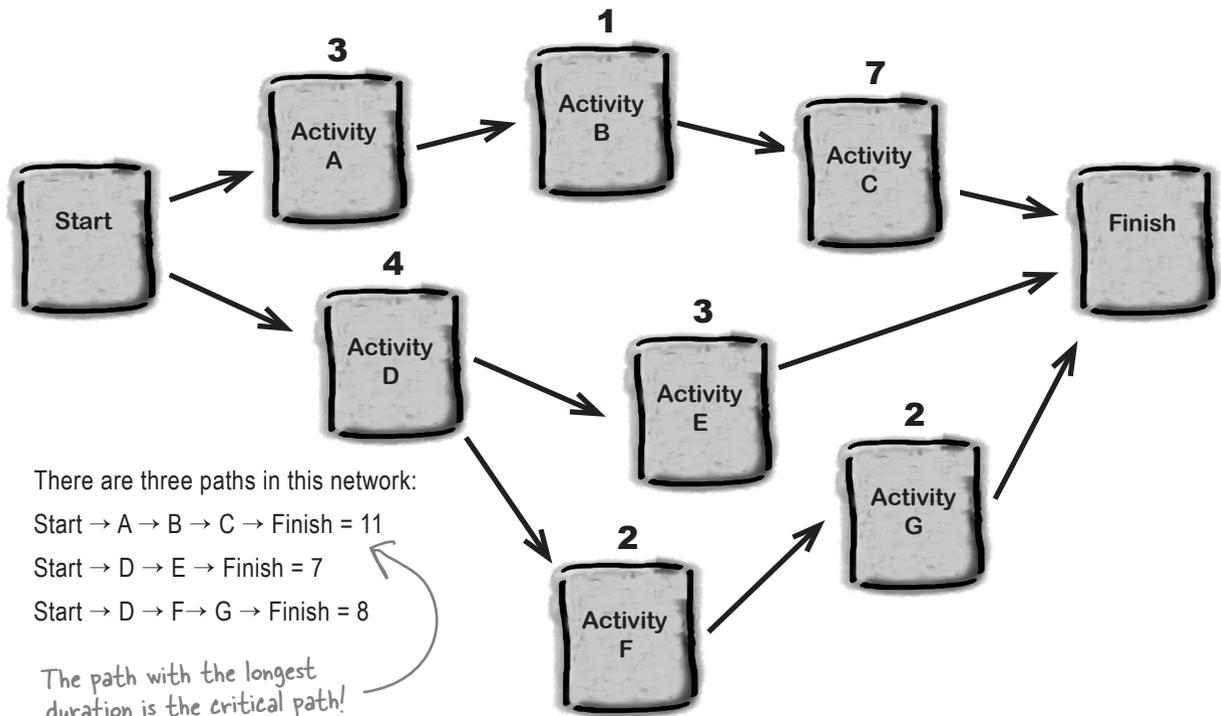
→ Answers on page 334.

## Finding the float for any activity

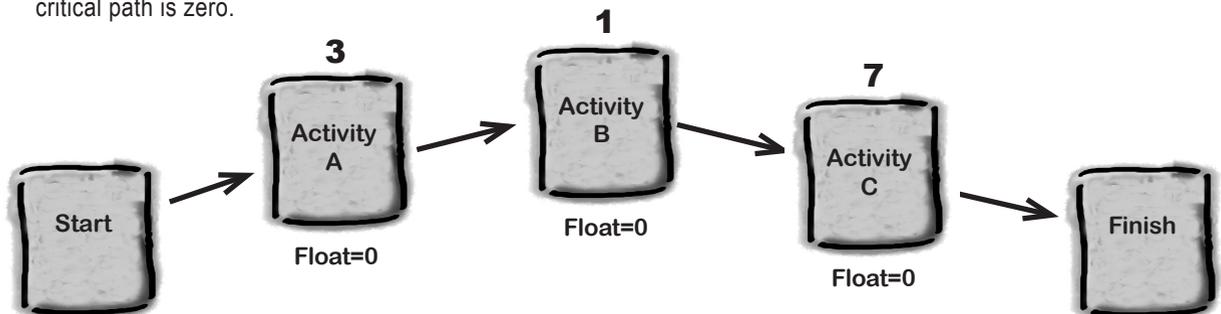
Once you've figured out the critical path, there's all sorts of useful stuff you can do with it. One of the most useful things you can do is calculate the **float**. The float for any activity is the amount of time that it can slip before it causes your project to be delayed. You might also see the word *slack*—it's the same thing.

Luckily, it's not hard to figure out the float for any activity in a network diagram. First you write down the list of all of the paths in the diagram, and you identify the critical path. The float for every activity in the critical path is zero.

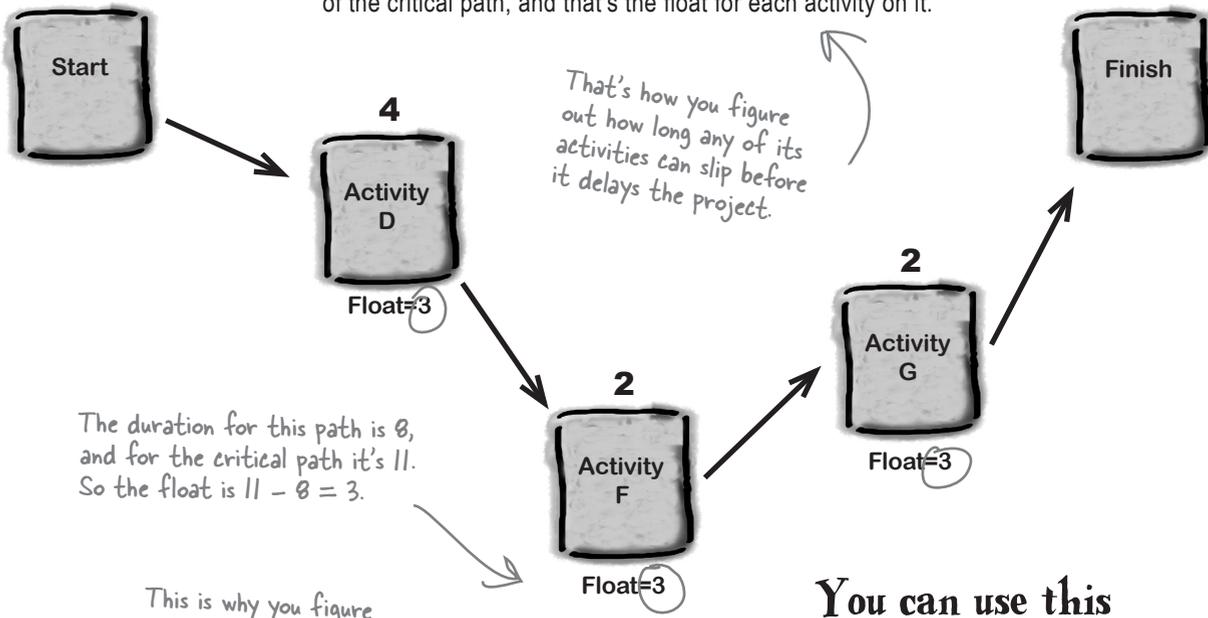
The goal is to find the float for each activity. We're not really concerned with finding a total float for each path—we're looking at the activities independently.



2 The float for each of the activities on the critical path is zero.

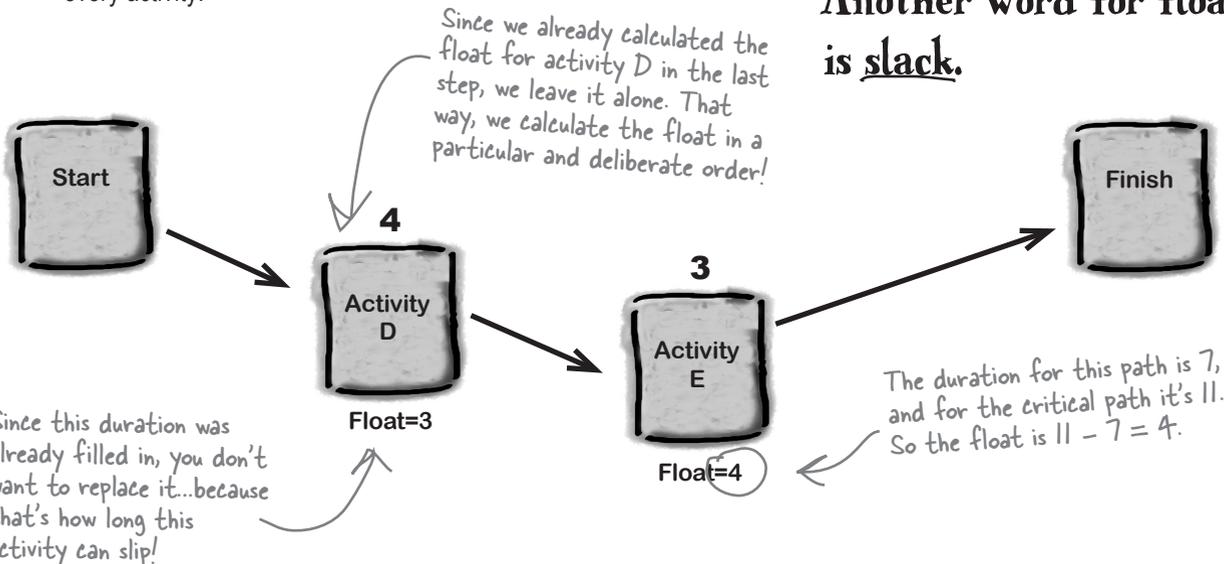


- 3 Find the **next longest path**. Subtract its duration from the duration of the critical path, and that's the float for each activity on it.



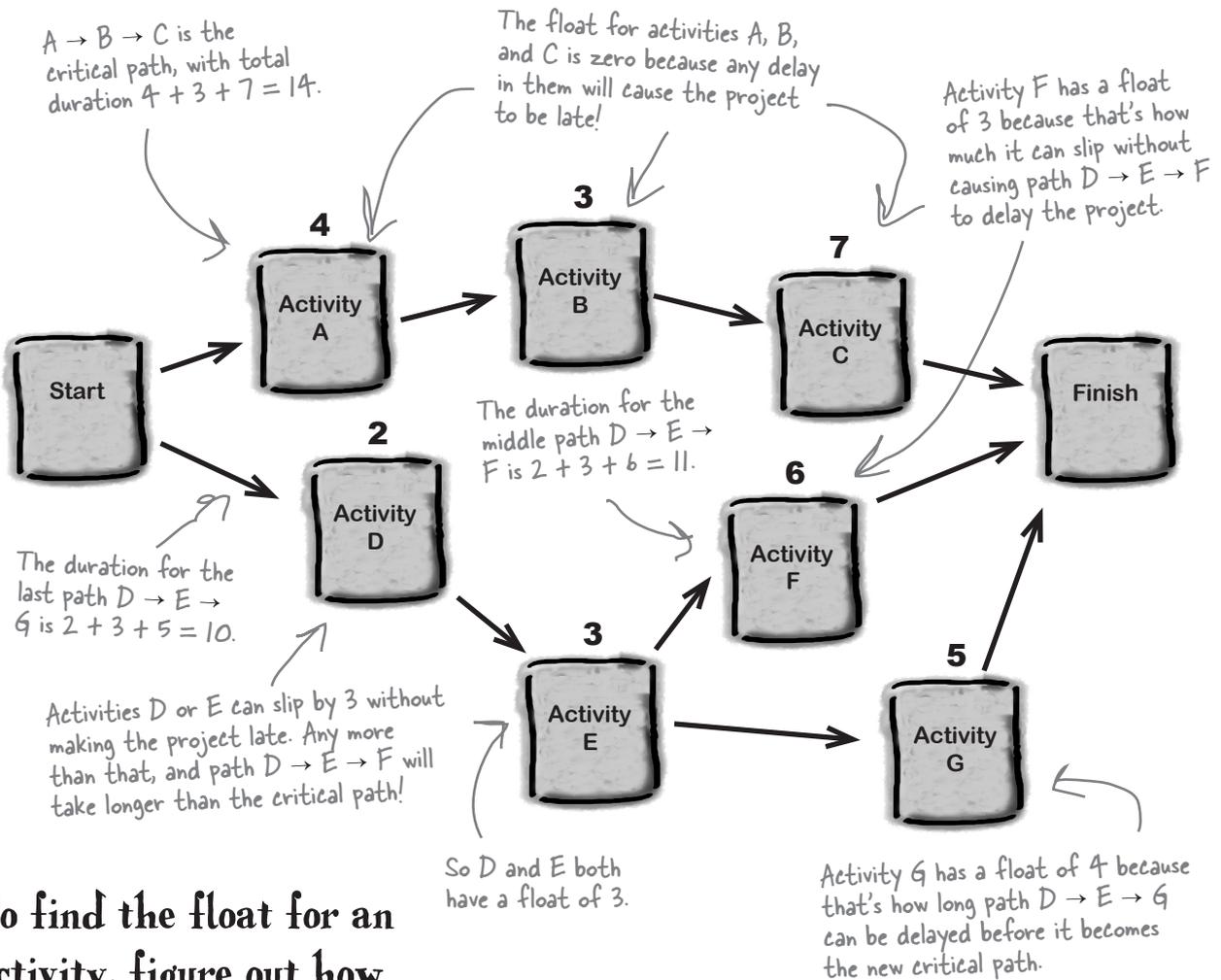
- 4 Do the same for the **next longest path**, and so on through the rest of the network diagram. Pretty soon, you'll fill in the float for every activity!

You can use this method to find the float for every activity in a network diagram. Another word for float is slack.



## Float tells you how much extra time you have

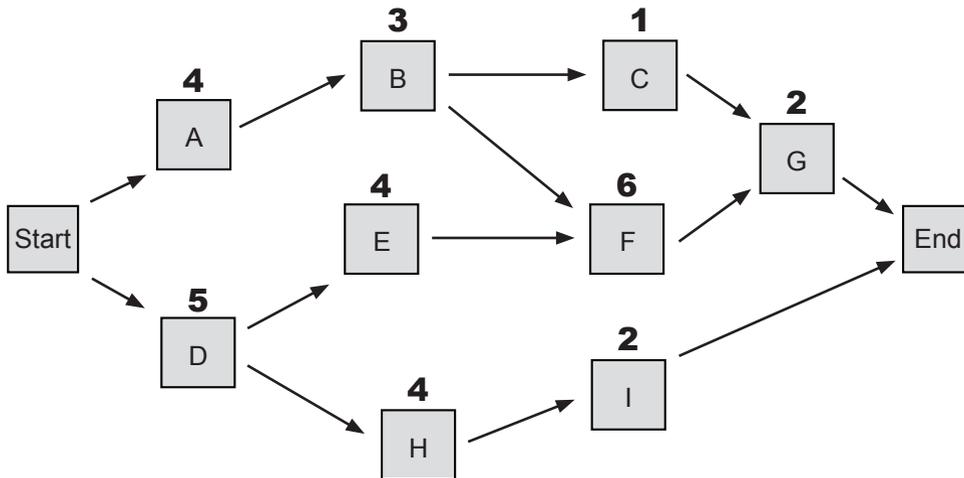
Once you know the float, you know how much play you have in your schedule. If an activity has a float of 2 days, it can slip by that much without affecting the end date.



**To find the float for an activity, figure out how much it can slip before it makes the project late. The float for any activity on the critical path is ZERO!**



You'll need to be able to calculate the float of an activity in a network diagram for the exam. Take another look at this PDM from the last exercise. Can you calculate the float for each activity?



1. What is the float for each activity on the critical path? .....
2. What is the total duration for path A → B → C → G? .....
3. What is the total duration for path A → B → F → G? .....
4. What is the total duration for path D → E → F → G? .....
5. What is the total duration for path D → H → I? .....
6. Which path is the critical path? ..... → ..... → ..... → .....
7. Write down the float for each activity:  
 A ..... B ..... C ..... D ..... E .....  
 F ..... G ..... H ..... I .....

*Hint: First fill in the float for the critical path activities. Then move on to the next longest path, and then the next longest one, filling in any float that hasn't been filled in yet.*



—————→ **Answers on page 335.**

there are no  
**Dumb Questions**

**Q:** Where do the duration numbers come from on each activity?

**A:** A lot of people ask that question. It's easy to forget that everything you do in Sequence Activities builds on the stuff you did in the other Project Schedule Management processes. Remember the estimates that you came up with during Estimate Activity Durations? You used techniques like three-point estimates, analogous estimating, and parametric estimating to come up with an estimate for each activity. Those are the estimates that you use on your network diagrams!

**Q:** What if there's a path that's not critical, but where even a small slip in one activity would delay the project?

**A:** This is exactly why it's important to know the float for each of your activities. When you're managing your project, it's not enough to just pay attention to the activities on the critical path. You need to look for any activity with a low float. And don't forget that there may be some activities that aren't on the critical path but still have a float of zero! These are the ones where you really want to pay attention and watch out for potential resource problems.

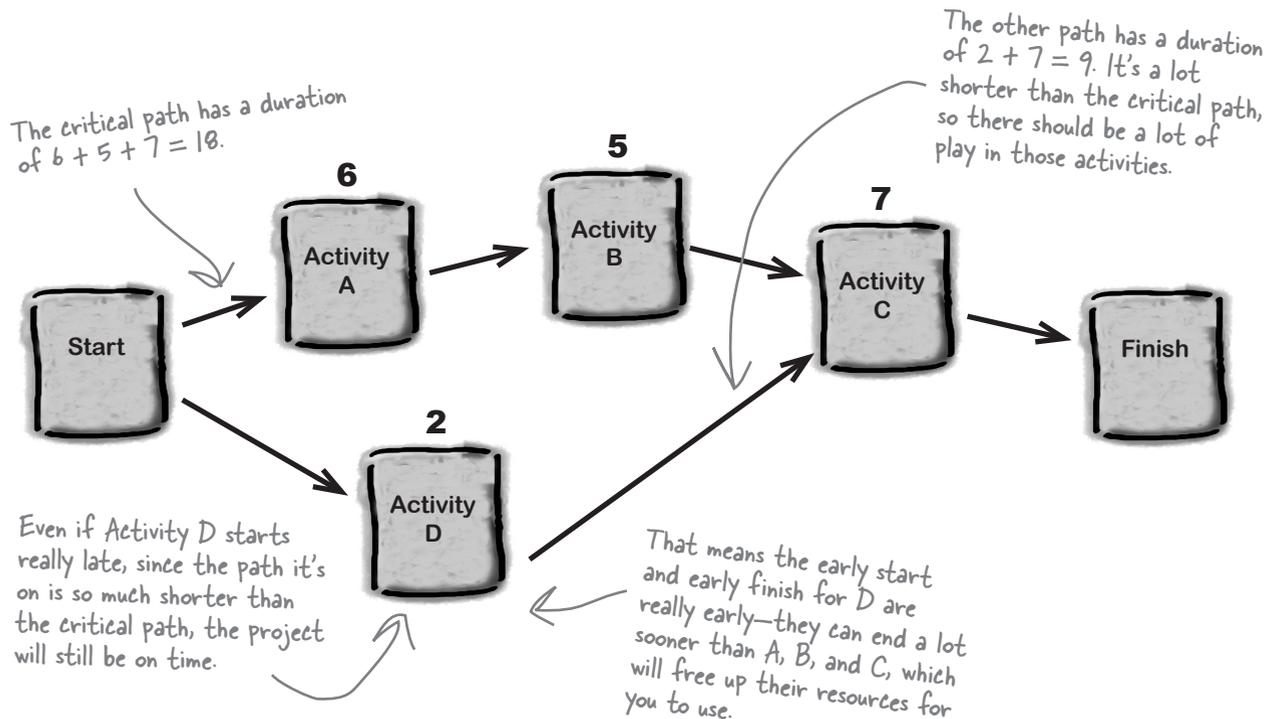


I SEE...SO WHEN I CREATED THE NETWORK DIAGRAM IN SEQUENCE ACTIVITIES, I WAS BUILDING ON WHAT I DID IN DEFINE ACTIVITIES. IT ALL TIES TOGETHER!

**All of the processes in Project Schedule Management tie together! When you develop your schedule, you're using the durations for your activities that you came up with in Estimate Activity Durations.**

## Figure out the early start and early finish

Coming up with the float for each activity is useful, but you can actually do better! When you have a long critical path, but the other paths in your network diagram are short, then you have a lot of freedom in when you can start and finish each of the activities that are not on the critical path. You can use **early start** and **early finish** to get a handle on exactly how much freedom you have in your schedule.



### Early start

Is the earliest time that an activity can start. An activity near the end of the path will only start early if all of the previous activities in the path also started early. If one of the previous activities in the path slips, that will push it out.

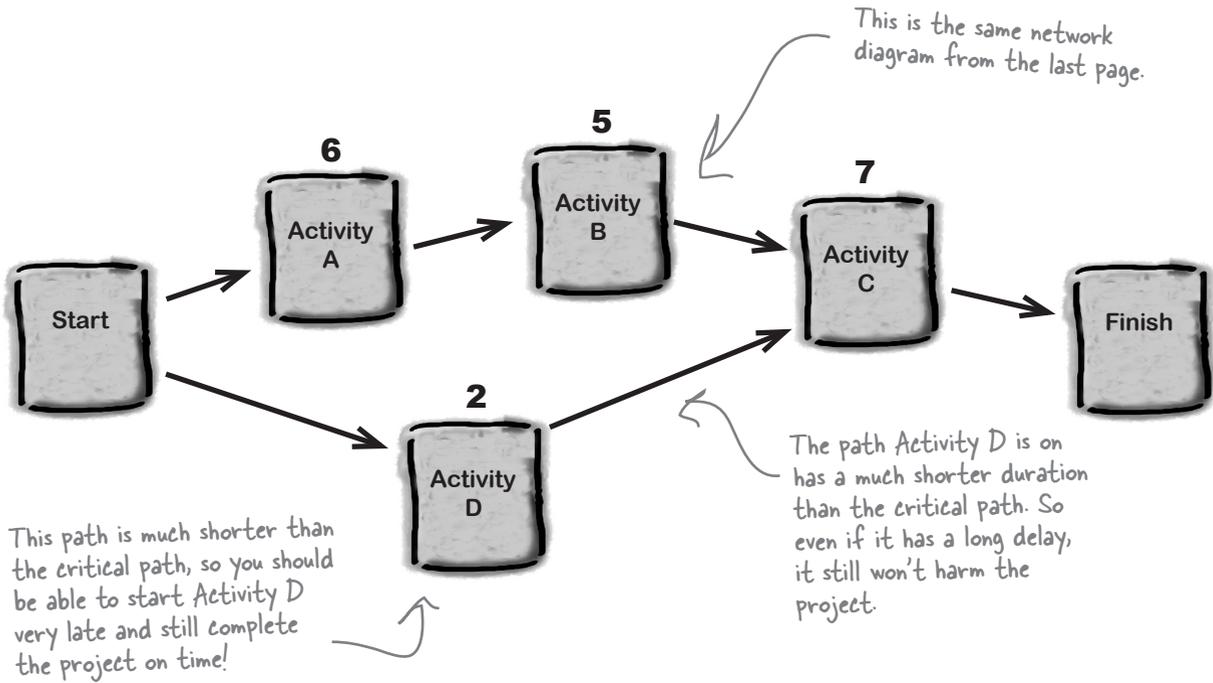
### Early finish

Is the earliest time that an activity can finish. It's the date that an activity will finish if all of the previous activities started early and none of them slipped.

**When you find the early start and early finish for each task, you know exactly how much freedom you have to move the start dates for those activities around without causing problems.**

## Figure out the latest possible start and finish

It's also important to know how late any activity can run before it delays the project. That's what **late start** and **late finish** are for! They let you figure out how late you can start a certain task and how much it can slip before it delays your project.



### Late start

Is the latest time that an activity can start. If an activity is on a path that's much shorter than the critical path, then it can start very late without delaying the project—but those delays will add up quickly if other activities on its path also slip!

### Late finish

Is the latest time that an activity can finish. If an activity is on a short path and all of the other activities on that path start and finish early, then it can finish very late without causing the project to be late.

**Figuring out the late start and late finish will help you see how much "play" you have in your schedule. An activity with a large late start or late finish means you have more options.**

## Add early and late durations to your diagrams

You can use a method called **forward pass** to add the early start and finish to each path in your network diagram. Once you've done that, you can use **backward pass** to add the late start and finish. It makes your network diagrams look a little more complicated, but it gives you a lot of valuable information.

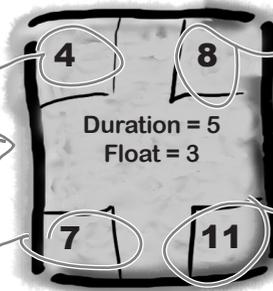
Early start and finish go in the upper corners. Write the name of the activity above it, and the duration and float inside the box.

You can use this special node in your network diagram to write down the early and late start and finish.

The early start for this activity is 4.

Write the late start in the lower-left hand corner. As long as the invitation design starts by day 7, it won't delay the critical path.

### Design invitations

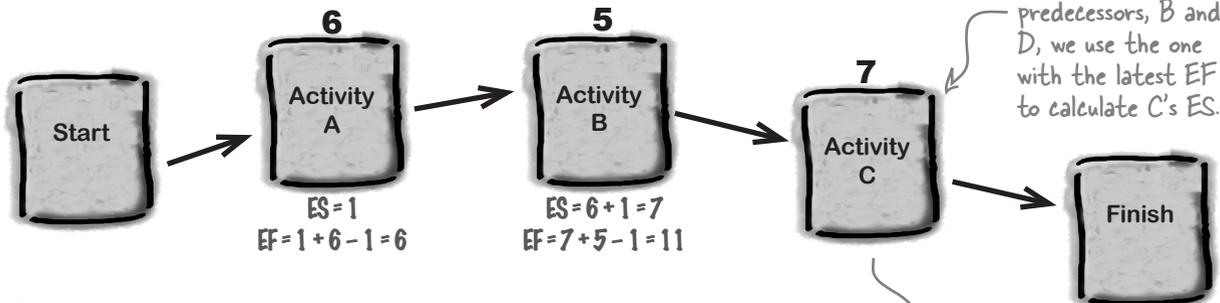


The early finish for this activity is 8. There's no way it can end before day 8.

The late finish for the Design Invitations activity is 11, which means the latest it can finish without delaying the schedule is on day #11. If it hasn't finished by then, Kathleen should worry!

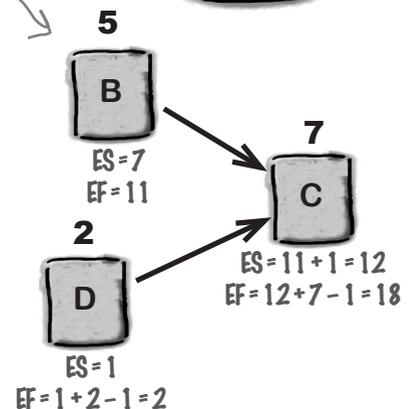
## Take a forward pass through the network diagram.

Start at the beginning of the critical path and move forward through each activity. Follow these three steps to figure out the early start and early finish!



Since C has two predecessors, B and D, we use the one with the latest EF to calculate C's ES.

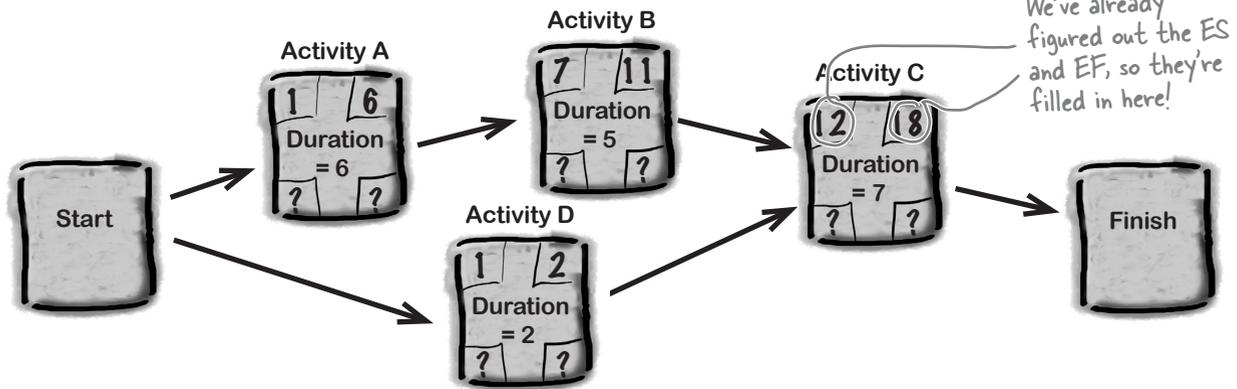
- 1 The ES (early start) of the first activity in the path is 1. The EF (early finish) of any task is its ES plus its duration minus 1. So start with Activity A. It's the first in the path, so  $ES = 1$ , and  $EF = 1 + 6 - 1 = 6$ .
- 2 Now move forward to the next activity in the path, which is Activity B in this diagram. To figure out ES, take the EF of the previous task and add 1. So for Activity B, you can calculate  $ES = 6 + 1 = 7$ , and  $EF = 7 + 5 - 1 = 11$ .
- 3 **Uh-oh! Activity C has two predecessors.** Which one do you use to calculate EF? Since C can't start until both B and D are done, use **the one with the latest EF**. That means you need to figure out the EF of Activity D (its ES is 1, so its EF is  $1 + 2 - 1 = 2$ ). Now you can move forward to Activity C and calculate its EF. The EF of Activity D is 2, which is smaller than B's EF of 11, so for Activity C the  $ES = 11 + 1 = 12$ , and  $EF = 12 + 7 - 1 = 18$ .



## Take a backward pass to find late start and finish

You can use a **backward pass** through the same network diagram to figure out the late finish and start for each activity.

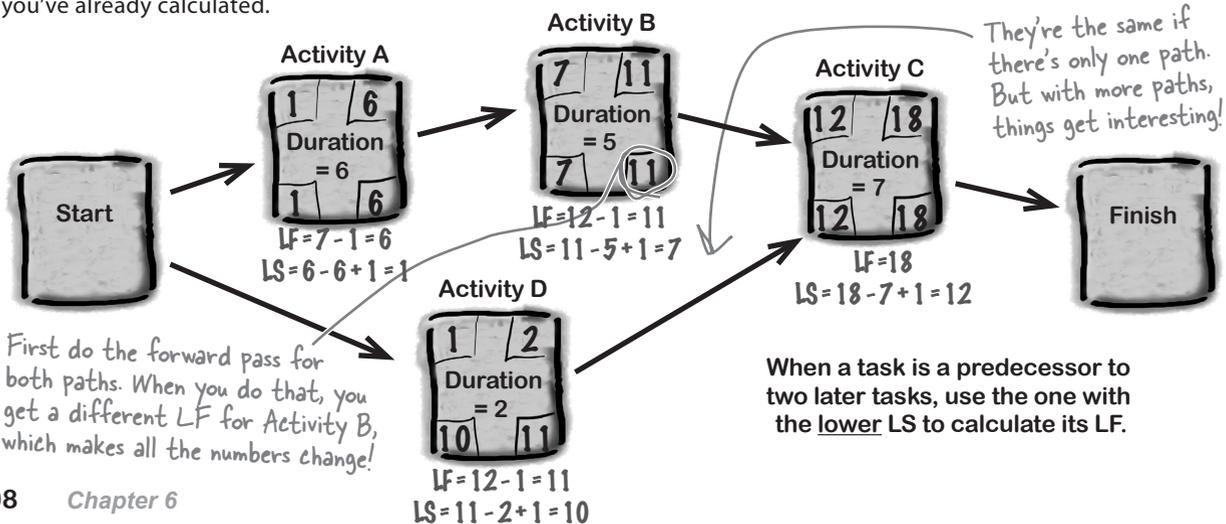
The backward pass is just as easy as the forward pass. Start at the end of the path you just took a pass through and work your way backward to figure out the late start and finish.



### Start with the critical path.

You're calculating the latest any activity can start and finish, so it makes sense that you need to start at the end of the project and work backward—and the last activity on the critical path is always the last one in the project. Then do these three steps, working backward to the next longest path, then the next longest, and so on, until you've filled in the LS and LF for all of the activities. Fill in the LF and LS for the activities on each path, but **don't replace** any LF or LS you've already calculated.

- 1 Start at the end of the path, with Activity C. The LF (late finish) of the last activity is the same as the EF. Calculate its LS (late start) by subtracting its duration from the LF and adding 1.  $LS = 18 - 7 + 1 = 12$ .
- 2 Now move backward to the previous activity in the path—in this case, Activity B. Its LF is the LS of Activity C minus 1, so  $LF = 12 - 1 = 11$ . Calculate its LS in the same way as step 1:  $LS = 11 - 5 + 1 = 7$ .
- 3 Now do the same for Activity A. LF is the LS for Activity B minus 1, so  $LF = 7 - 1 = 6$ . And LS is LF minus duration plus 1, so  $LS = 6 - 6 + 1 = 1$ .
- 4 Now you can move onto the next longest path, Start-D-C-Finish. If there were more paths, you'd then move on to the next longest one, and so on, filling in LF and LS for any nodes that **haven't already been filled in**.



When a task is a predecessor to two later tasks, use the one with the lower LS to calculate its LF.

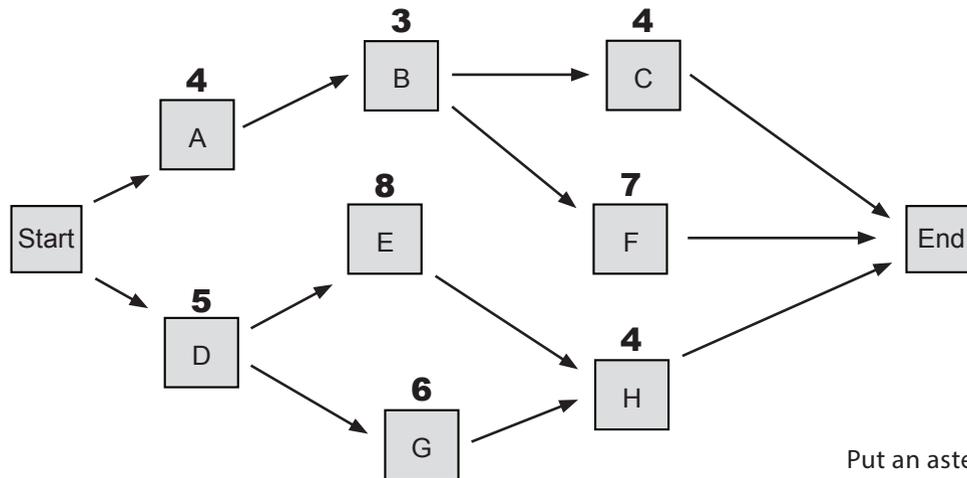
# Let's take some time out to walk through this!

All of this critical path stuff seems pretty serious, right? It seems like one of the toughest concepts on the exam...at first! But don't sweat it, because it's actually not hard—it just takes a little practice. Once you do it yourself, you'll see that there's really nothing to worry about.

*Calculating the ES, EF, LS, and LF may seem complicated, but it only takes a little practice to get the hang of it. Once you walk through it step by step, you'll see that it's actually pretty easy!*



There are four paths in this network diagram. Fill in the activity names and durations for each of the paths.



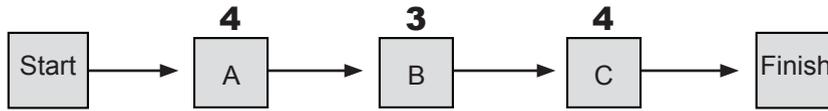
Put an asterisk (\*) next to the critical path.

Start	→	<input type="text"/>	→	<input type="text"/>	→	<input type="text"/>	→	Finish
Start	→	<input type="text"/>	→	<input type="text"/>	→	<input type="text"/>	→	Finish
Start	→	<input type="text"/>	→	<input type="text"/>	→	<input type="text"/>	→	Finish
Start	→	<input type="text"/>	→	<input type="text"/>	→	<input type="text"/>	→	Finish

**We're not done yet! There's more on the next page...**

# Sharpen your pencil

Take a forward pass through each of the four paths in the diagram and fill in the early starts and early finishes for each activity. Start with the first one.



Remember, the early start of the first activity in a path is 1.

ES= \_\_  
EF= \_\_

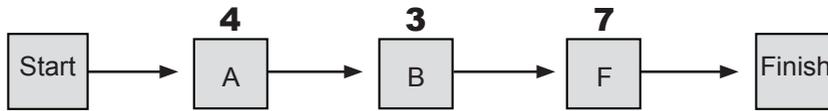
ES= \_\_  
EF= \_\_

ES= \_\_  
EF= \_\_

The early finish of an activity is its ES plus its duration minus 1.

The early start of an activity is the early finish of the previous activity plus 1.

Let's move on to the second path.

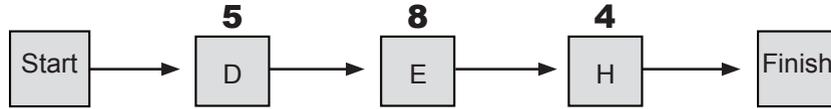


ES= \_\_  
EF= \_\_

ES= \_\_  
EF= \_\_

ES= \_\_  
EF= \_\_

The next path isn't as straightforward as it looks. Start by filling in its values.



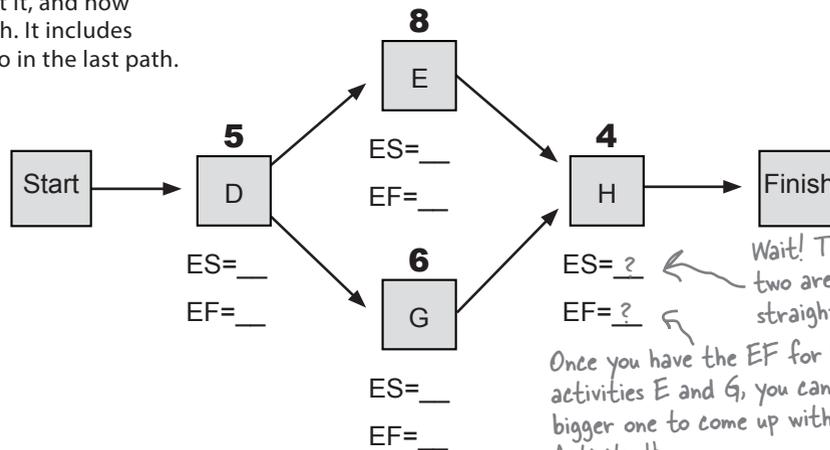
ES= \_\_  
EF= \_\_

ES= \_\_  
EF= \_\_

ES= \_\_  
EF= \_\_

Now take another look at it, and how it mixes with the last path. It includes Activity H, which was also in the last path.

H will have a different ES depending on which path you use! So which predecessor do you use: E or G? The idea here is that you **use the predecessor with the larger EF value** when you calculate the ES for activity H (because you want the **latest possible** start date).



ES= \_\_  
EF= \_\_

ES= \_\_  
EF= \_\_

ES= ?  
EF= ?

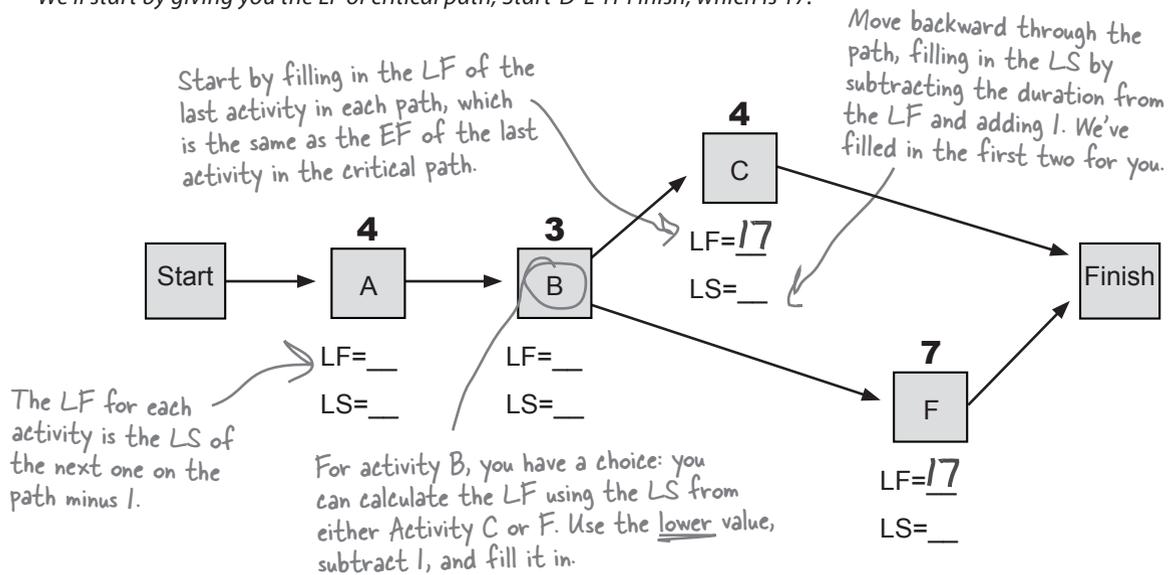
Wait! These two aren't so straightforward.

Once you have the EF for both activities E and G, you can use the bigger one to come up with the ES for Activity H.

You've calculated the ES for each activity. Use that information and take a backward pass through the paths, starting with the first two paths.

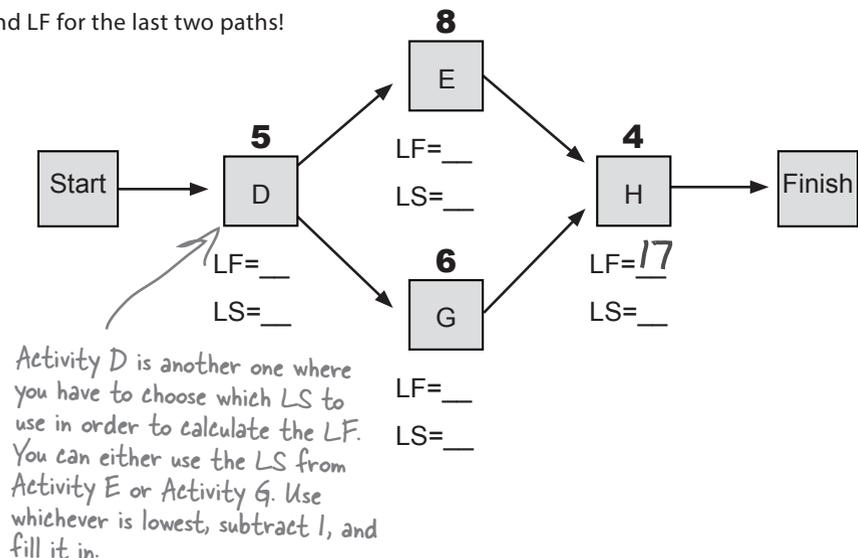
**First start with the critical path.** Take the EF of the last activity in the critical path and use it as the LF for the last activity in **every** path. If you take a minute to think about it, it makes sense to do that. The point of LF is to figure out the absolute latest that the activity can end without making the project late. And as long as every non-critical-path activity ends before the last activity in the critical path, then it won't be late.

We'll start by giving you the LF of critical path, Start-D-E-H-Finish, which is 17.



Finish up by calculating the LS and LF for the last two paths!

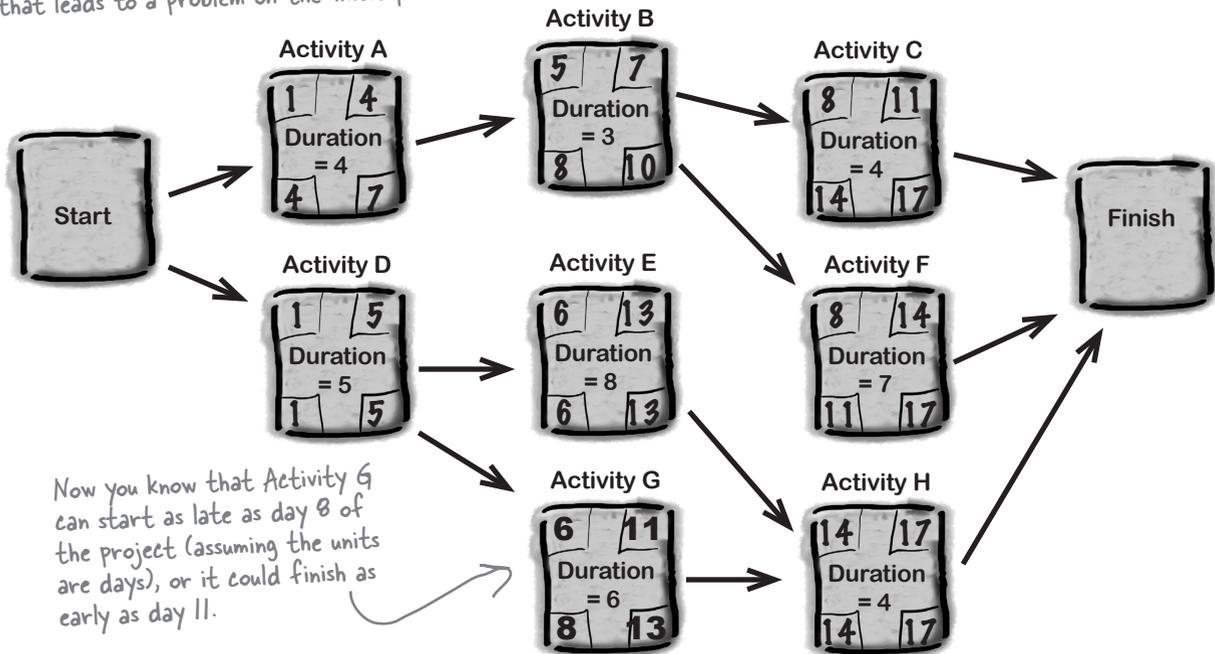
Activities B and D have two possible choices for which LS to use for the calculation. For Activity B, do you use the LS of C or the LS of F? And for Activity D, do you use Activity E or G? The answer is that you always **use the lowest value of LS to calculate the LF**. The reason is that you're trying to find the latest possible start date that *won't make the project late*. If you use an activity with a later LS, and the activity really is delayed by that much, then it'll cause a delay in both following activities. And that will make the one with the lower LS start too late.



## Sharpen your pencil Solution

If you got a few of these wrong, don't worry. It's easy to miss one calculation, and that leads to a problem on the whole path.

For the exam, you'll only have to do one or two of these calculations, not a whole string of them like this. You'll definitely be able to handle the exam questions now!



WAIT A MINUTE...I'VE NEVER HAD TO DO THIS FOR MY PROJECTS AT WORK! I'VE GOT PROJECTS WITH DOZENS OF ACTIVITIES, AND THIS WOULD TAKE ALL DAY!

**You won't have to do this kind of thing on the job...that's what computers are for!**

Project management software like Microsoft Project will do these calculations for you. But you need to know how to do it yourself, because when the computer is doing critical path analysis, this is exactly how it figures it out!

## there are no Dumb Questions

**Q:** Would I really use this critical path stuff in real life, or is it just something I need to memorize for the PMP exam?

**A:** Yes, critical path analysis really is important in real life! Sure, for a small project with a dozen or so activities, it's pretty easy to figure out which activities are critical and which can slip by a little bit. But what happens if you've got a project with dozens of team members and hundreds of activities? That's where critical path analysis can come in very handy. For a project like that, you'd probably be using project management software rather than calculating the critical path yourself, and the software will be able to highlight that path for you. Pay special attention to all of the activities that are on the critical path—those are the ones that could potentially delay the project.

**Q:** What about the other numbers? How do I use float?

**A:** Float is a very powerful planning tool that you can use to figure out how well your

project is going, and to predict where your trouble spots might be. Any activity with a low or zero float absolutely must come in on time, while the people performing an activity with a larger float have more freedom to slip without delaying the project. So you might want to assign your “superstar” resources to the low-float activities, and those people who need a little more mentoring to the ones with higher float.

**Q:** OK, but what about late start, early finish, and those other numbers? Do those do me any good?

**A:** Early and late start and finish numbers are also very useful. How many times have you been in a situation where you've been asked, “If we absolutely had to have this in two months, can we do it?” Or, “How late can this project realistically be?” Now you can use these numbers to give you real answers, with actual evidence to back them up.

Here's an example. Let's say you've got an activity in the middle of your project, and

one of your team members wants to plan a vacation right at the time that the activity will start. Do you need to find someone to fill in for him? If he'll be back before the late start date, then your project won't be late! But that comes at a cost—you'll have used up the extra slack in the schedule.

**Q:** I can see how the critical path is useful on its own, but what does it have to do with the rest of Project Schedule Management?

**A:** If you start putting together your schedule but the activities are in the wrong order, that's really going to cause serious problems...and sometimes doing critical path analysis is the only way you'll really figure out that you've made that particular mistake. That's why you need to pay a lot of attention to the Sequence Activities tools and techniques. If you've come up with an inefficient or inaccurate sequence, with too many or incorrect predecessors and dependencies, then your entire critical path analysis will be useless.

### BULLET POINTS: AIMING FOR THE EXAM

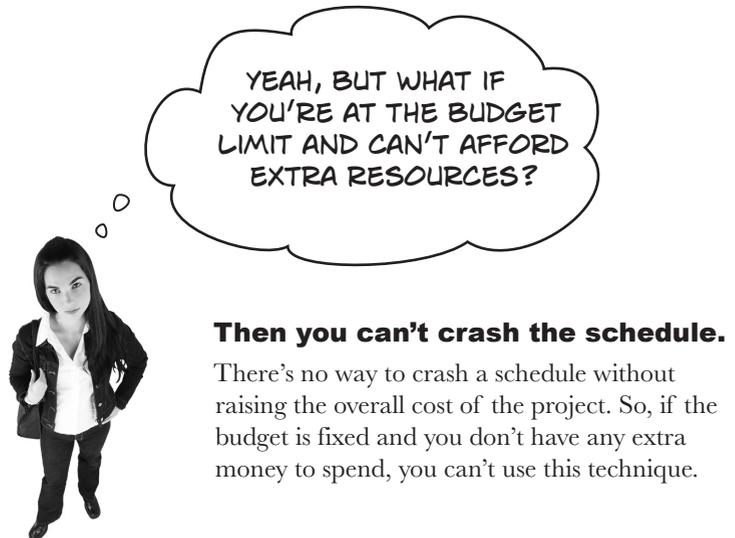
- The **critical path** is the path that has the longest duration.
- You should be able to figure out the number of paths in a **project network diagram**, and the duration of each path.
- The **float** for an activity is the amount that its duration can slip without causing the project to be delayed. The float for any activity on the critical path is zero.
- You'll need to know how to calculate the **early start, late start, early finish, and late finish** for an activity in a network diagram using the forward pass and backward pass. This is the core of critical path analysis.
- You may see a **PDM** (or **activity-on-node**) diagram with special nodes that have extra boxes in the corners for the ES, EF, LF, and LS.
- Don't forget that when two paths intersect, you have to decide which ES or LF value to take for the calculation in the next node. For the **forward pass**, use the larger value; for the **backward pass**, use the smaller one.

## Crash the schedule

There are two important **schedule compression** techniques that you can use to bring in your project's milestone dates...but each has its own cost. When you absolutely have to meet the date and you are running behind, you can sometimes find ways to do activities more quickly by adding more resources to critical path tasks. That's called **crashing**.



**Crashing the schedule means adding resources or moving them around to shorten it. Crashing ALWAYS costs more and doesn't always work!**



### **Then you can't crash the schedule.**

There's no way to crash a schedule without raising the overall cost of the project. So, if the budget is fixed and you don't have any extra money to spend, you can't use this technique.

## Fast-tracking the project

Another schedule compression technique is called **fast-tracking**. Sometimes you've got two activities planned to occur in sequence, but you can actually do them at the same time. On a software project, you might do both your user acceptance testing and your functional testing at the same time, for example. This is pretty risky, though. There's a good chance you will need to redo some of the work you have done concurrently.

*On the exam, if you see something about "overlapping activities," it's talking about fast-tracking.*



WE CAN SAVE TIME BY HAVING THE FLORIST WORK ON THE RECEPTION HALL FLOWERS WHILE WE FIGURE OUT THE REST OF THE DECORATIONS.

*If the decorations don't match the flowers well enough, we'll have to do some rework.*

**Crashing and fast-tracking are SCHEDULE COMPRESSION tools.**



### Exercise

Each of these scenarios describes a schedule compression technique. Pick which are examples of fast-tracking and which are crashing.

- Kathleen guesses that 70% of the invitees will RSVP. Instead of waiting for all of them to come in, she goes ahead and reserves the tables and chairs now.
 

Fast-tracking       Crashing
- Rebecca is taking a really long time to choose the decorations, so Kathleen brings in a professional decorator to help, even though it will cost more.
 

Fast-tracking       Crashing
- Kathleen needs to get the invitations out quickly, so she hires two temps to come in and help her stuff envelopes for a few days.
 

Fast-tracking       Crashing

→ **Answers on page 335.**

## Use data analysis techniques when you build your schedule

It's always a good idea to think about all of the things that could go wrong on your project in advance. Trying to think through all of the possible problems your project could run into is called **what-if analysis**.

- What if the limo breaks down?
- What if the florist cancels at the last minute?
- What if the dress doesn't fit?
- What if the band gets sick?
- What if the guests get food poisoning?
- What if there's a typo in the church address on the invitation?
- What if the bridesmaids don't show up?
- What if the cake tastes horrible?
- What if we lose the rings?

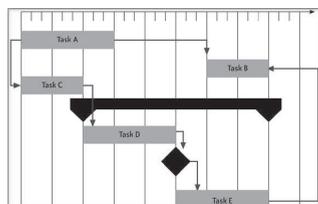


That way, you can figure out how to deal with any problems that might come your way. Sometimes there's no way to still meet your dates and deal with these scenarios. But it always makes sense to try to understand the impact they will have on your schedule.



### Simulation

This is a specific kind of what-if analysis where you model uncertainty using a computer. There are some packages that will help to calculate risk using random numbers and **Monte Carlo analysis** algorithms. While this is not a commonly used technique, there might be a question or two about it on the PMP exam, and you should know what it is.



### Scheduling tool

Using a project management software package to create a model of the schedule and adjusting various elements to see what might happen is another technique for analyzing network diagrams.

## Other Develop Schedule tools and techniques

There are just a few more tools and techniques in the Develop Schedule process that you should know.

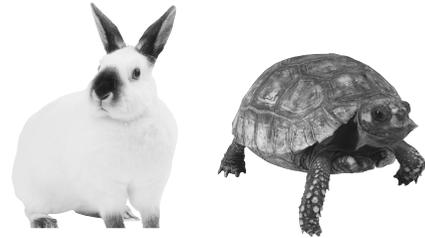
### Resource optimization techniques

Sometimes only one resource can do a given activity. If that resource is busy doing another activity on the critical path, the path itself needs to change to include that dependency. That's the point of resource leveling. It evaluates all of the resources to see if the critical path needs to change to accommodate resource assignments.



### Adjusting leads and lags

If you made any mistakes in your leads and your lags, you might be able to adjust them to change the projected end date.



### Data analysis: schedule compression and schedule network analysis

The last two tools and techniques in the Develop Schedule process are the ones you just learned over the last few pages: **schedule compression** and **schedule network analysis** using critical path, float, and the other schedule analysis techniques you just learned.



### Agile release planning

Agile teams typically have a cadence or timebox they use to develop. An Agile release plan takes the list of user stories that have been estimated for a release and uses their estimated size of effort to map them to an upcoming iteration. By presenting the release plan in this way, the team gives the product owner the ability to reprioritize stories and change the order in which stories will be released.

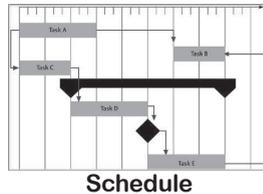
### Project management information system

Your company might have scheduling software that they use to generate schedules. You might also use a project management information system to reference existing company calendar information that might impact your schedule.

## Outputs of Develop Schedule

Of course, the main product of Develop Schedule is the schedule. But there are a few other supporting documents that help you understand how the work will get done as well.

### Outputs



### Project schedule

All of that analysis and modeling should produce a schedule that everyone can get behind. After thinking your way through everything that can go wrong and assigning resources, you should have a pretty accurate prediction of the work required to complete the project.

*The reason you go through all of that what-if analysis is to make sure everybody agrees that this schedule is achievable!*



Change requests

### Change requests

These are the same change requests that you've seen in other processes. They should be really familiar by now!



### Project calendars

Calendars will help you keep track of the time when team members will be away on vacation or unavailable to work on your project.

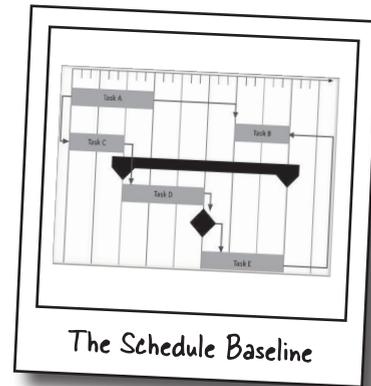
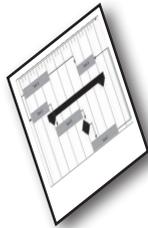


Schedule data

### Schedule data

The schedule data is a collection of information about your schedule. It will include things that you'll need to analyze your schedule later on in the project: alternative schedules, specific requirements for resources, milestone charts, bar charts, project schedule network diagrams, and other data and metrics about your schedule.

Before you can do change control, you need requested changes. Once the change is approved, you can update the baseline.



This is just like the scope baseline in the last chapter.



### Schedule baseline

When the Develop Schedule process is complete, a baseline is created so that actual progress can be compared to the plan.



### Project Management plan updates

Since the schedule baseline and Schedule Management plan are both part of the Project Management plan, it makes sense that it would have to be updated.



### Project documents updates

While you're creating the schedule, you might find that you need to update calendars, your resource requirements, the attributes of the activities themselves, or even your risk register, to name a few possibilities.

## \* WHAT'S MY PURPOSE \*

For the exam, you need to know Develop Schedule outputs. Several outputs from the wedding's Develop Schedule process are on the left. Match them to the correct description on the right.

- |                             |   |
|-----------------------------|---|
| A. Project schedule         | 1. Kathleen gives a list of dates to the caterer telling him when he will need to have his menu plans, and when the shopping for the ingredients will need to be complete for the reception and rehearsal dinner. |
| B. Schedule data            | 2. Kathleen realizes that she needs to make a change to how she keeps track of the waiters' time, so she makes a change to the document that describes it.  |
| C. Schedule baseline        | 3. While making the schedule, Kathleen realizes that the catering company can't work from 3 to 4 on the day of the event because they'll be traveling from another event.   |
| D. Project calendars        | 4. Kathleen makes a copy of the schedule when it's done so that she can compare how she is doing to the original plan.  |
| E. Project document updates | 5. There's a big poster on the wall where Kathleen keeps track of who does what, and when.  |

Answers: A-5; B-1; C-4; D-3; E-2

## there are no Dumb Questions

**Q:** Don't we need to go through change control before we update the resource requirements or the activity attributes?

**A:** No. You need to go through change control if you are requesting changes to, say, your Cost Management plan. But while you are working on creating your schedule, everything you have created as part of the Project Schedule Management knowledge area is fair game.

As you work your way through your network diagram and figure out new dependencies, you will find that you need more resources for some items or that the activity itself has changed. That's why this process gives you the freedom to refine your earlier idea and make all of the Project Schedule Management documents sync with your new understanding.

The Develop Schedule process is about taking all of the information you can think of up front and putting it into a schedule that is realistic. When you are done with this process, you should have a really good idea of what you are going to do, who will do it, and how long it will take.

**Q:** We always want to do our projects as quickly as we can. Why don't we always fast-track and crash our schedules?

**A:** Because crashing is expensive and fast-tracking is risky. While it may look good on paper to add a lot of resources to a project that is running late, it often adds so much management overhead and training issues that the project just comes in later.

Even though it might seem like some predecessors are really unnecessary, you usually planned them for a reason. So when you break your dependencies to fast-track your project, you can significantly compromise the quality of the work that gets done. That means you might have to redo it altogether—which would probably take a lot of time.

While fast-tracking and crashing might work sometimes, they always add both risk and cost to your project.

**Q:** Do people really do Monte Carlo analysis to figure out their schedules? I have never heard of that before.

**A:** It's true that most people don't use this technique to figure out what might go wrong on their projects, so don't feel bad if you've never heard of it. Some people think that this is just one of those things that is on the PMP exam, so you have to know what it is. But there really are some project managers who use it and get great results!

**Updates refine  
the outputs of  
previous processes  
so you don't have  
to go back and  
redo them.**

## Influence the factors that cause change

**Kathleen doesn't just sit around and wait for schedule changes to happen...**

You might get a question on the PMP exam that asks you about this.

SOMETHING DOESN'T SEEM RIGHT WITH THE CATERING.



**Joe (on phone):** Good afternoon, Joe's Catering. Joe speaking. How can I help you?

**Kathleen:** Hello, Joe. This is Kathleen calling about Rob and Rebecca's wedding.

**Joe:** Oh, hi! Everything's going fine with that wedding.

**Kathleen:** Are you sure? What about that big convention across town that's going to be happening at the same time? Won't it be tough to find waiters in June?

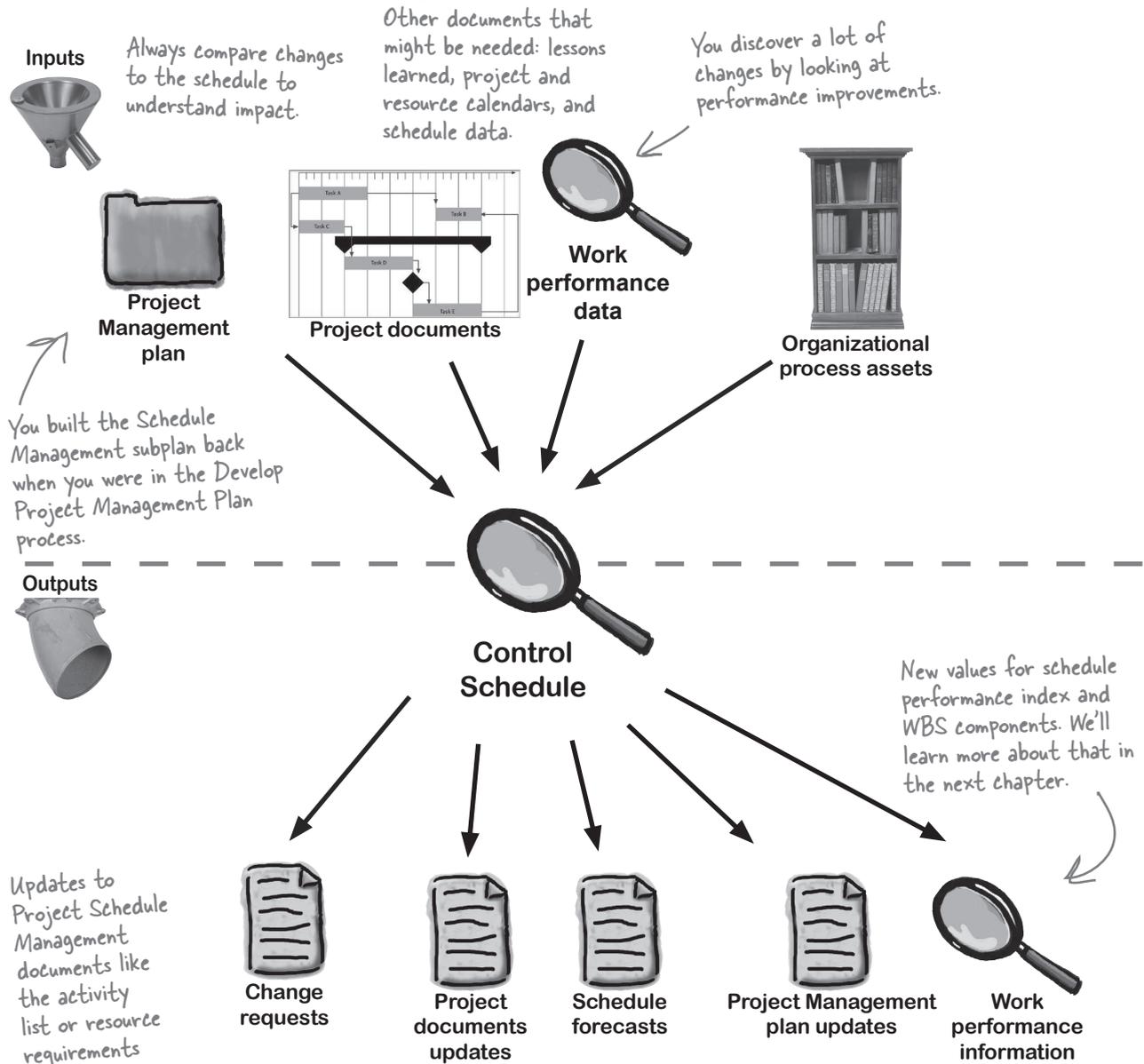
**Joe:** I didn't think of that; we'd better start figuring out how we'll handle it now.

By realizing that the convention across town will need waiters, too, Kathleen prevents a lot of changes before they cause schedule problems!

**The project manager doesn't just wait for change to happen! She finds the things that cause change and influences them.**

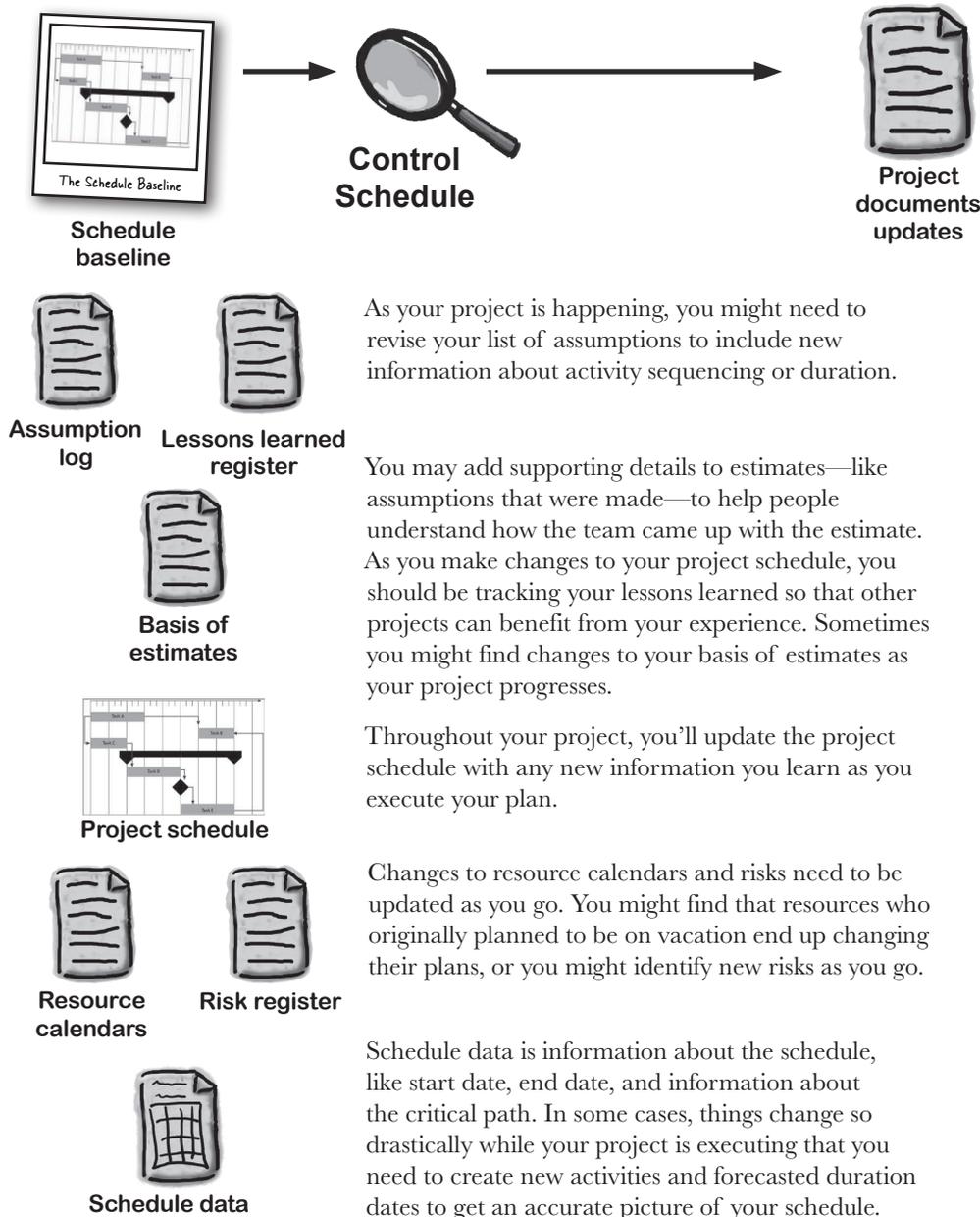
# Control Schedule inputs and outputs

As the project work is happening, you can always discover new information that makes you reevaluate your plan, and use the **Control Schedule process** to make the changes. The inputs to Control Schedule cover the various ways you can discover that information. The outputs are the changes themselves.



## What Control Schedule updates

All of the documents you made during the Develop Schedule process get updated during the Control Schedule process. Here's a closer look at what those updates mean.



As your project is happening, you might need to revise your list of assumptions to include new information about activity sequencing or duration.

You may add supporting details to estimates—like assumptions that were made—to help people understand how the team came up with the estimate. As you make changes to your project schedule, you should be tracking your lessons learned so that other projects can benefit from your experience. Sometimes you might find changes to your basis of estimates as your project progresses.

Throughout your project, you'll update the project schedule with any new information you learn as you execute your plan.

Changes to resource calendars and risks need to be updated as you go. You might find that resources who originally planned to be on vacation end up changing their plans, or you might identify new risks as you go.

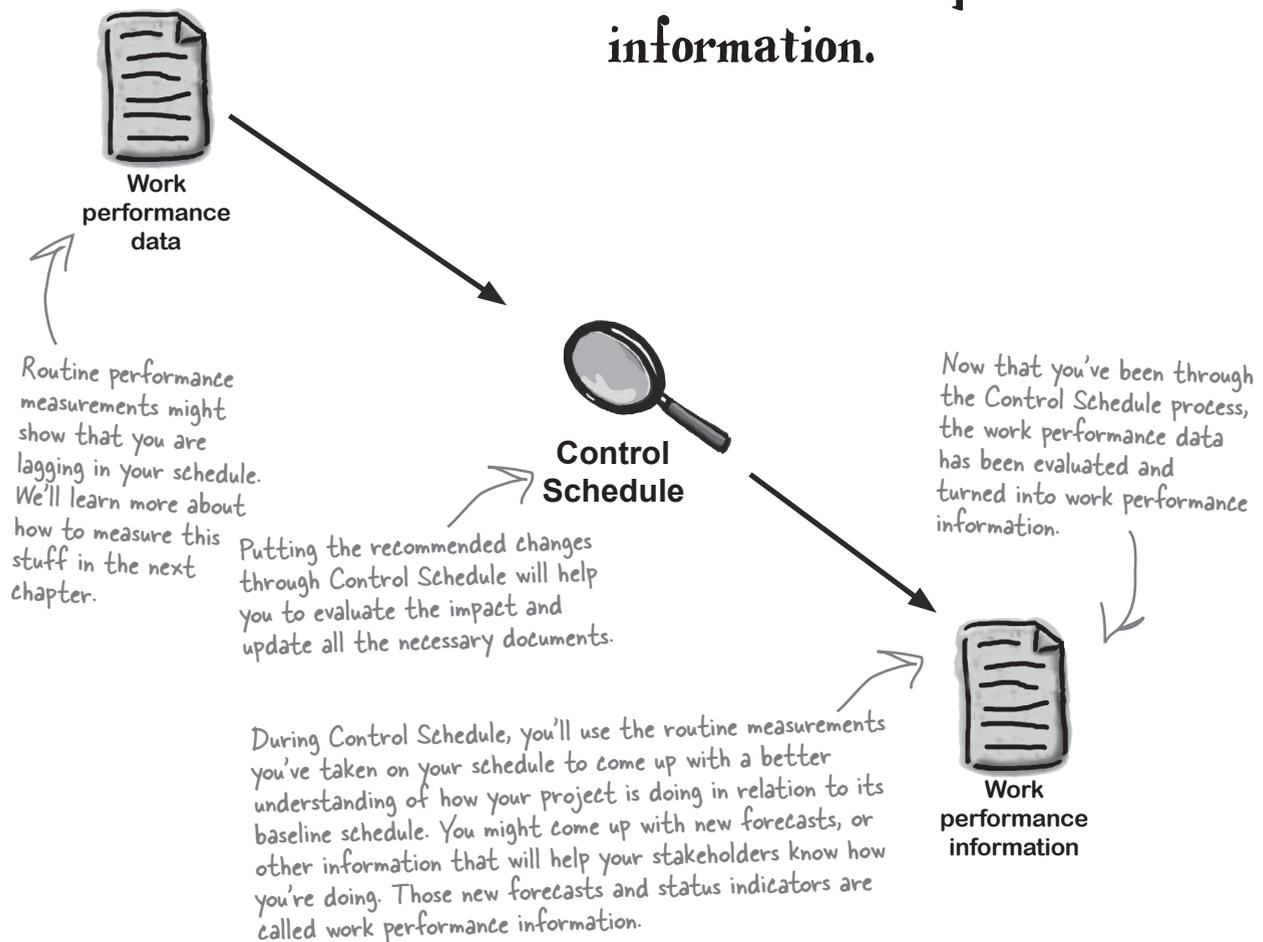
Schedule data is information about the schedule, like start date, end date, and information about the critical path. In some cases, things change so drastically while your project is executing that you need to create new activities and forecasted duration dates to get an accurate picture of your schedule.

**Managing  
schedule  
change  
means  
keeping  
all of your  
project  
documents  
up to date.**

## Measuring and reporting performance

Most often, you identify changes by looking at performance data. It's just as important once you make a change to gather performance data as it was when you found the change in the first place. Here's how performance data feeds into the Control Schedule process.

### The Control Schedule process turns work performance data into work performance information.



## Control Schedule tools and techniques

The tools and techniques for Control Schedule are all about figuring out where your project schedule stands. By comparing your actual project to the schedule you laid out in the baseline and looking at how people are performing, you can figure out how to handle every schedule change.



### Data analysis

In this process you use data analysis to evaluate the information coming in from the project to forecast whether or not your team is going to meet its forecasted dates. There are two important calculations called schedule variance (SV) and schedule performance index (SPI) that give you valuable information about how your project is doing. Those two calculations are part of the **earned value technique**, which you'll learn all about in the next chapter.

Agile teams often use **iteration burndown** charts to gauge whether they are ahead or behind on work they've committed to accomplishing within a given timeboxed iteration.

**Performance reviews** are used to compare actual dates versus the dates in the schedule baseline. **Trend analysis** lets you see if performance of the team is getting better or worse over time. **Variance analysis** is when you dig in and try to understand the cause of the variance between actual dates and the dates in the baseline. **What-if scenario analysis** allows you to model possible schedule changes to mitigate risks or respond to changes.

### Leads and lags, and schedule compression

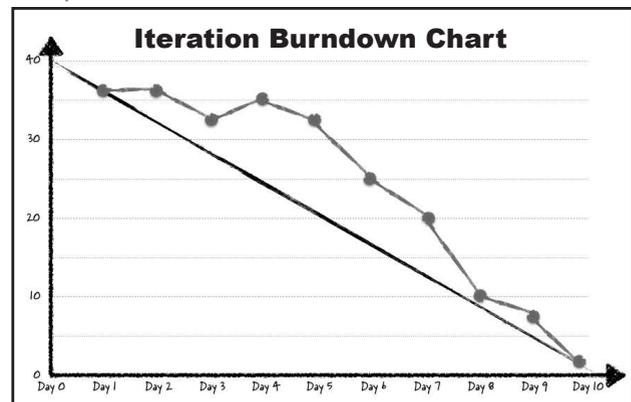
Most of the tools from the last process apply to this one too. As you find variances in the schedule, you need to figure out the impact of those issues and change your schedule to account for the new information.

### Resource optimization

As things change in your project, you need to make sure that resources are covering all of the activities in your plan. That means you need to distribute resources so that the work that needs to get done always has a resource available to do it.

Each item the team commits to is estimated in story points and the total story points in the plan are the high number on the y axis.

The top line represents how much work the team has left to do each day.



The straight line represents where the total number of points would be if the team accomplished the same amount of work every day.

### Critical path method

Use the precedence diagramming method to figure out your early start and late finish for all of the tasks in your project. Then calculate the float to find which tasks are in the critical path. Once you know the critical path, you can choose to fast-track or crash the schedule to optimize the amount of time your project will take.

### Project management information system

This is software like Microsoft Project that helps you organize and analyze all of the information you need to evaluate the schedule of any project.

## there are no Dumb Questions

**Q:** When I create work performance information, who uses it?

**A:** The work performance information that you create is used by a lot of people. The team uses it to keep an eye on the project. If there's a schedule problem coming up, it alerts the team so that they can help you figure out how to avoid it.

Performance information is also used by your project's sponsor and stakeholders, who are very interested in whether or not your project is on track. That information gives them a good picture of how the project is doing...and that's especially important in Control Schedule, because most change control systems require that every change is approved by a change control board that includes sponsors and stakeholders.

**Q:** What's schedule data used for?

**A:** You use the schedule data to build the schedule, and you'll usually generate and analyze it using a schedule tool (like Microsoft Project). It includes detailed information about things like resource requirements, alternate best-case and worst-case schedules, and contingency reserves.

When you put together your schedule, you should look at all of these things in order to create an accurate plan. The more information you have when you're building your schedule, the more likely it is that you'll catch those little problems that add up to big schedule slips.

**Q:** One of the tools is project management software. Do I need to know how to use software in order to pass the exam?

**A:** No. The PMP exam does not require that you know how to use software like Microsoft Project. However, if you spend a lot of time using project management software, then you probably have become very familiar with a lot of the Project Schedule Management concepts. It's a good way to learn the basics of schedule management.

**Q:** How often am I supposed to update the project calendar?

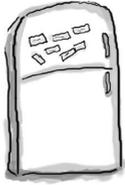
**A:** The project calendar shows you the working days for your team, holidays, nonworking days, planned training, and the dates that could affect your project. Luckily, in most companies these dates don't change very often. You probably won't need to update it—and most project managers just use their company's existing project calendar.

When you're doing Develop Schedule, you may discover that you need to make a change to the project calendar. That's why updates to the project calendar are an output of Develop Schedule.

**Q:** What do I do with work performance data and work performance information once I've collected it?

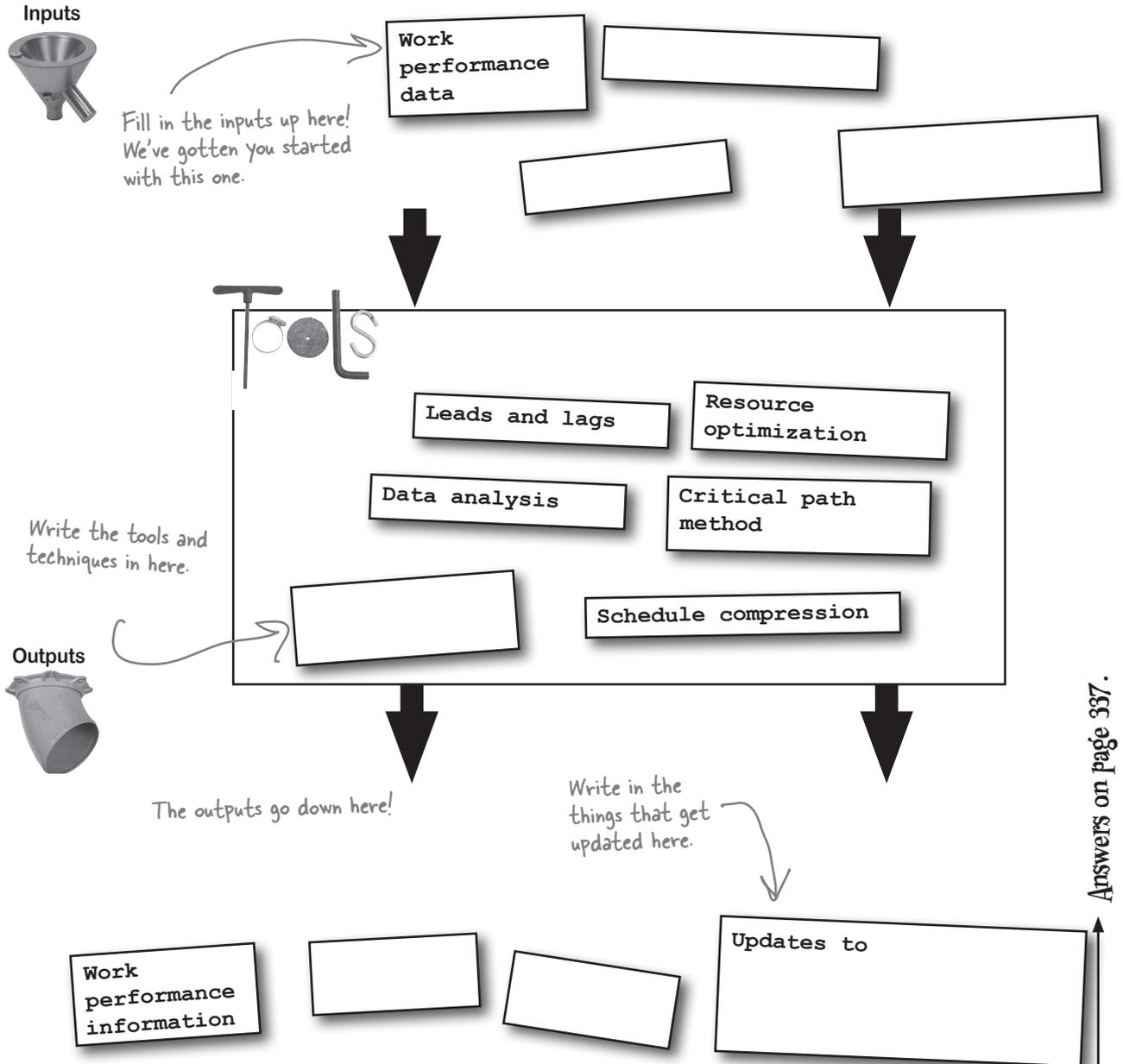
**A:** When you're planning your project, you'll often look to your company's past projects to see what went well and what could have been planned better. And where do you look? That information is in the organizational process assets. So where do you think that information comes from? It comes from project managers like you who added their work performance data and information to the company's organizational process asset library.

**Any time you generate data about your project, you should add it to your organizational process assets so you can use it for future projects.**



## Control Schedule Magnets

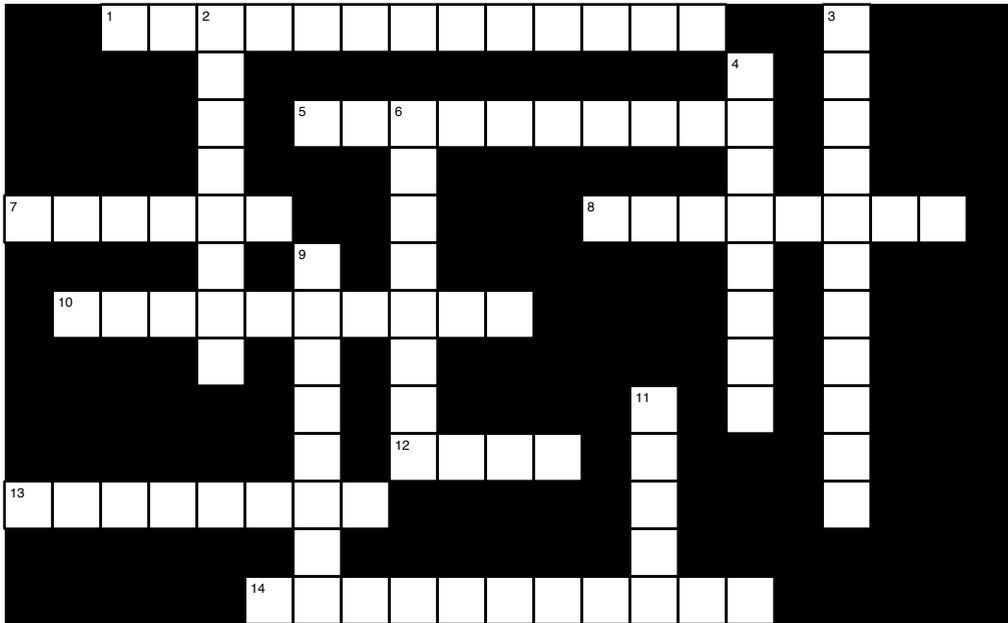
You'll see change control over and over again—every single knowledge area has its own change control process! Luckily, you'll start to see how similar they all are. But Control Schedule has its own quirks, and they're important for understanding Project Schedule Management.





# Schedulecross

Take some time to sit back and give your right brain something to do. It's your standard crossword; all of the solution words are from this chapter.



## Across

1. Taking work packages from the WBS and breaking them down into activities.
5. The "P" in PDM.
7. The kind of analysis where you ask a lot of questions about possibilities.
8. A snapshot of the schedule that you can use for later comparison.
10. \_\_\_\_\_ estimation means plugging data about your project into a database of historical information to get an estimate of how long it will take to do the work.
12. Giving a successor task some time to start before a predecessor finishes.
13. Adding more resources to a project so you can get it done faster is called \_\_\_\_\_ the schedule.
14. A PERT three-point estimate is optimistic time +  $4 \times$  most likely time + \_\_\_\_\_ time and divided by 6.

## Down

2. Any delay in an activity on the \_\_\_\_\_ path will delay the entire project.
3. You do this sort of planning when you get more information as the project progresses.
4. What you're doing to resources when you evaluate all of them to see if the critical path needs to change to accommodate their restrictions.
6. An activity with a dependency on something outside the project has an \_\_\_\_\_ predecessor.
9. \_\_\_\_\_ Activities is the process where you put the activities in order.
11. How long an activity can slip before the whole project is delayed.

—————▶ **Answers on page 338**



Understanding how long it will take to do the work within your project is a core part of the job. **Project Schedule Management** is how you come to understand the way your work stacks up once you figure in the order you'll use to do it and how long each thing your team needs to do will take.



## KEY CONCEPTS

We've talked about the processes you and your team will use when identifying and managing the schedule, but it's worth taking a minute to think about how your approach to schedule management affects the overall project.

- ★ The main product of the Project Schedule Management processes is a **detailed plan**. Your plan will make the timeline for your project clear and will show your stakeholders how your team plans to meet its goal and how long each step they've identified will take.
- ★ Most teams use **scheduling software** to figure out their planned dates once they've spent some time nailing down the list of activities they'll do and the estimated durations for those activities.
- ★ Some teams who are working on projects with smaller scope and more near-term deadlines think of their entire scheduling process as one step. They figure out all of the activities they'll need to accomplish, the sequence they'll do them in, and their durations all in **one estimation session**.
- ★ Since changes across all of the knowledge areas often affect the project timelines, the **schedule should be flexible** and updated frequently.

**SCHEDULE MANAGEMENT IS ABOUT GETTING A HANDLE ON HOW THE TEAM WILL WORK AND WHEN THE PROJECT WILL BE DELIVERED.**

## TRENDS

Here are a few trends in Schedule Management that might help you to improve and manage the timeline for your projects more effectively.

- ★ **Iterative scheduling** uses a backlog of requirements or user stories, and pulls items from that backlog into timeboxed iterations as a means of sequencing work at the last responsible moment. Agile teams use this technique to avoid determining all of their dependencies up front. This gives them the freedom to adapt to change without resetting detailed schedule expectations.
- ★ **On-demand scheduling** is similar because it focuses on pulling work from a backlog and completing it as soon as possible. The main difference between this technique and iterative scheduling is that it doesn't rely on predetermined timeboxed iterations to forecast an end date. Instead, items are delivered as they are completed.



## TAILORING

When you make changes to the processes your team will use during the course of your project, there are a few considerations, that might influence your decisions:



- ★ What development lifecycle will your project follow? Should you focus on building a detailed schedule up front, or will you define iteration timeboxes, prioritize the work, and let the team deliver in priority order?
- ★ Do you know if there are resources who won't be available for specific timeframes and if that will affect your schedule?
- ★ Is your project innovative or highly uncertain? How will you know if your project plan is focused on reducing uncertainty as it progresses? How will you track your progress on the project?
- ★ If your project is dependent on a tool or technology, will you be able to use that tool easily?

## AGILE CONSIDERATIONS

Agile teams focus on team collaboration around commitments and making decisions at the last responsible moment. They use short iterations to create feedback loops that let them change the activities they'll do and their sequence when new information arises. Agile teams use timeboxes and an understanding of the rate at which work is accomplished (velocity) to give a sense of when items will be completed, but always leave the option to change the approach to delivering products when priorities change.

## Another satisfied customer!

Rob and Rebecca had a beautiful wedding! Everything was perfect. The guests were served their meals, the band was just right, and everyone had a blast...



**...and Kathleen got lots of referrals!**





## Exercise Solution

Each of these scenarios describes a different tool or technique from Estimate Activity Durations. Write down which tool or technique is being described.

1. Kathleen comes up with three estimates (one where everything goes wrong, one where some things go wrong, and one where nothing goes wrong) for printing invitations, and averages them together to come up with a final number. **Three-point estimate**.....
2. There will be two different catering companies at the wedding. Kathleen asks the head chef at each of them to give her an estimate of how long it will take to do the job. **Expert judgment**.....
3. There's a spreadsheet Kathleen always uses to figure out how long it takes guests to RSVP. She enters the number of guests and their zip codes, and it calculates an estimate for her. **Parametric estimating**.....
4. Kathleen's done four weddings that are very similar to Rob and Rebecca's, and in all four of them it took exactly the same amount of time for the caterers to set up the reception hall. **Analogous estimating**.....



## Exercise Solution

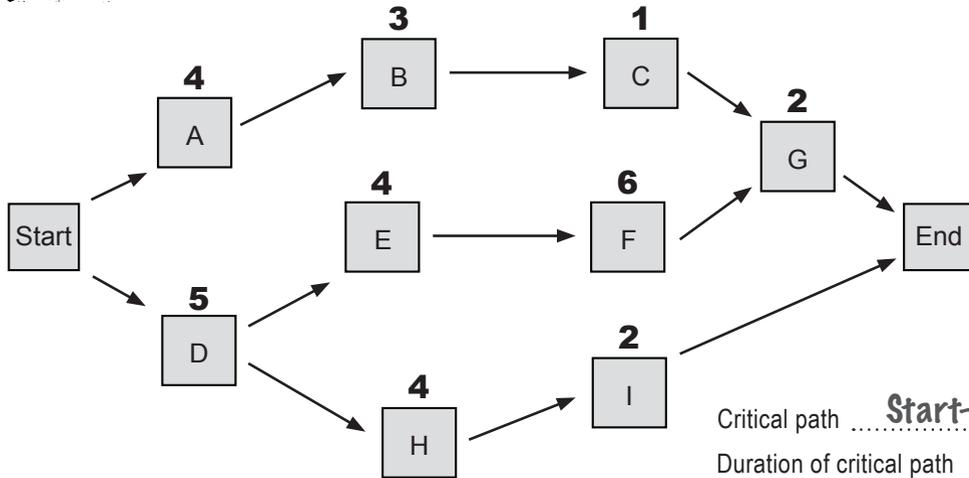
Here are some examples of three point estimates. Use the formula to figure out the expected time for each of these.

1. Expected duration = 50d; Optimistic duration = 30d; Most likely duration = 45d; Pessimistic duration = 90d
2. Expected duration = 20.3d; Optimistic duration = 12d; Most likely duration = 20d; Pessimistic duration = 30d
3. Expected duration = 25d; Optimistic duration = 10d; Most likely duration = 25d; Pessimistic duration = 40d
4. Expected duration = 51.8d; Optimistic duration = 33d; Most likely duration = 49d; Pessimistic duration = 82d

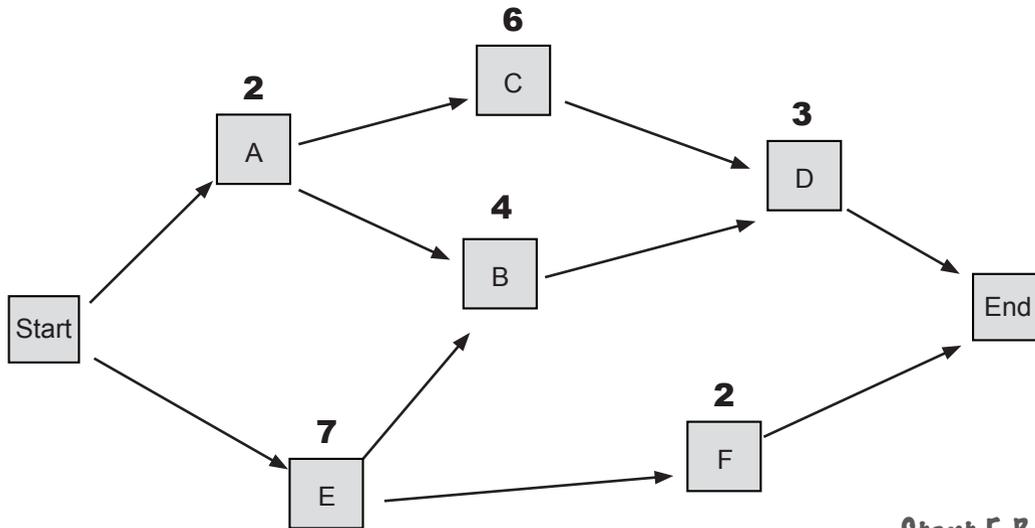


**Exercise Solution**

You may get questions on the exam asking you to identify the critical path in a network diagram. You had to practice that by finding the critical path and duration for this PDM.



Critical path ..... **Start-D-E-F-G-End**  
 Duration of critical path ..... **17**  
 Total number of paths ..... **3**



Critical path ..... **Start-E-B-D-End**  
 Duration of critical path ..... **14**  
 Total number of paths ..... **4**



## Exercise Solution

You'll need to be able to calculate the float of an activity in a network diagram for the exam. Take another look at this PDM from the last exercise. Can you calculate the float for each activity?

1. What is the float for each activity on the critical path? **0**
2. What is the total duration for path A – B – C – G? **10**
3. What is the total duration for path A – B – F – G? **15**
4. What is the total duration for path D – E – F – G? **17**
5. What is the total duration for path D – H – I? **11**
6. Which path is the critical path? **D – E – F – G**
7. Write down the float for each activity:  
 A **2** B **2** C **7** D **0** E **0**  
 F **0** G **0** H **6** I **6**



## Exercise Solution

Each of these scenarios describes a schedule compression technique. Pick which are examples of fast-tracking and which are crashing.

1. Kathleen guesses that 70% of the invitees will RSVP. Instead of waiting for all of them to come in, she goes ahead and reserves the tables and chairs now.
 

<input checked="" type="checkbox"/> Fast-tracking	<input type="checkbox"/> Crashing
---	-----------------------------------
2. Rebecca is taking a really long time to choose the decorations, so Kathleen brings in a professional decorator to help, even though it will cost more.
 

<input type="checkbox"/> Fast-tracking	<input checked="" type="checkbox"/> Crashing
--	--
3. Kathleen needs to get the invitations out quickly, so she hires two temps to come in and help her stuff envelopes for a few days.
 

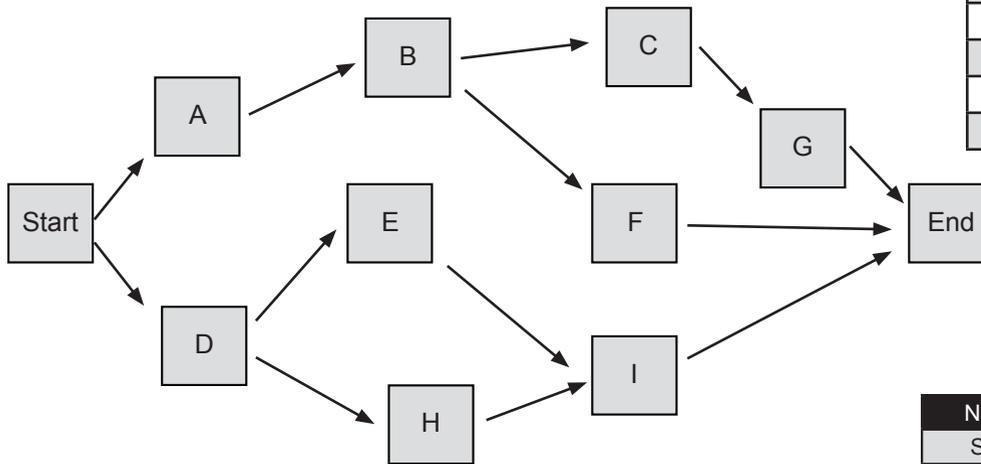
<input type="checkbox"/> Fast-tracking	<input checked="" type="checkbox"/> Crashing
--	--

# Sharpen your pencil Solution



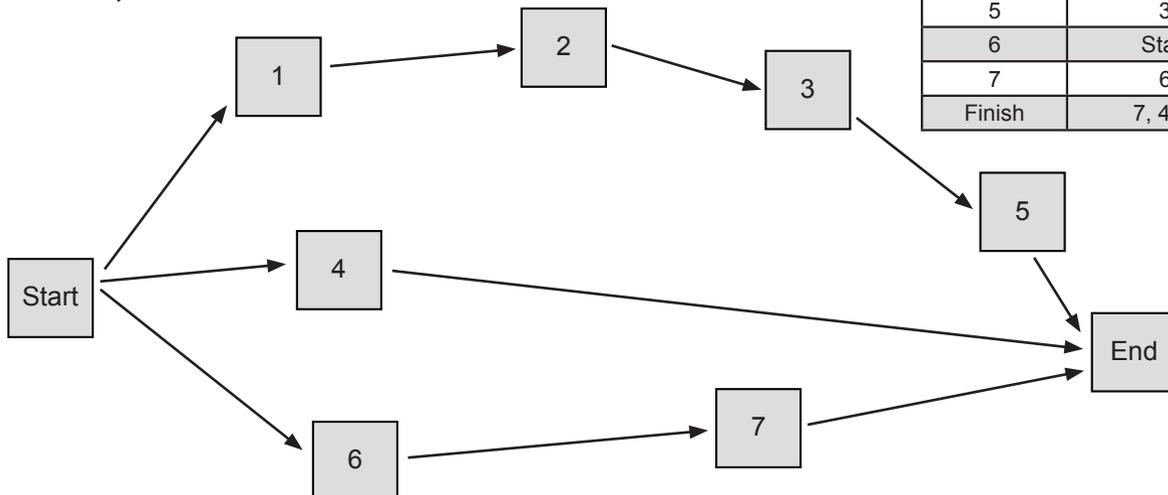
You'll need to know how to turn a table of nodes into a network diagram, so here's your chance to get some practice! Here's a list of nodes for a PDM network diagram. Try drawing the diagram based on it:

Name	Predecessor
Start	—
A	Start
B	A
C	B
D	Start
E	D
F	B
G	C
H	D
I	E, H
Finish	F, G, I

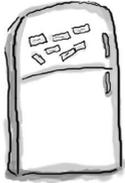


Name	Predecessor
Start	—
1	Start
2	1
3	2
4	Start
5	3
6	Start
7	6
Finish	7, 4, 5

Now try another one!



# Control Schedule Magnets Answers



You'll see change control over and over again—every single knowledge area has its own change control process! Luckily, you'll start to see how similar they all are. But Control Schedule has its own quirks, and they're important for understanding Project Schedule Management.

This is just like Scope Management! You start with a plan, a baseline, and change requests.



Inputs

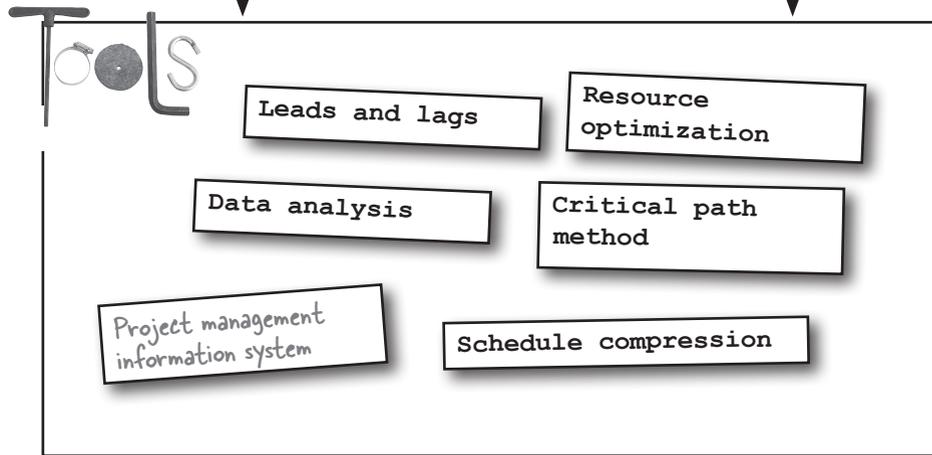
You use these to figure out which milestones you hit and which activities are slipping.

Work performance data

Project Management plan

Project documents

Organizational process assets



These tools are all about figuring out where you stand in relation to the baseline!



Outputs

This should also look really familiar. When you go through change control, you end up with a bunch of updates and some corrective actions.

Work performance information

Schedule forecasts

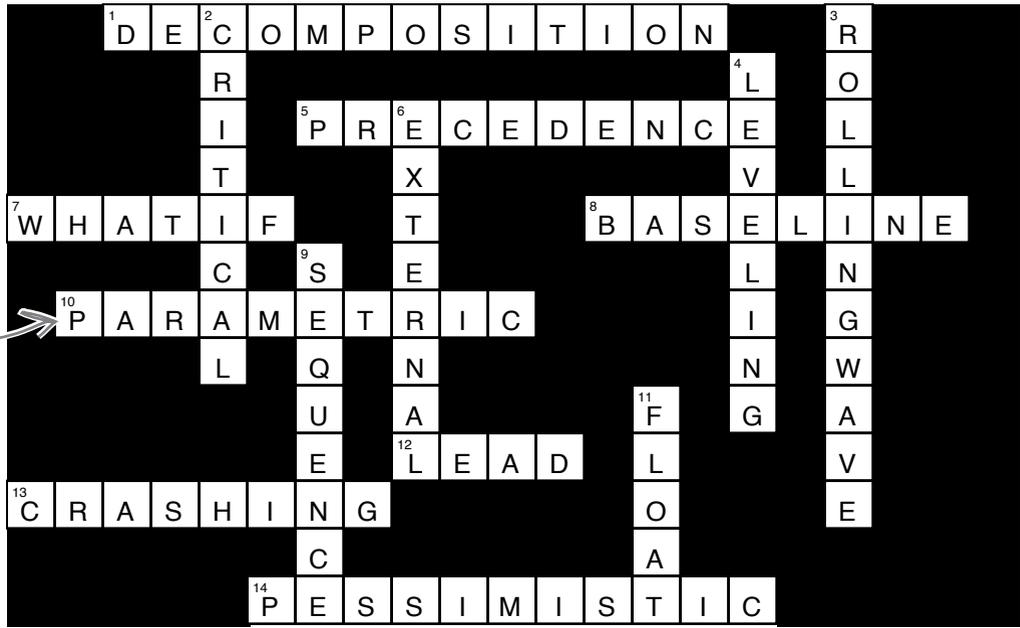
Change requests

Updates to Project documents  
Project Management plan



# Schedulecross solution

Did you get thrown because you thought using a historical database meant that you were doing analogous estimation? If you're plugging values into a database or spreadsheet, you're doing parametric estimation. A lot of people consider this a special type of analogous estimation, but describing it as parametric is more accurate.



## Exercise Solution

Here are some examples of three-point estimates. Use the formula to figure out the expected time for each of these.

1. Expected duration = 50d; Optimistic duration = 30d; Most likely duration = 45d; Pessimistic duration = 90d
2. Expected duration = 20.3d; Optimistic duration = 12d; Most likely duration = 20d; Pessimistic duration = 30d
3. Expected duration = 25d; Optimistic duration = 10d; Most likely duration = 25d; Pessimistic duration = 40d
4. Expected duration = 51.8d; Optimistic duration = 33d; Most likely duration = 49d; Pessimistic duration = 82d

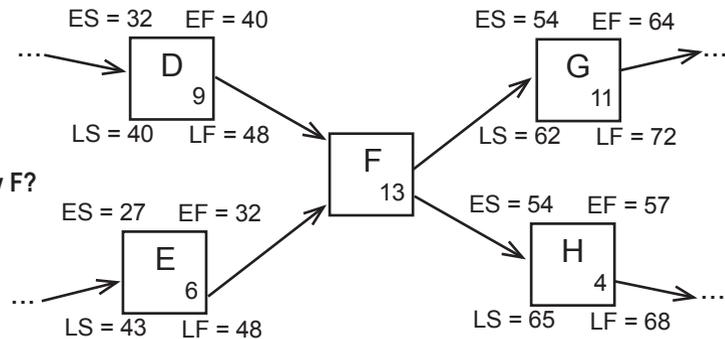
## Exam Questions

1. You're managing a project when your client tells you that an external problem happened, and now you have to meet an earlier deadline. Your supervisor heard that in a situation like this, you can use schedule compression by either crashing or fast-tracking the schedule, but he's not sure which is which. What do you tell him?

- A. Crashing the project adds risk, while fast-tracking adds cost.
- B. When you crash a project, it always shortens the total duration of the project.
- C. Crashing the project adds cost, while fast-tracking adds risk.
- D. When you fast-track a project, it always shortens the total duration of the project.

2. Given this portion of the network diagram to the right, what's the EF of activity F?

- A. 41
- B. 49
- C. 53
- D. 61



3. Given this portion of the network diagram to the right, what's the LS of activity F?

- A. 41
- B. 49
- C. 53
- D. 61

4. You are managing a software project. Your QA manager tells you that you need to plan to have her team start their test planning activity so that it finishes just before testing begins. But other than that, she says it can start as late in the project as necessary. What's the relationship between the test planning activity and the testing activity?

- A. Start-to-Start (SS)
- B. Start-to-Finish (SF)
- C. Finish-to-Start (FS)
- D. Finish-to-Finish (FF)

5. You're managing an industrial design project. You've come up with the complete activity list, created network diagrams, assigned resources to each activity, and estimated their durations. What's the next thing that you do?

- A. Use rolling wave planning to compensate for the fact that you don't have complete information.
- B. Create the schedule.
- C. Consult the project scope statement and perform Sequence Activities.
- D. Use fast-tracking to reduce the total duration.

## Exam Questions

6. Which of the following is NOT an input to Develop Schedule?

- A. Activity list
- B. Project schedule network diagrams
- C. Resource calendars
- D. Schedule baseline

7. Three members of your project team want to pad their estimates because they believe there are certain risks that might materialize. What is the BEST way to handle this situation?

- A. Estimate the activities honestly, and then use a contingency reserve to cover any unexpected costs.
- B. Allow more time for the work by adding a buffer to every activity in the schedule.
- C. Tell the team members not to worry about it, and if the schedule is wrong it's OK for the project to be late.
- D. Crash the schedule.

8. You're managing a software project. You've created the schedule, and you need to figure out which activities cannot slip. You've done critical path analysis, identifying the critical path and calculating the early start and early finish for each activity. Which activities cannot slip without making the project late?

- A. The ones with the biggest difference between ES and LF
- B. The activities on the critical path
- C. The activity with the most lag
- D. The last activity in the project, because it has no float

9. What is the critical path in the activity list to the right?

- A. Start-A-B-C-Finish
- B. Start-A-D-E-F-Finish
- C. Start-G-H-I-J-Finish
- D. Start-A-B-J-Finish

10. What is the float for activity F in the activity list to the right?

- A. 0
- B. 7
- C. 8
- D. 10

Name	Predecessor	Duration
Start	—	—
A	Start	6
B	A	4
C	B	8
D	A	1
E	D	1
F	E	2
G	Start	3
H	G	3
I	H	2
J	B, I	3
Finish	F, J, C	—

11. You're managing an interior decoration project when you find out that you need to get it done earlier than originally planned. You decide to fast-track the project. This means:

- A. Starting the project sooner and working overtime
- B. Assigning more people to the tasks at a greater total cost, especially for activities on the critical path
- C. Starting activities earlier and overlapping them more, which will cost more and could add risks
- D. Shortening the durations of the activities and asking people to work overtime to accommodate that

## Exam Questions

12. Slack is a synonym for:

- A. Float
- B. Lag
- C. Buffer
- D. Reserve

13. You're managing a construction project. You've decomposed work packages into activities, and your client needs a duration estimate for each activity that you come up with. Which of the following will you use for this?

- A. Milestone list
- B. Activity list
- C. Critical path analysis
- D. Project schedule network diagram

14. What's the correct order of the Project Schedule Management planning processes?

- A. Sequence Activities, Define Activities, Estimate Activity Resources, Estimate Activity Durations, Develop Schedule
- B. Plan Schedule Management, Define Activities, Sequence Activities, Develop Schedule, Estimate Activity Resources, Estimate Activity Durations
- C. Plan Schedule Management, Define Activities, Sequence Activities, Estimate Activity Resources, Estimate Activity Durations, Develop Schedule
- D. Plan Schedule Management, Develop Schedule, Define Activities, Sequence Activities, Estimate Activity Resources, Estimate Activity Durations

15. Which of the following is NOT a tool or technique used in Estimate Activity Durations?

- A. SWAG estimation
- B. Parametric estimation
- C. Analogous estimation
- D. Three-point estimation

16. You're managing a project to build a new project management information system. You work with the team to come up with an estimate of 27 weeks. In the best case, this could be shortened by two weeks because you can reuse a previous component. But there's a risk that a vendor delay could cause the project to be delayed by five weeks. Use PERT to calculate a three-point estimate for this project.

- A. 25.83 weeks
- B. 26 weeks
- C. 27.5 weeks
- D. 28.3 weeks

## Exam Questions

17. Given the network diagram below, what's the critical path?

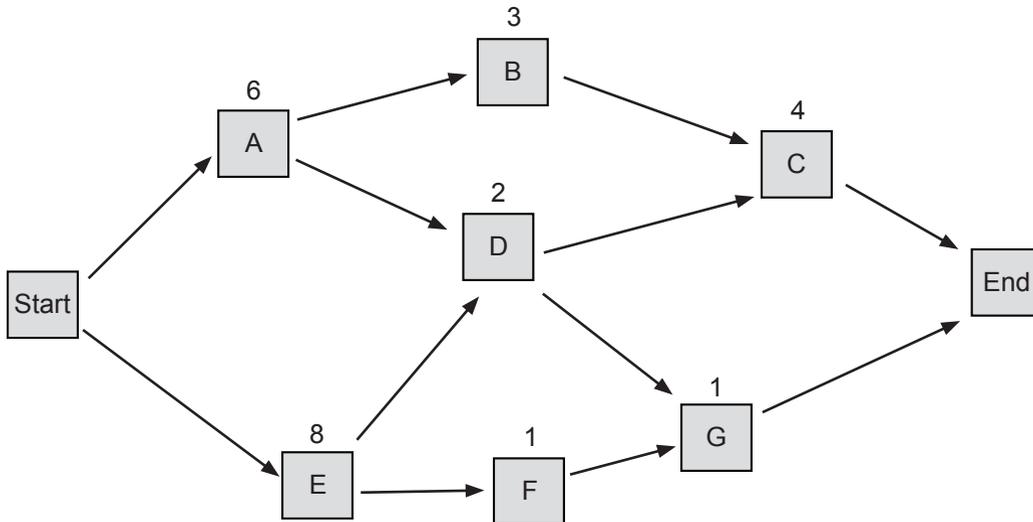
- A. Start-A-B-C-End
- B. Start-A-D-G-End
- C. Start-E-D-C-End
- D. Start-E-F-G-End

18. For that same network diagram below, what's the float for activity A?

- A. 0 weeks
- B. 1 week
- C. 2 weeks
- D. 4 weeks

19. For that same network diagram below, what's the float for activity E?

- A. 0 weeks
- B. 1 week
- C. 2 weeks
- D. 4 weeks



## Exam Questions

**20. You're managing a software project when your customer informs you that a schedule change is necessary. Which is the BEST thing to do?**

- A. Consult the schedule management plan.
- B. Notify the team and the sponsor that there's going to be a schedule change.
- C. Influence the factors that cause change.
- D. Refuse to make the change because there's already a schedule baseline.

**21. Your company has previously run other projects similar to the one you're currently managing. What is the BEST way to use that information?**

- A. Check the organizational process assets for lessons learned and other information about the past projects.
- B. Use parametric estimation to estimate your project based on past projects' performance.
- C. Start from scratch because you don't want mistakes from past projects to influence you.
- D. Reuse the Project Management plan from a past project.

**22. You're planning the schedule for a highway construction project, but the final date you came up with will run into the next budget year. The state comes up with capital from a reserve fund, and now you can increase the budget for your resources. What's the BEST way to compress the schedule?**

- A. Go back to your three-point estimates and use the most optimistic ones.
- B. Use the extra budget to increase your contingency reserve.
- C. Hire more experts to use expert judgment so your estimates are more accurate.
- D. Crash the schedule.

**23. You're managing a construction project. You've decomposed work packages into activities, and your client needs a duration estimate for each activity that you came up with. Which of the following BEST describes what you are doing?**

- A. Evaluating each activity to figure out how much effort it will take
- B. Estimating the number of person-hours that will be required for each activity
- C. Understanding, in calendar time, how long each activity will take
- D. Estimating how many people it will take to perform each activity

Answers

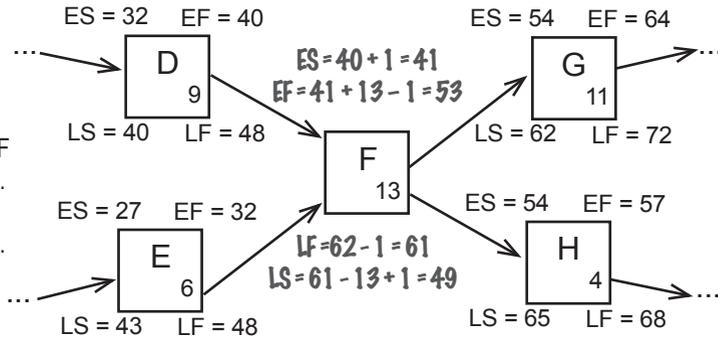
~~Exam Questions~~

1. Answer: C

You're likely to get some questions that ask you about crashing and fast-tracking, and it's important to know the difference between them. When you crash the project, it means that you add resources to it, especially to the critical path. There's no real risk in doing that—in the worst-case scenario, the extra people just sit around!—but it does cost more. Fast-tracking means adjusting the schedule so that activities overlap. The same resources are doing the work, so it's not going to cost more, but it's definitely riskier, because now you've eliminated buffers and possibly broken some dependencies! And remember that crashing or fast-tracking won't always work to make the project go faster!

2. Answer: C

To calculate EF for a task with two predecessors, start by calculating the ES: choose the highest EF of the predecessors and add 1:  $ES = 40 + 1 = 41$ . Then use that ES to calculate EF by adding the duration and subtracting 1:  $EF = 41 + 13 - 1 = 53$ .



3. Answer: B

To calculate LS for a task that's the predecessor to two other tasks, start by calculating the LF. Take the lowest LS and subtract 1:  $LF = 61 - 1 = 61$ . Then use that LF to calculate LS by subtracting the duration and adding 1:  $LS = 61 - 13 + 1 = 49$ .

4. Answer: C

Don't let the jargon fool you! You don't need to know anything about software testing to answer this question. When you have two activities, and the first activity has to be timed so that it finishes before the second one starts, then you've got a Finish-to-Start relationship, or FS.

5. Answer: B

← Did answer A trick you? No need for rolling wave planning when you've got enough info to define all the activities!

This is a which-is-next question that describes a project that's completed the Define Activities, Sequence Activities, Estimate Activity Resources, and Estimate Activity Durations processes. The next process in Project Schedule Management is Develop Schedule, which means that the next thing you do is create the schedule!

## Answers

~~Exam Questions~~**6. Answer: D**

The schedule baseline is an output of the Develop Schedule process, not an input. You should definitely know what goes into the schedule baseline: it's a specific version of the schedule that you set aside and use for comparison later on, when you want to know if the project is running late.



I GET IT: WE CAN USE THE SCHEDULE BASELINE THE SAME WAY THAT WE USE THE SCOPE BASELINE! WE TAKE A SNAPSHOT OF IT AND THEN SAVE IT, SO WE CAN COMPARE THE PROJECT'S PERFORMANCE AGAINST IT LATER!

**7. Answer: A**

You always want to be honest with your estimates. Every project has unknowns and risks, and there's no way to estimate any activity exactly! Luckily, we have tools to deal with this. You can use reserve analysis, a tool of Estimate Activity Durations, to come up with a contingency reserve that you can use to plan for these risks.

**8. Answer: B**

The critical path is the path in the network diagram where any delay will cause a delay in the schedule. These are the activities that cannot slip without making the project late.

**9. Answer: A**

When you draw out a network diagram for the activities in the table, you end up with four paths. And you definitely should draw out the activity diagram for a question like this! You're allowed to use scratch paper on the exam, and this is one place where you should definitely do it. Of the four paths, only one has the longest duration: Start-A-B-C-Finish, which has a duration of  $6 + 4 + 8 = 18$ . That's the critical path.

## Answers

~~Exam Questions~~**10. Answer: C**

Activity F is in the path Start-A-D-E-F-Finish. This path has a duration of  $6 + 1 + 1 + 2 = 10$ . The float of an activity is the longest time it can slip before it affects the critical path. In this case, activity F can slip by 8 without causing the path that it's on to go beyond the critical path. But any more than that, and its path becomes the new critical path!

Did you notice answer A? Don't forget that the float of any activity in the critical path is zero!

**11. Answer: C**

This is the definition of fast-tracking, and you're probably getting the hang of this one by now. You may get a question like this, but you'll almost certainly see fast-tracking as an incorrect answer to several questions.

**12. Answer: A**

Remember that when you see *slack*, it's the same thing as float. Either term could appear on the exam.

**13. Answer: B**

When a question asks what you'd use for a process, it's asking you to pick an input, tool, or technique that's part of the process.

This question is asking about the Estimate Activity Durations process. Take a look at the answers—there's only one answer that's used in that process: you need to start with the activity list in order to do the estimates for the activities. The other answers are things that are inputs, tools, or techniques for other processes.

**14. Answer: C**

It's not hard to remember the order in which the Project Schedule Management processes are performed. If you use a little common sense, you can reason your way through a question like this. You need to define your activities before you can sequence them, you need to know who's going to be doing an activity before you can estimate how long it's going to take, and you need to do all of that before you can build a schedule!

Control Schedule isn't included in the list of processes because if a schedule change happens, you'll have to go back and revisit the other Project Schedule Management processes. So it doesn't have a specific order!

**15. Answer: A**

You'll have to know the different kinds of estimating techniques for the exam. You don't necessarily have to be good at doing them, but you should recognize which are which. Parametric estimating is when you plug values into a formula, program, or spreadsheet and get an estimate. Analogous estimating uses similar activities from past projects to calculate new estimates. Three-point estimating uses an optimistic, pessimistic, and realistic estimate.

## Answers

~~Exam Questions~~**16. Answer: C**

This question is asking you to apply the PERT three-point estimation formula: (optimistic time + 4 × most likely time + pessimistic time) ÷ 6. When a question gives you these values directly, it's easy. But in this case, to answer the question you had to figure out the values for the optimistic time and pessimistic time, which meant that you needed to look at the assumptions that the team was making. The most likely time was given: 27 weeks. The best-case scenario would come in two weeks earlier, at 25 weeks, and the worst case would come in five weeks late, at 32 weeks. So the estimate is  $(25 \text{ weeks} + 4 \times (27 \text{ weeks}) + 32 \text{ weeks}) \div 6 = 27.5 \text{ weeks}$ .

Sometimes you'll get a question about applying a formula, but you'll need to read the text in the question to figure out all of the variables.

**17. Answer: C**

The path Start-E-D-C-End has a duration of  $8 + 2 + 4 = 14$ , which is the longest total duration in the entire network.

**18. Answer: B**

Activity A is on three different paths: Start-A-B-C-End (13), Start-A-D-C-End (12), and Start-A-D-G-End (9). To calculate its float, you take the longest path's length and subtract it from the length of the critical path:  $14 - 13 = 1$ .

Can you think of how a question might quiz you on this information without actually asking you to look at a network diagram?

IT LOOKS LIKE THERE WILL BE A BUNCH OF QUESTIONS ON THE CRITICAL PATH METHOD! IT'S A GOOD THING I'VE GOT SO MUCH PRACTICE WITH IT.

**19. Answer: A**

Since Activity E is on the critical path, its float is zero, because the float of any activity on the critical path is zero.

**20. Answer: A**

The Schedule Management plan tells you how changes to the schedule are to be handled. Any time there's a change, the first thing you should do is consult the plan to see how it should be handled.

## Exam Questions

### 21. Answer: A

The organizational process assets contain historical information about past projects. When you write up your lessons learned, or create work performance information, you store it in your company's organizational process asset library! Also, did you notice that answer B was the wrong definition of parametric estimation?

### 22. Answer: D

Crashing the schedule is the form of schedule compression that increases cost. This is a difficult question because all of the answers sound good, and one or two are a little misleading! Don't fall into the trap of choosing an answer because you recognize a valid tool or technique in it. Reserve analysis and three-point estimates are very useful techniques, but they're not the answer to this question.

### 23. Answer: C

This question was really about the definition of *duration*, and the key to answering it is to understand how duration is different from effort. The correct answer talks about "calendar time," which is what a duration is: it's a measurement (or estimate) of how long the activity will take in real life, taking into account the number of people who will be doing the work, the availability of the people and other resources, everyone's vacation time, time taken away from the schedule because people are pulled off of the activity to work on higher-priority activities, and other real-world factors. That's different from effort (which is often measured in person-hours), and it's different from resource estimating (which involves estimating how many people and what other resources will be used for the activity).

## 7 Cost management

# *Watching the bottom line*



**Every project boils down to money.** If you had a bigger **budget**, you could probably get more people to do your project more quickly and deliver more. That's why no project plan is complete until you come up with a budget. But no matter whether your project is big or small, and no matter how many **resources** and **activities** are in it, the process for figuring out the bottom line is *always the same!*

## Time to expand Head First Kitchen

The Head First Kitchen is doing so well that their owners are going to go ahead and open a second location near you! They found a great location, and now all they need to do is renovate it.

WE'D NEVER  
COMPROMISE ON  
THE QUALITY OF  
OUR FOOD.

Tamika



SO WE WON'T  
COMPROMISE ON  
THE EXPENSE OF OUR  
DINING ROOM DÉCOR,  
EITHER.

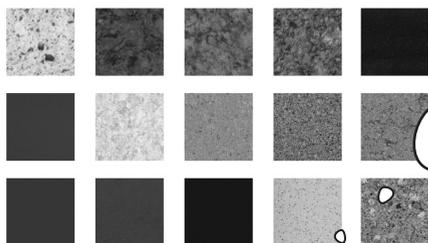
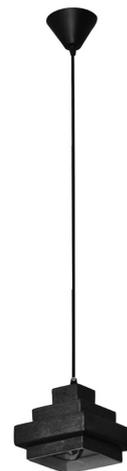
Sue



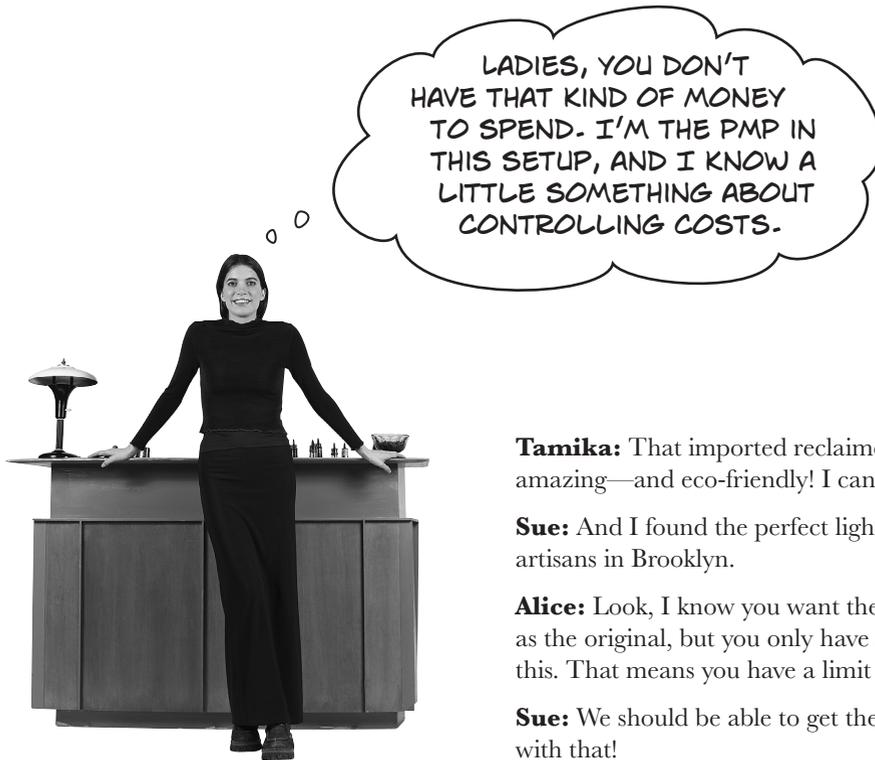
Tamika and Sue worked  
tirelessly to build Head First  
Kitchen into one of the best-  
reviewed eateries in town.

## The renovation goes overboard

When they start planning out what to buy, they want really expensive furniture and fixtures for the dining room—antique tables, luxury flooring, even a historic bar shipped in from another city. This is going to cost a lot of money...



## Kitchen conversation



LADIES, YOU DON'T HAVE THAT KIND OF MONEY TO SPEND. I'M THE PMP IN THIS SETUP, AND I KNOW A LITTLE SOMETHING ABOUT CONTROLLING COSTS.

↑  
Alice, the Head First Kitchen's hostess—and project manager, since she got her PMP certification.

**Tamika:** That imported reclaimed wood flooring is amazing—and eco-friendly! I can just imagine how it will look.

**Sue:** And I found the perfect light fixtures made by hand by artisans in Brooklyn.

**Alice:** Look, I know you want the new Kitchen to look as good as the original, but you only have a little spare cash to spend on this. That means you have a limit of \$10,000.

**Sue:** We should be able to get the new place looking amazing with that!

**Alice:** Costs can creep up on you if you don't watch what you're doing. The best way to handle this is to create a budget and check your progress against it as you go.

**Tamika:** You always turn everything into a project! Can't you see that we have a vision?

**Alice:** Of course...but you don't want that vision to drive you into the red.

## Introducing the Cost Management processes

To make sure that they don't go over budget, Tamika, Sue, and Alice sit down and come up with detailed estimates of their costs. Once they have that, they add up the cost estimates into a budget, and then they track the project according to that budget while the work is happening.



### Plan Cost Management

Just like all of the other knowledge areas, you need to plan out all of the processes and methodologies you'll use for Cost Management up front.



### Estimate Costs

This means figuring out exactly how much you expect each work activity you are doing to cost. So each activity is estimated for its time and materials cost, and any other known factors that can be figured in.

You need to have a good idea of the work you're going to do and how long it will take to do that work.



### Determine Budget

Here's where all of the estimates are added up and baselined. Once you have figured out the baseline, that's what all future expenditures are compared to.

This is just like the scope baseline from Chapter 5 or the schedule baseline from Chapter 6.



### Control Costs

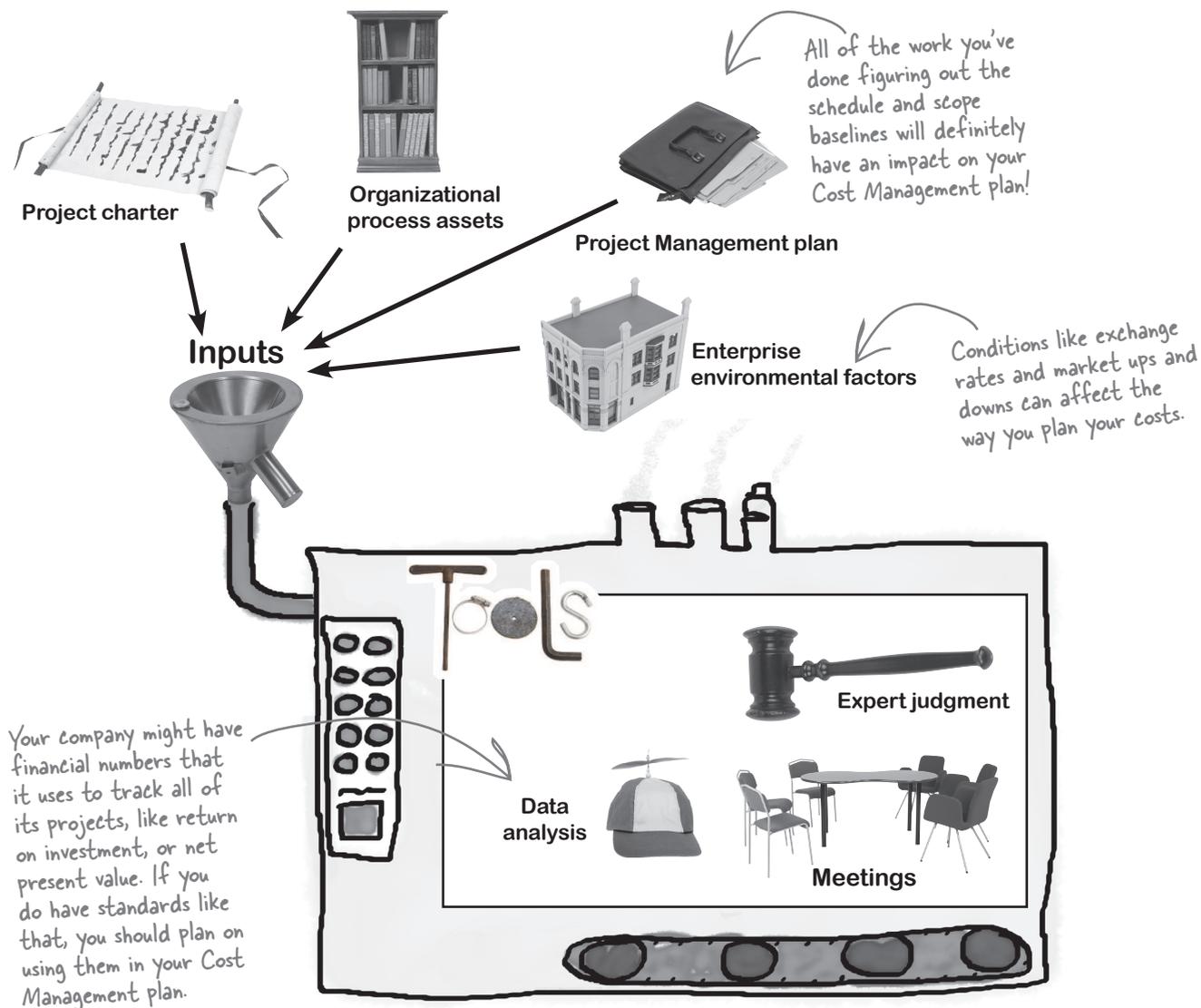
This just means tracking the actual work according to the budget to see if any adjustments need to be made.

Controlling costs means always knowing how you are doing compared to how you thought you would do.

# Plan how you'll estimate, track, and control your costs



When you've got your project charter written and you're starting to put together your Project Management plan, you need to think about all of the processes and standards you'll follow when you estimate your budget and track to that estimate. By now, you're pretty familiar with the inputs, outputs, tools, and techniques you'll use in the **Plan Cost Management** process.



## Now you've got a consistent way to manage costs

There's only one output of the Plan Cost Management process, and that's the Cost Management plan. You'll use this document to specify the accuracy of your cost estimates, the rules you'll use to determine whether or not your cost processes are working, and the way you'll track your budget as the project progresses. When you've planned out your Cost Management processes, you should be able to estimate how much your project will cost using a format consistent with all the rest of your company's projects. You should also be able to tell your management how you'll know if your project starts costing more than you estimated.

### Outputs



### Cost Management plan

Here's where you write down the subsidiary plan inside the Project Management plan that deals with costs. You plan out all of the work you'll do to figure out your budget and make sure your project stays within it.

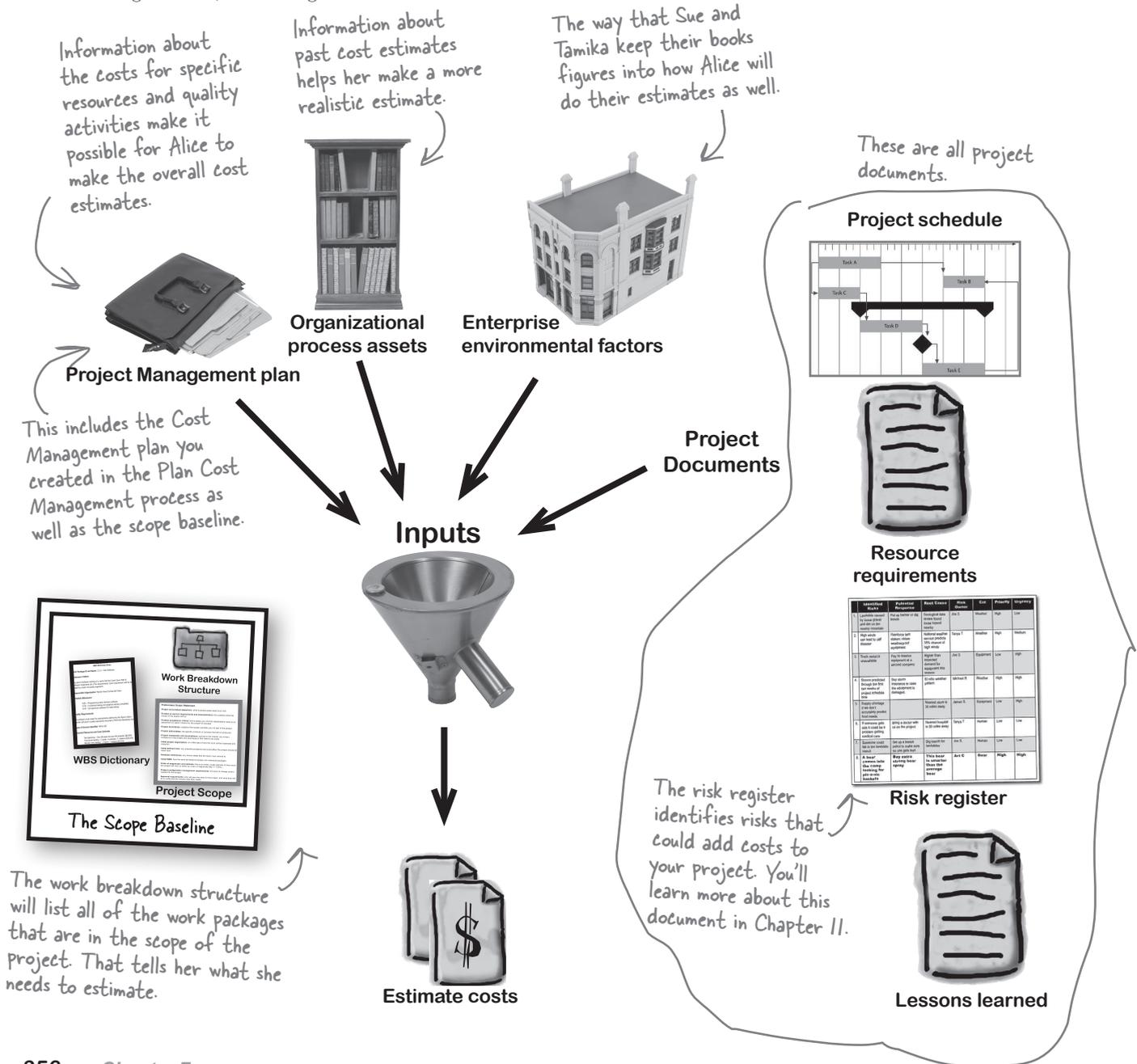
You'll want to define the units you'll use to manage your budget. For some projects, that's total person-hours; for others, it's an actual value in money. However you plan to track your costs, you need to let everybody on the project know up front.

**The Plan Cost Management process is where you plan out all the work you'll do to make sure your project doesn't cost more than you've budgeted.**

# What Alice needs before she can estimate costs



Alice wants to keep the Kitchen project's costs under control, and that starts with the **Estimate Costs** process. Before Alice can estimate costs, she needs the scope baseline. Once she knows who's doing what work, and how long it'll take, she can figure out how much it will cost.



 **Sharpen your pencil**

You've actually seen five of the tools and techniques in the Estimate Costs process before. Take a look at the list of tools below, and try to figure out which one of them Alice is using when she estimates costs. Can you write down which tool is being used in each scenario?

**A. Bottom-up estimating**

**B. Analogous estimating**

**C. Expert judgment**

1. The café across the street opened just a few months ago. Alice sits down with the contractor who did the work there and asks him to help her figure out how much it will cost. He takes a look at the equipment Sue and Tamika want to buy and the specs for the cabinets and seating and tells her what she can afford to do with the budget she has.

Tool: .....

2. Alice creates a spreadsheet with all of the historical information from similar remodeling projects that have happened on her block. She sits down and types in Tamika and Sue's desired furnishings and the square footage of the room to generate an estimated cost.

Tool: .....

3. Before Alice finishes her schedule, she gathers all of the information she has about previous projects' costs (like how much labor and materials cost). She also talks to a contractor, who gives valuable input.

Tool: .....

**D. Parametric estimating**

**E. Three-point estimates**

4. Alice sits down and estimates each and every activity and resource that she is going to need. Then she adds up all of the estimates into "rolled-up" categories. From there she adds up the categories into an overall budget number.

Tool: .....

5. Tamika sets up an appointment with the same contractor her friend used for some remodeling work. The contractor comes to the house, takes a look at the room, and then gives an estimate for the work.

Tool: .....

6. Alice figures out a best-case scenario, a most likely scenario, and a worst-case scenario. Then she uses a formula to come up with an expected cost for the project.

Tool: .....



## Sharpen your pencil Solution

Did you work out which estimating tool from Schedule Management Alice is using when she estimates costs in each of these scenarios?

### 1: B. Analogous estimating

Since Alice is using the contractor's experience with a similar project to figure out how long her project will take, she is assuming that her project will go like the café one did.

### 2: D. Parametric estimating

In this one Alice is just applying some numbers particular to her project to some historical information she has gathered from other projects and generating an estimate from that.

### 3: C. Expert judgment

Expert judgment often involves going back to historical information about past projects as well as consulting with experts or using your own expertise.

### 4: A. Bottom-up estimating

Starting at the lowest level and rolling up estimates is bottom-up estimating. Alice started with the activities on her schedule and rolled them up to categories and finally to a budget number.

### 5: C. Expert judgment

This is another example of asking somebody who has direct experience with this kind of work to give an estimate.

### 6: E. Three-point estimate

Alice came up with the three estimates and then performed a triangular distribution calculation.



Watch it!

**Analogous estimating is sometimes called “top-down estimating.”**

Take a minute and think about why it would be called “top-down.” When you're doing bottom-up estimating, first you break it down into pieces, estimate each piece, and add them up. Analogous estimation is the opposite: you start with the whole project (without breaking it up at all), find other projects that were like it, and use those projects to come up with a new estimate.

HOLD ON! HOW CAN YOU USE THE SAME TOOLS TO ESTIMATE BOTH TIME AND COST?



### Good question.

Not all of the estimation techniques for cost are the same as the ones we used for time. Often, people only have a certain amount of time to devote to a project, and a fixed amount of money too. So, it makes sense that some of the tools for estimating both would overlap. We'll learn a few new ones next.

## Other tools and techniques used in Estimate Costs

A lot of times you come into a project and there is already an expectation of how much it will cost or how much time it will take. When you make an estimate really early in the project and you don't know much about it, that estimate is called a **rough order of magnitude** estimate. (You'll also see it called a **ROM** or a **ballpark estimate**.) It's expected that it will get more refined as time goes on and you learn more about the project. Here are some more tools and techniques used to estimate cost:

*This estimate is REALLY rough! It's got a range of -25% to +75%, which means it can be anywhere from half to one and a half times the actual cost! So you only use it at the very beginning of the project.*

### Data analysis

These techniques are part of the data analysis necessary to create cost estimates:

#### Vendor bid analysis



Sometimes you will need to work with an external contractor to get your project done. You might even have more than one contractor bid on the job. This tool is all about evaluating those bids and choosing the one you will go with.

#### Reserve analysis



You need to set aside some money for cost overruns. If you know that your project has a risk of something expensive happening, it's better to have some cash laying around to deal with it. Reserve analysis means putting some cash away just in case.

#### Cost of quality

You will need to figure the cost of all of your quality-related activities into the overall budget, too. Since it's cheaper to find bugs earlier in the project than later, there are always quality costs associated with everything your project produces. Cost of quality is just a way of tracking the cost of those activities.



#### Project management information system

Project managers will often use specialized estimating software to help come up with cost estimates (like a spreadsheet that takes resource estimates, labor costs, and materials costs and performs calculations).

#### Decision making

You'll need to work with groups of people to figure out your costs. It's important that your team feels like they can commit to the overall budget and schedule.

## Let's talk numbers

There are a few numbers that can appear on the test as definitions. You won't need to calculate these, but you should know what each term means.

### **Benefit-cost ratio (BCR)**

This is the amount of money a project is going to make versus how much it will cost to build it. Generally, if the benefit is higher than the cost, the project is a good investment.

You'll get exam questions asking you to use BCR or NPV to compare two projects. The higher these numbers are, the better!

### **Net present value (NPV)**

Money you'll get in three years isn't worth as much to you as money you're getting today. NPV takes the "time value" of money into consideration, so you can pick the project with the best value in today's dollars.

This is the actual value at a given time of the project minus all of the costs associated with it. This includes the time it takes to build it as well as labor and materials. People calculate this number to see if it's worth doing a project.

### **Opportunity cost**

When an organization has to choose between two projects, it's always giving up the money it would have made on the one it doesn't do. That's called opportunity cost. It's the money you don't get because you chose not to do a project.

If a project will make your company \$150,000, then the opportunity cost of selecting another project instead is \$150,000 because that's how much your company's missing out on by not doing the project.

### **Internal rate of return**

This is the amount of money the project will return to the company that is funding it. It's how much money a project is making the company. It's usually expressed as a percentage of the funding that has been allocated to it.

### **Depreciation**

This is the rate at which your project loses value over time. So, if you are building a project that will only be marketable at a high price for a short period of time, the product loses value as time goes on.

### **Lifecycle costing**

Before you get started on a project, it's really useful to figure out how much you expect it to cost—not just to develop, but to support the product once it's in place and being used by the customer.

## \* \* \* WHAT'S MY PURPOSE \* \* \*

Match each scenario to the cost numbers that Alice is using in each one.

1. Alice does such a good job planning out her entertainment center remodeling that the Smiths down the street ask if they can have her help with their home theater upgrade. Since she is too busy doing the work on the Kitchen, she has to say no. Rob Smith says, "That's a shame; we were willing to pay \$1,000 to someone to help us out with this."

A. Opportunity cost

2. The minute the TV gets installed, Alice starts inviting all of her friends over to the Kitchen to watch the games on the weekend. She charges a \$2 cover charge for her football Saturdays and has been clearing about \$20 per week even though the room isn't finished.

B. Benefit-cost ratio

3. Even though the system she is currently installing is state of the art, Alice knows that within a year or so it will be on sale for half as much as she is paying now.

C. Internal rate of return

4. Alice wants to figure out how much the project is worth so far. So she adds up the value of all of the materials she has used, and subtracts the labor and any depreciation that needs to be accounted for. The number she ends up with gives the value of the overall project right now.

D. Depreciation

5. Before Tamika and Sue decided to do the remodeling, they compared how much the project was going to cost to how much good they thought it would do for them.

E. Net present value

Answers: 1-A, 2-C, 3-D, 4-E, 5-B

## Now Alice knows how much the Kitchen will cost

Once you've applied all of the tools in the Estimate Costs process, you'll get an estimate for how much your project will cost. It's always important to keep all of your supporting estimate information, too. That way, you know the assumptions you made when you were coming up with your numbers.

### Outputs



#### Cost estimates

This is the cost estimate for all of the activities in your activity list. It takes into account resource rates and estimated duration of the activities.

#### Basis of estimates

Just like the WBS has a WBS dictionary, and the activity list has activity attributes, the cost estimate has a supporting detail called the **basis of estimates**. Here is where you list out all of the rates and reasoning you have used to come to the numbers you are presenting in your estimates.

#### Updates to project documents

Along the way, you might find that you need to change the way you measure and manage cost. These updates allow you to make changes to the Project Management plan to deal with those improvements.



Activity cost estimates



Basis of estimates



Project document updates



Once Alice has an estimate of the project's cost, what should she do with that information?

## Kitchen conversation



**Tamika:** OK, how do we start? There are a lot of things to buy here.

**Alice:** We already have your savings, and the rest will come in July at the end of the quarter. The Kitchen is having another great year, so the profits are pretty good. Your savings are around \$4,000 and the profits will probably be closer to \$6,000. That's definitely enough money to work with.

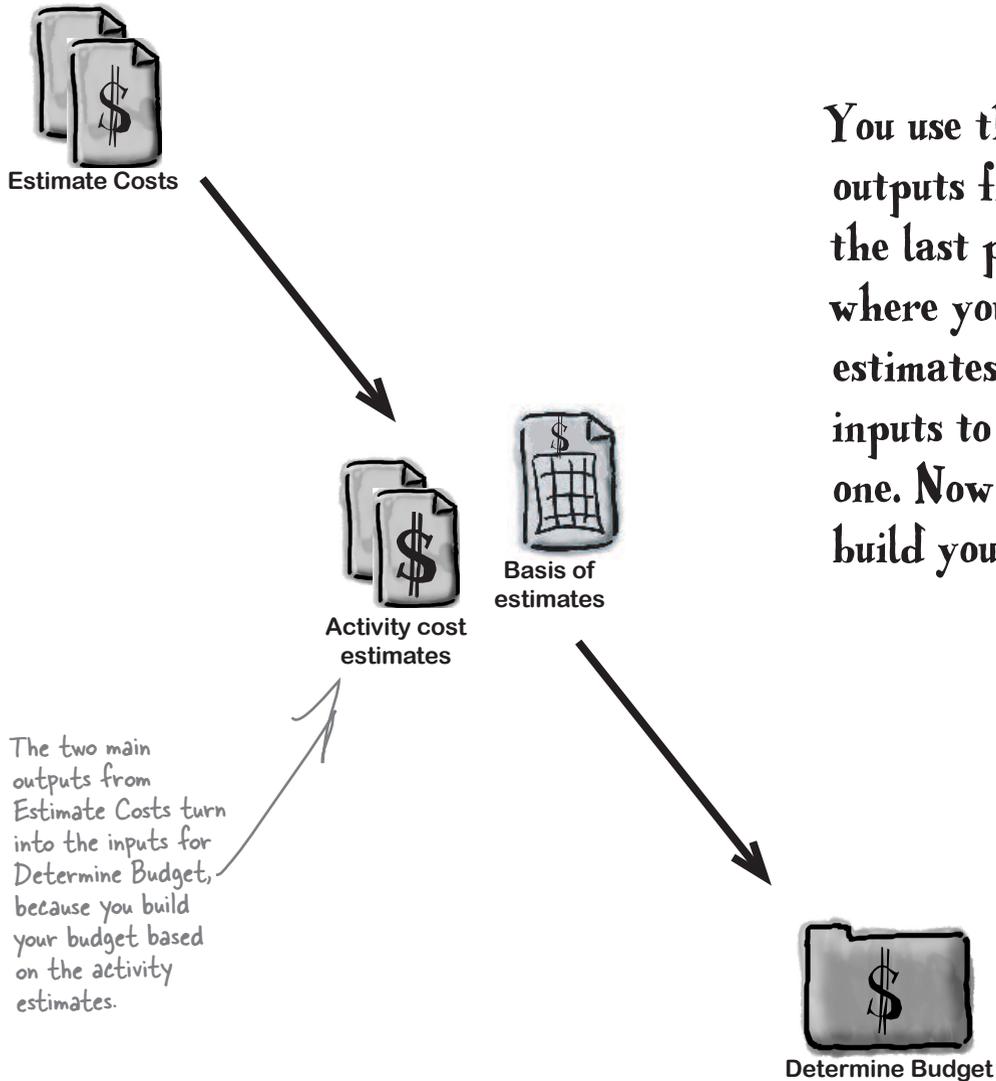
**Sue:** Well, the furnishings I want aren't back in stock until June.

**Alice:** OK, so we have to time our costs so that they're in line with our cash flow.

**Tamika:** Oh! I see. So we can start building now, but we'll still have money in June and July when the furnishings come in. Perfect.

## The Determine Budget process

Once Alice has cost estimates for each activity, she's ready to put a budget together. She does that using the **Determine Budget** process. Here's where you take the estimates that you came up with and build a budget out of them. You'll build on the activity cost estimates and basis of cost estimates that you came up with in Estimate Costs.

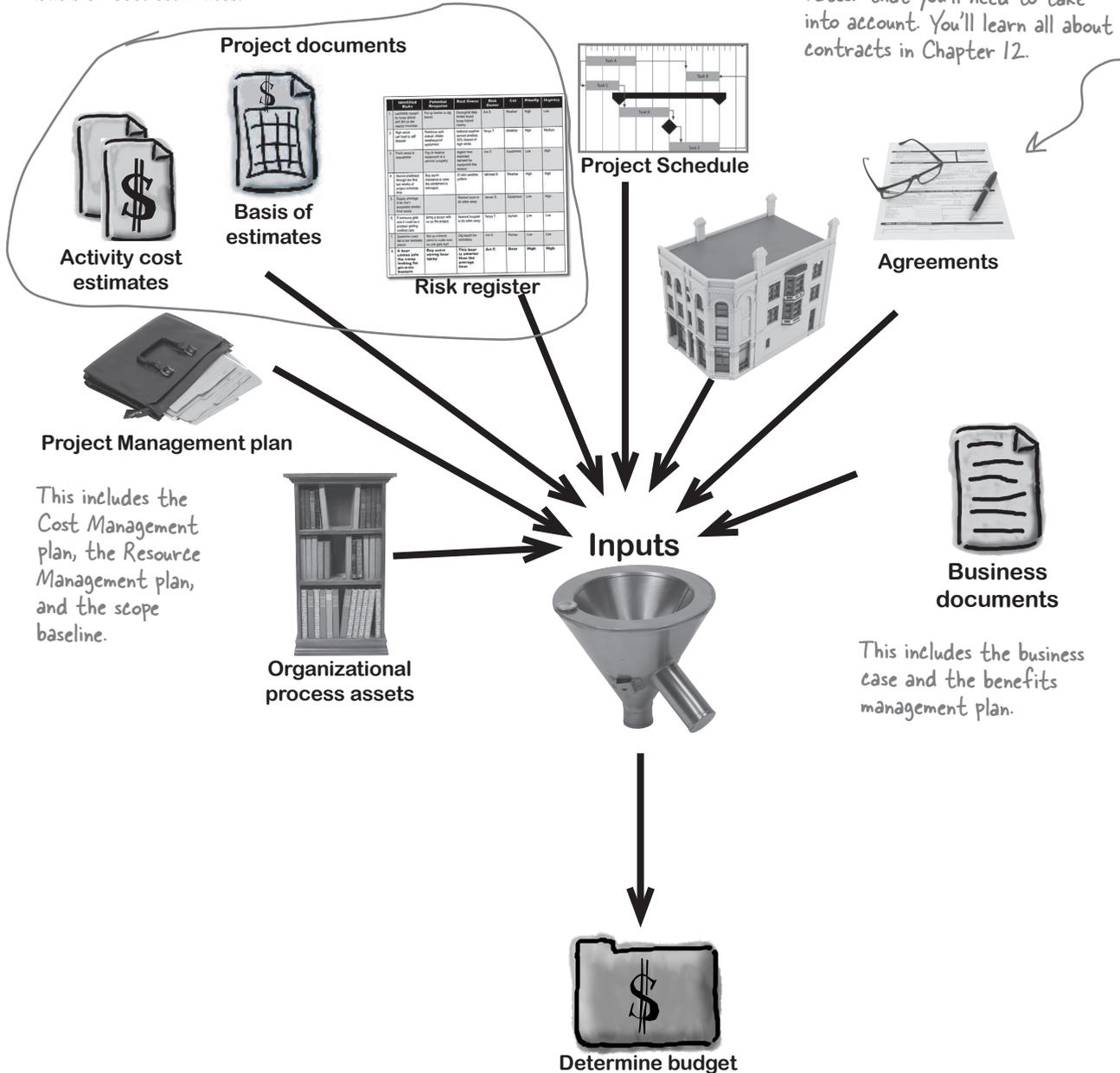


You use the outputs from the last process, where you created estimates, as inputs to this one. Now you can build your budget.

# What you need to build your budget

The **inputs** to Determine Budget are largely the same ones that you saw in Estimate Costs, with the notable additions of activity cost estimates and basis of cost estimates.

If you're doing work that's been contracted, then your agreement will have information (like fees or rates) that you'll need to take into account. You'll learn all about contracts in Chapter 12.

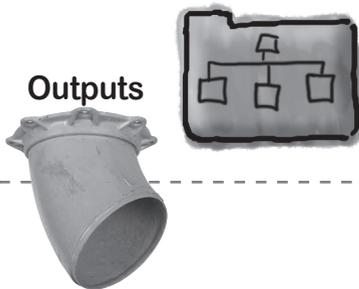


## Determine budget: how to build a budget



### 1 Roll up your estimates into control accounts.

This tool is called **cost aggregation**. You take your activity estimates and roll them up into control accounts on your work breakdown structure. That makes it easy for you to know what each work package in your project is going to cost.



### 2 Come up with your reserves.

When you evaluate the risks to your project, you will set aside some cash reserves to deal with any issues that might come your way. This tool is called **data analysis**.



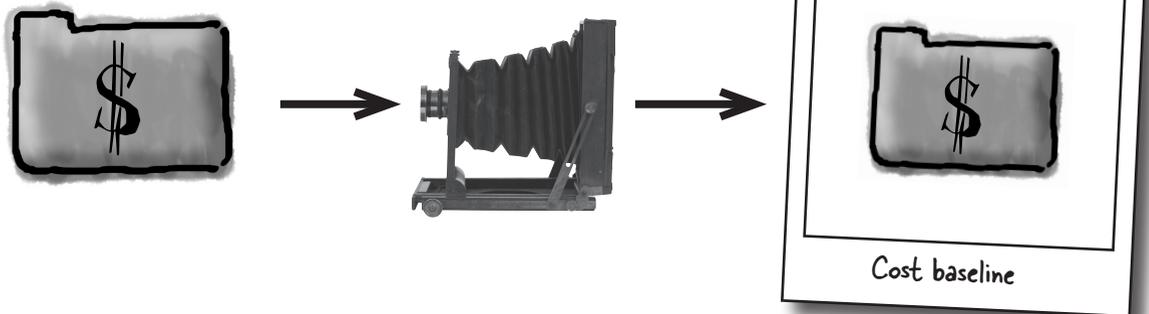
### 3 Use your expert judgment.

Here's where you compare your project to historical data that has been collected on other projects to give your budget some grounding in real-world **historical information**, and you use your own expertise and the expertise of others to come up with a realistic budget to cover your project's costs.



### 6 Build a baseline.

Just like your scope and schedule baselines, a **cost baseline** is a snapshot of the planned budget. You compare your actual performance against the baseline so you always know how you are doing versus what you planned.



### Your company's management plans for project overruns!

Just because you plan out a budget in your cost baseline, that doesn't mean your project is 100% guaranteed to fall inside that budget. It's common for a company to have a standard policy for keeping a **management reserve** to cover unexpected, unplanned costs. When you need to get your project funded, that funding has to cover both the budget in your cost baseline *and* the management reserve.

4

#### Make sure you haven't blown your limits.

This tool is **funding limit reconciliation**. Since most people work in companies that aren't willing to throw unlimited money at a project, you need to be sure that you can do the project within the amount that your company is willing to spend.

*It's true that not everybody has access to historical data to do a check like this. But, for the purposes of the test, you need to know that it's a tool for making your budget accurate.*

*If you blow your limit, you need to replan or go to your sponsor to figure out what to do. It could be that a scope change is necessary, or the funding limit can be increased.*

5

#### Secure funding for your project.

This tool is **financing**. Since some companies go to external organizations to fund specific projects, you might need to meet special external requirements to get the financing. In this tool, you make sure you meet those requirements and get the finance commitments to make your project a success.

7

#### Figure out funding requirements.

It's not enough to have an overall number that everyone can agree to. You need to plan out how and when you will spend it, and document those plans in the **project funding requirements**. This output is about figuring out how you will make sure your project has money when it's needed, and that you have enough to cover unexpected risks as well as known cost increases that change with time.



*So these requirements need to cover both the budget and the management reserve.*

8

#### Update your Project Management plan and project documents.

Once you have estimated and produced your baseline and funding requirements, you need to update your Cost Management plan, cost baseline, and performance measurement baseline with the new information you've obtained. You might have updates to project documents as well.





What tool or technique is Alice using to estimate costs and/or build the budget?

1. Alice reads a newspaper article that says that there has been a sharp increase in lumber costs recently. She knows this wasn't in her contractor's original plan and decides to put a few hundred dollars aside to deal with the price hike if it should happen.

- Parametric estimating     Reserve analysis     Cost aggregation     Funding limit reconciliation

2. Tamika helps Alice add up all of the estimates they have done into control accounts so that they can figure out how much the stereo installation is going to cost versus building the entertainment center.

- Parametric estimating     Reserve analysis     Cost aggregation     Funding limit reconciliation

3. Once the budget is close to done, Alice looks over their financial plans for the year to be sure that they can afford everything at the time that it is needed.

- Parametric estimating     Reserve analysis     Cost aggregation     Funding limit reconciliation

Answers: 1. Reserve analysis 2. Cost aggregation 3. Funding limit reconciliation



## BULLET POINTS: AIMING FOR THE EXAM

- **Parametric estimation** is used in Estimate Costs and Determine Budget.
- **Cost aggregation** is rolling up costs from the work package level to the control account level so that the numbers can be followed down through the WBS hierarchy.
- **Control accounts** are high-level WBS items that are used to track cost estimates. They do not represent activities or work packages. They represent the cost of the work packages and activities that appear under them in the WBS.
- The main outputs of Estimate Costs are the activity cost estimate and the basis of estimates. The main outputs of Determine Budget are the cost baseline and project funding requirements.
- You will get questions on the exam asking you to select between projects using **net present value (NPV)** or **benefit-cost ratio (BCR)**. Always choose the project with the biggest NPV or BCR!
- **Lifecycle costing** means estimating the money it will take to support your product or service when it has been released.
- **Rough order of magnitude estimation** is estimating with very little accuracy at the beginning of a project and then refining the estimate over time. It's got a range of -25% to +75%.
- A **management reserve** is money set aside to cover unplanned, unexpected costs. Your project's funding requirements need to cover both the budget in the cost baseline and the management reserve.

there are no  
Dumb Questions

**Q:** Isn't it enough to know my project's scope and schedule, and then trust the budget to come out all right?

**A:** Even if you don't have a strict budget to work within, it makes sense to estimate your costs. Knowing your costs means that you have a good idea of the value of your project all the time. That means you will always know the impact (in dollars) of the decisions you make along the way. Sometimes understanding the value of your project will help you to make decisions that will keep your project healthier.

Many of us do have to work within a set of cost expectations from our project sponsors. The only way to know if you are meeting those expectations is to track your project against the original estimates.

It might seem like fluff. But knowing how much you are spending will help you relate to your sponsor's expectations much better as well.

**Q:** In my job I am just handed a budget. How does estimating help me?

**A:** In the course of estimating, you might find that the budget you have been given is not realistic. It's better to know that while you're planning, before you get too far into the project work, rather than later.

You can present your findings to the sponsor and take corrective action right away if your estimate comes in pretty far off target. Your sponsor and your project team will thank you for it.

Take a minute to think about what "value" really means. How does the sponsor know if he's getting his money's worth halfway through the project? Is there an easy way you can give the sponsor that information?

**Q:** What if I don't have all of this information and I am supposed to give a ballpark estimate?

**A:** This is where those rough order of magnitude estimates come in. That's just a fancy way of saying you take your best guess, knowing that it's probably inaccurate, and you let everybody know that you will be revising your estimates as you learn more about the project.

**Q:** My company needs to handle maintenance of projects after we release them. How do you estimate for that?

**A:** That's called lifecycle costing. The way you handle it is just like you handle every other estimate. You sit down and try to think of all of the activities and resources involved in maintenance, and project the cost. Once you have an estimate, you present it along with the estimate for initially building the product or service.

**Q:** I still don't get net present value. What do I use it for?

**A:** The whole idea behind net present value is that you can figure out which of two projects is more valuable to you. Every project has a value—if your sponsor's spending money on it, then you'd better deliver something worth at least that much to him! That's why you figure out NPV by coming up with how much a project will be worth, and then subtracting how much it will cost. But for the exam, all you really need to remember are two things: net present value has the cost of the project built into it, and if you need to use NPV to select one of several projects, always choose the one with the biggest NPV. That's not hard to remember, because you're just choosing the one with the most value!

**Q:** Hold on just a minute. Can we go back to the rough order of magnitude estimate? I remember from my math classes that an order of magnitude has something to do with a fixed ratio. Wouldn't -50% to +100% make more sense as an order of magnitude?

**A:** Yes, it's true that in science, math, statistics, or engineering, an order of magnitude typically involves a series of magnitudes increasing by a fixed ratio. So if an order of magnitude down is 50%, then you'd typically maintain that same 2:1 ratio between orders of magnitude, so the next order of magnitude higher would be 100%.

However, the *PMBOK® Guide* defines it as follows: "a project in the initiation phase could have a rough order of magnitude (ROM) estimate in the range of -25% to +75%." [5th Edition, p. 201] Since that's the definition in the *PMBOK® Guide*, that's what to remember for the exam.

**Estimate Costs is just like Estimate Activity Durations. You get the cost estimate and the basis of cost estimates, updates to the plan, and requested changes when you are done.**

## Question Clinic: The red herring



SOMETIMES A QUESTION WILL GIVE YOU A LOT OF EXTRA INFORMATION THAT YOU DON'T NEED. IT'LL INCLUDE A RAMBLING STORY OR A BUNCH OF EXTRA NUMBERS THAT ARE IRRELEVANT.

104. You are managing a highway construction project. You have to build a three-mile interchange at a cost of \$75,000 per quarter-mile. Your project team consists of a road planner, an architect, an engineer, a foreman, and 16 highway workers. The workers will not be available until week 10 of the project. Your business case document is complete, and you have met with your stakeholders and sponsor. Your senior managers are now asking you to come up with an estimate. Your company has done four other highway projects very similar to this one, and you have decided to make your estimate by looking at the costs of those previous projects.

What kind of estimate involves comparing your project to a previous one?

- A. Parametric
- B. Analogous
- C. Bottom-up
- D. Rough order of magnitude

You only needed to read this sentence to get the answer right.

Did you read that whole paragraph, only to find out the question had nothing to do with it?

WHEN YOU SEE A RED HERRING QUESTION, YOUR JOB IS TO FIGURE OUT WHAT PART OF IT IS RELEVANT AND WHAT'S INCLUDED JUST TO DISTRACT YOU. IT SEEMS TRICKY, BUT IT'S ACTUALLY PRETTY EASY ONCE YOU GET THE HANG OF IT.



Red Herring



# HEAD LIBS



Fill in the blanks to come up with your own red herring question!

You are managing a \_\_\_\_\_ project.  
*(kind of project)*

You have \_\_\_\_\_ at your disposal, with \_\_\_\_\_. Your  
*(describe a resource)* *(how that resource is restricted)*

\_\_\_\_\_ contains \_\_\_\_\_. The \_\_\_\_\_  
*(a project document)* *(something that document would contain)* *(a team member)*

alerts you that \_\_\_\_\_, and suggests \_\_\_\_\_.  
*(a problem that affected your project)* *(a suggested solution)*

\_\_\_\_\_?  
*(a question vaguely related to one of the things in the paragraph above)*

A. \_\_\_\_\_  
*(wrong answer)*

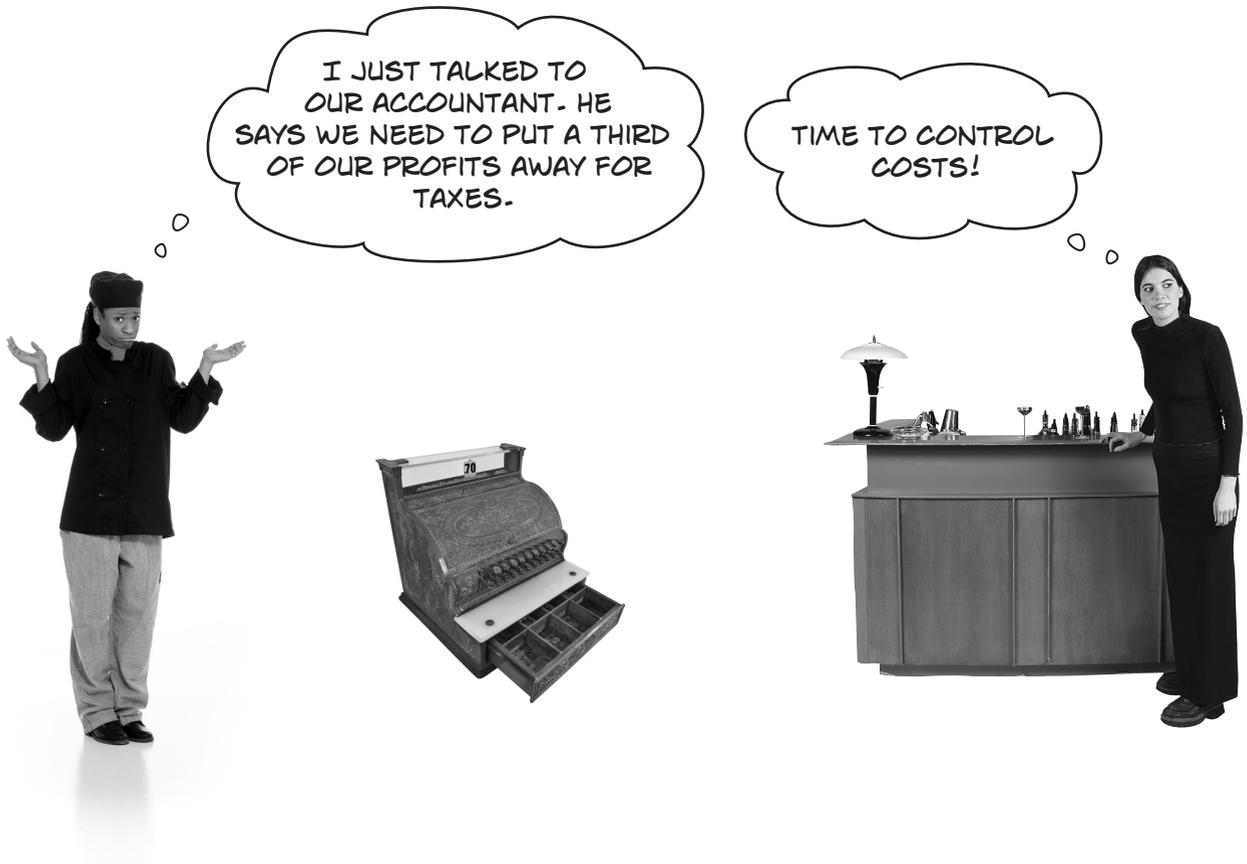
B. \_\_\_\_\_  
*(trickily wrong answer)*

C. \_\_\_\_\_  
*(correct answer)*

D. \_\_\_\_\_  
*(ridiculously wrong answer)*

## The Control Costs process is a lot like schedule control

When something unexpected comes up, you need to understand its impact on your budget and make sure that you react in the best way for your project. Just as changes can cause delays in the schedule, they can also cause cost overruns. The **Control Costs process** is all about knowing how you are doing compared to your plan and making adjustments when necessary.



### BRAIN POWER

Given what you already know about controlling your scope and schedule, how would you handle this problem?

# Sharpen your pencil

Using what you already know about the Control Scope and Control Schedule processes, can you take a guess at what each of these inputs will be used for?



.....  
.....  
.....  
.....  
.....  
.....



**Project documents:  
Lessons learned register**

.....  
.....  
.....  
.....  
.....

Remember the Cost Management plan? It's the subplan that you built back in the Develop Project Management Plan process.



**Project Management plan**

.....  
.....  
.....  
.....  
.....  
.....



**Work performance data**

.....  
.....  
.....  
.....  
.....



**Organizational process assets**

.....  
.....  
.....  
.....  
.....  
.....

could you figure out the inputs?

## Sharpen your pencil Solution



Project funding requirements

On top of the baseline cost, you have added some reserves to deal with known risks. You've also spread your budget out, so that you always have money when you need it. Changes to your project might also mean changes to your funding requirements.

Using what you already know about the Control Scope and Control Schedule processes, can you take a guess at what each of these inputs will be used for?



Project documents:  
Lessons learned register

As your project is progressing, you're noting all of the lessons you're learning. It's a good idea to use those lessons to maintain control of your project costs as well.



Project Management plan

You may find that you need to change the P.M. plan and its Cost Management subplan as a result of information coming from your project. So, you'll need to evaluate your work performance information in relation to it.



Work performance data

This is the actual data being generated by your project. It tells how are you spending your budget right now. You'll need this information to figure out if you need to make any changes to stay on track.



Organizational process assets

Your company probably has some guidance on how to control costs and report on your budget. Here's where you'll find that information.

## A few new tools and techniques

The tools in Control Costs are all about helping you figure out where to make changes so you don't overrun your budget.

### Data Analysis

#### Earned value management

Here's where you measure how your project is doing compared to the plan. This involves using the earned value formulas to assess your project.

*You'll learn more about the formulas in just a few pages!*

#### Performance reviews

Reviews are meetings where the project team reviews performance data to examine the variance between actual performance and the baseline. Earned value management is used to calculate and track the variance. Over time, these meetings are a good place to look into trends in the data.

#### Forecasting

Use the information you have about the project right now to predict how close it will come to its goals if it keeps going the way it has been. Forecasting uses some earned value numbers to help you come up with preventive and corrective actions that can keep your project on the right track.

#### Reserve analysis

Throughout your project, you are looking at how you are spending versus the amount of reserve you've budgeted. You might find that you are using reserved money at a faster rate than you expected or that you need to reserve more as new risks are uncovered.



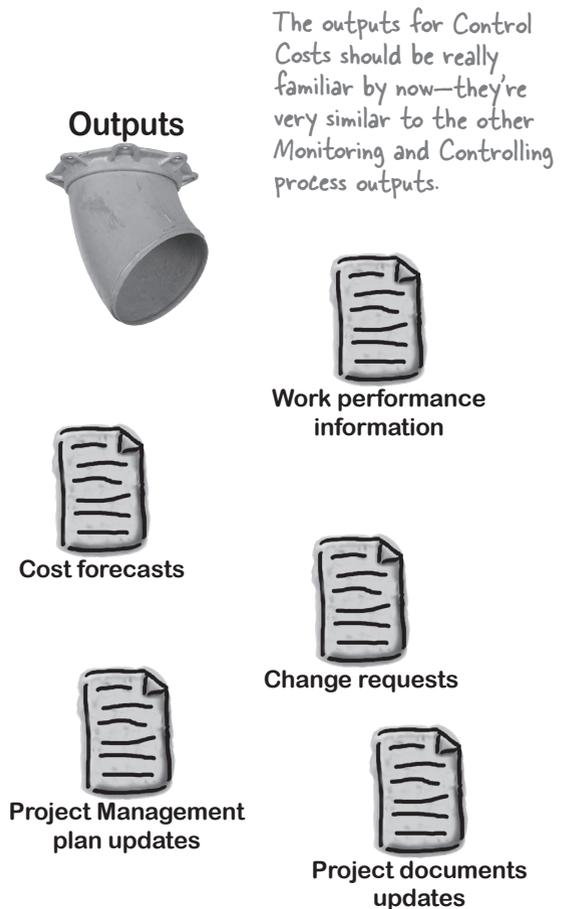
### Project management information system

You can use software packages to track your budget and make it easier to know where you might run into trouble.

### To-complete performance index

The to-complete performance index (TCPI) is a calculation that you can use to help you figure out how well your project needs to perform in the future in order to stay on budget.

*You'll learn more about TCPI, too!*



## Look at the schedule to figure out your budget

The tools in Control Costs are all about helping you figure out where to make changes so you don't overrun your budget.



● \$10,000

### Budget at completion (BAC)

How much money are you planning on spending on your project? Once you add up all of the costs for every activity and resource, you'll get a final number...and that's the total project budget. If you only have a certain amount of money to spend, you'd better make sure that you haven't gone over!

# How to calculate planned value

Once you figure this out, you can figure out your project's planned value.

If you look at your schedule and see that you're **supposed to have done** a certain percentage of the work, then that's the percent of the total budget that you've "earned" so far. This value is known as planned value. Here's how you calculate it.

## 1 First, write down your

### BAC—Budget at completion

This is the **first number you think of** when you work on your project costs. It's the **total budget** that you have for your project—how much you plan to spend on your project.

BAC x

The name "BAC" should make sense—it's the budget of your project when it's complete!

## 2 Then multiply that by your

### Planned % complete

If the schedule says that your team should have done 300 hours of work so far, and they will work a total of 1,000 hours on the project, then your planned % complete is 30%.

BAC x Planned % complete

Planned % complete is easy to work out, as it's just the calculation  
Given amount ÷ Total amount.

## 3 The resulting number is your

### PV—Planned value

This is how much of your budget you planned on using so far. If the BAC is \$200,000, and the schedule says your planned % complete is 30%, then the planned value is  $\$200,000 \times 30\% = \$60,000$ .

BAC x Planned % complete = PV

BAC x Planned % complete = PV

PV = BAC x Planned % complete

You may also see the planned value formula flipped around and written with the PV out front, but it's exactly the same formula.

# Sharpen your pencil



Now it's your turn! See if you can figure out BAC and PV for a typical project.

1. You're managing a project to install 200 windows in a new skyscraper and need to figure out your budget. Each week of the project costs the same: your team members are paid a total of \$4,000 every week, and you need \$1,000 worth of parts each week to do the work. If the project is scheduled to last 16 weeks, what's the BAC for the project?

BAC = .....

2. What will the planned % complete be four weeks into the project?

Planned % complete = .....

3. What should the PV be four weeks into the project?

PV = ..... × ..... = .....

Even though we are at the beginning of the project now, we can still figure out what the PV will be in four weeks.



This is the part that takes some thinking. How do you know what % you are through the project?

—————> **Answers on page 404.**



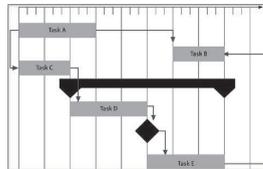
### **Not yet, it doesn't.**

But wouldn't be nice if, when your schedule said you were supposed to be 37.5% complete with the work, then you knew that you'd actually spent 37.5% of your budget?

Well, in the real world things don't always work like that, but there are ways to work out—approximately—how far on (or off) track your budget actually is.

## Earned value tells you how you're doing

When Alice wants to track how her project is doing versus the budget, she uses **earned value**. This is a technique where you figure out how much of your project's value has been delivered to the customer so far. You can do this by comparing the value of **what your schedule says** you should have delivered against the value of what you **actually** delivered.



Today is May 14



The schedule says we should have delivered this by now...



...but we only delivered this.



**Your schedule tells you a lot about where you are supposed to be right now.**



• \$2,200



• \$1,650

The actual cost of this project on May 14th is \$1,650.  
The planned value was \$2,200.

## How to calculate earned value

If you could estimate each activity exactly, every single time, you wouldn't need earned value. Your schedule would always be perfectly accurate, and you would always be exactly on budget.

But you know that real projects don't really work that way! That's why earned value is so useful—it helps you put a number on how far off track your project actually is. And that can be a really powerful tool for evaluating your progress and reporting your results. Here's how you calculate it.

When you do work, you convert the money your sponsor invests in your project into value. So, **earned value** is about **how much work you have been able to accomplish with the money you've been given**. When you calculate earned value, you're showing your sponsor how much value that investment has earned.

**1** First, write down your

### BAC—Budget at completion

Remember, this is the **total budget** that you have for your project.

BAC x

**2** Then multiply that by your

### Actual % complete

Say the schedule says that your team should have done 300 hours of work so far, out of a total of 1,000. But you talk to your team and find out they actually completed 35% of the work. That means the actual % complete is 35%.

BAC x Actual % complete

If your team actually got 35% of the work done when the schedule says they should only have gotten 30% done, that means they're more efficient than you planned!

**3** The resulting number is your

### EV—Earned value

This figure tells you how much your project *actually* earned. Every hour that each team member works adds value to the project. You can figure it out by taking the percentage of the hours that the team has actually worked and multiplying it by the BAC. If the total cost of the project is \$200,000, then the earned value is  $\$200,000 \times 35\% = \$70,000$ .

BAC x Actual % complete = EV

Again, you might see the earned value formula flipped around and written with the EV out front, but remember, it's exactly the same formula.

EV = BAC x Actual % complete



## BRAIN POWER

What's the difference between actual cost and planned value? What does it mean if your AC is bigger than your PV? What if it's smaller?

This is a harder problem to solve than it seems! Take a minute and really think about it before you turn the page.

You'll be doing a lot of calculations in a minute. The best way to approach any calculation is to understand what it's for and why you use it. So before you go on, grab a cup of coffee and think for a few minutes about the difference between BAC and PV. Also, how do you compute actual % complete on a real project? Doing that will really help you get these ideas firmly embedded into your brain!

## Put yourself in someone else's shoes

Earned value is one of the most difficult concepts that you need to understand for the PMP exam. The reason it's so confusing for so many people is that these calculations seem a little weird and arbitrary to a lot of project managers.

But **they make a lot more sense** if you **think about your project the way your sponsor thinks about it**. If you put yourself into the sponsor's shoes, you'll see that this stuff actually makes sense!

**Think about earned value from the sponsor's perspective. It all makes a lot more sense then.**

### Let's say you're an executive:

You're making a decision to spend \$300,000 of your company's money on a project. To a project manager, that's a project's budget. But to you, the sponsor, that's \$300,000 of value you expect to get!

That's the total budget, or the BAC.

### So how much value is the project delivering?

If you're the sponsor, you're thinking about the bottom line. And that bottom line is whether or not you're getting your money's worth from the project. If the team's done 50% of the work, then you've gotten \$150,000 of value so far.

If you put the value in dollar terms, your sponsor knows what return she's getting for her investment.

That's earned value—it's based on how much work the team actually did.

But if the schedule says that they should have done 60% of the work by now, then **you're getting less value than you were promised!**

The sponsor doesn't care as much about how you spend the budget. She just wants to get the most value for her money!

Look at the schedule to figure out how much value you planned to deliver to your sponsor.

# Sharpen your pencil



Let's get back to that 16-week project from page 378. In the last exercise you figured out what the project should look like by using planned value. Now you can use earned value to figure out if your project is really going the way you planned.

1. Fast-forward four weeks into the project installing those 200 skyscraper windows. Fill in the BAC and PV you figured out before. (Check your answer at the top of page 404 to make sure you got it right!)

BAC = .....

PV = .....

Figure out the actual % complete by dividing the actual work done into the total amount you're planning on.

2. You've checked with your team, but they have bad news. The schedule says they were supposed to have installed 50 windows by now, but they've only installed 40. Can you figure out the actual % complete?

Actual % complete =  $\frac{\text{.....}}{\text{.....}}$  = .....

← Fill in the number of windows the team's actually installed.

← Fill in the total number of windows that will be installed

3. What should the earned value be right now? over the course of the project.

EV = ..... × ..... = .....

Fill in the BAC

Fill in the actual % complete

4. Look at the planned value, and then look at the earned value. Are you delivering all the value you planned on delivering?

Yes

No

—————> Answers on page 404.



NEAT. I THINK I CAN USE THESE FORMULAS TO TRACK MY SCHEDULE AND MY BUDGET!

**You can definitely use them to track the schedule and budget on smaller projects.**

But once your projects start getting more complex, your formulas are going to need to take into account that you've got several people all doing different activities, and that could make it harder to track whether you're ahead of schedule or over budget.

So now that you know how to calculate PV and EV, they're all you need to stay on top of everything. What are you waiting for? Flip the page to find out how!

## Is your project behind or ahead of schedule?

Figuring out if you're on track in a small project with just a few people is easy. But what if you have dozens or hundreds of people doing lots of different activities? And what if some of them are on track, some are ahead of schedule, and some of them are behind? It starts to get hard to even figure out whether you're meeting your goals.

Wouldn't it be great if there were an easy way to figure out if you're ahead or behind schedule? Well, good news: that's exactly what earned value is used for!

### Schedule performance index (SPI)

If you want to know whether you're ahead of or behind schedule, use SPIs. The key to using this is that when you're ***ahead of schedule***, you've ***earned more value*** than planned! So **EV will be bigger than PV**.

To work out your SPI, you just divide your EV by your PV.

$$SPI = \frac{EV}{PV}$$

If SPI is greater than 1, that means EV is bigger than PV, so you're ahead of schedule!

If SPI is less than 1, then you're behind schedule because the amount you've actually worked (EV) is less than what you'd planned (PV).

### Schedule variance (SV)

It's easy to see how variance works. The **bigger the difference** between ***what you planned*** and ***what you actually earned***, the **bigger the variance**.

So, if you want to know how much ahead or behind schedule you are, just subtract PV from EV.

$$SV = EV - PV$$

Remember, for the sponsor's benefit, we measure this in dollars...

...so if the variance is positive, it tells you exactly how many dollars you're ahead. If it's negative, it tells you how many dollars you're behind.



Relax

**Don't get freaked out by the thought of all these formulas.**

They're really not very complex. All you need to remember is that they all use EV and PV in different ways. Once you've learned how EV and PV interact in each one, you're golden!

# Sharpen your pencil

Meanwhile, back in the Kitchen, Alice is working out if the project's coming in on schedule and on budget. Here are the steps she's taking and her notes. She was called away, so it's up to you to work out whether Tamika and Sue need to push the schedule.

- 1 Start with the schedule and budget.** Figure out how much work you planned, how much the team has done, and the total budget (BAC).

Tamika and Sue have a total budget of \$10,000, and they're currently halfway through the schedule.

$$\text{BAC} = \underline{\hspace{2cm}}$$

$$\text{Planned \% complete} = \underline{\hspace{2cm}}$$

- 2 Figure out PV.** Multiply the BAC by the percentage of the work that your schedule says the team should have worked so far to get the planned value.

So their planned value is?

$$\text{PV} = \$ \quad \times \quad \% = \$ \underline{\hspace{2cm}}$$

$$\text{PV} = \text{BAC} \times \text{Planned \% complete}$$

- 3 Figure out EV.** This is the part that actually takes some thinking! You need to figure out what percentage of work the team has actually done. Once you have that, multiply it with the BAC to find the earned value.

Uh-oh! On a closer look, it seems they've really only gotten 40% of the work done.

$$\text{EV} = \$ \quad \times \quad = \$ \underline{\hspace{2cm}}$$

$$\text{EV} = \text{BAC} \times \text{Actual \% complete}$$

- 4 Now you can calculate SPI and SV.** Once you've figured out EV and PV, you can do the calculations.

Now that you have the EV and PV, you can tell Tamika and Sue if they're getting their money's worth!

$$\text{SPI} = \$ \div \$ = 0.8$$

$$\text{SV} = \$ - \$ = \$$$

- 5 How's the schedule looking?** What do all these figures tell us?

So are we ahead of schedule or behind it?

—————> **Answers on page 405.**

## Are you over budget?

You can do the same thing for your budget that you can do for your schedule. The calculations are almost exactly the same, except instead of using planned value—which tells you how much work the schedule says you should have done so far—you use **actual cost** (AC). That's the amount of money that you've spent so far on the project.

*Remember, EV measures the work that's been done, while AC tells you how much you've spent so far.*

### Cost performance index (CPI)

$$CPI = \frac{EV}{AC}$$

If you want to know whether you're over or under budget, use CPI.

### Cost variance (CV)

This tells you the difference between what you planned on spending and what you actually spent.

So, if you want to know how much under or over budget you are, just take AC away from EV.

$$CV = EV - AC$$

*Remember what CV means to the sponsor: EV says how much of the total value of the project has been earned back so far. If CV is negative, then she's not getting good value for her money.*

### To-complete performance index (TCPI)

This tells you how well your project will need to perform to stay on budget.

$$TCPI = \frac{(BAC-EV)}{(BAC-AC)}$$

*We'll talk about this in just a few pages...*

## You're within your budget if...

**CPI is greater than or equal to 1 and CV is positive.** When this happens, your actual costs are less than earned value, which means the project is delivering more value than it costs.

*Now Alice can take a look at the Kitchen's checkbook. She figures out that she spent \$5,750 on the project so far.*

$$CPI = \$4,000 \div \$5,750 = 0.696$$

*Since CPI is less than 1, it means that Tamika and Sue have blown their budget.*

## You've blown your budget if...

**CPI is less than 1 and CV is negative.** When your actual costs are more than earned value, that means that your sponsor is not getting her money's worth of value from the project.

$$CV = \$4,000 - \$5,750 = -\$1,750$$

*And that's how much they've gone over! Tamika, Sue, and Alice had better figure out how to contain those runaway costs, or they'll have a nasty surprise later.*



**Measuring your cost difference in dollars is easy, but**

**what if your schedule variance is negative?**

A lot of people worry about that, but it's actually not bad. Planned value just means that you planned on delivering a certain amount of value to your sponsor at a certain time. An SV of, say, -\$5,000 tells you that you haven't delivered all the value you promised.

## The earned value management formulas

**Earned value management (EVM)** is just one of the tools and techniques in the Control Costs process, but it's a big part of PMP exam preparation. When you use these formulas, you're measuring and analyzing how far off your project is from your plan. Remember, think of everything in terms of how much value you're delivering to your sponsor! Take a look at the formulas one more time:

*Remember, your sponsor always cares most about what the project is worth to him. BAC says how much value he's getting for the whole project, and EV tells him how much of that value he's gotten so far.*

Name	Formula	What it says	Why you use it
<b>BAC—Budget at completion</b>	No formula—it's the project budget	How much money you'll spend on the project	To tell the sponsor the total amount of value that he's getting for the project
<b>PV—Planned value</b>	$PV = BAC \times \frac{\text{Planned \% complete}}{100}$	What your schedule says you should have spent	To figure out what value your plan says you should have delivered so far
<b>EV—Earned value</b>	$EV = BAC \times \frac{\text{Actual \% complete}}{100}$	How much of the project's value you've really earned	To translate how much work the team's finished into a dollar value
<b>AC—Actual cost</b>	What you've actually spent on the project	How much you've actually spent so far	The amount of money you spend doesn't always match the value you get!
<b>SPI—Schedule performance index</b>	$SPI = \frac{EV}{PV}$	Whether you're behind or ahead of schedule	To figure out whether you've delivered the value your schedule said you would
<b>SV—Schedule variance</b>	$SV = EV - PV$	How much behind or ahead of schedule you are	To put a dollar value on exactly how far ahead or behind schedule you are
<b>CPI—Cost performance index</b>	$CPI = \frac{EV}{AC}$	Whether you're within your budget or not	Your sponsor is always most interested in the bottom line!
<b>TCPI—To-complete performance index</b>	$TCPI = \frac{BAC - EV}{BAC - AC}$	How well your project must perform to stay on budget	To forecast whether or not you can stick to your budget
<b>CV—Cost variance</b>	$CV = EV - AC$	How much above or below your budget you are	Your sponsor needs to know how much it costs to get him the value you deliver

## Interpret CPI and SPI numbers to gauge your project

The whole idea behind earned value management is that you can use it to easily put a number on how your project is doing. That's why there will be exam questions that test you on your ability to interpret these numbers! Luckily, it's pretty easy to evaluate a project based on the EVM formulas.

If the SPI is below 1, then your project is behind schedule. But if you see a CPI under 1, your project is over budget!



If your project is on track, that means you're delivering the value you promised.

You can tell that your project is on track because the two index numbers—CPI and SPI—are both very close to 1, and the variance numbers—CV and SV—are very close to zero dollars. It's very rare that you'll get exactly to a CPI of 1 or an SV of \$0, but an SPI of 1.02 means you're slightly ahead of schedule, and a CV of  $-\$26$  means you're slightly over budget.

A lot of PMOs have a rule where a CPI or SPI between 0.95 and 1.10 is absolutely fine!

Sometimes you'll see negative values written in parentheses—in this case,  $(\$26)$ .



Ahead of schedule or under budget

You can tell if your project is ahead of schedule or under budget by looking for larger numbers.

If the **CPI** is much **bigger than 1**, it means you're **under budget**. And you can tell how much under by looking at the CV—that's what variance is for! It helps you see just how much the actual cost **varies** from the value you were supposed to earn by now.

Being a long way under budget isn't always a good thing. It means you asked for and were given resources that you didn't need—and which your company could have used elsewhere.



Behind schedule or over budget

A project that's behind schedule or over budget will have lower numbers.

When you see an **SPI** that's **between 0 and 1**, that tells you that the project is **behind schedule**...and that means you're not delivering enough value to the sponsor! That's when you check the SV to see how much less value you're delivering. And the same goes for cost—a **low CPI** means that your project is **over budget**, and CV will tell you how much more value you promised to deliver to the sponsor.

CPI and SPI can't be below zero, because they're ratios!

OH, I GET IT... **SPI AND CPI ARE JUST RATIOS!** IF SPI IS REALLY CLOSE TO 1, THEN SV WILL BE REALLY CLOSE TOO, AND IT MEANS THAT MY PROJECT IS GOING AS PLANNED!



**Exactly! And when your CPI is really close to 1, it means that every dollar your sponsor's spending on the project is earning just about a dollar in value.**

The biggest thing to remember about all of these numbers is that **the lower they are, the worse your project is doing**. If you've got an SPI of 1.1 and a CPI of 1.15, then you're within your budget and ahead of schedule. But if you calculate a SPI of 0.6 and a CPI of 0.45, then you're behind schedule and you've blown your budget. And when these ratios are below 1, then you'll see a negative variance!

Make it Stick

EV = BAC  
× Actual %  
Complete

LOWER  
=  
LOSER

wash  
the  
dog

Remember:

**Lower = Loser**

If CPI or SPI is below 1, or if CV or SV is negative, then you've got trouble!



### Exercise

You'll definitely need to be able to calculate earned value numbers for the exam! But remember, like planning that trip way back in Chapter 4, the best way to do that is with practice.

Your project has a total budget of \$300,000. You check your records and find that you've spent \$175,000 so far. The team has completed 40% of the project work, but when you check the schedule it says that they should have completed 50% of the work. **Calculate the following:**

There were two dollar values given in the problem. Which is AC, and which is BAC?

BAC = \$ .....

AC = \$ .....

Now you just need to figure out which numbers that you've already calculated are being divided into one another!

SPI =  $\frac{\$ \dots}{\$ \dots} = \dots$

PV = \$ ..... x % = \$ .....

EV = \$ ..... x % = \$ .....

SV = \$ ..... - \$ ..... = \$ .....

CV = \$ ..... - \$ ..... = \$ .....

CPI =  $\frac{\$ \dots}{\$ \dots} = \dots$

The trick is figuring out which percentage you need to put here!

You're managing a highway construction project. Your total budget is \$650,000, and there is a total of 7,500 hours of work scheduled on the project. You check with your accounting department, and they tell you that you've spent a total of \$400,000. According to the schedule, your crew should have worked 4,500 hours, but your foreman says that the crew was allowed to work some overtime, and they've actually put in 5,100 hours of work. **Calculate these earned value numbers:**

BAC = .....

PV = .....

AC = .....

EV = .....

SV = .....

CV = .....

SPI = .....

CPI = .....

Answers on page 406.



You are the project manager at an industrial design firm. You expect to spend a total of \$55,000 on your current project. Your plan calls for six people working on the project eight hours a day, five days a week, for four weeks. According to the schedule, your team should have just finished the third week of the project. When you review what the team has done so far, you find that they have completed 50% of the work, at a cost of \$25,000. **Based on this information, calculate the earned value numbers:**

BAC = .....	PV = .....
AC = .....	EV = .....
SV = .....	CV = .....
SPI = .....	CPI = .....

Check all of the following that apply:

- |  |   |
|--|---|
| <input type="checkbox"/> The project is ahead of schedule          | <input type="checkbox"/> The project is over budget         |
| <input type="checkbox"/> The project is behind schedule            | <input type="checkbox"/> The project is under budget        |
| <input type="checkbox"/> You should consider crashing the schedule | <input type="checkbox"/> You should find a way to cut costs |

Your current project is an \$800,000 software development effort, with two teams of programmers that will work for six months, at a total of 10,000 hours. According to the project schedule, your team should be done with 38% of the work. You find that the project is currently 40% complete. You've spent 50% of the budget so far. **Calculate these numbers:**

BAC = .....	PV = .....
AC = .....	EV = .....
SV = .....	CV = .....
SPI = .....	CPI = .....

Check all of the following that apply:

- |  |   |
|--|---|
| <input type="checkbox"/> The project is ahead of schedule          | <input type="checkbox"/> The project is over budget         |
| <input type="checkbox"/> The project is behind schedule            | <input type="checkbox"/> The project is under budget        |
| <input type="checkbox"/> You should consider crashing the schedule | <input type="checkbox"/> You should find a way to cut costs |

Answers on page 407.



## Forecast what your project will look like when it's done

There's another piece of earned value management, and it's part of the last tool and technique in Cost Management: **forecasting**. The idea behind forecasting is that you can use earned value to come up with a pretty accurate prediction of what your project will look like at completion.

**If you know your CPI now, you can use it to predict what your project will actually cost when it's complete.** Let's say that you're managing a project with a CPI of 0.8 today. If you assume that the CPI will be 0.8 for the rest of the project—and that's not an unreasonable assumption when you're far along in the project work—then you can predict your total costs when the project is complete. We call that **estimate at completion (EAC)**.

There are a bunch of different ways to calculate EAC, but this one is sufficient for the PMP exam.

If your CPI is below 1, that means you're running over budget—which will give you an EAC that's larger than your current budget.

$$EAC = \frac{BAC}{CPI}$$

If your CPI is above 1, you're running under budget, so the estimate will end up smaller than your BAC.

## Meanwhile, back in the Kitchen

Alice is forecasting how the new Kitchen project will look when it's done.



IF TAMIKA AND SUE HAVE A CPI OF 0.869 AND A TOTAL BUDGET OF \$10,000, THEN THEY CAN FORECAST THEIR FINAL COSTS:  $EAC = BAC \div CPI \dots$

Here's what Alice wrote down first...

$$\frac{\$10,000}{0.869} = \$11,507$$

...now Alice can take a look at the Kitchen's checkbook. She figures out that she spent \$5,750 on the project so far...

## Once you've got an estimate, you can calculate a variance!

There are two useful numbers that you can compute with the EAC. One of them is called **estimate to complete** (ETC), which tells you how much more money you'll probably spend on your project. And the other one, **variance at completion** (VAC), predicts what your variance will be when the project is done.

$$\text{ETC} = \text{EAC} - \text{AC}$$

Since EAC predicts how much money you'll spend, if you subtract the AC, you'll find out how much money the rest of the project will end up costing.

$$\text{VAC} = \text{BAC} - \text{EAC}$$

If you end up spending more than your budget, the VAC will be negative...just like CV and SV!

You can use EAC, ETC, and VAC to predict what your earned value numbers will look like when your project is complete.

IF THE EAC IS \$11,507, AND THE AC IS \$5,750, THEN I CAN FIGURE OUT WHAT TAMIKA AND SUE HAVE LEFT TO SPEND.  
ETC = EAC - AC.

SO, WE'RE OVER BUDGET. BUT WHAT WILL THE DAMAGE BE? AT LEAST NOW I CAN FIGURE OUT THE FINAL VARIANCE.  
VAC = BAC - EAC.

$$\$11,507 - \$5,750 = \$5,757$$

...and now she knows how much money the rest of the project is likely to cost...

$$\$10,000 - \$11,507 = -\$1,507$$

...but will Tamika and Sue be able to come up with the extra money?





You're a project manager working on a large project scheduled to last for two years. You've got six different teams working on five major functional areas. Some teams are ahead of schedule, and others are falling behind. That means that you have cost overruns in some areas, but you've saved costs in others—and that's making it very hard to get an intuitive grasp on whether your project is over or under budget!

It's nine months into your project. The total budget for your project is \$4,200,000. You've spent \$1,650,000 so far, and you've got a CPI of .875. Use the earned value management formulas from forecasting to figure out where things stand.

$$EAC = \frac{\$ \dots\dots\dots}{\dots\dots\dots} = \$ \dots\dots\dots$$

$$ETC = \$ \dots\dots\dots - \$ \dots\dots\dots = \$ \dots\dots\dots$$

$$VAC = \$ \dots\dots\dots - \$ \dots\dots\dots = \$ \dots\dots\dots$$

Will the project be over or under budget when it's complete? (Check one.)

..... The project will be over budget      ..... The project will be within its budget

How much will the project be over or under budget? \$ .....

Now it's six months later, and your project looks very different. You need to work out a new forecast for what your budget situation will be like at project completion. You've now spent a total of \$2,625,000. You look at all of the activities done by the team, and you find that the project is 70% complete. Can you come up with a new forecast for your project?

BAC = \$ .....

AC = \$ .....

EV = .....

CPI =  
.....

EAC =  
.....

ETC =  
.....

VAC =  
.....

Your project will be **over/under** budget at completion.  
(Circle one.)

How much will the project be over or under budget?  
\$ .....

—————▶ **Answers on page 408.**

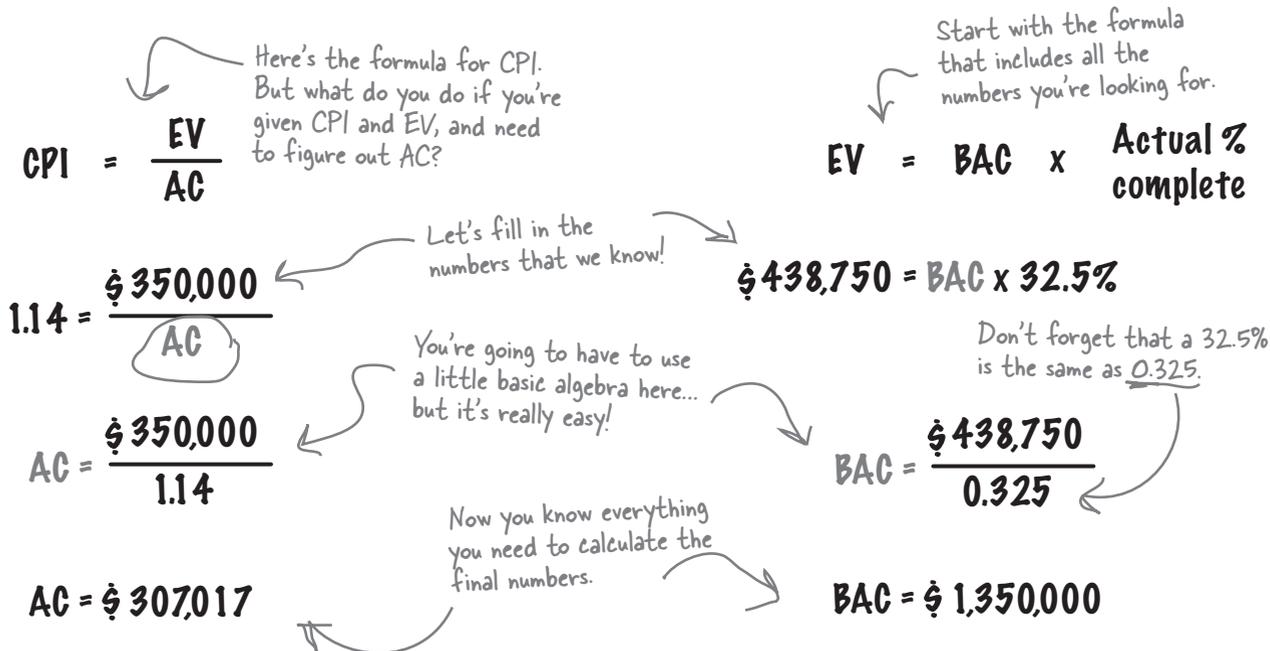
## Finding missing information

Most of the earned value questions on the exam will be pretty straightforward: you'll be given the numbers that you need to plug into a formula, and when you do it you'll get the answer. But once in a while, you'll get a question that isn't quite so straightforward.

### Let's say you're given...

...the CPI and earned value, and you want to figure out the actual costs. Why would you ever see this? Sometimes it's hard to figure out how important a project is unless you know how much it's really spending—if a project is more expensive, people in your company probably care more about it. If you're told that a project's CPI is 1.14 and its EV is \$350,000, how do you figure out the actual costs?

...the earned value and actual percent complete, and you want to figure out the project's budget. This can be really helpful when you need to "read between the lines" to make a decision about a project when someone doesn't want to give you all the information you need. When you have a project's EV of \$438,750 and its actual % complete of 32.5%, how do you figure out the total budget (BAC)?



**There are some times when you'll need to flip the formulas upside down!** Sometimes you're going to be on the receiving end of earned value numbers. If you're working at a company with a bunch of project managers, then sometimes you'll get a report from one of them that only gives you part of the picture!

# Sharpen your pencil



You'll probably get a question or two where you'll need to flip your formulas over to figure out one of the values you'd normally be given. **Don't worry if you're math-phobic!** This is really easy—you'll definitely get it with a little practice.

If EV is \$93,406 and SPI is 0.91, what is the planned value?

Write down the formula for SPI.

$$SPI = \frac{\text{EV}}{\text{PV}} = 0.91 = \frac{\$93,406}{\text{PV}}$$

Now flip around the formula so PV is on the left.

$$PV = \frac{\$93,406}{0.91} = \$102,644$$

Fill in the numbers that you have.

And now you can solve for PV!

If PV is \$252,000 and BAC is \$350,000, what is the planned % complete?

Start with the formula for PV.

$$PV = \frac{\text{BAC} \times \% \text{ complete}}{100}$$

Now flip around the formula so % complete is on the left.

$$\% \text{ complete} = \frac{\$252,000 \times 100}{\$350,000} = 72\%$$

And now you can solve it!

Now try one on your own. If BAC is \$126,500 and EAC is \$115,000, what is the CPI?

- 1 First write out the formula that has EAC, CPI, and BAC.
- 2 Next fill in the numbers that you know.

.....

- 3 Now flip around the formula so the number you're looking for is on the left.
- 4 Now you can solve the problem!

.....

.....

Answers on page 409.



## there are no Dumb Questions

**Q:** What does CPI really mean, and why can it predict your final budget?

**A:** Doesn't it seem a little weird that you can come up with a pretty accurate forecast of what you'll actually spend on your project just by dividing CPI into your BAC, or the total amount that you're planning to spend on the project? How can there be one "magic" number that does that for you?

But when you think about it, it actually makes sense. Let's say that you're running 15% over budget today. If your budget is \$100,000, then your CPI will be  $\$100,000 \div \$115,000 = .87$ . One good way to predict what your final budget will look like is to assume that you'll keep running 15% over budget. Let's say your total budget is \$250,000. If you're still 15% over at the end of the budget, your final CPI will still be  $\$250,000 \div \$287,500 = .87$ ! Your CPI will always be .87 if you're 15% over budget.

That's why we call that forecast EAC—it's an *estimate* of what your budget will look like *at completion*. By dividing CPI into BAC, all you're doing is calculating what your final budget will be if your final budget overrun or underrun is exactly the same as it is today.

**Q:** Is that really the best way to estimate costs? What if things change between now and the end of the project?

**A:** EAC is a good way to estimate costs, because it's easy to calculate and relatively accurate—assuming that nothing on the project changes too much. But you're right, if a whole lot of unexpected costs happen or your team members figure out a cheaper and better way to get the job done, then an EAC forecast could be way off!

It turns out that there are over 25 different ways to calculate EAC, and the one in this chapter is just one of them. Some of those other formulas take risks and predictions into account. But for the PMP exam, you just need to know  $EAC = BAC \div CPI$ .

**Q:** Wow, there are a lot of earned value formulas! Is there an easy way to remember them?

**A:** Yes, there are a few ways that help you remember the earned value formulas. One way is to notice that the performance reporting formulas all have something either being divided into or subtracted from EV. This should make sense—the whole point of earned value management is that you're trying to figure out how much of the value you're delivering to your sponsor has been earned so far. Also, remember that a variance is always subtraction, and an index is always division. The schedule formulas SV and SPI both involve PV numbers you got from your schedule, while the cost formulas CV and CPI both involve AC numbers from your budget.

And remember, the lower the index or variance, the worse your project is doing! A negative variance or an index that's below 1 is bad, while a positive variance or an index that's above 1 is good!

**The earned value formulas have numbers divided into or subtracted from EV. SV and SPI use PV, while CV and CPI use AC.**

## Keep your project on track with TCPI

You can use earned value to gauge where you need to be to get your project in under budget. TCPI can help you find out not just whether or not you're on target, but exactly where you need to be to make sure you get things done with the money you have.

### To-complete performance index (TCPI)

This number represents a **target that your CPI would have to hit** in order to hit your forecasted completion cost. If you're performing within your budgeted cost, it'll be based on your BAC. If you're running over your budget, you'll have to estimate a new EAC and base your TCPI on that.

There are two different formulas for TCPI. One is for when you're trying to get your project within your original budget, and the other is for when you are trying to get your project done within the EAC you've determined from earned value calculations.

Have you ever wondered halfway through a project just how much you'd have to cut costs in order to get it within your budget? This is how you figure that out!

BAC based:

$$TCPI = \frac{(BAC-EV)}{(BAC-AC)}$$

How much budgeted work is left divided by how much budgeted money is left

EAC based:

$$TCPI = \frac{(BAC-EV)}{(EAC-AC)}$$

How much budgeted work is left divided by how much estimated money is left

### TCPI for the Head First Kitchen renovation project

Alice figured out the BAC and EAC for the project and realized that the Kitchen was over budget, so she did a TCPI calculation to figure out exactly where she needed to keep her CPI if she wanted to get the project in without blowing the budget. Alice's earned value calculations have put the renovation project's numbers here:

EAC= \$11,507

AC= \$5,750

BAC=\$10,000

EV=\$5000

The project is over budget! So Alice uses the BAC-based formula to figure out where she needs to keep the CPI for the project if she wants to complete it within the original budget. Here's the calculation:

$$TCPI = \frac{(BAC-EV)}{(BAC-AC)}$$

$$TCPI = \frac{(\$10,000-\$5,000)}{(\$10,000-\$5,750)} = 1.17$$

So, if the project were going to get back on budget, it would have to run at a 1.17 CPI for the rest of the project to make up for the initial overage. Alice doesn't think that's going to happen. Tamika and Sue pushed for an antique tin ceiling in the dining room that cost an extra \$750 in the beginning, and, the way things are going, it's probably a safe bet that there will be a few more cost overruns like that as the project goes on. She prepared a second TCPI to see what the numbers would be to complete the project based on the current EAC.

$$TCPI = \frac{(BAC-EV)}{(EAC-AC)}$$

$$TCPI = \frac{(\$10,000-\$5,000)}{(\$11,507-\$5,750)} = .87$$

## A high TCPI means a tight budget

When you're looking at the TCPI for a project, a higher number means it's time to take a stricter cost management approach. The higher the number, the more you're going to have to rein in spending on your project and cut costs. When the number is lower than 1, you know you're well within your budget and you can relax a bit.

Remember "lower = loser"? Well, with TCPI, it's the opposite. A higher number means that your budget is too tight. You want it lower to give you more room to spend money!

### Sharpen your pencil

You'll need to know the formula for TCPI and be ready to calculate it for the exam. Here are a couple of problems to help you get a little practice.

BAC is \$40,000 and EAC is \$30,000, EV is \$17,000, and AC is \$15,000. What is the BAC-based TCPI?

Write down the formula for TCPI.

$$\text{TCPI} = \frac{\text{BAC}}{\text{EAC}} = \$ \frac{\text{EV}}{\text{AC}} = \dots$$

Fill in the numbers and solve the problem.

BAC is \$100,000 and EAC is \$107,000, EV is \$68,000, and AC is \$70,000. What is the EAC-based TCPI?

Write down the formula for TCPI.

$$\text{TCPI} = \frac{\text{BAC}}{\text{EAC}} = \$ \frac{\text{EV}}{\text{AC}} = \dots$$

Fill in the numbers and solve the problem.

BAC is \$20,000 and EAC is \$20,000, AC is \$15,000, and the project is 75% complete. What is the EAC-based TCPI?

First, write down the formula for EV =

Write down the formula for TCPI.

$$\text{TCPI} = \frac{\text{BAC}}{\text{EAC}} = \$ \frac{\text{EV}}{\text{AC}} = \dots$$

Fill in the numbers and solve the problem.

## Party time!

Tamika and Sue finished the new Kitchen! It looks great, and they're really happy about it...because Alice managed their costs well. She used earned value to correct their budget problems, and they managed to cut a few costs while they still had time. And they had just enough money left over at the end to throw a great opening party!



# Head First Kitchen *Downtown*

THANKS, ALICE! WE  
COULDN'T HAVE DONE THIS  
WITHOUT YOU!



Since Alice used earned value to stay on top of the budget throughout the project, Tamika and Sue were able to renovate the Kitchen in style and still manage to stay within their spending limits.



The goal of **Project Cost Management** is to plan, estimate, budget, and control your project's costs. When your project is in its early stages, that's when you have the greatest influence on the project's costs. And even a small project needs to estimate and budget costs, even if those activities are simple enough to be done by a single person.



## KEY CONCEPTS

We've talked about the processes you and your team will use when planning, controlling, and managing costs, but it's worth taking a minute to think about how your approach to Project Cost Management affects the overall project.

- ★ Don't lose sight of the big picture. Making "penny-wise, pound-foolish" cost cuts today can increase your entire product's costs tomorrow. For example, you could reduce your budget by cutting out testing tasks, but that will likely increase the operating costs for your project.
- ★ Different stakeholders measure your project's costs in different ways, and even change the way they measure costs over time. A chef may think about the costs of ingredients and kitchen staff, while an owner or partner might consider accounting and financing costs.
- ★ The way costs are managed can differ a LOT from one organization to another. One company may do predictions of financial performance and analysis of project costs entirely outside of the project, while another company might include those activities as part of its day-to-day project management work.
- ★ When project teams are responsible for financial analysis, their Project Cost Management activities might include some advanced financial management techniques (which we didn't cover in this chapter because they aren't in the *PMBOK® Guide* or on the exam).

Spoiler alert—you'll learn more about this in the next chapter!

**PROJECT COST MANAGEMENT IS ABOUT UNDERSTANDING AND MANAGING THE COSTS OF YOUR PROJECT'S RESOURCES AND ACTIVITIES.**

## TRENDS

Here are a few trends in Project Cost Management that might help you to improve and manage your projects' costs more effectively.

- ★ **Earned schedule** (or ES) is an extension to earned value management (EVM) to track progress against your schedule. Instead of using PV and EV to measure how much value has been planned or delivered, ES and actual time (AT) use the *schedule* to determine planned versus actual project performance.
- ★ **Earned schedule theory** gives project managers new ways to calculate schedule variance (SV) and schedule performance index (SPI). Earlier we learned about using earned value (EV) and planned value (PV) to calculate schedule variance ( $SV = EV - PV$ ). With earned schedule theory, we use earned schedule (ES) and actual time (AT) in place of EV, calculating  $SV = ES - AT$  and  $SPI = ES \div AT$ .



## TAILORING

When you make changes to the processes your team will use during the course of your project, there are a few considerations that might influence your decisions:



- ★ Are project managers required to use a financial database repository? Do they have access to it?
- ★ Are there existing policies that drive how project managers do cost estimation or build budgets?
- ★ Is your company already using earned value management? Is it new to the company?
- ★ Has there been an agile adoption effort at the organization? That can have an impact on how project costs are handled.
- ★ Are there audits or other governance procedures that your projects must comply with? This is especially common in regulated industries like financial services or health care.

## AGILE CONSIDERATIONS

Agile teams are often comfortable working in an environment with a high degree of uncertainty. While this may sound like a “high-risk/high-reward” situation that could have severe consequences, many agile teams are actually very good at managing their project costs using lightweight estimation techniques, which can be at least as accurate as more traditional techniques for long-term costs. They’ll save detailed estimation for near-term costs—just-in-time estimation tends to be accurate because it’s based on recent information.

## Sharpen your pencil Solution



Now it's your turn! See if you can figure out BAC and PV for a typical project.

1. You're managing a project to install 200 windows in a new skyscraper and need to figure out your budget. Each week of the project costs the same: your team members are paid a total of \$4,000 every week, and you need \$1,000 worth of parts each week to do the work. If the project is scheduled to last 16 weeks, what's the BAC for the project?

$$\text{BAC} = \underline{\$ 5,000} \times 16 = \underline{\$ 80,000}$$

The project's 16 weeks long. Multiply that by the costs per week to get the total budget for the project.

Each week costs \$4,000 for labor and \$1,000 for parts.

2. What will the planned % complete be four weeks into the project?

$$\text{Planned \% complete} = \underline{25\%}$$

You're 4 weeks into a 16-week project. That means you're 25% of the way through.

3. What should the PV be four weeks into the project?

$$\text{PV} = \underline{\$ 80,000} \times \underline{25\%} = \underline{\$ 20,000}$$

Fill in the BAC from question 1. Fill in the planned % complete from question 2. Now multiply them to get the PV.

## Sharpen your pencil Solution



Let's get back to that 16-week project from page 378. Can you figure out how to use EV?

1. Fast-forward four weeks into the project installing those 200 skyscraper windows. Fill in the BAC and PV you figured out above. (Check your answer above to make sure you got it right!)

$$\text{BAC} = \underline{\$ 80,000}$$

$$\text{PV} = \underline{\$ 20,000}$$

2. You've checked with your team, but they have bad news. The schedule says they were supposed to have installed 50 windows by now, but they've only installed 40. Can you figure out the actual % complete?

$$\text{Actual \% complete} = \frac{\underline{40}}{\underline{200}} = \underline{20\%}$$

The team installed 40 windows out of a total of 200. That means they're 20% of the way done with the work.

3. What should the earned value be right now?

$$\text{EV} = \underline{\$ 80,000} \times \underline{20\%} = \underline{\$ 16,000}$$

4. Look at the planned value, and then look at the earned value. Are you delivering all the value you planned on delivering?

Yes

No

You planned on delivering \$20,000 worth of value, but you've only delivered \$16,000 worth. That means the customer isn't getting all the value he's paying for!

## Sharpen your pencil Solution



Meanwhile, back in the Kitchen, Alice is working out if the project's coming in on schedule and on budget. Here are the steps she's taking and her notes. She was called away, so it's up to you to work out whether Tamika and Sue need to push the schedule.

- 1 Start with the schedule and budget.** Figure out how much work you planned, how much the team has done, and the total budget (BAC).

Tamika and Sue have a total budget of \$10,000, and they're currently halfway through the schedule.

$$\text{BAC} = \underline{\$10,000}$$

$$\text{Planned \% complete} = \underline{50\%}$$

- 2 Figure out PV.** Multiply the BAC by the percentage of the work that your schedule says the team should have worked so far to get the planned value.

So their planned value is?

$$\text{PV} = \underline{\$10,000} \times \underline{50\%} = \underline{\$5,000}$$

$$\text{PV} = \text{BAC} \times \text{Planned \% complete}$$

- 3 Figure out EV.** This is the part that actually takes some thinking! You need to figure out what percentage of work the team has actually done. Once you have that, multiply it with the BAC to find the earned value.

Uh-oh! On a closer look, it seems they've really only gotten 40% of the work done.

$$\text{EV} = \underline{\$10,000} \times \underline{40\%} = \underline{\$4,000}$$

$$\text{EV} = \text{BAC} \times \text{Actual \% complete}$$

- 4 Now you can calculate SPI and SV.** Once you've figured out EV and PV, you can do the calculations.

Now that you have the EV and PV, you can tell Tamika and Sue if they're getting their money's worth!

$$\text{SPI} = \underline{\$4,000} \div \underline{\$5,000} = \underline{0.8}$$

$$\text{SV} = \underline{\$4,000} - \underline{\$5,000} = \underline{-\$1,000}$$

- 5 How's the schedule looking?** What do all these figures tell us?

So are we ahead of schedule or behind it?

The Kitchen project is behind schedule.



## Exercise

You'll definitely need to be able to calculate earned value numbers for the exam! But remember, like planning that trip way back in Chapter 4, the best way to do that is with practice.

Your project has a total budget of \$300,000. You check your records and find that you've spent \$175,000 so far. The team has completed 40% of the project work, but when you check the schedule it says that they should have completed 50% of the work. **Calculate the following:**

$$BAC = \$ 300,000$$

$$PV = \$ 300,000 \times 50\% = \$ 150,000$$

Planned value uses what's on the schedule; earned value uses what actually happened.

$$AC = \$ 175,000$$

$$EV = \$ 300,000 \times 40\% = \$ 120,000$$

Did you notice how the formulas for SV and SPI use the same numbers? You subtract for one, and divide for the other!

$$SV = \$ 120,000 - \$ 150,000 = \$ -30,000$$

You may have to round the CPI and SPI numbers. Don't worry; since the PMP exam is multiple choice, you'll see a match!

$$CV = \$ 120,000 - \$ 175,000 = \$ -55,000$$

$$SPI = \frac{\$ 120,000}{\$ 150,000} = 0.8$$

The formulas for CV and CPI use the same numbers, too.

$$CPI = \frac{\$ 120,000}{\$ 175,000} = 0.68$$

You're managing a highway construction project. Your total budget is \$650,000, and there is a total of 7,500 hours of work scheduled on the project. You check with your accounting department, and they tell you that you've spent a total of \$400,000. According to the schedule, your crew should have worked 4,500 hours, but your foreman says that the crew was allowed to work some overtime, and they've actually put in 5,100 hours of work. **Calculate these earned value numbers:**

$$BAC = \$ 650,000$$

4,500 out of a total of 7,500 hours you planned to work:  
 $4,500 \div 7,500 = 60\%$

$$PV = \$ 650,000 \times 60\% = \$ 390,000$$

$$AC = \$ 400,000$$

Do the same for actual hours:  
 $5,100 \div 7,500 = 68\%$

$$EV = \$ 650,000 \times 68\% = \$ 442,000$$

$$SV = \$ 442,000 - \$ 390,000 = \$ 52,000$$

$$CV = \$ 442,000 - \$ 400,000 = \$ 42,000$$

$$SPI = \frac{\$ 442,000}{\$ 390,000} = 1.13$$

$$CPI = \frac{\$ 442,000}{\$ 400,000} = 1.11$$



### Exercise Solution

You are the project manager at an industrial design firm. You expect to spend a total of \$55,000 on your current project. Your plan calls for six people working on the project eight hours a day, five days a week, for four weeks. According to the schedule, your team should have just finished the third week of the project. When you review what the team has done so far, you find that they have completed 50% of the work, at a cost of \$25,000. **Based on this information, calculate the earned value numbers:**

BAC = \$55,000

The schedule says the team should have just finished the third week of a four-week project, so the planned % complete is 75%.

PV = \$55,000 x 75% = \$41,250

AC = \$25,000

EV = \$55,000 x 50% = \$27,500

SV = \$27,500 - \$41,250 = (\$13,750)

CV = \$27,500 - \$25,000 = \$2,500

SPI =  $\frac{\$27,500}{\$41,250} = 0.67$

Get used to seeing negative numbers in parentheses instead of using a minus sign.

CPI =  $\frac{\$27,500}{\$25,000} = 1.1$

Check all of the following that apply:

An SPI below 1 means your project's behind schedule. It's time to think about schedule compression!

- The project is ahead of schedule
- The project is behind schedule
- You should consider crashing the schedule
- The project is over budget
- The project is under budget
- You should find a way to cut costs

Your current project is an \$800,000 software development effort, with two teams of programmers that will work for six months, at a total of 10,000 hours. According to the project schedule, your team should be done with 38% of the work. You find that the project is currently 40% complete. You've spent 50% of the budget so far. **Calculate these numbers:**

BAC = \$800,000

This SPI means that the project is ahead of schedule, but it's very close to 1, which means the schedule is pretty accurate.

PV = \$800,000 x 38% = \$304,000

AC = \$400,000

EV = \$800,000 x 40% = \$320,000

SV = \$320,000 - \$304,000 = \$16,000

CV = \$320,000 - \$400,000 = (\$80,000)

SPI =  $\frac{\$320,000}{\$304,000} = 1.05$

Since CPI is below 1 and CV is negative, the project is over budget. Cost-cutting is definitely a good idea!

CPI =  $\frac{\$320,000}{\$400,000} = 0.8$

Check all of the following that apply:

- The project is ahead of schedule
- The project is behind schedule
- You should consider crashing the schedule
- The project is over budget
- The project is under budget
- You should find a way to cut costs



**Exercise Solution**

You're a project manager working on a large project scheduled to last for two years. You've got six different teams working on five major functional areas. Some teams are ahead of schedule, and others are falling behind. That means that you have cost overruns in some areas, but you've saved costs in others—and that's making it very hard to get an intuitive grasp on whether your project is over or under budget!

It's nine months into your project. The total budget for your project is \$4,200,000. You've spent \$1,650,000 so far, and you've got a CPI of .875. Use the earned value management formulas from forecasting to figure out where things stand.

$$EAC = \frac{\$4,200,000}{0.875} = \$4,800,000$$

$$ETC = \$4,800,000 - \$1,650,000 = \$3,150,000$$

$$VAC = \$4,200,000 - \$4,800,000 = (\$600,000)$$

*You're starting to get the hang of this stuff! These formulas look a little intimidating at first, but they're really not that bad once you get used to them.*

*Since VAC is negative, it means that you'll be \$600,000 over budget at the end of the project.*

Will the project be over or under budget when it's complete? (Check one.)

The project will be over budget       The project will be within its budget

How much will the project be over or under budget?      \$ 600,000

Now it's six months later, and your project looks very different. You need to work out a new forecast for what your budget situation will be like at project completion. You've now spent a total of \$2,625,000. You look at all of the activities done by the team, and you find that the project is 70% complete. Can you come up with a new forecast for your project?

$$BAC = \$4,200,000$$

$$AC = \$2,625,000$$

$$EV = \$4,200,000 \times 70\% = \$2,940,000$$

$$CPI = \frac{\$2,940,000}{\$2,625,000} = 1.12$$

$$EAC = \frac{\$4,200,000}{1.12} = \$3,750,000$$

$$ETC = \$3,750,000 - \$2,625,000 = \$1,125,000$$

$$VAC = \$4,200,000 - \$3,750,000 = \$450,000$$

Your project will be over under budget at completion. (Circle one.)

How much will the project be over or under budget?

Take a second to think about what these numbers really mean. Are you delivering good value to the sponsor?

This VAC means your project is \$450,000 under budget.      \$ 450,000

# Sharpen your pencil Solution



You'll probably get a question or two where you'll need to flip your formulas over to figure out one of the values you'd normally be given. **Don't worry if you're math-phobic!** This is really easy—you'll definitely get it with a little practice.

If EV is \$93,406 and SPI is 0.91, what is the planned value?

$$SPI = \frac{EV}{PV} = 0.91 = \$ \frac{\$93,406}{PV}$$

When you're dividing, you just need to swap these two numbers.

$$PV = \frac{\$93,406}{0.91} \quad PV = \$102,644$$

Sometimes your answers aren't nice, round numbers. That doesn't mean that they're wrong!

If PV is \$252,000 and BAC is \$350,000, what is the planned % complete?

$$PV = \frac{BAC}{\text{Scheduled \% complete}} \quad \$252,000 = \frac{\$350,000}{\text{Scheduled \% complete}}$$

$$\% \text{ complete} = \frac{\$252,000}{\$350,000} \quad PV = 72\%$$

Don't forget that when you're calculating a percentage, 72% is the same as 0.72.

Now try one on your own. If BAC is \$126,500 and EAC is \$115,000, what is the CPI?

1 First write out the formula that has EAC, CPI, and BAC.

$$EAC = \frac{BAC}{CPI}$$

If you're still stumped here, don't worry! You'll only see one or two questions like this on the exam.

2 Next fill in the numbers that you know.

$$\$115,000 = \frac{\$126,500}{CPI}$$

3 Now flip around the formula so the number you're looking for is on the left.

$$CPI = \frac{\$126,500}{\$115,000}$$

4 Now you can solve the problem!

$$CPI = 1.1$$



# Sharpen your pencil Solution

You'll need to know the formula for TCPI and be ready to calculate it for the exam. Here are a couple of problems to help you get a little practice.

BAC is \$40,000 and EAC is \$30,000, EV is \$17,000, and AC is \$15,000. What is the BAC-based TCPI?

$$TCPI = \frac{BAC-EV}{BAC-AC} = \$ \frac{40,000-17,000}{40,000-15,000} = .92$$

The index number is under 1. No need to tighten the belt here.

BAC is \$100,000 and EAC is \$107,000, EV is \$68,000, and AC is \$70,000. What is the EAC-based TCPI?

$$TCPI = \frac{BAC-EV}{EAC-AC} = \$ \frac{100,000-68,000}{107,000-70,000} = .86$$

This project should have no trouble hitting its budget goals.

BAC is \$20,000 and EAC is \$20,000, AC is \$15,000, and the project is 75% complete. What is the EAC-based TCPI?

$$EV = 20,000 \times .75$$

$$TCPI = \frac{BAC-EV}{EAC-AC} = \$ \frac{20,000-15,000}{20,000-15,000} = 1$$

This project is right on budget.

## Exam Questions

1. You are creating your cost baseline. What process are you in?

- A. Determine Budget
- B. Control Costs
- C. Estimate Costs
- D. Cost Baseline

Some of the earned value numbers have alternate four-letter abbreviations. This one stands for "budgeted cost of work scheduled." Don't worry—you don't need to memorize them!



2. You're working on a project that has an EV of \$7,362 and a PV (BCWS) of \$8,232. What's your SV?

- A. -\$870
- B. \$870
- C. 0.89
- D. Not enough information to tell

3. You are managing a project for a company that has previously done three projects that were similar to it. You consult with the cost baselines, lessons learned, and project managers from those projects, and use that information to come up with your cost estimate. What technique are you using?

- A. Parametric estimating
- B. Net present value
- C. Rough order of magnitude estimation
- D. Analogous estimating

4. You are working on a project with a PV of \$56,733 and an SPI of 1.2. What's the earned value of your project?

- A. \$68,079.60
- B. \$47,277.50
- C. \$68,733
- D. .72

5. Your company has two projects to choose from. Project A is a billing software project for the Accounts Payable department; in the end it will make the company around \$400,000 when it has been rolled out to all of the employees in that department. Project B is a payroll application that will make the company around \$388,000 when it has been put to use throughout the company. After a long deliberation, your board chooses to go ahead with Project B. What is the opportunity cost for choosing Project B over Project A?

- A. \$388,000
- B. \$400,000
- C. \$12,000
- D. 1.2

## Exam Questions

6. Your company has asked you to provide a cost estimate that includes maintenance, installation, support, and upkeep costs for as long as the product will be used. What is that kind of estimate called?

- A. Benefit-cost ratio
- B. Depreciation
- C. Net present value
- D. Lifecycle costing

7. You are working on a project with an SPI of .72 and a CPI of 1.1. Which of the following BEST describes your project?

- A. Your project is ahead of schedule and under budget.
- B. Your project is behind schedule and over budget.
- C. Your project is behind schedule and under budget.
- D. Your project is ahead of schedule and over budget.

8. Your project has a BAC of \$4,522 and is 13% complete. What is the earned value (EV)?

- A. \$3,934.14
- B. There is not enough information to answer.
- C. \$587.86
- D. \$4,522

9. A project manager is working on a large construction project. His plan says that the project should end up costing \$1.5 million, but he's concerned that he's not going to come in under budget. He's spent \$950,000 of the budget so far, and he calculates that he's 57% done with the work, and he doesn't think he can improve his CPI above 1.05. Which of the following BEST describes the current state of the project?

- A. The project is likely to come in under budget.
- B. The project is likely to exceed its budget.
- C. The project is right on target.
- D. There is no way to determine this information.

10. You are managing a project laying underwater fiber optic cable. The total cost of the project is \$52/ meter to lay 4 km of cable across a lake. It's scheduled to take eight weeks to complete, with an equal amount of cable laid in each week. It's currently the end of week 5, and your team has laid 1,800 meters of cable so far. What is the SPI of your project?

- A. 1.16
- B. 1.08
- C. .92
- D. .72

## Exam Questions

**11. During the execution of a software project, one of your programmers informs you that she discovered a design flaw that will require the team to go back and make a large change. What is the BEST way to handle this situation?**

- A. Ask the programmer to consult with the rest of the team and get back to you with a recommendation.
- B. Determine how the change will impact the project constraints.
- C. Stop all work and call a meeting with the sponsor.
- D. Update the cost baseline to reflect the change.

**12. If AC (ACWP) is greater than your EV (BCWP), what does this mean?**

- A. The project is under budget.
- B. The project is over budget.
- C. The project is ahead of schedule.
- D. The project is behind schedule.

**13. A junior project manager is studying for her PMP exam, and asks you for advice. She's learning about earned value management, and wants to know which of the variables represents the difference between what you expect to spend on the project and what you've actually spent so far. What should you tell her?**

- A. Actual cost (AC)
- B. Cost performance index (CPI)
- C. Earned value (EV)
- D. Cost variance (CV)

**14. You are managing an industrial architecture project. You've spent \$26,410 so far to survey the site, draw up preliminary plans, and run engineering simulations. You are preparing to meet with your sponsor when you discover that there is a new local zoning law that will cause you to have to spend an additional estimated \$15,000 to revise your plans. You contact the sponsor and initiate a change request to update the cost baseline.**

**What variable would you use to represent the \$26,410 in an earned value calculation?**

- A. PV
- B. BAC
- C. AC
- D. EV

## Exam Questions

15. You are working on the project plan for a software project. Your company has a standard spreadsheet that you use to generate estimates. To use the spreadsheet, you meet with the team to estimate the number of functional requirements, use cases, and design wireframes for the project. Then you categorize them into high, medium, or low complexity. You enter all of those numbers into the spreadsheet, which uses a data table derived from past projects' actual costs and durations, performs a set of calculations, and generates a final estimate. What kind of estimation is being done?

- A. Parametric
- B. Rough order of magnitude
- C. Bottom-up
- D. Analogous

16. Project A has an NPV of \$75,000, with an internal rate of return of 1.5% and an initial investment of \$15,000. Project B has an NPV of \$60,000 with a BCR of 2:1. Project C has an NPV of \$80,000, which includes an opportunity cost of \$35,000. Based on these projects, which is the BEST one to select:

- A. Project A
- B. Project B
- C. Project C
- D. There is not enough information to select a project.

17. What is the range of a rough order of magnitude estimate?

- A. -5% to +10%
- B. -25% to +75%
- C. -50% to +50%
- D. -100% to +200%

18. You are managing a software project when one of your stakeholders needs to make a change that will affect the budget. What defines the processes that you must follow in order to implement the change?

- A. Perform Integrated Change Control
- B. Monitoring and Controlling process group
- C. Change control board
- D. Cost baseline

## Exam Questions

19. You are managing a software project when one of your stakeholders needs to make a change that will affect the budget. You follow the procedures to implement the change. Which of the following must get updated to reflect the change?

- A. Project Management plan
- B. Project cost baseline
- C. Cost change control system
- D. Project performance reviews

20. You are managing a project with a BAC of \$93,000, EV (BCWP) of \$51,840, PV (BCWS) of \$64,800, and AC (ACWP) of \$43,200. What is the CPI?

- A. 1.5
- B. 0.8
- C. 1.2
- D. \$9,000

↑ Again, don't panic if you see these four-letter abbreviations. You'll always be given the ones you're used to on the exam!

21. You are managing a project that has a TCPI of 1.19. What is the BEST course of action?

- A. You're under budget, so you can manage costs with lenience.
- B. Manage costs aggressively.
- C. Create a new schedule.
- D. Create a new budget.

22. You are starting to write your project charter with your project sponsor when the senior managers ask for a time and cost estimate for the project. You have not yet gathered many of the project details. What kind of estimate can you give?

- A. Analogous estimate
- B. Rough order of magnitude estimate
- C. Parametric estimate
- D. Bottom-up estimate

23. You are managing a project for a defense contractor. You know that you're over budget, and you need to tell your project sponsor how much more money it's going to cost. You've already given him a forecast that represents your estimate of total cost at the end of the project, so you need to take that into account. You now need to figure out what your CPI needs to be for the rest of the project. Which of the following BEST meets your needs?

- A. BAC
- B. ETC
- C. TCPI (BAC calculation)
- D. TCPI (EAC calculation)

## Answers

~~Exam Questions~~

## 1. Answer: A

This is really a question about the order of the processes. Control Costs uses the cost baseline, so it has to be created before you get to it. Cost Baselining isn't a process at all, so you should exclude that from the choices right away. The main output of Determine Budget is the cost baseline and supporting detail, so that's the right choice here.

D. Cost Baselining

← Watch out for fake processes! This isn't a real process name.

## 2. Answer: A

This one is just testing whether or not you know the formula for schedule variance. Just plug the values into the SV formula:  $SV = EV - PV$  and you get answer A. Watch out for negative numbers, though! Answer B is a trap because it's a positive value. Also, the test will have answers like C that check if you're using the right formula. If you use the SPI formula, that's the answer you'll get! You can throw out D right away—you don't need to do any calculation to know that you have enough information to figure out SV!

2. You're working on a project that has an EV of \$7,362 and a PV (BCWS) of \$8,232. What's your SV?

Don't get thrown off by four-letter abbreviations like BCWS—some people have different abbreviations for PV, EV, and AC. The PMP exam will always give you the abbreviations you're familiar with.

## 3. Answer: D

When you're using the past performance of previous projects to help come up with an estimate, that's called analogous estimation. This is the second time you've seen this particular technique—it was also in Chapter 6. So there's a good chance that you'll get an exam question on it.

## 4. Answer: A

The formula for SPI is:  $SPI = EV \div PV$ . So you just have to fill in the numbers that you know, which gets you  $1.2 = EV \div \$56,733$ . Now flip it around. You end up with  $EV = 1.2 \times \$56,733$ , which multiplies out to \$68,079.60.

## 5. Answer: B

← Did you notice the red herring in the question? It didn't matter what the projects were about, only how much they cost!

If you see a question asking the opportunity cost of selecting one project over another, the answer is the value of the project that was not selected! So even though the answers were all numbers, there's no math at all in this question.

## Answers

~~Exam Questions~~**6. Answer: D**

This is one of those questions that gives you a definition and asks you to pick the term that's being defined. So which one is it?

Try using the process of elimination to find the right answer! It can't be benefit-cost ratio, because you aren't being asked to compare the overall cost of the project to anything to figure out what its benefit will be. Depreciation isn't right—that's about how your project loses value over time, not about its costs. And it's not net present value, because the question didn't ask you about how much value your project is delivering today. That leaves lifecycle costing.

If you don't know the answer to a question, try to eliminate all the answers you know are wrong.

Don't forget: Lower = Loser!

**7. Answer: C**

When you see an SPI that's lower than 1, that means your project is behind schedule. But your CPI is above 1, which means that you're ahead on your budget!

**8. Answer: C**

Use the formula:  $EV = BAC \times \text{actual \% complete}$ . When you plug the numbers into the formula, the right answer pops out!

I LOVE THESE  
CALCULATION QUESTIONS  
BECAUSE WHEN I SEE THAT THE  
ANSWER ON MY CALCULATOR  
MATCHES ONE OF THE CHOICES, I  
KNOW I GOT IT RIGHT!

**9. Answer: B**

You might not have recognized this as a TCPI problem immediately, but take another look at the question. It's asking you whether or not a project is going to come in under budget, and that's what TCPI is for. Good thing you were given all of the values you need to calculate it! The actual % complete is 57%, the BAC is \$1,500,000, and the AC is \$950,000. You can calculate the EV =  $BAC \times \text{actual \% complete} = \$1,500,000 \times 57\% = \$855,000$ . So now you have everything you need to calculate TCPI: this means he needs a TCPI of 1.17 in order to come in under budget. Since he knows that he can't get better than 1.05, he's likely to blow the budget.

$$TCPI = \frac{BAC - EV}{BAC - AC} = \frac{(\$1,500,000 - \$855,000)}{(\$1,500,000 - \$950,000)} = 1.17$$



## Answers

~~Exam Questions~~

## 10. Answer: D

Some of these calculation questions can get a little complicated, but that doesn't mean they're difficult! Just relax—you can do them!

The formula you need to use is:  $SPI = EV \div PV$ . But what do you use for EV and PV? If you look at the question again, you'll find everything you need to calculate them. First, figure out earned value:  $EV = BAC \times \text{actual \% complete}$ . But wait! You weren't given these in the question!

OK, no problem—you just need to think your way through it. The project will cost \$52/meter to lay 4 km (or 4,000 meters) of cable, which means the total cost of the project will be  $\$52 \times 4,000 = \$208,000$ . And you can figure out actual % complete too! You've laid 1,800 meters so far out of the 4,000 meters you'll lay in total...so that's  $1,800 \div 4,000 = 45\%$  complete. All right! Now you know your earned value:  $EV = \$208,000 \times 45\% = \$93,600$ .

So what's next? You've got half of what you need for SPI—now you have to figure out PV. The formula for it is:  $PV = BAC \times \text{scheduled \% complete}$ . So how much of the project were you supposed to complete by now? You're five weeks into an eight-week project, so  $5 \div 8 = 62.5\%$ . Your PV is  $\$208,000 \times 62.5\% = \$130,000$ . Now you've got everything you need to calculate SPI!  $EV \div PV = \$93,600 \div \$130,000 = .72$

SO THAT QUESTION  
WAS REALLY ABOUT  
WHETHER I COULD FIGURE  
OUT HOW TO CALCULATE  
EV AND PV FROM WHAT I  
WAS GIVEN.

Did you think that this was a red herring? It wasn't—you needed all the numbers you were given.

## 11. Answer: B

You'll run into a lot of questions like this where a problem happens, a person has an issue, or the project runs into trouble. When this happens, the first thing you do is stop and gather information. And that should make sense to you, since you don't know if this change will really impact cost or not. It may seem like a huge change to the programmer, but may not actually cost the project anything. Or it may really be huge. So the first thing to do is figure out the impact of the change on the project constraints, and that's what answer B says!



## Answers

~~Exam Questions~~

## 12. Answer: B

What formula do you know that has AC and EV? Right: the CPI formula does! Take a look at it:  $CPI = EV \div AC$ . So what happens if AC is bigger than EV? Make up two numbers and plug them in. You get CPI that's below 1, and you know what that means...it means that you've blown your budget!

12. If AC (ACWP) is greater than your EV (BCWP), what does this mean?

Here are more of those four-letter abbreviations. Don't worry—you don't need to memorize these.

IF I WRITE DOWN ALL OF THE FORMULAS ON MY SCRATCH PAPER BEFORE THE TEST STARTS, QUESTIONS LIKE THIS WILL BE A LOT EASIER!

## 13. Answer: D

This question gave you a definition and is checking to see if you know what it refers to. You should take a minute to look at the four possible answers and see if you can think of the definition for each of them. It's definitely worth taking the time to understand what each of these formulas and variables represents in real life! It will make the whole exam a lot easier.

## 14. Answer: C

This is a classic red herring question! The money you've spent so far is the actual cost. It's a simple definition question, wrapped up in a whole bunch of fluff!

14. You are managing an industrial architecture project. You've spent \$26,410 so far to survey...

This is the only part of the question that matters—the rest is a red herring.

## 15. Answer: A

When you plug a bunch of values into a formula or computer program, and it generates an estimate, that's called parametric estimation. Parametric estimation often uses some historical data, but that doesn't mean it's the same as analogous estimation.



~~Exam Questions~~**16. Answer: C**

You've been given a net present value (NPV) for each project. NPV means the total value that this project is worth to your company. It's got the costs—including opportunity costs—built in already. So all you need to do is select the project with the biggest NPV.

**17. Answer: B**

The rough order of magnitude estimate is a very preliminary estimate that everyone knows is only within an order of magnitude of the actual cost (or  $-25$  to  $+75\%$ ).

**18. Answer: A**

You should definitely have a pretty good idea of how change control works by now! The change control system defines the procedures that you use to carry out the changes. And Control Costs has its own set of procedures, which are part of the Perform Integrated Change Control process you learned about in Chapter 4.

**19. Answer: B**

You use the project cost baseline to measure and monitor your project's cost performance. The idea behind a baseline is that when a change is approved and implemented, the baseline gets updated.

I RECOGNIZE THIS! A CHANGE IS REQUESTED, APPROVED, AND IMPLEMENTED, AND THEN THE BASELINE IS UPDATED. SO I'M USING THE COST BASELINE JUST LIKE I USED THE SCOPE BASELINE BACK IN CHAPTER 5.

**20. Answer: C**

You should have the hang of this by now! Plug the numbers into the formula ( $CPI = EV \div AC$ ), and it spits out the answer. Sometimes the question will give you more numbers than you actually need to use—just ignore them like any other red herring and use only the ones you need!

**21. Answer: B**

If your TCPI is above 1, you need to manage costs aggressively. This means that you need to meet your goals without spending as much money as you have been for the rest of the project.



## Answers

~~Exam Questions~~**22. Answer: B**

If you are just starting to work on your project charter, it means you're just starting the project and you don't have enough information yet to do analogous, parametric, or bottom-up estimates.

The only estimation technique that you can use that early in the project is the rough order of magnitude estimate. That kind of estimate is not nearly as accurate as the other kinds of estimate and is used just to give a rough idea of how much time and cost will be involved in doing a project.

**23. Answer: D**

This question may have seemed a little wordy, but it's really just a question about the definition of TCPI. You're being asked to figure out where you need to keep your project's CPI in order to meet your budget. And you know it's the EAC-based TCPI number, because the question specified that you already gave him a forecast, which means you gave him an EAC value already. So now you can calculate the EAC-based TCPI number to figure out where you need to keep your CPI for the rest of the project.

By calculating this based on the EAC, you show your sponsor just how much money he needs to kick in (or less, if you've got good news!) in order to come in under budget.





## 8 Quality management

# Getting it right

I CAN'T REMEMBER IF I USED CHOCOLATE CHIPS OR MARBLES, BUT I GUESS IT'S OK. SOMEONE'S SURE TO FIGURE IT OUT BEFORE THE BIG BAKE SALE.



**It's not enough to make sure you get it done on time and under budget.** You need to be sure you make the right product to suit your stakeholders' needs. Quality means making sure that you build what you said you would, and that you do it as efficiently as you can. That means trying not to make too many mistakes and always keeping your project working toward the goal of creating the right product!

## What is quality?

Everybody “knows” what **quality** is. But the way the word is used in everyday life is a little different than how it is used in project management. You manage quality on your project by setting goals and taking measurements. That’s why you need to understand the quality levels your stakeholders believe are acceptable, and ensure that your project meets those targets...just like it needs to meet their budget and schedule goals.



How do you know if this is a high-quality product?



How can you tell a high-quality product from a low-quality one?

# You need more than just tests to figure out quality

A lot of people confuse quality with testing. When projects run into quality problems, some project managers will respond by adding more testers to the project to try to find more bugs. But testing is only one part of the story. To know your product's quality, you need to do more than test it:



The Black Box 3000™



### Scenario 1

Lisa presses the button, but nothing happens.



### Scenario 2

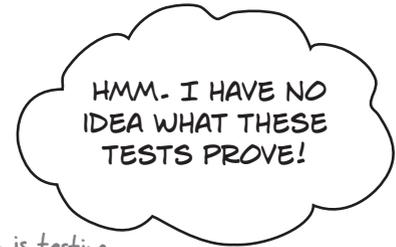
Lisa presses the button and a voice comes out of the box that says, "You pressed the button incorrectly."



### Scenario 3

Lisa presses the button and the box heats up to 628°F. Lisa drops the box and it shatters into hundreds of pieces.

How does Lisa know which of these boxes is working, and which failed her test?



Lisa, our tester, is testing the Black Box 3000™, but she isn't sure what she's supposed to be testing for.

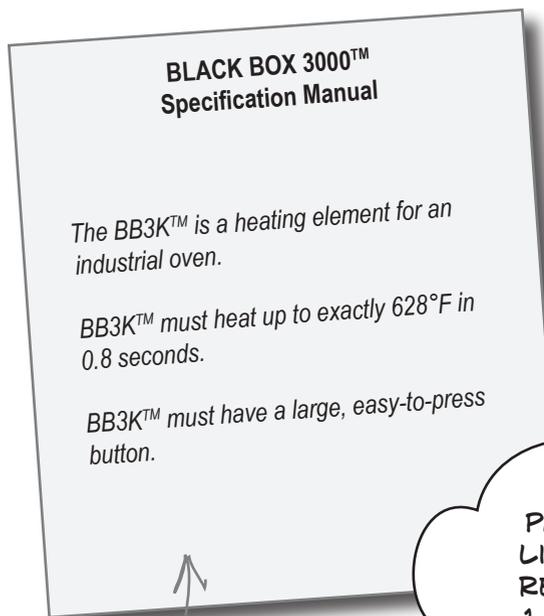


## Once you know what the product is supposed to do, it's easy to tell which tests pass and which fail

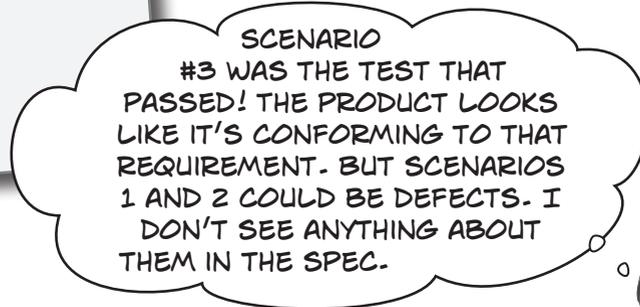
Testing is all about checking to be sure that the product does what it is supposed to do. That means that you need to have a good idea of what it is supposed to do to judge its quality. That's why the most important concept in defining quality for the PMP exam is **conformance to requirements**. That just means that your product is only as good as the requirements you have written for it. To say that something is a high-quality product means that it fulfills the requirements your team agreed to when you started the work.

That's why getting the Collect Requirements process right is so important!

Quality is the measurement of how closely your product meets its requirements.



The spec lists all of the requirements that must be met by the product.



Now that she knows what she is supposed to be testing for, Lisa can report on what behavior was correct and what wasn't.





## Quality up close

There are a few general ideas about quality that will help you understand a little better where the PMP exam is coming from. A lot of work has been done on quality engineering in the past 50 years or so that was originally focused on manufacturing. Those ideas have been applied to product quality over lots of different industries. Here are a few concepts that are important for the exam.

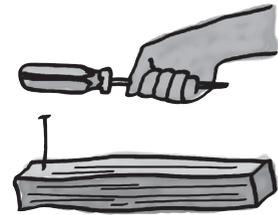
**Customer satisfaction** is about making sure that the people who are paying for the end product are happy with what they get. When the team gathers requirements for the specification, they try to write down all of the things that the customers want in the product so that you know how to make them happy.

Customer needs should be written down as requirements before you start to build your product. That way, you can always plan on building the right thing.

Some requirements can be left **unstated**, too. Those are the ones that are implied by the customer's explicit needs. In the end, if you fulfill all of your requirements, your customers should be really satisfied.

Some requirements are just common sense—like a product that people hold can't be made from toxic stuff that kills you. It might not be stated, but it's definitely a requirement.

**Fitness for use** is about making sure that the product you build has the best design possible to fit the customer's needs. Which would you choose: a product that's beautifully designed, well constructed, solidly built, and all around pleasant to look at but does not do what you need, or a product that does what you want despite being really ugly to look at and a pain in the butt to work with?



You'll always choose the product that fits your needs, even if it's seriously limited. That's why it's important that the product both does what it is supposed to do and does it well.

You could pound in a nail with a screwdriver, but a hammer is more fit for the job.

This idea came from a quality theorist named Joseph Juran.

**Conformance to requirements** is the core of both customer satisfaction and fitness for use. Above all, your product needs to do what you wrote down in your requirements specification. Your requirements should take into account both what will satisfy your customer and the best design possible for the job.

Philip Crosby made this idea popular in the early 1980s. It's been really important to quality engineering ever since.

In the end, your product's quality is judged by whether you built what you said you would build.

Quality is a measure of how well your product does what you intend.

That means conforming to both stated and implied requirements.



I KNOW QUALITY WHEN I SEE IT. CAN'T I JUST LOOK AT THE FINAL PRODUCT AND REJECT IT IF IT'S LOW QUALITY?

**It's easy to mistake a low-grade product for a low-quality one.**

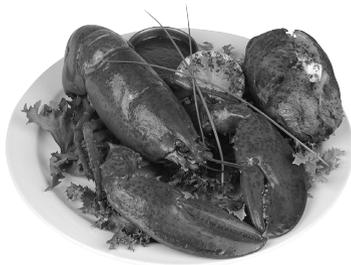
When people talk about the quality of their car or their meal, they are often talking about its **grade**. You can judge something's *grade* without knowing too much about its requirements. But that's a lot different than knowing its *quality*.

## Quality vs. grade

You can eat a lobster platter for dinner, or you can eat a hot dog. They are both types of food, right? But they have very different tastes, looks, feels, and most importantly, cost. If you order the lobster in a restaurant, you'll be charged a lot more than if you order a hot dog. But that doesn't mean the lobster is a higher-quality meal. If you'd ordered a salad and got lobster or a hot dog instead, you wouldn't be satisfied.

Quality means that something does what you needed it to do. Grade describes how much people value it.

Higher-grade stuff typically costs more, but just because you pay more for something doesn't mean it does what you need it to do.



The lobster is a high-grade meal; the hot dog is a low-grade one. But they're both low quality if you actually wanted a salad.

# Sharpen your pencil



Take a look at each of these situations and figure out if they're talking about quality or grade.

1. You ordered mushrooms on your pizza, but you got onions.

Quality

Grade

3. The pizza arrived, but it had canned mushrooms.

Quality

Grade

2. You called the pizza parlor to complain and the guy yelled at you.

Quality

Grade

4. The pizza was cold.

Quality

Grade

5. You just got a brand new luxury car that cost a whole lot of money.

Quality

Grade

7. Your neighbors make fun of you because your chrome hubcaps aren't very classy...

Quality

Grade

6. But it's in the shop every two weeks.

Quality

Grade

*You probably didn't tell the salesman you needed the car to work, but you expected it to. That's an unstated requirement.*

8. ...even though they do a great job of protecting the wheels from dirt, which is why you bought them in the first place.

Quality

Grade

—————▶ **Answers on page 466.**

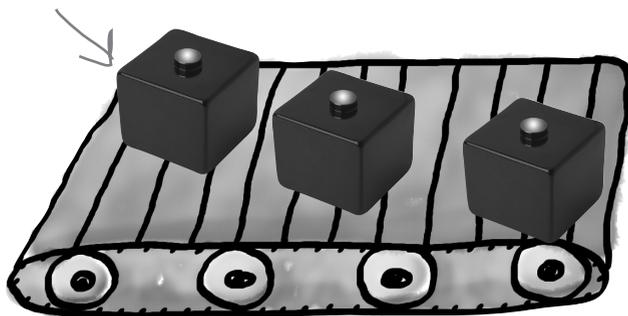
# BRAIN POWER

We've talked about how you can't simply test the product to figure out its quality. Can you think of ways that you can make a product's quality higher?

## “An ounce of prevention...”

It's not enough to go to the dentist to get your cavities filled. You need to brush your teeth every day. The same goes with product quality. If you focus on preventing mistakes on your project before they happen, you are more likely to get the product done on time and without spending too much money.

10% of the Black Boxes have buttons that stick when you press them.



We could hire a lot more inspectors to check to see if each of the products has a sticky button and send it for repair...

### And that's why you need the three Quality Management processes!

There are **three processes** in the Quality Management knowledge area, and they're all designed to make sure that you and your team deliver the highest quality product that you can.

**Plan Quality Management** is like the other planning processes you've learned about—you create a Quality Management plan to help guide you and your team through quality activities.

**Manage Quality** is where you take a step back and look at how well your project fits in with your company's overall quality standards and guidelines.



# When it comes to defects, prevention is always better than inspection!

OR  
WE COULD CHANGE THE DESIGN TO MAKE THE BUTTON A MILLIMETER SMALLER AND ELIMINATE THE PROBLEM ALTOGETHER.



**Control Quality** is the Monitoring and Controlling process where you look at each deliverable and inspect it for defects.



Which of these activities are prevention, and which are inspection?

1. You find that 40% of the sneakers your factory makes have the left foot insole put into the right shoe and the right insole put into the left shoe. So, you print an L on the underside of the left insole so that factory workers can tell them apart more easily.

Prevention       Inspection

2. The applications being built by your programming team have lots of bugs. So you add extra test cycles and make them longer and more intensive to try to find more problems before you ship.

Prevention       Inspection

3. The applications being built by your programming team have lots of bugs. So you write up coding standards that will guide everyone in building the product with more attention to quality.

Prevention       Inspection

4. Some of the Black Boxes being built at the factory are only heating up to 500 degrees when the button is pushed. So you set up an automated button presser to press each one and measure its temperature as it comes off of the assembly line.

Prevention       Inspection

5. You set up code reviews at important milestones in your project to catch defects as early as you can.

Prevention       Inspection

6. The programmers on your team write unit tests before they write the code for the application they're writing. That helps them to think of ways that the application's design might go wrong and avoid major pitfalls.

Prevention       Inspection



**Exercise Solution**

Which of these activities are prevention, and which are inspection?

1. You find that 40% of the sneakers your factory makes have the left foot insole put into the right shoe and the right insole put into the left shoe. So, you print an L on the underside of the left insole so that factory workers can tell them apart more easily.

Prevention

Inspection

The focus here is on making sure that no more defects happen, rather than on finding them.

2. The applications being built by your programming team have lots of bugs. So you add extra test cycles and make them longer and more intensive to try to find more problems before you ship.

Prevention

Inspection

Catching the bugs after they've been put in the product is not the most efficient way to deal with this problem. It will cost more money and take longer.

3. The applications being built by your programming team have lots of bugs. So, you write up coding standards that will guide everyone in building the product with more attention to quality.

Prevention

Inspection

This is a much better way of dealing with the same problem. It focuses on making sure the bugs never make it into the software rather than finding them and fixing them.

4. Some of the Black Boxes being built at the factory are only heating up to 500 degrees when the button is pushed. So you set up an automated button presser to press each one and measure its temperature as it comes off of the assembly line.

Prevention

Inspection

This one is also focused on finding the problems once they're in the product.

5. You set up code reviews at important milestones in your project to catch defects as early as you can.

Prevention

Inspection

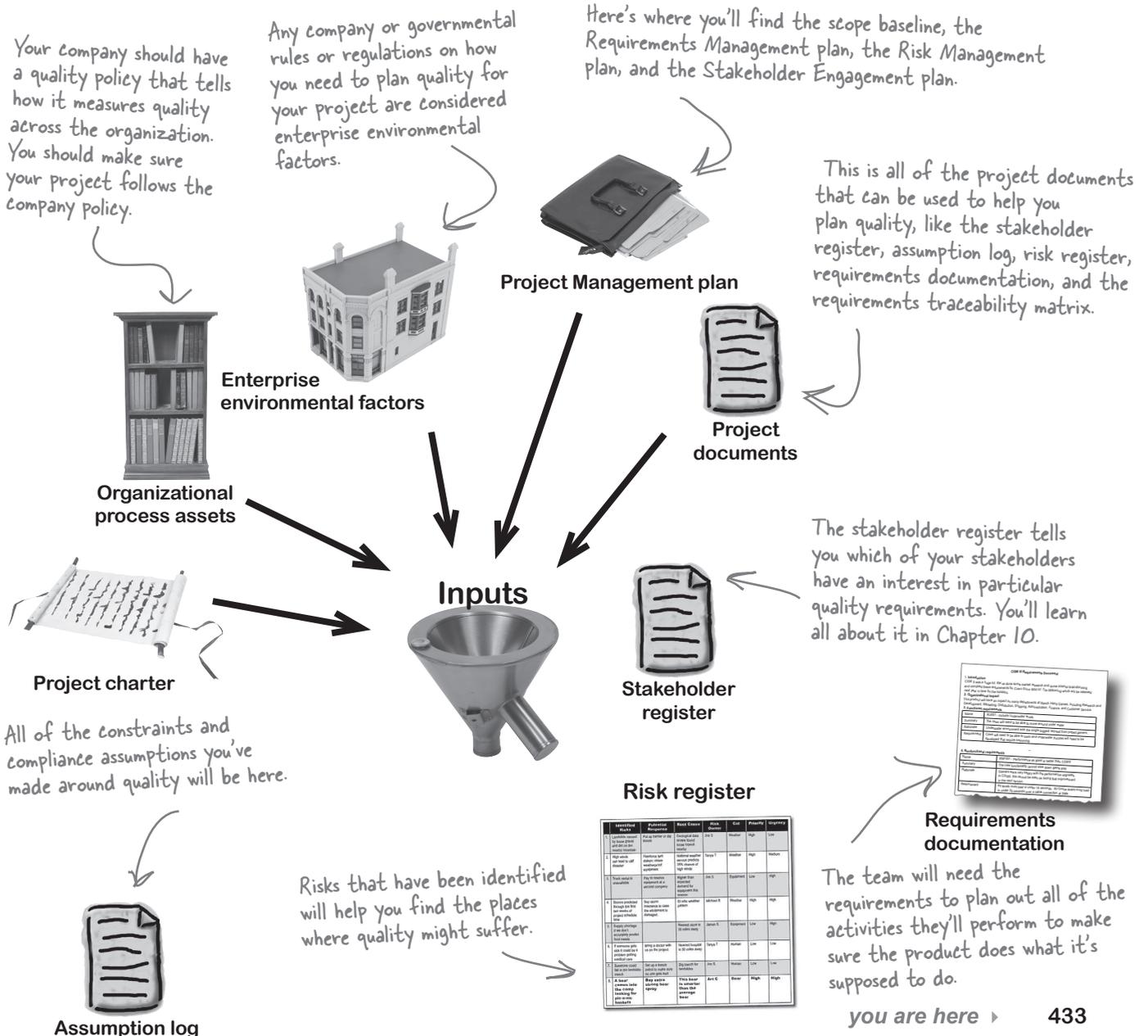
6. The programmers on your team write unit tests before they write the code for the application they're writing. That helps them to think of ways that the application's design might go wrong and avoid major pitfalls.

Prevention

Inspection

# Plan Quality is how you prevent defects

Since prevention is the best way to deal with defects, you need to do a lot of planning to make sure that your product is made with as few defects as possible. The **Plan Quality Management process** focuses on taking all of the information available to you at the beginning of your project and figuring out how you will measure your quality and prevent defects.



Assessment	Category	Priority	Impact	Probability	Owner	Status	Update
1. Review project charter for quality requirements	Quality	High	High	High	Project Manager	Open	2023-10-27
2. Review project charter for quality requirements	Quality	Medium	Medium	Medium	Project Manager	Open	2023-10-27
3. Review project charter for quality requirements	Quality	Low	Low	Low	Project Manager	Open	2023-10-27
4. Review project charter for quality requirements	Quality	High	High	High	Project Manager	Open	2023-10-27
5. Review project charter for quality requirements	Quality	Medium	Medium	Medium	Project Manager	Open	2023-10-27
6. Review project charter for quality requirements	Quality	Low	Low	Low	Project Manager	Open	2023-10-27
7. Review project charter for quality requirements	Quality	High	High	High	Project Manager	Open	2023-10-27
8. Review project charter for quality requirements	Quality	Medium	Medium	Medium	Project Manager	Open	2023-10-27
9. Review project charter for quality requirements	Quality	Low	Low	Low	Project Manager	Open	2023-10-27
10. Review project charter for quality requirements	Quality	High	High	High	Project Manager	Open	2023-10-27

## How to plan for quality

You need to plan out which activities you're going to use to measure the quality of the product of your project. And you need to be sure that the activities you plan are going to pay off in the end. So you'll need to think about the cost of all of the quality-related activities you want to do. Then you'll need to set some guidelines for what you're going to measure against. Finally, you'll need to design the tests you're going to run when the product is ready to be tested.



### Data gathering

**Benchmarking** means using the results of Plan Quality on other projects to set goals for your own. You might find that the last project your company did had 20% fewer defects than the one before it. You would want to learn from a project like that, and put in practice any of the ideas the company used to make such a great improvement. Benchmarks can give you some reference points for judging your own project before you even get started with the work.

**Brainstorming.** We'll learn more about this technique in Chapter 11. Teams use brainstorming to identify the best way to manage quality on the project.

**Interviews.** The people participating in the project have a lot of information from their experience that can help you plan quality management.

### Data analysis

**Cost-benefit analysis** is looking at how much your quality activities will cost versus how much you will gain from doing them. The costs are easy to measure; the effort and resources it takes to do them are just like any other task on your schedule. Since quality activities don't actually produce a product, though, it is harder for people to measure the benefits sometimes. The main benefits are less rework, higher productivity and efficiency, and more satisfaction from both the team and the customer.



← That makes sense. A team that is making a high-quality product will be really proud of their work.

**Cost of quality** is what you get when you add up the cost of all of the prevention and inspection activities you are going to do on your project. It doesn't just include the testing. It includes any time spent writing standards, reviewing documents, meeting to analyze the root causes of defects, doing rework to fix the defects once the team finds them—absolutely everything you do to ensure quality on the project.



Cost of quality can be a good number to check whether your project is doing well or having trouble. If your company tracks cost of quality on all of its projects, you could tell if you were spending more or less than the others are, so you can get your project up to snuff.

**Expert judgment** means going directly to the people with expertise and getting their help.

**Decision making**

**Multicriteria decision analysis** let you analyze multiple issues and prioritize so that you can work on the most important ones first.

**Test planning**

This is where you apply the scientific method to create a set of tests for your project's deliverables. It's a *statistical* method, which means you use statistics to analyze the results of your experiments to determine how your deliverables best meet the requirements. A lot of quality managers use this technique to produce a list of tests that they'll run on the deliverables, so they have data to analyze later.

**Data representation**

**Flowcharts** give you a way to see all of the steps your team will follow when they perform Manage Quality activities on your project.

**Matrix diagrams** are tables, spreadsheets, or pivot tables that help you analyze complex relationships.

**Logical data models** give you a visual way to think about your data, which can help you see quality issues you didn't see before.

**Meetings**

These are used to figure out how your team will do all of the quality-related activities your project requires. The whole team might collaborate on the Quality Management plan in these meetings.



Read each of these scenarios and identify which tool or technique is being used.

**Exercise**

1. You look through your company's asset library and find that a recent project was able to reduce defects by 20% by inserting defect prevention meetings early in the construction phase. You put the same process in your quality plan and set the target for shipped defects to be 20% lower than the company average for your project.

Tool/technique: .....

2. You add up all of the costs projected for quality activities and track that number in your Quality Management plan. You use this number to gauge the health of your project compared to other projects in your company.

Tool/technique: .....

3. You write up a list of all of the tests you are going to run on the Black Box 3000™ when it rolls off the assembly line. You determine what kinds of failures might cause you to stop testing, what it would take for you to resume test activities, and requirements that the product would need to fulfill to be considered accepted into test.

Tool/technique: .....

Answers on page 467.

# The Quality Management plan gives you what you need to manage quality

Once you have your Quality Management plan, you know your guidelines for managing quality on your project. Your strategies for monitoring your project quality should be included in the plan, as well as the reasons for all of the steps you are taking. It's important that everyone on the team understands the rationale behind the metrics being used to judge success or failure of the project.

The Quality Management plan is the main tool for preventing defects on your project.

The Quality Management plan is the main output of Plan Quality Management. It's a subplan of the Project Management plan.



Outputs

A metric is just a number you use to measure your product's quality.

Even though this number is part of Cost Management, you'll often measure it in your Quality Management plan because it's part of customer satisfaction on the project.

**BLACK BOX 3000™**  
Quality Management Plan

**Project Background:**  
*The project goal is to create as many industrial heating elements as possible with no defects. Past problems included sticky buttons and difficulty testing the product. This was corrected when a specification was given to the test team.*

**Goals for Project Metrics:**

Metric	Goal	Rationale	How we'll do it
Schedule variance	<5%	Because shipments of Black Boxes are planned with clients in advance, very few delays are acceptable.	Track any activities that might cause delays. Use extra resources if necessary to meet the deadline.
Defect density	0 High priority 2 Medium priority 5 Low priority (defects per thousand Black Boxes)	Defect repair is extremely costly. We need to get as many products shipped as possible on the first try.	Set up defect prevention activities early in the process. Monitor the results of inspections and adjust if necessary.

**Defect Prevention Plan:**

## Outputs



Project Management plan

**Project Management plan updates** might need to be made because the Quality Management planning process identifies new risks or activities that add to the scope of the project. Those changes would be made in the Risk Management plan and the scope baseline.

**Quality metrics** are the kinds of measurements you'll take throughout your project to figure out its quality. If you're running a project to install windows in a skyscraper, and 15% of them have to be reinstalled because they were broken, that's an important metric. You'll probably want to work with your company to bring that number down.

Here's where you document how you'll be figuring out the product's quality. You need to write down the formulas you'll use, when you will do the measurements, why you are taking them, and how you will interpret them.

The stakeholder register might need to be updated if you find new stakeholders in the course of planning quality activities.



Stakeholder register

**Project document updates** might need to be made because you have found new information in the course of planning your quality activities that affects one of the other plans you've already made. That's why this process includes an output for making those kinds of changes.

# WHAT'S MY PURPOSE

Match each Plan Quality output to its description.

Quality Management plan

Updates to the stakeholder register, risk register, and lessons learned, to name a few.

Project Management plan updates

Helps you to plan out all of your quality activities.

Project documents updates

Describes how you'll measure a particular attribute of a deliverable during testing.

Quality metrics

Updates to the scope baseline and Risk Management plan

Answers on page 467.

## there are no Dumb Questions

**Q:** Why do you need to track the cost of testing?

**A:** You mean **cost of quality**, right? Cost of quality isn't just the cost of testing. It's the cost of all of your quality activities. Even preventive activities like spending time writing checklists and standards are part of it. The reason you track cost of quality is that it can tell you a lot about the health of your project as a whole.

Say you find you're spending twice as much on quality activities as you are on building your product. You need to use that number to start asking some questions about the way the work is being done.

Are people not doing enough up front to prevent defects, and adding a lot of expensive test activities at the end of the project to compensate? Is the design not clear, so your team needs to do a lot of rework trying to get what the customer needs? There are many reasons that could be causing a high cost-of-quality number, but you wouldn't even know to ask about them if *you didn't track it*.

**Q:** How do you know your benchmarks before you start building?

**A:** That's what your organizational process assets are for. Since your company keeps a record of all of the projects that have been done over the years, those projects' quality measurements can help you gauge how your project will perform too. If your company knows that all of the projects in your division had a cost of quality that was 40% of the overall cost of development, you might set 40% cost of quality as a benchmark for your project as well. Your company might have stated a goal of having a schedule variance of plus or minus 10% on all projects for this calendar year. In that case, the schedule variance is a benchmark for your project.

**Q:** I don't really have good requirements for my projects because everyone on the team starts out with just a good idea of what we're building. How do I handle quality?

**A:** You should never do that. Remember how you spent all that time collecting requirements in the Collect Requirements process? Well, this is why you needed them. And it's why it's **your** responsibility to make sure that the project starts out with good, well-defined, and correct requirements. If you don't have them, you can't measure quality—and quality is an important part of project management.

Without requirements, you have no idea what the product is supposed to do, and that means you can't judge its quality. You can learn a lot about a product by testing it, but if you don't know its requirements, a product could pass all of its tests and still not do what the customer expects it to do. So having good requirements really is the only way to know whether or not your product is high quality.

# Inspect your deliverables



It's not enough to inspect the final product. You must look at all of the things that you make throughout a project to find bugs. In fact, the earlier you find them, the easier they are to fix. The **Control Quality process** is all about inspecting work products to find defects.

## LAST WEEK

Lisa looked for defects in the parts as they were being made.

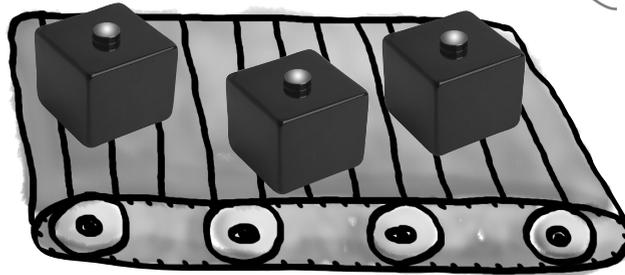


She also inspected the blueprints for the Black Box when they were designed.



## TODAY

Lisa takes a good look at a sample of all of the products that are about to be shipped to Black Box 3000™ customers.



Control Quality is in the Monitoring and Controlling process group. As in Control Scope and Control Costs, you look at the work performance information that is coming from your project and compare it to your plan. ***If there are problems, you recommend a change. That way, you can either fix the problem or make sure that it doesn't happen again.***



How would you use your checklists and metrics to inspect all of the deliverables and find defects?

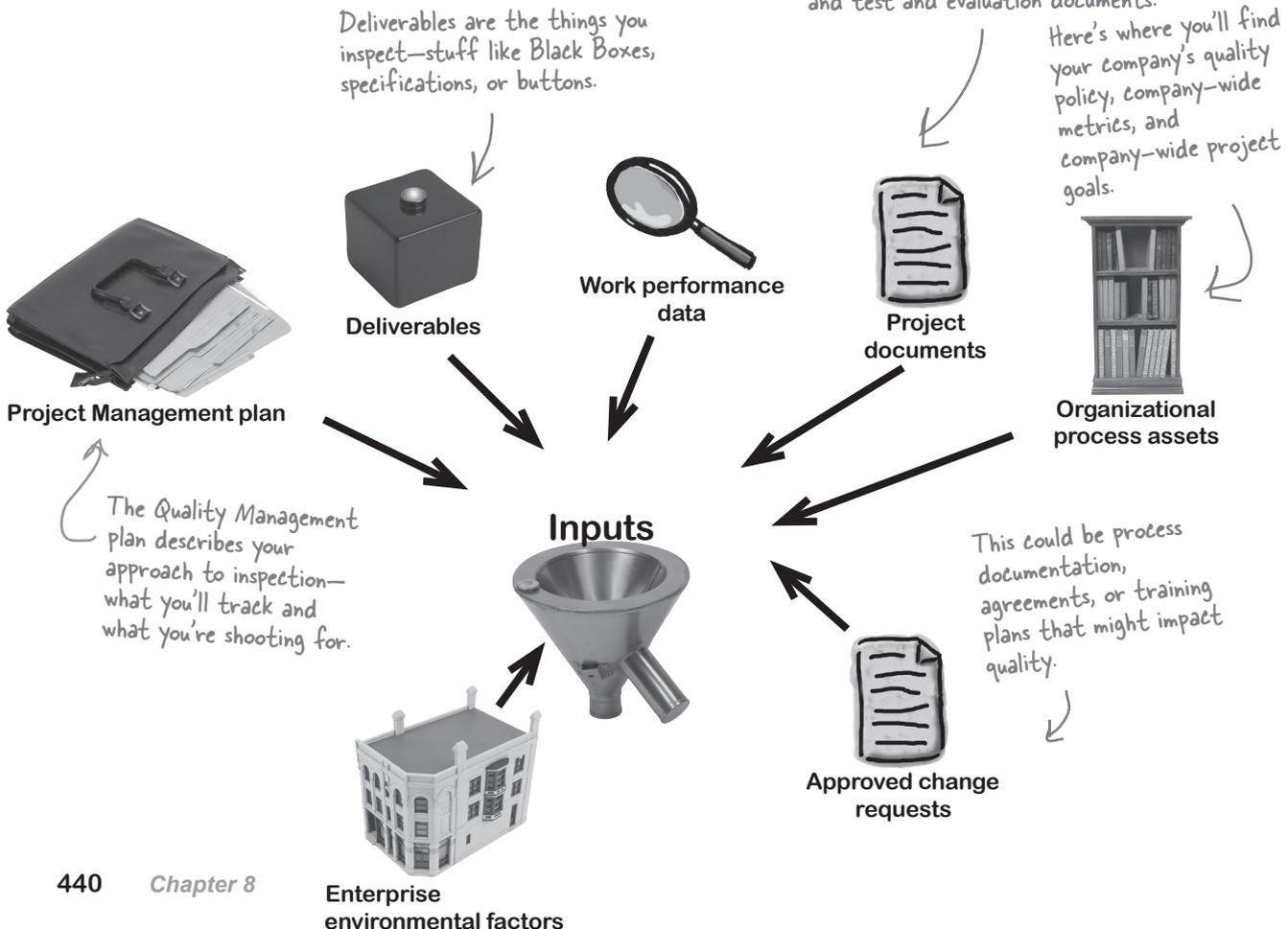
## Use the planning outputs for Control Quality

You've come up with a plan to make sure each deliverable is right. Now it's time to monitor the work that's being done to the requirements—and that's just a matter of following your plan! You'll need to look at everything that is being produced and make sure that it stands up to all of the requirements that have been gathered. And you'll need nearly everything you produced in Plan Quality Management in order to get a handle on your product's quality.

# Metrics make it easy for you to check how well your product meets expectations.

Metrics tell what and how you are going to measure your product's quality. Other documents you might use here are lessons learned, and test and evaluation documents.

Here's where you'll find your company's quality policy, company-wide metrics, and company-wide project goals.



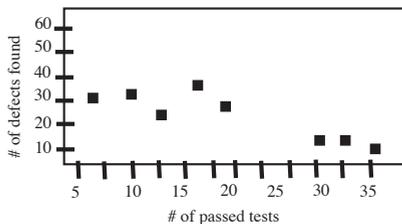


## Tools for data gathering

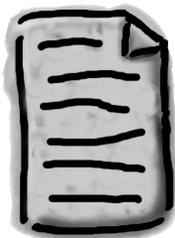
You'll need to gather data about the product or service your project is building to understand its quality. Expect a bunch of questions on these tools in the exam!



**Checksheets** allow you to collect data on the product under test. Checksheets are sometimes called *checklists* or *tally sheets*. You can use them to organize the test activities you'll be performing and track whether the product passes or fails tests. Checksheets are often used as a means of gathering the data that's displayed in trending and charting tools.



**Statistical sampling** is when you look at a representative sample of something to make decisions. For example, you might look at a selection of widgets produced in a factory to figure out which quality activities would help you prevent defects in them. Statistical sampling helps you make decisions about your product without looking at each and every thing you make. Lisa is responsible for the quality of the Black Box 3000™, but there's no way she can inspect each one as it comes off the assembly line. It makes sense for her to take a sample of the products and inspect those. From that sample she can learn enough about the project to make good judgments.



**Questionnaires and surveys** can be used to gather feedback from customers when they've had some time to use the product. Sometimes a defect is higher priority to a customer than the team anticipated, and surveys can uncover the customer's perception of a product in a way that otherwise might be difficult for the team to understand.

**Meetings** are also a tool for Control Quality. (Meetings are not part of data gathering, but a tool on their own.)



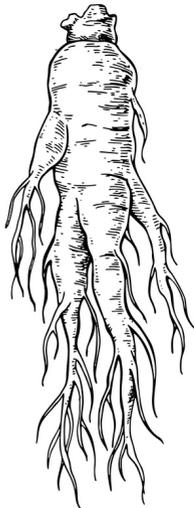
Oops! This is part of the template for the page. We forgot to change it! Too bad we didn't catch this when we were performing quality management.

## Tools for data analysis



Once you have all of the data you have gathered from quality checksheets, surveys, and statistical sampling, you need to analyze it and look for differences between what you expected when you planned the project and how it is currently performing.

**Performance reviews** are how you and your team will evaluate the current measurements of your product's quality in comparison to the measurements you expected to see. Say you set a threshold in your Quality Management Plan for a software project that it should not contain more than 10 noncritical priority defects per 10,000 lines of code. In a performance review, you would review the number of defects encountered during tests to understand if the product was meeting that quality threshold.



**Root cause analysis** is all about evaluating the product your project is creating to understand why defects are occurring. It's not enough to just find the problem, you need to trace it back to the thing that caused it. Sometimes you'll end up asking "Why?" again and again until you finally identify a cause of multiple problems, which you can then fix with more impact than if you'd just fixed the initial problem.

↑  
Taiichi Ohno, one of the first Lean thinkers, popularized the idea of root cause analysis by asking "Why?" five times to find the root of problems encountered as part of the Toyota Production System. This technique came to be called "the five whys."

### BRAIN POWER

Can you think of an example of a problem that appeared to be isolated on a project you've managed but was actually related to other problems you were seeing? How might root cause analysis have helped you solve those issues?

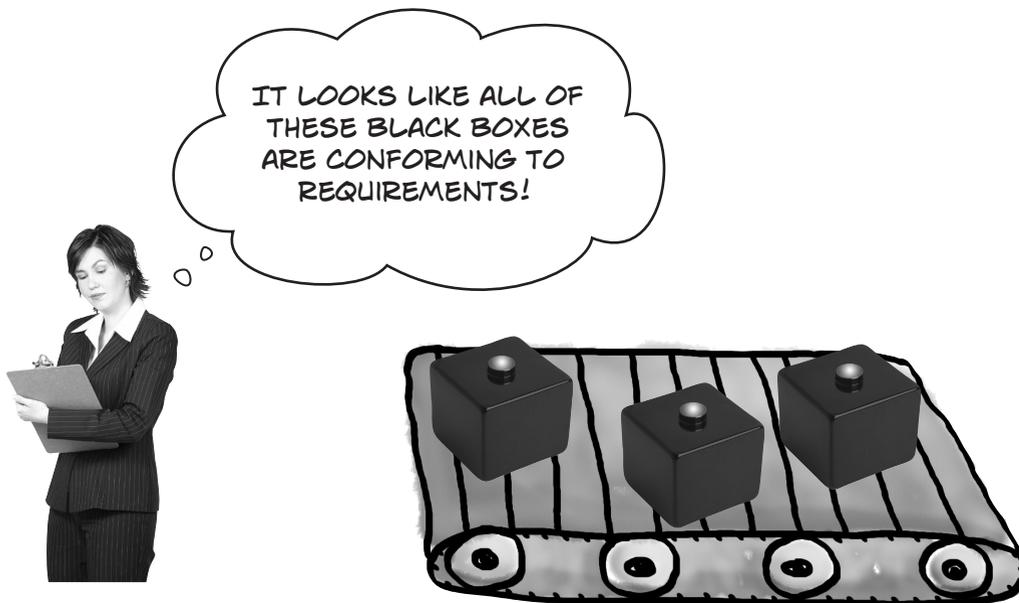


## Inspection, testing, and product evaluation

As soon as you create deliverables on your project, your team inspects, tests, and evaluates them to make sure that they are meeting the standards you set when you were planning.

**Inspection** means comparing the deliverables in your project to the standards you've created for them. If deliverables don't meet your project's standards, you've found a defect. It's not just the product of your project that gets inspected, though. You can inspect any interim deliverable as you go—and the sooner you inspect and find defects in a deliverable, the less expensive it is to fix. That's why many agile practices focus on the creator of a document or product inspecting their own work as they build and using peer reviews to inspect deliverables before calling them done.

**Testing/product evaluations** are planned as part of the Plan Quality process. As new deliverables are made available throughout your project, the team tests them to understand how much they conform to the requirements that have been defined up front. Where the product doesn't behave as specified, that's considered a defect. Usually teams will review all of the defects found during testing to determine whether or not they need to be fixed and the impact of making those fixes on other planned work.

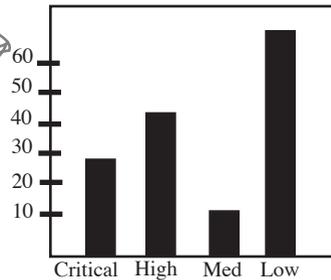




## Tools for data representation

Once you've gathered data and analyzed it, you'll need to show the data to other people to help drive decisions. These tools for data representation help visualize your data so that everyone in your project can use it to get a handle on quality in your project.

This product probably isn't ready to ship—it still has a lot of bugs. But at least you know that the bugs aren't all critical!



Don't call this a "bar chart"! In the PMP world, a bar chart is another name for a Gantt chart, which is a kind of project schedule.

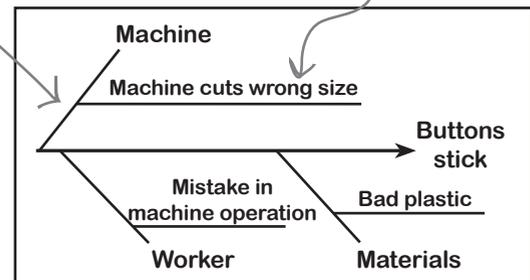
The PMBOK® Guide does refer to a histogram as a "vertical bar chart," so you might see that term where you might normally see "bar chart."

**Histograms** give you a good idea of how your data breaks down. If you heard that your product had 158 defects, you might think that they were all critical. So looking at a chart like this one would help you to get some perspective on the data. A lot of the bugs are low priority. It looks like only 28 or so are critical. Histograms are great for helping you to compare characteristics of data and make more informed decisions.

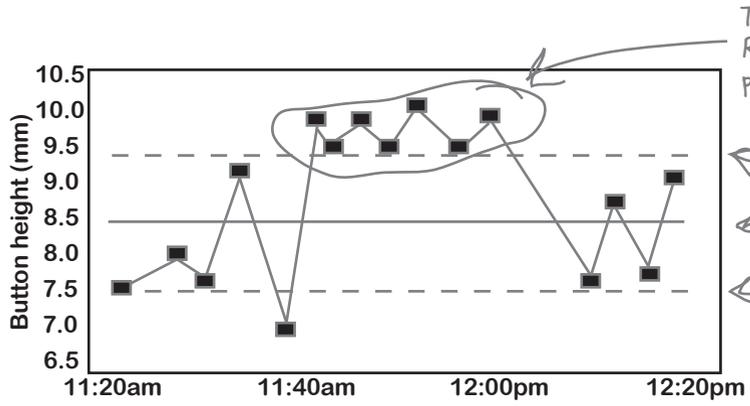
**Cause and effect diagrams** are also called **fishbone** and **Ishikawa** diagrams. They are used to figure out what caused a defect. You list all of the categories of the defects that you have identified and then write the possible causes of the defect you are analyzing from each category.

Fishbone diagrams help you **see all of the possible causes** in one place so you can think of how you might prevent the defect in the future.

The vertical "fishbone" lines are categories to help you find and organize the root causes of defects. Horizontal lines show the root causes you've found for each category.



Fishbone or Ishikawa diagram



These points are showing the Rule of Seven AND that this process is out of control.

There are three lines on a control chart. The first one is the upper control limit.

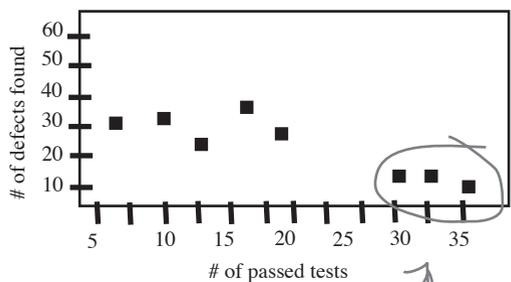
Mean is the average height in your sample of buttons.

The lower control limit is the last line. This one represents the shortest that you want the buttons to be.

**Control charts** are a way of visualizing how processes are doing over time. Let's say that the button on each Black Box needs to be between 7.5 and 9.5 millimeters tall, and the chart above represents sample height measurements of boxes being made. Since we want the boxes to all be between 7.5 mm and 9.5 mm, the **lower control limit** of the chart is 7.5 mm, and the **upper control limit** is 9.5 mm. The chart above shows control limits as dashed lines. The **mean** is the solid line in the middle, and it shows the average height of all of the buttons in the sample. By looking at the chart above, you can see that there are a lot of buttons that were taller than 9.5mm manufactured and only one that was shorter than 7.5mm. When a data point falls outside of the control limits, we say that data point is **out of control**, and when this happens we say that the **entire process is out of control**.

It's pretty normal to have your data fluctuate from sample to sample. But when seven data points in a row fall **on one side of the mean**, that's an uncommon enough occurrence that it means your process might have a problem. So when you see this, you need to look into it and try to figure out what's going on. That's called the **rule of seven**, and you'll definitely see questions about it on the PMP exam.

When you're looking at the whole process, that's called Manage Quality—and it's coming up next.



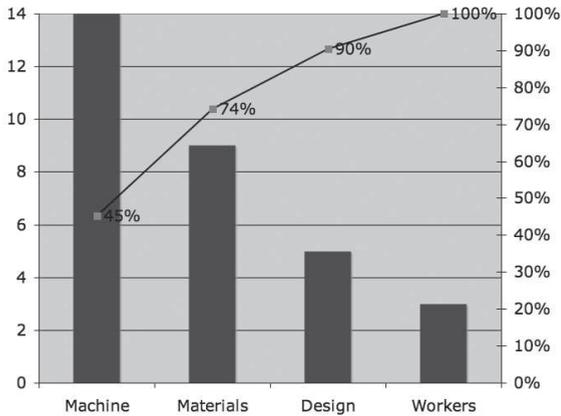
When the number of tests passing goes up, fewer defects are found.

**Scatter diagrams** show how two different types of data relate to each other. If you worked with your test team to create a bunch of new tests, you might use a scatter diagram to see if the new test cases had any impact on the number of defects you found. The chart here shows that as more test cases pass, fewer defects are found.



# Exercise

Answer the questions about the Black Box 3000™ using the Control Quality charts below.



Which root cause is responsible for the most defects in the project?

.....

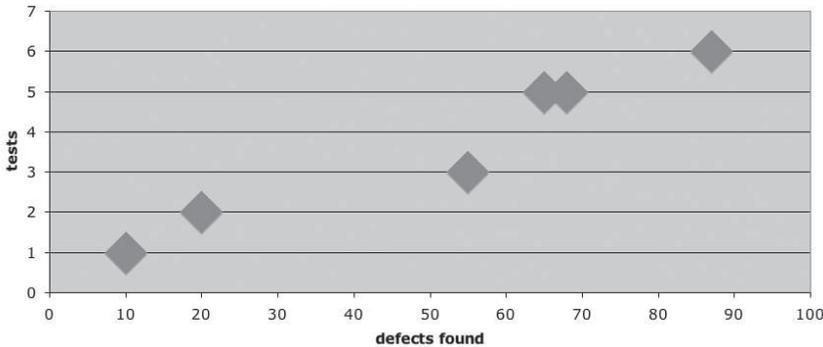
What is the lowest-priority area for defect prevention?

.....

What is the cumulative percentage of machine, materials, and design defects?

.....

defects and testers



*Hint: Look for a gap in the chart that shows you how adding an extra test caught a lot more defects.*

Did adding more tests find more bugs?

.....

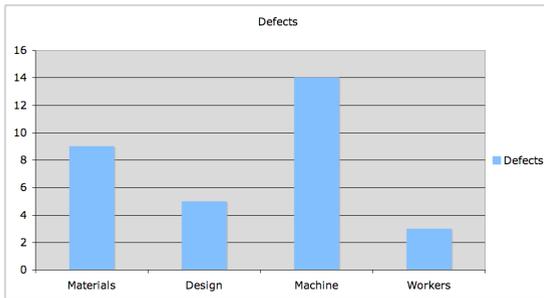
Where did you see the biggest increase in defect detection?

.....

Looking at this chart, should you continue to add more tests to the project?

.....

*In other words, did adding extra tests help you find more defects?*



How many machine defects were found?

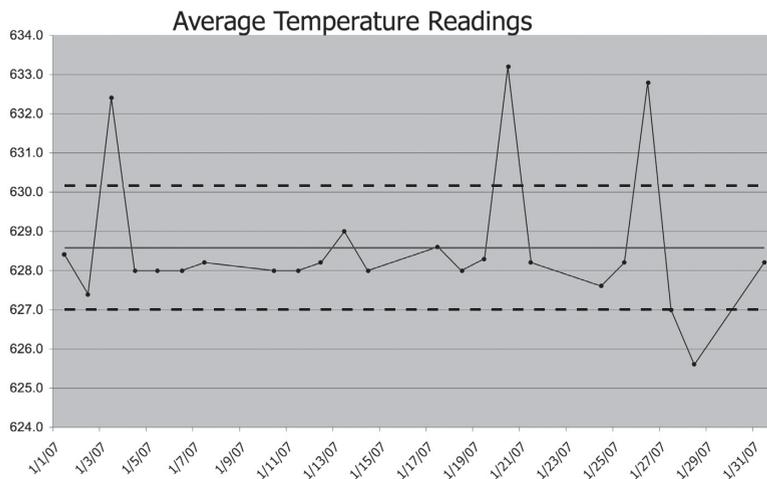
.....

How many defects were caused by workers?

.....

How many total defects are shown on this chart?

.....



Circle the data points that make up the rule of seven.

Is this process in control?

.....

What's the upper control limit?

.....

What's the mean temperature reading?

.....

What's the lower control limit?

.....

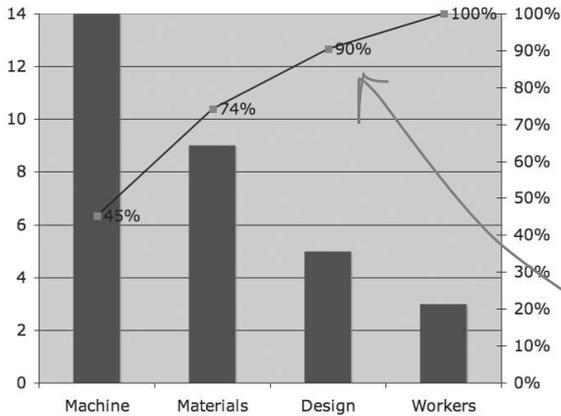


**Exercise Solution**

Answer the questions about the Black Box 3000™ using the Control Quality charts below.

This is a type of histogram called a Pareto chart that's used to plot out the frequency of defects and sort them in descending order.

*You have the most machine defects. So, that's the root cause you should tackle first.*



Which root cause is responsible for the most defects in the project?

**Machine**

What is the lowest-priority area for defect prevention?

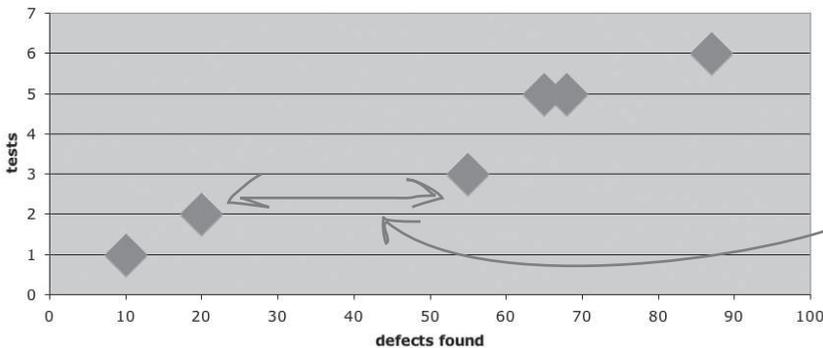
**Workers**

What is the cumulative percentage of machine, materials, and design defects?

**90%**

*Since you don't have very many worker-related defects, they're the lowest priority for improvement tasks.*

defects and testers



*The gap between 2 and 3 was the largest, so that's where we had the biggest jump in defect detection.*

Did adding more tests find more bugs?

**Yes**

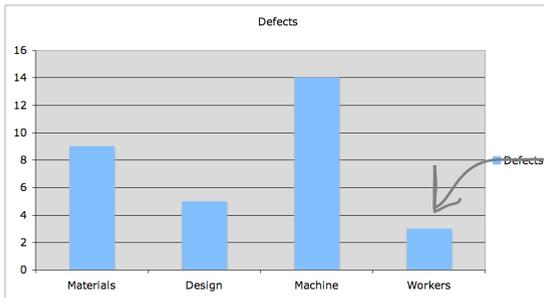
*Looks like the number of defects found kept increasing as you added more tests.*

Looking at this chart, should you continue to add more tests to the project?

**Yes**

Where did you see the biggest increase in defect detection?

**Three tests**



How many machine defects were found?

14

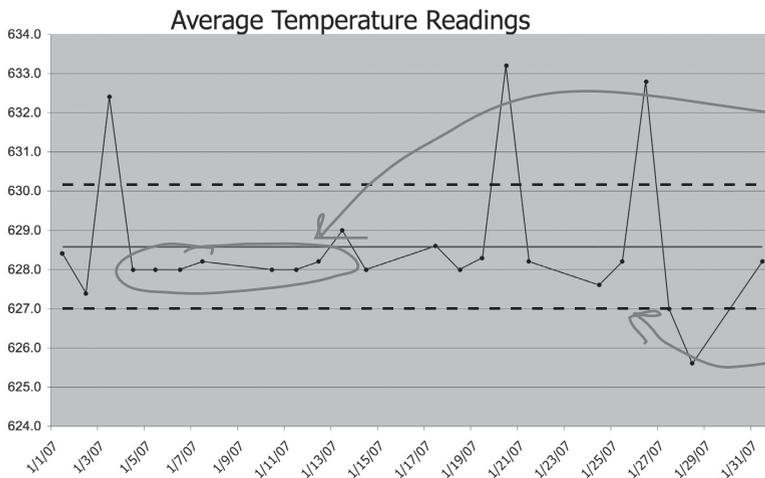
How many defects were caused by workers?

3

How many total defects are shown on this chart?

31

Adding up all of the numbers in the chart tells you how big the dataset is.



Looks like there's something worth investigating here. There are seven data points in a row that are on the lower side of the mean.

The lower limit is the bottom line and the mean is in the middle.

Circle the data points that make up the rule of seven.

Is this process in control?

No

The points both above and below the control limits tell us that the process is out of control.

What's the upper control limit?

630.2

What's the mean temperature reading?

628.6

What's the lower control limit?

627

## Question Clinic: The which-one question



YOU'LL SEE A LOT OF QUESTIONS ON THE EXAM THAT DESCRIBE A SITUATION AND ASK YOU TO IDENTIFY THE TOOL, TECHNIQUE, OR PROCESS THAT'S BEING USED OR IS MOST APPROPRIATE. LUCKILY, PROCESS OF ELIMINATION IS REALLY USEFUL WHEN YOU SEE A WHICH-ONE QUESTION.

This can't be right—it's not even a tool! It's just a rule.

The run chart just tells you trends, and that's not what you're looking for.

The histogram will show you categories of defects, but not root cause.

Aha! This is what a Ishikawa diagram is for. It shows you how a number of defects can be attributed to the same root cause.

83. You're managing a project to install 13,000 light switches in a new strip mall. You hire a team of inspectors to help your lead electrician find any defective light switches. They check a sample of 650 light switches, and find that 15% of them are defective. You ask your lead electrician to produce a diagram that shows the root cause of defects.

- A. Rule of seven
- B. Run chart
- C. Histogram
- D. Ishikawa diagram

WHEN YOU THINK ABOUT IT, ALL QUESTIONS ARE WHICH-ONE QUESTIONS...BUT WHEN THE QUESTION ASKS TO CHOOSE ONE ITEM FROM A LIST OF FOUR REALLY SIMILAR OR RELATED THINGS, THEN THAT'S WHEN YOU REALLY GET TO WORK YOUR WAY BACKWARD AND START ELIMINATING THEM ONE AT A TIME.



# HEAD LIBS



Fill in the blanks to come up with your own which-one question! Start by thinking of the correct tool and then figure out three really similar answers that sound right, but can't be because the question gives more specific details, allowing you to eliminate the wrong ones.

You're working on a \_\_\_\_\_ project, and you want to  
measure \_\_\_\_\_ . Which of the seven basic tools of  
quality is best for doing that?

- A. \_\_\_\_\_  
(an obviously wrong tool)
- B. \_\_\_\_\_  
(something that isn't a tool at all)
- C. \_\_\_\_\_  
(another incorrect tool)
- D. \_\_\_\_\_  
(the right answer)

## Control Quality means finding and correcting defects

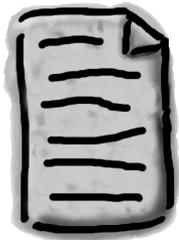
When you look for bugs in your deliverables, you produce two kinds of things: outputs from the inspections and outputs from the repairs you've made. All of the **outputs of the Control Quality process** fall into those two categories.

### Outputs



**Quality control measurements** are all of the results of your inspections: the numbers of defects you've found, numbers of tests that passed or failed—stuff like that. You'll use them when you look at the overall process you are using in your company to see if there are trends across projects.

That's coming up next in the Quality Assurance process.



Project documents updates

You might need to update templates for quality metrics or checklists.

**Lessons learned updates** are where you keep a record of all of the major problems that you solve in the course of your project so that you can use them later.

**Test and evaluation documents** are records of quality activities that are performed through the course of the project and their results. It's a good idea to keep records of the results of reviews and quality tests.

There's just one output here, project documents updates. You'll store your lessons learned and records of your completed checklists along with all of the other documents for your project.

### Project Management plan updates

You may need to update the Quality Management plan, which is a subplan of the Project Management plan.



Project Management plan updates

You might need to update the PM plan because of what you find in Control Quality.

**Verified deliverables and validated changes** are two of the most important outputs of Control Quality. Every single deliverable on the project needs to be inspected to make sure it meets your quality standards. If you find defects, the team needs to fix them—and then those repairs need to be checked, to make sure the defects are now gone.

First the team inspects every deliverable to find defects that need to be fixed.



Deliverables



Validated defect repair

When you've finished inspecting your product, you know whether or not your fixes worked.

**Change requests** are recommended or preventive actions that also require changes to the way you are doing your project. Those kinds of changes will need to be **put through change control**, and the appropriate baselines and plans will need to be updated if they are approved.



Work performance information

**Work performance information** might include all of the data your quality processes are producing. Once you've looked at the results of your quality tools, you might find places where the processes you're using to build your product need to be changed. The data you collect in the Control Quality process can help you make those kinds of changes.

## there are no Dumb Questions

**Q:** What exactly are Pareto charts for?

**A:** Pareto charts go together with the **80/20 rule**. It says that 80 percent of the problems you'll encounter in your project are caused by 20 percent of the root causes you can find. So if you find that most of your problems come from misunderstanding requirements, changing the way you gather requirements and making sure that everybody understands them earlier in the process will have a big impact on your project's quality.

To get the data for your Pareto chart, first you have to categorize all of the defects that have been found in your project by their root causes. Then you can graph them in a Pareto chart to show the frequency of bugs found with each root cause and the percentage of the cumulative defects that are caused by each root cause. The one with the highest frequency is the root cause that you should work on first.

**Q:** If I am trying to prevent quality problems, why can't I just test more?

**A:** You can find a lot of problems by testing. If you find them during testing, then you have to go back and fix them. The later you find them, the more expensive they are to fix. It's much better for everybody if you never put the bugs in the product in the first place. It's much easier to fix a problem in a specification document than it is to fix it in a finished product. That's why most of the Plan Quality Management process group is centered on setting standards and doing reviews to be sure that bugs are never put into your product and, if they are, they're caught as early as possible.

**Q:** I still don't get that thing where a control chart can show you defects that are out of control, but also show you that your process is out of control.

**A:** The reason that's a little confusing to some people is that you use the same tool to look at defects that you do when you're looking at the whole process.

A lot of the time, you'll use charts to measure processes, not just projects. They're used to look at sample data from processes and make sure that they operate within limits over time. But they are considered Control Quality tools because those data samples come from inspecting deliverables as they are produced. Yes, it's a little confusing, but if you think of control charts as the product of inspection, you'll remember that they are Control Quality tools for the test.



### BULLET POINTS: AIMING FOR THE EXAM

- **Inspection** means **checking each deliverable** for defects. That means checking your specs and your documentation, as well as your product, for bugs.
- The better you plan the quality activities for your project, the **less inspection** you need.
- Ishikawa diagrams help you to **pinpoint the causes** of defects.
- The **rule of seven** means that any time you have seven data points in a row that fall on the same side of the mean on a control chart, you need to figure out why.
- When data points fall above the upper limit or below the lower limit on a control chart, the process is out of control.
- For the test, using any of the seven basic quality tools is **usually** a good indication that you are in the Control Quality process.
- **Ishikawa, fishbone, and cause-and-effect** diagrams are all the same thing.
- **Scatter charts** help you look at the **relationship** between two different kinds of data.
- **Flowcharts** help you get a handle on how processes work by showing all of the decision points graphically.
- **Grade** refers to the **value** of a product, but not its quality. So, a product can be low-grade by design, and that's fine. But if it's a low-quality product, that's a big problem.

# Trouble at the Black Box 3000™ factory

It's not enough to inspect your deliverables. Sometimes it's the way you work that's causing your problems. That's why you need to spend some time thinking about how you will make sure you are doing the work efficiently and with as few defects as possible. The **Manage Quality process** is about tracking the way you work and improving it all of the time.

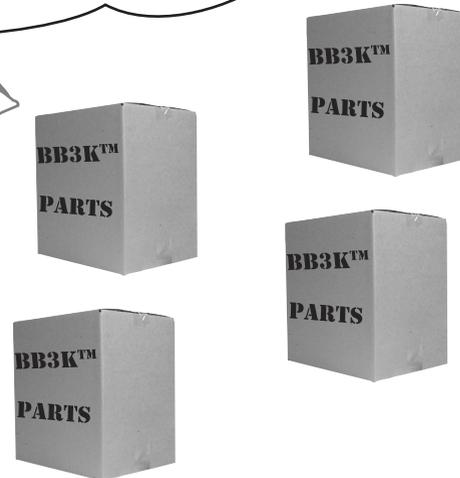


**Executing process group**

THE PRODUCTS ARE LOOKING GREAT, AND CUSTOMERS ARE REALLY HAPPY! BUT WAIT—WE HAVE BOXES FULL OF PARTS COLLECTING DUST IN OUR WAREHOUSE, AND WE'VE GOT SO MANY INSPECTORS THAT OUR BUDGET'S THROUGH THE ROOF. WE NEED TO DO SOMETHING!



These boxes are full of parts that the company uses to build the Black Box 3000™. They were ordered from suppliers who delivered them to the BB3K™ warehouse, but they've been sitting around for weeks taking up valuable space.



## BRAIN POWER

What do you do if the quality is good but you aren't satisfied with the speed or efficiency of the work?

# Introducing Manage Quality

In the **Manage Quality process**, you take all of the outputs from Plan Quality Management and Control Quality and look at them to see if you can find ways to improve your process. If you find improvements, you recommend changes to your process and your individual project plan to implement them.

This is in the Executing group because you need to make sure your project is done in a way that complies with your company's quality standards.



## Inputs



Organizational process assets



Project Management plan



Project documents

This includes lessons learned, quality control measurements, quality metrics, and your risk report

**Plan Quality Management tools and techniques** are all of the tools you used in Plan Quality. They come in handy when you're reviewing your process, too.

**Control Quality tools and techniques** are all of the tools from Control Quality. You can use histograms, control charts, and flowcharts—all of them can be used to help you figure out how your process is working.

**Quality improvement methods** are how you use data from performing quality practices to improve the way your project team does their work. Plan-do-check-act (which you'll learn about later in this chapter) is a common quality improvement method.

**Problem solving** is exactly what it sounds like. Fixing quality problems means actually figuring out what's causing the problems and coming up with new solutions for them.

**Quality audits** are reviews of your project by your company. They figure out whether or not you are following the company's process.

**Design for X** is when you design your product to solve a specific problem. The goal could be to improve performance or reduce operating costs as an example.

## Outputs



Project Management plan updates



Change requests



Project documents updates



Quality reports



Test and evaluation documents

The project documents that get updated are quality audits, training plans, and process documentation.



## A closer look at some tools and techniques

Fixing the bugs in your project solves the problems that give you trouble. But fixing bugs in your **process** means that other projects can learn from the problems you've faced and avoid your project's bugs altogether. The tools that are used in quality assurance are the same as the ones in quality control, but they're used to examine the process rather than the project.

**Quality audits** are when your company reviews your project to see if you are following its processes. The point is to figure out if there are ways to help you be more effective by finding the stuff you are doing on your project that is inefficient or causes defects. When you find those problem areas, you recommend corrective actions to fix them.

Even if your company has the best process in the world, it doesn't do your project any good if you don't follow it!

A lot of companies have Quality Assurance departments whose job is to perform these audits and report findings from projects to a process group.

**Design for X** means designing your product to solve a particular problem. You might design a product to be particularly fast or to use fewer resources or to run in a distributed environment, for example. By designing to optimize a specific aspect of your product, you might be able to deliver higher value to a customer than if you had focused only on feature delivery.

**Quality management and control tools** are the same ones you already know about from earlier in this chapter. But instead of using them to look for problems with specific defects, you'll use them to look at your overall process. A good example of this is using a control chart to see if your whole process is in control. If it's not, then you'll want to make a change to the whole way you do your work in order to bring it under control.

Here's another example. If you created a Pareto chart that showed all of the defects in all of your projects, you could find the one or two categories of defects that caused problems for the whole company. Then you could get all of the PMs together to figure out an improvement that they could all make that would help the whole company.



How would **you** use these tools to manage your project?

## More ideas behind managing quality

There are a couple more things you need to know about managing quality. These are some of the most important ideas behind modern quality and process improvement.

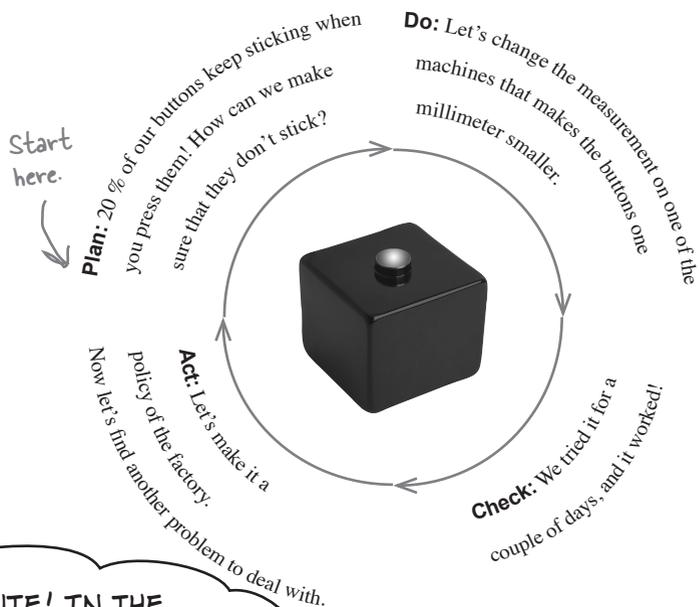
**Kaizen** means continuous improvement. It's all about constantly looking at the way you do your work and trying to make it better. *Kaizen* is a Japanese word that means **improvement**. It focuses on making small improvements and measuring their impact. Kaizen is a philosophy that guides management, rather than a particular way of doing quality assurance.

**Just-in-time** means *keeping only the inventory you need on hand when you need it*. So, instead of keeping a big inventory of parts sitting around, the Black Box company might have only the parts it needs for that day. Some companies have done away with warehouses altogether and have production lines take the parts directly off the trucks to do the work. If you're working in a just-in-time shop, quality is really important because **there isn't any extra inventory to deal with mistakes**.

Plan-Do-Check-Act was created by Walter Shewhart, who also created the control chart while he was working at Bell Labs in the 1920s.



**Plan-Do-Check-Act** is one way to go about improving your process, and it's used by a lot of Kaizen practitioners. It was popularized by a well-known quality theorist named W. Edwards Deming and is also known as the Deming Cycle. Plan-Do-Check-Act is about *making small improvements*, and *measuring* how much *benefit* they make **before** you change your process to include them. Here's how it works:



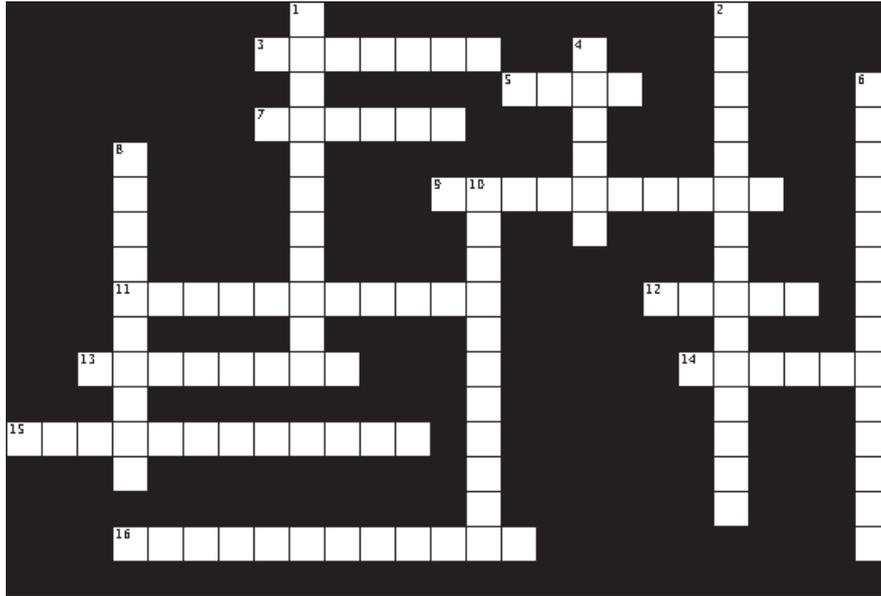
WAIT A MINUTE! IN THE BEGINNING OF THE BOOK, YOU SAID THAT PROJECTS WERE TEMPORARY. THIS STUFF IS ALL ABOUT PROCESSES! WHAT GIVES?

**You're right. The Manage Quality process is all about improving the process**, and that isn't what most of project management is about. But your project is really affected by the process you are working in, so you should fully understand it and help to make it better wherever you can. The bottom line is that your project has a better chance of succeeding if you stay involved with process improvement and keep your eye on how your project stacks up to your company's expectations of quality and process.



## Qualitycross

Take some time to sit back and give your right brain something to do. It's your standard crossword; all of the solution words are from this chapter.



### Across

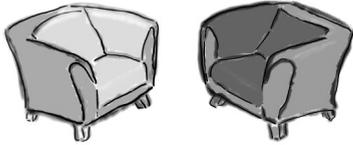
3. When a process has data points above the upper limit or below the lower limit, those data points are out of \_\_\_\_\_.
5. The middle line on a control chart.
7. The quality theorist who popularized Plan-Do-Check-Act.
9. \_\_\_\_\_ is more important than inspection in Quality Management.
11. An important definition of quality is \_\_\_\_\_ to requirements.
12. Tool used to make sure your project is following the company's process.
13. What you compare your work performance information to.
14. Tool for finding the 20% of root causes responsible for 80% of defects.
15. Tool for comparing two kinds of data to see if they are related.
16. Tool used in Plan Quality Management to set numeric goals for your project.

### Down

1. Quality theorist who came up with the idea of fitness for use.
2. Tool for finding the root cause of a defect.
4. Synonym for continuous improvement.
6. Process where you inspect deliverables to look for defects.
8. Tools that help you visualize processes and all of their decision points.
10. Heuristic that says that seven data points on one side of the mean requires investigation.

—————> **Answers on page 468.**

## Fireside Chats



Tonight's talk: **Two quality processes discuss the best ways to correct problems on your project.**

### **Control Quality:**

I'd like to go first, because I'm what most people think of as quality. Whenever you see one of those "Inspected by #8" stickers on the inside of your sneaker, that's me!

Whoa, there, buddy. That's a strong statement!

That's right. And don't forget, I'm everywhere. Any time you call for customer service, I'm there to tell you that your call will be recorded for quality purposes. I'm always warning you to make sure package contents haven't shifted, and to check your car's emissions once a year.

I guess I don't really understand exactly how you do your job, then, because I'm having a hard time figuring out how I would ever be able to take a long weekend.

Well, last week it was because the company logo came out upside-down on a bunch of the shoes. It turned out that the logo was being stitched into the leather and then put on another assembly line, and once in a while it was placed on the belt upside-down.

### **Manage Quality:**

You're right—most people do think that quality begins and ends with inspection. Which is funny, because we wouldn't even need you if people paid attention to me.

Now don't get me wrong. Nobody's ever felt comfortable enough with me that they've eliminated inspection entirely. You always need someone at the end of the line to look at what's been produced and make sure that we delivered what we meant to.

Right, but don't you get tired of doing all of that tedious work? An ounce of prevention is worth a pound of cure, after all.

Let's take a look at those sneakers you mentioned. What's the most common reason you throw a pair back to the factory floor to be restitched?

### Control Quality:

We had to throw out about 10% of our sneakers last week. Let's just say that the boss wasn't happy. You could see the little veins in his forehead throbbing. It was kind of gross.

The boss yelled at everyone, and we'll check even more carefully to make sure we don't ship it.

Wow, I never thought of that.

We'd have to pay someone else to paint that on. This is no time to be *increasing* our costs!

Huh. Um. No.

### Manage Quality:

That seems like an honest mistake. How much did it cost?

Wow, that sounds expensive. What's keeping it from happening again?

So next week your inspection costs will be even higher, and you'll probably still have to throw out just as many shoes, or more!

What if you painted a little arrow on the inside of the leather showing which direction the logo should be placed on the belt?

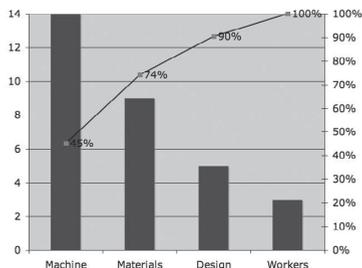
But a small increase in the cost of painting the leather will cause you to throw out a whole lot fewer sneakers.

I call that **cost of quality**. You have to pay more to put quality in at the beginning, but you can reduce the number of inspectors and scrap a lot less product. In the end, I save you far more money than I cost. Can you say the same about yourself?



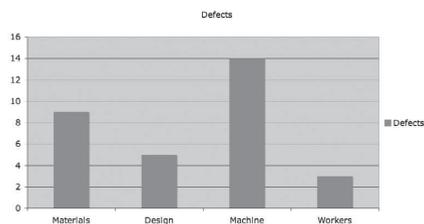
## Exercise

Choose whether the tools are being used in Control Quality or Manage Quality.



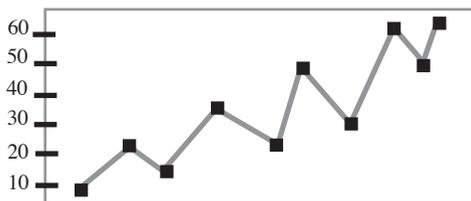
1. You use a Pareto chart to figure out which root causes are responsible for the most defects in the current batch of Black Boxes. It looks like most of them are coming from a machine calibration problem. So you run them back through the machine after recalibrating it.

Control Quality       Manage Quality



2. You use a histogram to look at the root cause category for all defects that have been found over the past year. You find that machine errors are habitually responsible for the largest number of errors across all batches of Black Boxes. You schedule machine calibration checks at the start of every shift to be sure that the machine is always set properly.

Control Quality       Manage Quality

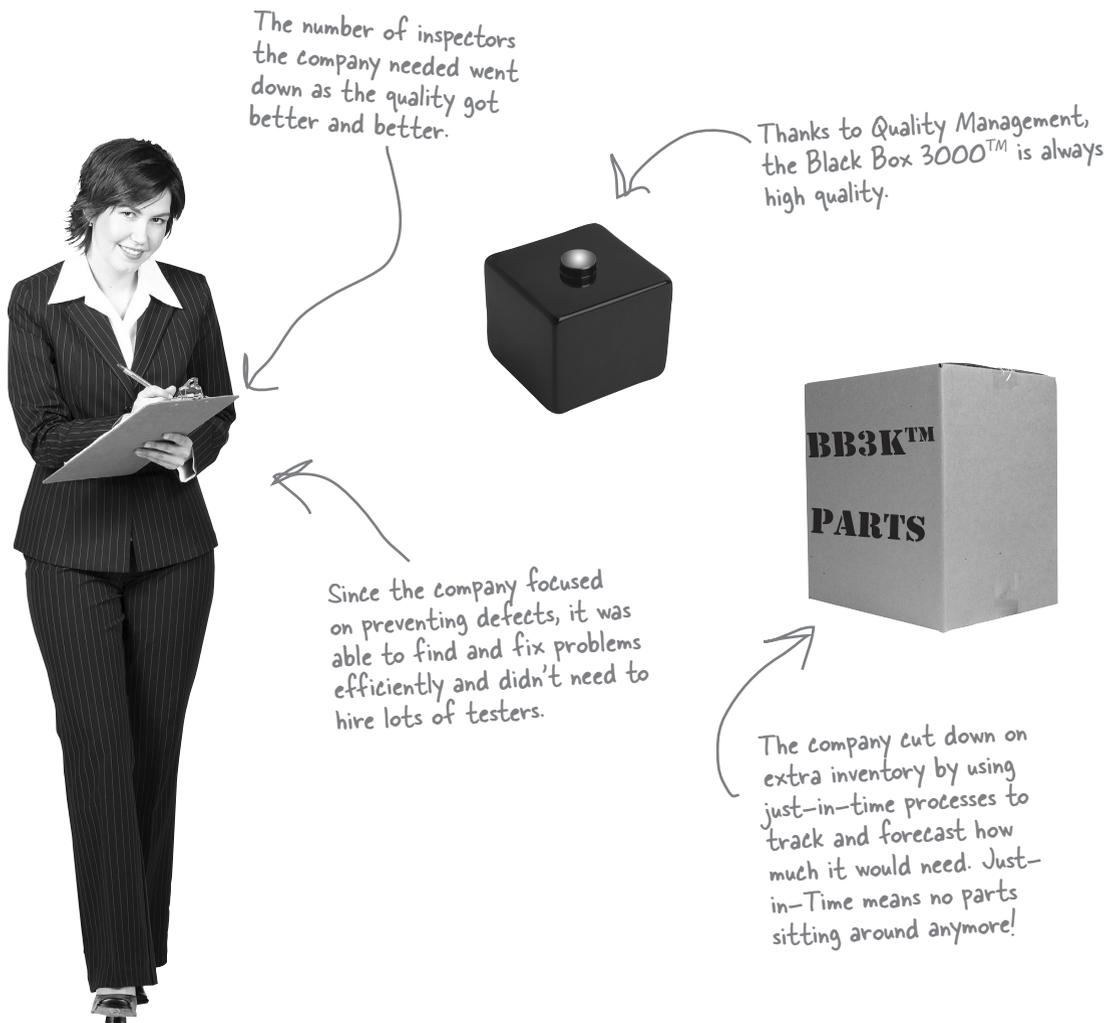


3. You look at defects in all of the inspection runs for the past year and notice that you seem to be finding more and more defects per inspection as time goes on. You create a quality task force to try to figure out what is causing these defects.

Control Quality       Manage Quality

## The Black Box 3000™ makes record profits!

People who bought the product were thrilled with it. They were happy that the Black Box company always kept its promises and the products were always high quality. The company managed to save a lot of money by implementing process improvement measures that caught defects before they cost too much money to fix. And Lisa got a big promotion—now she's in charge of quality assurance for the whole company. Great job, Lisa!





Building a high-quality product that meets the needs your project set out to solve is the goal of **Project Quality Management**. No matter what kind of project you are managing, the quality of the product or service you are producing is one of the most important aspects of your work.



## KEY CONCEPTS

We've talked about the processes you and your team will use when planning, controlling, and managing quality, but it's worth taking a minute to think about how your approach to quality management affects the overall project.

- ★ It's often tempting for teams to cut down on quality inspections and product evaluations when there's a time crunch. **Doing this can lead to missed defects** and expensive reactions to problems found late in your project that ultimately delay your project even further.
- ★ **Quality and grade** are different concepts. It's possible to intentionally build a low-grade product that is high quality and fit for specific use.
- ★ The earlier in the project that your team thinks about and addresses the overall quality of the product or service you're building, the more efficient your process will be. Thinking about quality during design is important. Building quality into the product up front and **introducing feedback loops** while you're building ensures that the product you build will have fewer defects to address as the project nears its close.
- ★ The most expensive way to find defects is to have the customer encounter them after your project has completed. The **least expensive** way to find them is to build a culture in your organization that is focused on **continuously improving** the way you work.

**QUALITY MANAGEMENT IS ABOUT MAKING SURE YOUR PROJECT PRODUCES A PRODUCT THAT DOES WHAT IT'S SUPPOSED TO DO.**

## TRENDS

Here are a few trends in Quality Management that might help you to improve and more effectively manage the quality activities for your projects.

- ★ **Continuous improvement** means constantly evaluating the processes you use to build products to see if they're building the highest-quality product as efficiently as possible. Teams focus on continuous improvement by measuring the output of their work, making small improvements, and then measuring the effects of those improvements in a plan-do-check-act cycle.
- ★ **Mutually beneficial partnerships with suppliers** are established when both the supplier and the customer share a view of quality and work to build quality in up front. That way, customers don't have to spend time looking for defects in products delivered by the supplier and slow down their own delivery.



## TAILORING

When you make changes to the processes your team will use during the course of your project, there are a few considerations that might influence your decisions:

- ★ Are there specific requirements your process needs to meet to be compliant with some regulation?
- ★ What's the culture of your organization around quality? Will your project fit into a larger continuous improvement culture in your organization? Are there metrics all teams work to produce to get a sense for how your project is working?
- ★ How much will other teams or upper management act as active stakeholders in your project? Will you need to get feedback from many sources to understand how your project is doing from a quality perspective?



## AGILE CONSIDERATIONS

Agile teams focus on implementing feedback loops in very short iterations, or sprints. You can think of a sprint in Scrum as a two-week Plan-Do-Check-Act Cycle with the retrospective at the end as a means of evaluating how well the process is working for the team. You can even think of the daily Scrum meeting as an inspection of the sprint's plan, where team members think about how likely the team is to reach their sprint goal and how to make adjustments to help each other deliver.

# Sharpen your pencil Solution



Take a look at each of these situations and figure out if they're talking about quality or grade.

1. You ordered mushrooms on your pizza, but you got onions.

Quality

Grade

3. The pizza arrived, but it had canned mushrooms.

Quality

Grade

2. You called the pizza parlor to complain and the guy yelled at you.

Quality

Grade

4. The pizza was cold.

Quality

Grade

5. You just got a brand new luxury car that cost a whole lot of money.

Quality

Grade

7. Your neighbors make fun of you because your chrome hubcaps aren't very classy...

Quality

Grade

6. But it's in the shop every two weeks.

Quality

Grade

8. ...even though they do a great job of protecting the wheels from dirt, which is why you bought them in the first place.

Quality

Grade



**Exercise Solution**

Read each of these scenarios and identify which tool or technique is being used.

1. You look through your company's asset library and find that a recent project was able to reduce defects by 20% by inserting defect prevention meetings early in the construction phase. You put the same process in your quality plan and set the target for shipped defects to be 20% lower than the company average for your project.

Tool/technique: **Benchmarking**

2. You add up all of the costs projected for quality activities and track that number in your Quality Management plan. You use this number to gauge the health of your project compared to other projects in your company.

Tool/technique: **Cost of quality**

3. You write up a list of all of the tests you are going to run on the Black Box 3000™ when it rolls off the assembly line. You determine what kinds of failures might cause you to stop testing, what it would take for you to resume test activities, and requirements that the product would need to fulfill to be considered accepted into test.

Tool/technique: **Test planning**

**\* WHAT'S MY PURPOSE \***

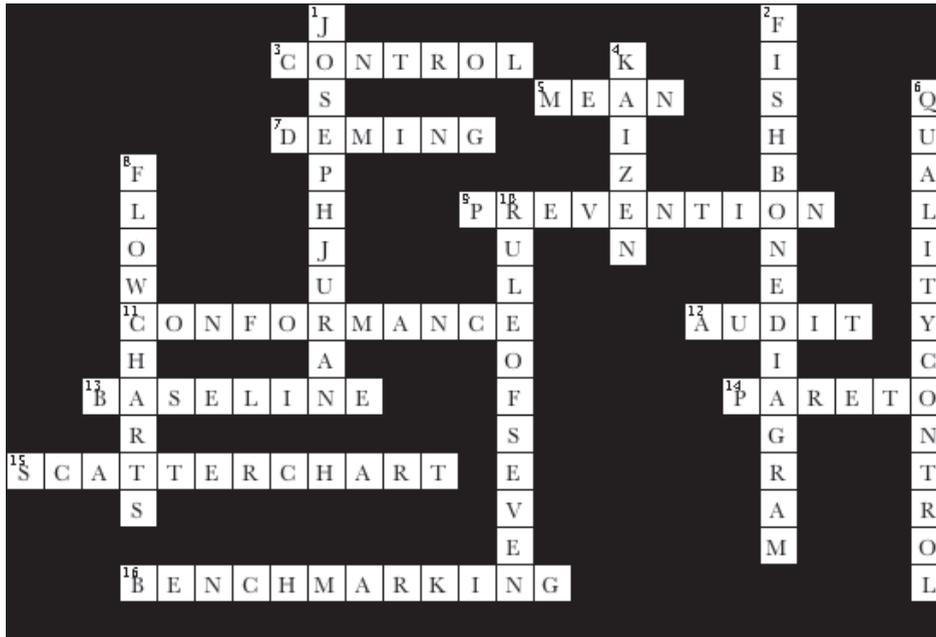
Match each Plan Quality output to its description.

Quality Management plan		Updates to the stakeholder register, risk register, and lessons learned, to name a few.
Project Management plan updates		Updates to the scope baseline and Risk Management plan
Project documents updates		Helps you to plan out all of your quality activities.
Quality metrics		Describes how you'll measure a particular attribute of a deliverable during testing.



# Qualitycross

Take some time to sit back and give your right brain something to do. It's your standard crossword; all of the solution words are from this chapter.



**Across**

- 3. When a process has data points above the upper limit or below the lower limit, those data points are out of \_\_\_\_\_.
- 5. The middle line on a control chart.
- 7. The theorist who came up with Plan-Do-Check-Act.
- 9. \_\_\_\_\_ is more important than inspection in Quality Management.
- 11. An important definition of quality is \_\_\_\_\_ to requirements.
- 12. Tool used to make sure your project is following the company's process.
- 13. What you compare your work performance information to.
- 14. Tool for finding the 20% of root causes responsible for 80% of defects.

15. Tool for comparing two kinds of data to see if they are related.

16. Tool used in Plan Quality to set numeric goals for your project.

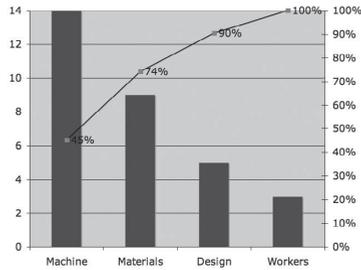
**Down**

- 1. Quality theorist who came up with the idea of fitness for use.
- 2. Tool for finding the root cause of a defect.
- 4. Synonym for continuous improvement.
- 6. Process where you inspect deliverables to look for defects.
- 8. Tools that help you visualize processes and all of their decision points.
- 10. Heuristic that says that seven data points on one side of the mean requires investigation.



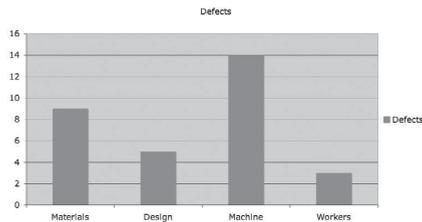
## Exercise Solution

Choose whether the tools are being used in Control Quality or Manage Quality.



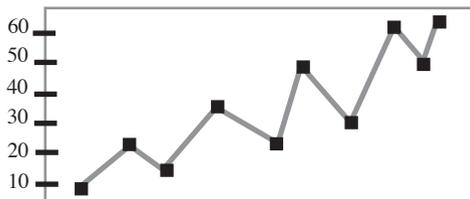
1. You use a Pareto chart to figure out which root causes are responsible for the most defects in the current batch of Black Boxes. It looks like most of them are coming from a machine calibration problem. So you run them back through the machine after recalibrating it.

Control Quality       Manage Quality



2. You use a histogram to look at the root cause category for all defects that have been found over the past year. You find that machine errors are habitually responsible for the largest number of errors across all batches of Black Boxes. You schedule machine calibration checks at the start of every shift to be sure that the machine is always set properly.

Control Quality       Manage Quality



3. You look at defects in all of the inspection runs for the past year and notice that you seem to be finding more and more defects per inspection as time goes on. You create a quality task force to try to figure out what is causing these defects.

Control Quality       Manage Quality

## Exam Questions

**1. Which of the following is NOT a part of quality?**

- A. Fitness for use
- B. Conformance to requirements
- C. Value to the sponsor
- D. Customer satisfaction

**2. A project manager is using a histogram to analyze defects found by the team during inspection activities. What process is being performed?**

- A. Plan Quality Management
- B. Control Quality
- C. Manage Quality
- D. Verify Scope

**3. Which of the following is NOT an example of cost of quality?**

- A. Having team members spend extra time reviewing requirements with the stakeholders
- B. Paying extra programmers to help meet a deadline
- C. Hiring extra inspectors to look for defects
- D. Sending a crew to repair a defective product that was delivered to the client

**4. You're working with an audit team to check that your company's projects all meet the same quality standards. What process is being performed?**

- A. Plan Quality Management
- B. Control Quality
- C. Manage Quality
- D. Perform Quality Management

**5. You're managing a project to deliver 10,000 units of custom parts to a manufacturer that uses just-in-time management. Which of the following constraints is most important to your client?**

- A. The parts must be delivered on time.
- B. The parts must be delivered in a specific order.
- C. The parts must conform to ISO specifications.
- D. The parts must be packaged separately.

## Exam Questions

**6. Which of the following is NOT part of the Quality Management plan?**

- A. Strategies for handling defects and other quality problems
- B. Guidance on how the project team will implement the company's quality policy
- C. Metrics for measuring your project's quality
- D. A description of which deliverables don't have to be inspected

**7. Which of the following tools and techniques is used to show which categories of defects are most common?**

- A. Control charts
- B. Pareto charts
- C. Checksheets
- D. Flowcharts

**8. You're managing a highway construction project. The foreman of your building team alerts you to a problem that the inspection team found with one of the pylons, so you use an Ishikawa diagram to try to figure out the root cause of the defect. What process is being performed?**

- A. Quality Management
- B. Plan Quality Management
- C. Control Quality
- D. Manage Quality

**9. Which tool or technique is used to break data into categories for analysis?**

- A. Scatter chart
- B. Histogram
- C. Checklist
- D. Flowchart

**10. When is inspection performed?**

- A. At the beginning of the project
- B. Any time a project deliverable is produced
- C. Just before the final product is delivered
- D. At the end of the project

## Exam Questions

**11. What's the difference between Control Quality and Validate Scope?**

- A. Control Quality is done at the end of the project, while Validate Scope is done throughout the project.
- B. Control Quality is performed by the project manager, while Validate Scope is done by the sponsor.
- C. Control Quality is performed by the sponsor, while Validate Scope is done by the project manager.
- D. Control Quality means looking for defects in deliverables, while Validate Scope means validating that the product is acceptable to the stakeholders.

**12. You're a project manager at a wedding planning company. You're working on a large wedding for a wealthy client, and your company has done several weddings in the past that were very similar to the one you're working on. You want to use the results of those weddings as a guideline to make sure that your current project's quality is up to your company's standards. Which tool or technique are you using?**

- A. Checklists
- B. Benchmarking
- C. Design of experiments
- D. Cost-benefit analysis

**13. You are using a control chart to analyze defects when something on the chart causes you to realize that you have a serious quality problem. What is the MOST likely reason for this?**

- A. The rule of seven
- B. Upper control limits
- C. Lower control limits
- D. Plan-Do-Check-Act

**14. Which of the following BEST describes defect repair review?**

- A. Reviewing the repaired defect with the stakeholder to make sure it's acceptable
- B. Reviewing the repaired defect with the team to make sure they document lessons learned
- C. Reviewing the repaired defect to make sure it was fixed properly
- D. Reviewing the repaired defect to make sure it's within the control limits

**15. The project team working on a project printing 3,500 technical manuals for a hardware manufacturer can't inspect every single manual, so they take a random sample and verify that the manuals have been printed correctly. This is an example of:**

- A. Root cause analysis
- B. Cost-benefit analysis
- C. Benchmarking
- D. Statistical sampling

## Exam Questions

**16. What's the difference between Control Quality and Manage Quality?**

- A. Control Quality involves charts like histograms and control charts, while Manage Quality doesn't use those charts.
- B. Control Quality and Manage Quality mean the same thing.
- C. Control Quality means inspecting for defects in deliverables, while Manage Quality means auditing a project to check the overall process.
- D. Manage Quality means looking for defects in deliverables, while Control Quality means auditing a project to check the overall process.

**17. Which Control Quality tool is used to analyze processes by visualizing them graphically?**

- A. Checklists
- B. Flowcharts
- C. Pareto charts
- D. Histograms

**18. You are looking at a control chart to figure out if the way you are doing your project fits into your company's standards. Which process are you using?**

- A. Plan Quality Management
- B. Manage Quality
- C. Control Quality
- D. Quality Management

**19. Which of the following is associated with the 80/20 rule?**

- A. Scatter chart
- B. Histogram
- C. Control chart
- D. Pareto chart

**20. Validated defect repair is an output of which process?**

- A. Integrated change control
- B. Plan Quality Management
- C. Control Quality
- D. Manage Quality

## Answers

~~Exam Questions~~**1. Answer: C**

It's important for projects to produce a valuable product, but value isn't really a part of quality. That's why earned value is part of Cost Management, not Quality Management.

**2. Answer: B**

In the Control Quality process, the team inspects the product for defects and uses the seven basic tools to analyze them. Since the defects came from inspection, you know it's Control Quality.

**3. Answer: B**

Cost of quality is the time and money that you spend to prevent, find, or repair defects.

**4. Answer: C**

The Manage Quality process is all about how well your company meets its overall quality goals.

**5. Answer: A**

Keep an eye out for fake process names like Perform Quality Management.

A manufacturer that uses just-in-time management is relying on its suppliers to deliver parts exactly when they're needed. This saves costs, because it doesn't have to warehouse a lot of spare parts.

**6. Answer: D**

But those parts had better not have a lot of defects, because there aren't a lot of spare parts lying around to do repairs!

Your project team needs to inspect ALL of the deliverables! That means every single thing that gets produced needs to be reviewed by team members, so they can find and repair defects.

**7. Answer: B**

A Pareto chart divides your defects into categories, and shows you the percentage of the total defects each of those categories represents. It's really useful when you have a limited budget for Plan Quality Management and want to spend it where it's most effective!

Don't forget that ALL deliverables need to be inspected, including the stuff you create—like the schedule, WBS, and Project Management plan. So you'll get defects for them, too!

## Answers

~~Exam Questions~~

## 8. Answer: C

Keep your eye out for questions asking you about Ishikawa or fishbone diagrams. When you use those tools to analyze defects, you're in the Control Quality process.



Watch it!

**Don't assume that just because you're using a fishbone diagram, you're always doing quality control!**

*It's also used in Risk Management; you'll see that in Chapter 11. The key thing to watch for here is that the fishbone diagram is being used to find the root cause of a DEFECT, not a risk or something else.*

## 9. Answer: B

A histogram is one of the seven basic tools of quality. It's a bar chart that can be used to show how your data breaks down.

OK, SO I CAN USE A HISTOGRAM TO FIGURE OUT HOW MY DATA BREAKS DOWN OVER THE COURSE OF MY PROJECT.



## 10. Answer: B

Inspection is when your team examines something that they produced for defects...and every single deliverable needs to be inspected! That's what "prevention over inspection" means: if you produce a deliverable that's needed later in the project today, it's a lot cheaper to fix defects in it now than it will be when that deliverable is used later on in the project.

## 11. Answer: D

A lot of people get Control Quality and Validate Scope confused because they seem really similar. Both of them involve looking closely at deliverables to make sure that they meet requirements. But they serve really different purposes! You use Control Quality to find defects that you're going to repair. Validate Scope happens at the very end of the Executing phase; it's when you work with the stakeholder to get formal acceptance for the deliverables.



*You'd better have found all the defects before you take the product to the customer!*

## 12. Answer: B

Benchmarking is when you use previous projects to set quality guidelines for your current project. You can always find the results of the past projects in the organizational process assets.

## Exam Questions

### 13. Answer: A

The rule of seven tells you that when seven consecutive data points on your control chart come out on the same side of the mean, you've got a process problem. That sounds a little complicated, but it's actually pretty straightforward. Defects tend to be scattered around pretty randomly; in any project that makes a lot of parts, even if they're all within the specification, you'll get a couple of parts that are a little bigger, and a couple that are a little smaller. But if you have a bunch of them in a row that all run a little big, that's a good indication that something's gone wrong on your assembly line!

### 14. Answer: C

Going back and repairing defects can be a pretty risky activity, because it's really easy to introduce new defects or not fully understand why the defect happened in the first place. Answer C says exactly that: you go back and review the defects to make sure they're fixed.

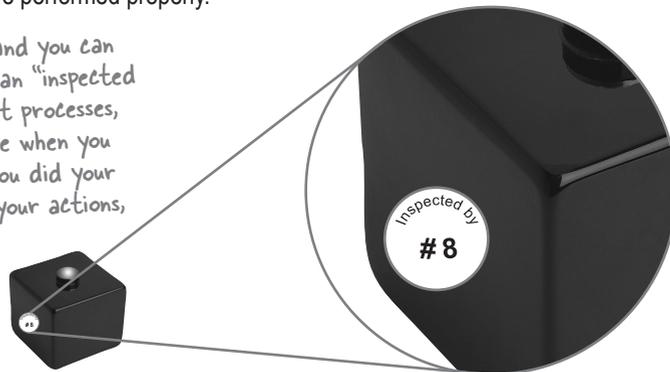
### 15. Answer: D

A lot of times it's impractical to check every single product that rolls off of your assembly line. Statistical sampling is a great tool for that; that's when you pull out a small, random sample of the products and inspect each of them. If they're all correct, then there's a very good chance that your whole product is acceptable!

### 16. Answer: C

A lot of people get confused about the difference between Control Quality and Manage Quality. Control Quality is where you inspect deliverables for defects, while Manage Quality is where you audit the project to make sure the quality activities were performed properly.

*You inspect products for defects, and you can remember that because you'll find an "inspected by #8" tag in a product. You audit processes, and you can remember that because when you get audited, they're making sure you did your taxes correctly—they're auditing your actions, not a product.*



## Answers

**Exam Questions****17. Answer: B**

A flowchart is one of the seven basic tools of quality. You use it to analyze processes that are part of your project in order to look for quality problems and inefficiencies.

**18. Answer: B**

You're analyzing the process, so you are using Manage Quality.



Just because you see a Control Quality tool, that doesn't mean you're in the Perform Control Quality process...because they're also tools used in Manage Quality! You always need to figure out what you're using them for.

**19. Answer: D**

Pareto charts are based on the 80/20 rule. They sort your defects in descending order by root cause. So you always know which 20% of root causes are responsible for 80% of defects on your project.

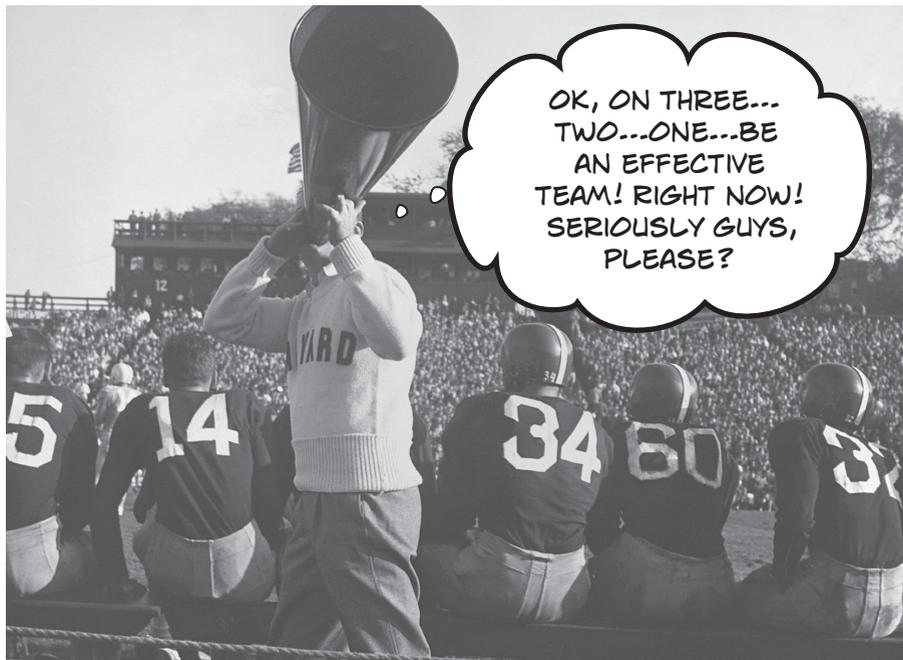
**20. Answer: C**

Control Quality is where you inspect your work, including your repairs!



## 9 Project resource management

# *Getting the team together*



**Behind every successful project is a great team.** So how do you make sure that you get—and keep—the best possible team for your project? You need to **plan carefully**, set up a good **working environment**, and negotiate for the **best people** you can find. But it's not enough to put a good team together...if you want your project to go well, you've got to keep the team motivated and deal with any conflicts that happen along the way. **Project resource management** gives you the tools you need to get the best team for the job and lead them through a successful project.

## Mike needs a new team

*Cows Gone Wild III* was a huge success! But now the Ranch Hand Games team is gearing up for their next big hit. How are things shaping up?



The box is done, but Brian, Mike, and Amy are just getting started on the game.

OK! LET'S GET THE TEAM BACK TOGETHER! HEY BRIAN, WHEN CAN YOUR TEAM GET STARTED?

Mike, the project manager



NOT SO FAST, MIKE. REMEMBER THE ONLINE PORTION OF CGW III? WELL, THE TEAM'S SWAMPED WITH SERVER MAINTENANCE.

Uh-oh! Looks like Mike's going to need to put together a new team.

Brian, the development team manager



## Cubicle conversation



↑  
Amy, the creative director

HEY, WE'RE ALL ON THE SAME TEAM HERE. LOOK, WHY DON'T WE HAVE PEOPLE FROM OUR TEAMS JUST HELP OUT WHENEVER YOU NEED SOMEONE?

**Brian:** Yeah, there's no reason you need our resources dedicated to your project. We can get **multiple** projects done that way.

**Mike:** Come on, guys. You don't really think that's gonna work, do you?

**Amy:** Sure, why not?

**Mike:** We can't just staff up as we go; that's going to cause huge problems.

**Brian:** You're overreacting, Mike. Look, I'm a team player, and I want to get the project done. You just tell me when you need someone off my team, and I'll make sure you've got the developers and testers you need. What's wrong with that?

**Mike:** OK, so what if I need three developers starting tomorrow for the next two weeks? Can you do that?

**Brian:** Well, no, I've got a deadline on Friday. It'll have to wait until next Monday. But that's just a couple of days.

**Mike:** See, that's what I'm talking about! A few days here, a few days there...if we have to wait a few days every time the team needs someone, we'll totally blow the schedule.



How can Mike solve his problem? What can he do to make sure that he gets the team members he needs when he needs them?

# Get your team together and keep them moving

You want to stay in control of your project team, right? But when you work in a matrix organization, your team members don't directly report to you. So how do you make sure you get the best people, and keep them motivated and productive? That's what the processes in **Resource Management** are for: guiding you through all the things you need to do to make sure you get everyone for your project when you need them.

A lot of the stuff in this chapter applies mostly to matrix organizations...but you'll still find it really useful, even if you don't work in a matrix company!

This shouldn't be a surprise—every knowledge area has its planning process, and Plan Resource Management is no exception.

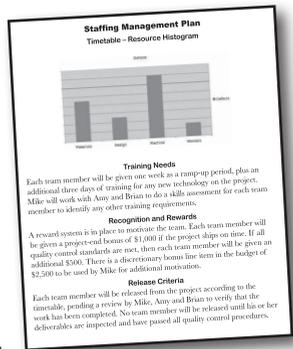


Planning process group

This is where you generate the estimates for the activities being performed.



In the Plan Resource Management process, you plan out exactly which resources you'll need, what their roles and responsibilities are, and how you'll train your team and make sure they stay motivated.



Plan Resource Management

This is where you plan out the resource needs for your project, and how you'll manage and reward the team.



Estimate Activity Resources



Planning process group

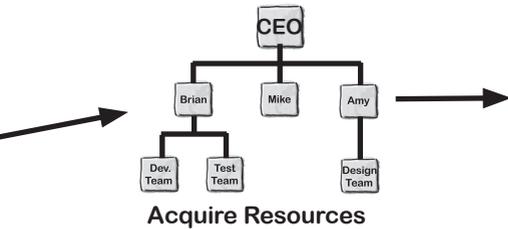
It makes sense that Acquire Project Team and Develop Team are in the Executing group—you only put the team together AFTER the project has started.



**Executing process group**

You'll need to train your team, and keep them motivated with rewards in order to get the project done.

No project goes perfectly. People have conflicts, and it's up to you to make sure they get resolved.



**Acquire Resources**



**Develop Team**

All three of these processes are part of the Executing process group, because they happen while your team's executing the project!



**Manage Team**



**Control Resources**

Once the project gets started, you need to put together your team. This means you may need to negotiate for some of the resources.



**Monitoring & Controlling process group**



**Executing process group**



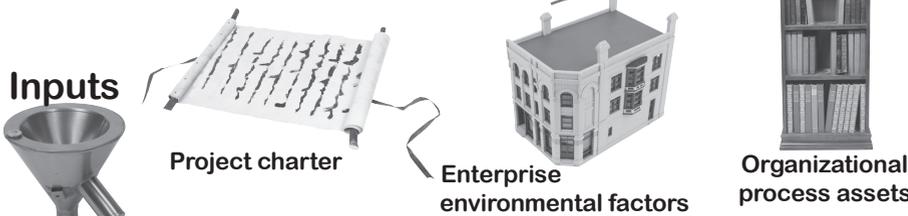
What can you do to make sure that you get the right people for your team exactly when you need them? What can you do before the project starts to make sure they stay motivated?

# Figure out who you need on your team

Project teams don't just assemble themselves spontaneously! It takes a lot of planning and guidance to get a team together, and that's the idea behind the **Plan Resource Management** process. Remember, in a matrix organization your team doesn't report directly to the project manager. You need to work with the functional managers to get the team members that you need for your project...which means there's a lot of information that you need to give to everyone so they know exactly who you need for your team.



You've seen these two inputs a whole bunch of times now!



Project Management plan



Project documents

**Data representation** tells everyone how your team is structured with hierarchical charts, responsibility assignment matrixes, and text-based displays of your organization's make-up.

**Organizational theory** is where you use proven principles to guide your decisions.

**Expert judgment** is used to figure out resource requirements and position descriptions.

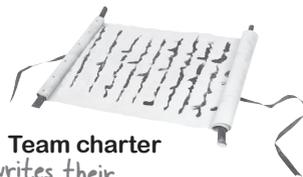
**Meetings** help the team come together and agree on what's needed for the project.

This is a lot like the other planning processes you've seen already! You start with your project plan and what you know about your company, and you come up with a plan.

The Resource Management plan tells everyone on the project who you'll need on your team, when you need them, and what skills they'll need.

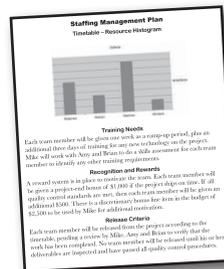
The Resource Management plan includes your project organization charts, roles and responsibilities, and training and team development approaches.

## Outputs



Here's where the team writes their agreements, values, and guidelines for how to work together.

Team charter



Resource Management plan



Project documents updates



## Sharpen your pencil

The inputs, tools and techniques, and outputs of **Plan Resource Management** should seem pretty familiar! Write down what you think you'd use each of them for. Notice that there are a few that you haven't seen before—take an educated guess at those.

### INPUTS

Enterprise environmental factors

Organizational process assets

### TOOLS AND TECHNIQUES

Data representation

There are a couple of other tools and techniques—this isn't the only one!



### OUTPUTS

- Resource Management plan
- Team charter
- Project documents updates

Think about which documents might need to be updated with your Resource Management plan information.



## Sharpen your pencil Solution



The inputs, tools and techniques, and outputs of **Plan Resource Management** should seem pretty familiar! Write down what you think you'd use each of them for. Notice that there are a few that you haven't seen before—take an educated guess at those.

### INPUTS

Enterprise environmental factors

**This is information about the company's culture and structure**

Your company's culture—stuff like common languages, technical disciplines, and how people normally relate to one another—is really important.

Organizational process assets

**Templates and lessons learned from past projects**

You've already seen lots of ways we use templates and checklists. They're just as important in Plan Resource Management.

It's easy to lose track of who reports to whom, and what different people do in your company. You need to know that stuff if you want to staff your project!

### TOOLS AND TECHNIQUES

Data representations

**Shows the relationships between managers, team members, and other people inside and outside the company who will work on the project**

### OUTPUTS

- Resource Management plan

**Describes how you'll manage and control your resources**

Your Resource Management plan describes who will be on your project, when they'll do the work and for how long, and the reward system you'll use to keep the team motivated.

- Team charter

**Describes the policies and ground rules the team will use along with their values**

Every role on the project needs to be defined—it has a title, has authority to do certain things, and is responsible for specific deliverables.

- Project documents updates

**Updates to the assumption log and risk register**

## A closer look at the Plan Resource Management outputs

The two main outputs of the Plan Resource Management process are the Resource Management plan and the team charter. Together they lay the groundwork for a successful team management approach.



Team charter

**The team charter is where the team makes their ground rules visible for everyone**

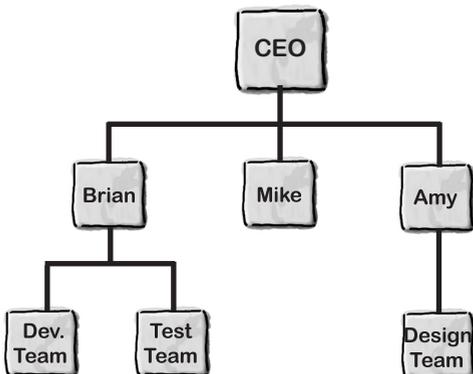
Teams can run into trouble if they don't make their policies clear to everyone they work with. By writing a charter, the team decides how they will handle conflict, run meetings, make decisions, and manage their day-to-day work. Most importantly, the team agrees to their values and goals.

## Important components of the Resource Management plan

The Resource Management plan contains a training plan, specifics on recognition and reward, and plans for how the team members will ramp up and roll off. But before we talk about those parts of the plan, there are a couple of sections of the plan that should be noted up front:

**The project organization chart shows how your team members relate with one another.**

This might include people or relationships that may not necessarily show up on a company organization chart. If you've got a team built from multiple consultants and subcontractors, this chart will be the only place where everyone is listed at once.



**Roles and responsibilities show who's responsible for what.**

It's really common to see the roles and responsibilities for a project written out as an **RACI matrix**, which is just a table that lists the role or people on the top; the specific activities, work, or responsibilities down the side; and the level of responsibility that each person or role has for each of the activities or responsibilities. (RACI stands for "Responsible, Accountable, Consulted, and Informed.")

*This could also list roles, like Project Manager, Creative Director, or Development Manager.*

RACI Matrix		People			
		Mike	Amy	Brian	CEO
Work Package	Project Management	R	I	I	I
	Design	C	R	C	I
	Construction	C	C	R	I
	Testing	C	C	R	I

R = Responsible A = Accountable C = Consulted I = Informed

## The Resource Management plan

An important component of the Plan Resource Management process is the **Resource Management plan**. It tells you everything that you need in order to build your team, keep them motivated, and manage them to resolve conflicts and get the work done.

A common way of showing the timetable—or when people will work on what—is to use a resource histogram.

This is really important for telling the functional managers exactly who you'll need on your team, so they can provide the staff that you need to get the job done.

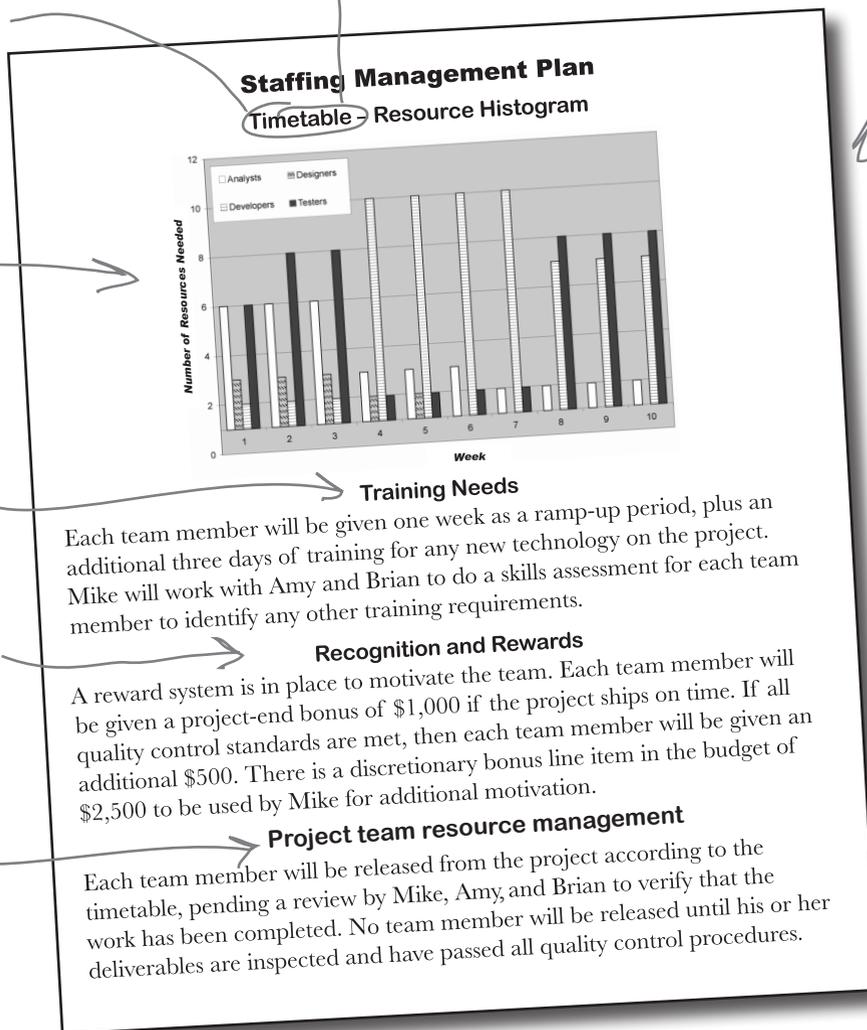
The resource histogram tells you the type and number of resources you need at any time. It's usually a vertical bar chart.

You need to make sure everyone on the team has the skills he or she needs to do the job.

A really important part of Resource Management is keeping your team motivated, and rewards tied to goals are a great way to do that.

You'll need to plan out exactly how your team members will roll off of your project so functional managers and other project managers will know if they're available for other projects.

Everything you do with your team—acquiring them, developing them, and managing them—depends on a good Resource Management plan.





**Exercise**

Read the **Resource Management plan** on the facing page and answer these questions about the project.

1. How many designers, developers, and testers are needed in week #7 of the project?

..... designers ..... developers ..... testers

2. Who is responsible for verifying that each team member has the skills appropriate to the project?

.....

3. Rewards should always be tied to performance goals in order to motivate the team. What performance goal has been set for the team, and what reward will each team member receive if it's achieved?

.....

.....

Answers on page 522.



there are no  
**Dumb Questions**

**Q:** I still don't get the resource histogram. Am I supposed to make this myself, or does it come from somewhere?

**A:** You need to come up with the histogram yourself when you put together the Resource Management plan. Since you're managing the project, you're the only one who knows when each person is needed on the project. Remember all of the activities that you came up with back when you were building the schedule in Chapter 6? Well, each of those activities had resource requirements, right? That means you know exactly what resources you'll need at any time in your project! That's why the activity resource requirements are an input to Plan Resource Management—you need the schedule and the activities in order to figure out the timetable. The histogram is the easiest way to show that information.

**Q:** Is that RACI chart really necessary?

**A:** Yes, definitely! Sometimes people split up responsibilities in ways that aren't immediately obvious just from people's titles or the names of their roles on the project—that's one of the big advantages of a matrix organization. RACI charts help everyone figure out their assignments. Mike might have Brian's senior developers sit in on Amy's design meetings, even though they don't usually do that. He'd put that in the RACI matrix to show everyone that's now part of their jobs for the project.

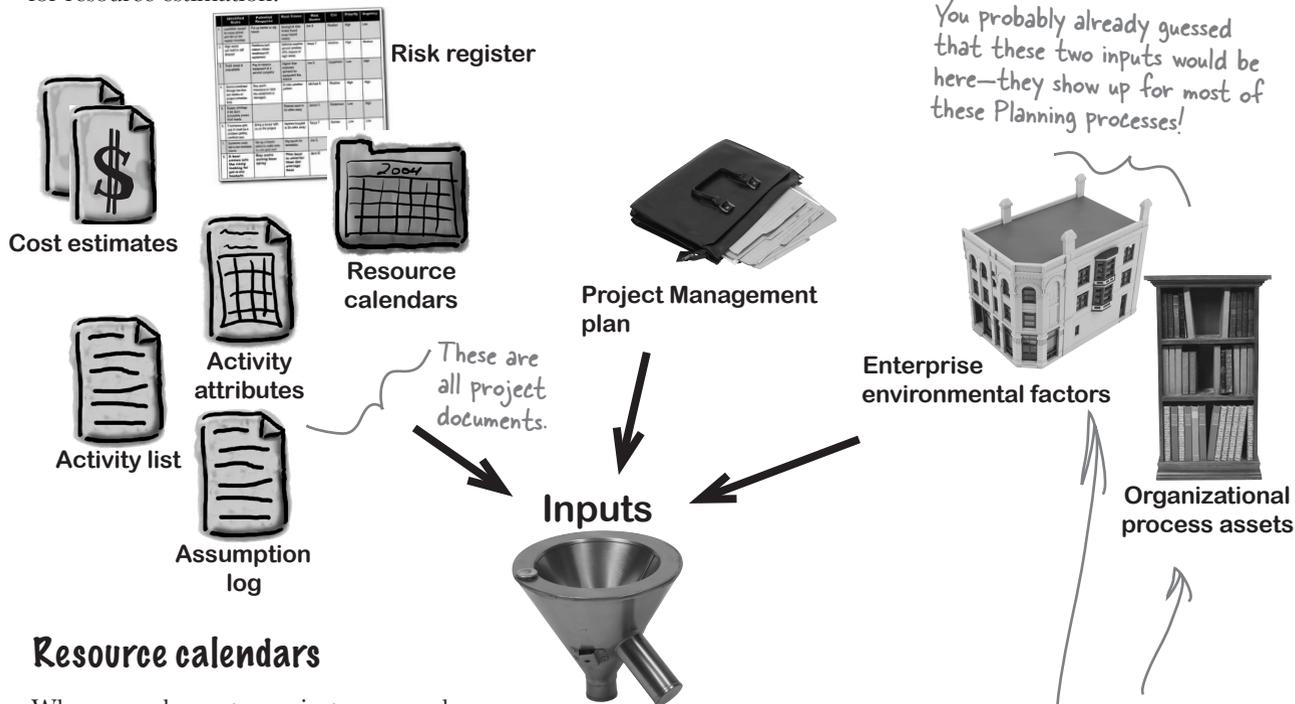
**Q:** Once I know what roles need to be filled on my project, how do I actually get the team on board?

**A:** That's what the next process is all about! It's called **Acquire Project Team**, and it's where you actually staff your project. Of course, you don't staff it during the planning phase. You have to wait until the project work begins, which is why it's in the *Executing* process group.

The hardest part about staffing your project is negotiating with the functional managers. The best resources are the ones that are in demand, which means your negotiating skills will be very important when it comes time to staff your project team.

## What you need to estimate resources

Good news: you've already seen most of the inputs to the **Estimate Activity Resources process** already! Before you can assign resources to your project, you need to know which ones you're authorized to use on your project. That's an input, and it's called **resource calendars**. You'll also need the activity list that you created earlier, and you'll need to know about how your organization typically handles resources. Once you've got a handle on these things, you're set for resource estimation.



You probably already guessed that these two inputs would be here—they show up for most of these Planning processes!

How could policies, lessons learned, and historical information help you assign resources to your project?

A June wedding is harder to plan than one in December, because the wedding halls are all booked up. That's a resource constraint!

### Resource calendars

When you plan out a project, you need information about what resources you can use for various activities, and when they're available to you. That's what **resource calendars** are for. Don't forget that some resources, like consultants or training rooms, have to be scheduled in advance, and they might only be available at certain times. You'll need to know this before you can finish planning your project.

**Resource calendars are the only new input to the Estimate Activity Resources process. You've already seen the rest of the inputs.**

# Estimating the resources

The goal of **Estimate Activity Resources** is to estimate the resources needed for each activity in the activity list. There are **seven tools and techniques** for the Estimate Activity Resources process. Some of them have technical-sounding names, but they're all actually pretty sensible when you think about it. They should all make sense to you when you think about what you have to do to figure out what resources your project needs.



**Expert judgment** means bringing in experts who have done this sort of work before and getting their opinions on what resources are needed.

**Project management information system** like Microsoft Project will often have features designed to help project managers play around with resources and constraints and find the best combination of assignments for the project.

**Analogous estimation** is making estimates based on the number of resources and amount of effort necessary to complete a project like the one you're currently estimating.

**Meetings** are used to get stakeholders to work collaboratively to estimate the project's resource needs.

**Parametric estimation** is when estimates are made by typing values into a mathematical model that has been created based on data from past projects.

**Bottom-up estimating** is a technique that you may have used before without even knowing it! It means breaking down complex activities into pieces, and working out the resource assignments for each of those simpler pieces using the other six tools and techniques.

## Outputs

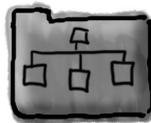


Basis of estimates



Resource requirements

The outputs of Estimate Activity Resources describe how the resources will be used, and include information about where those estimates came from.



Resource breakdown structure



Activity attributes

Project documents updates



Assumption log

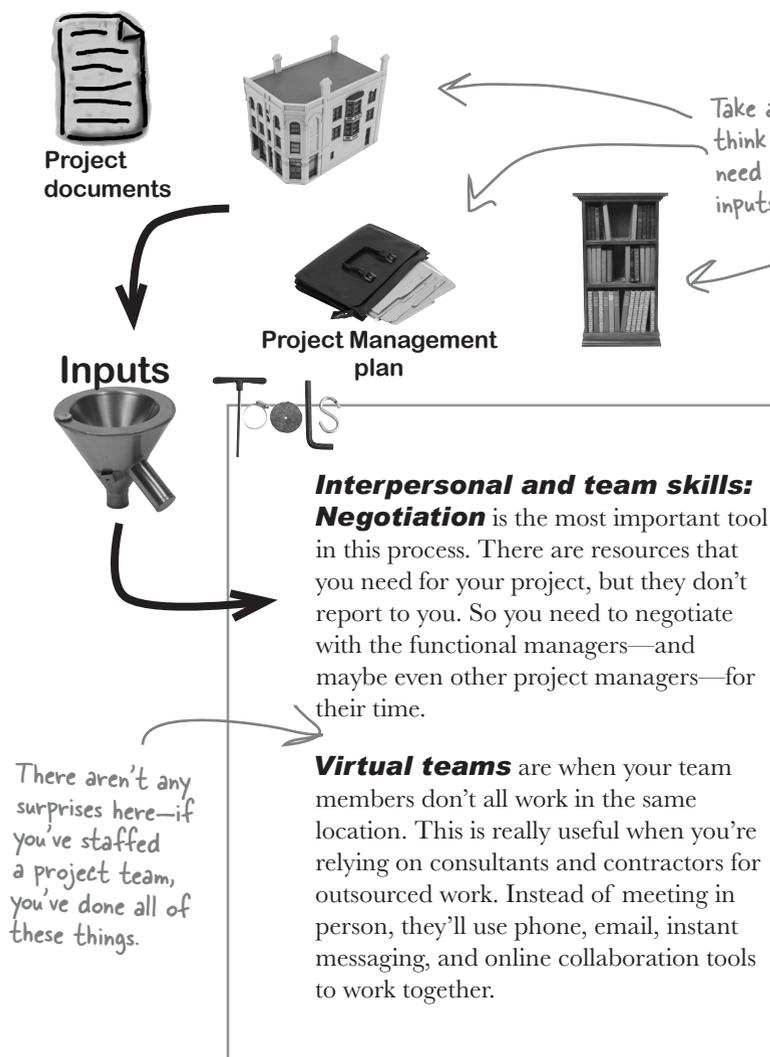


Lessons learned register

## Get the team together

Your Resource Management plan is in place, you've estimated your project resource needs, and your project is ready to roll, so now it's time to begin the actual project work! You need your team, and the way you bring them on board is through the **Acquire Resources** process.

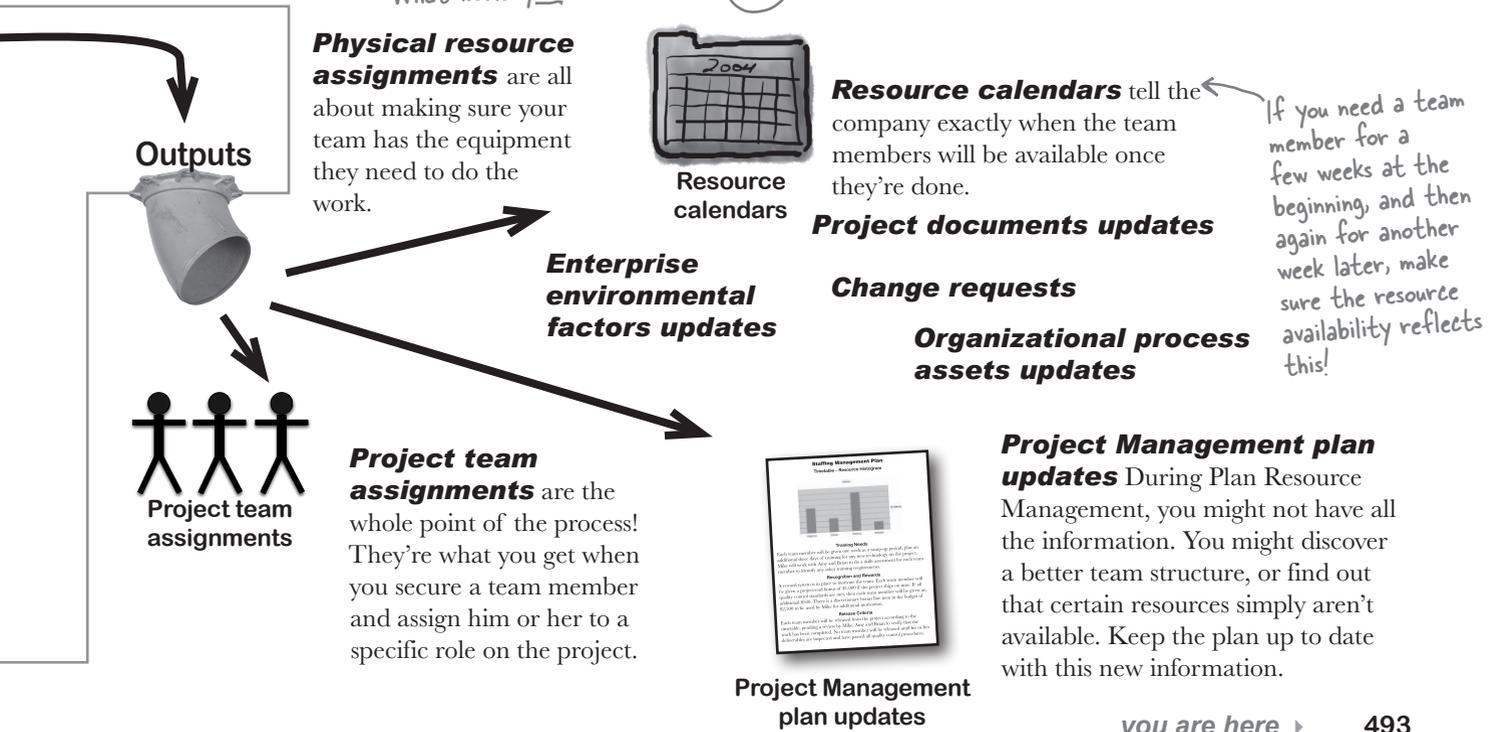
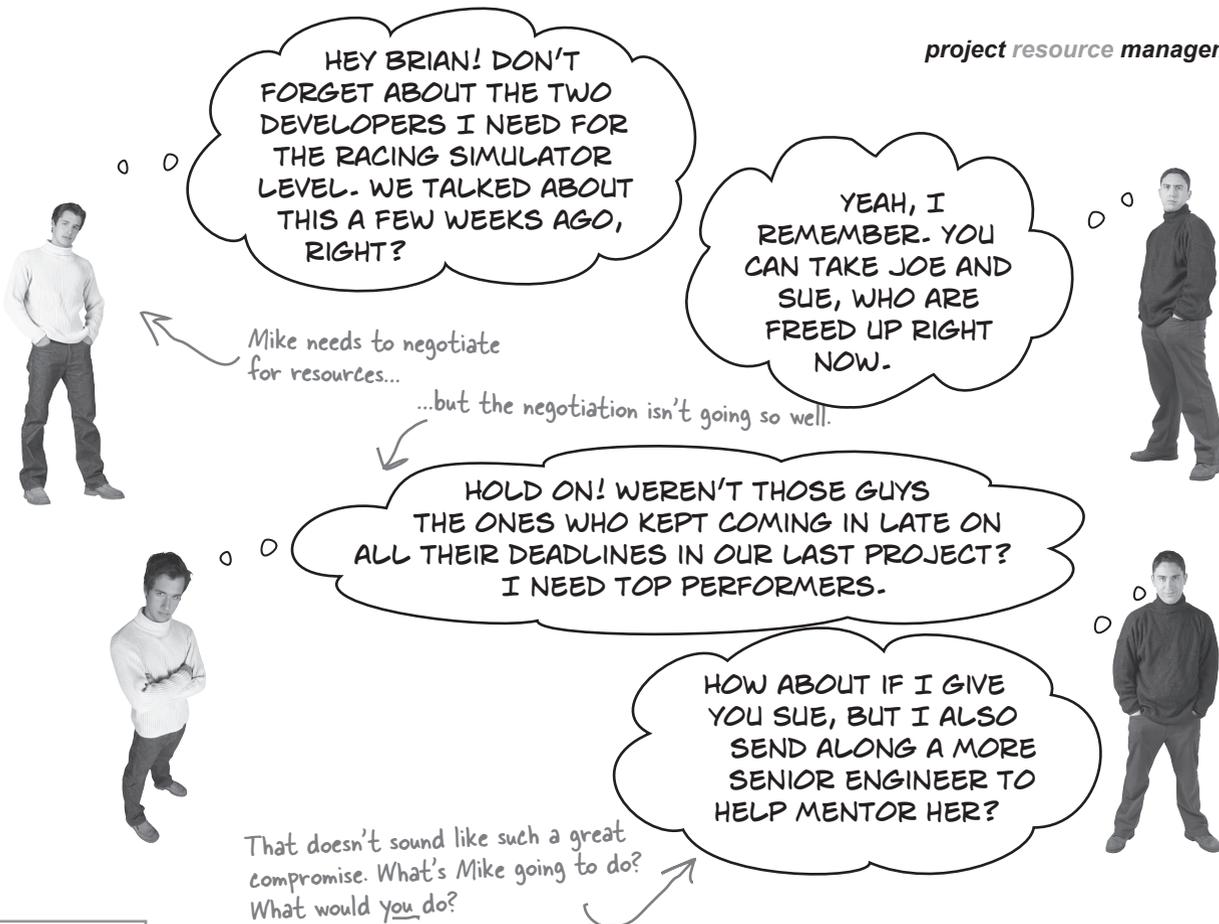
This is where you negotiate with functional managers for your project team members. You need the right people for the project, and you've done all the prep work to figure out who you need and when you need them. So now it's time to go get your team!



**Watch it!**

### **Beware the halo effect!**

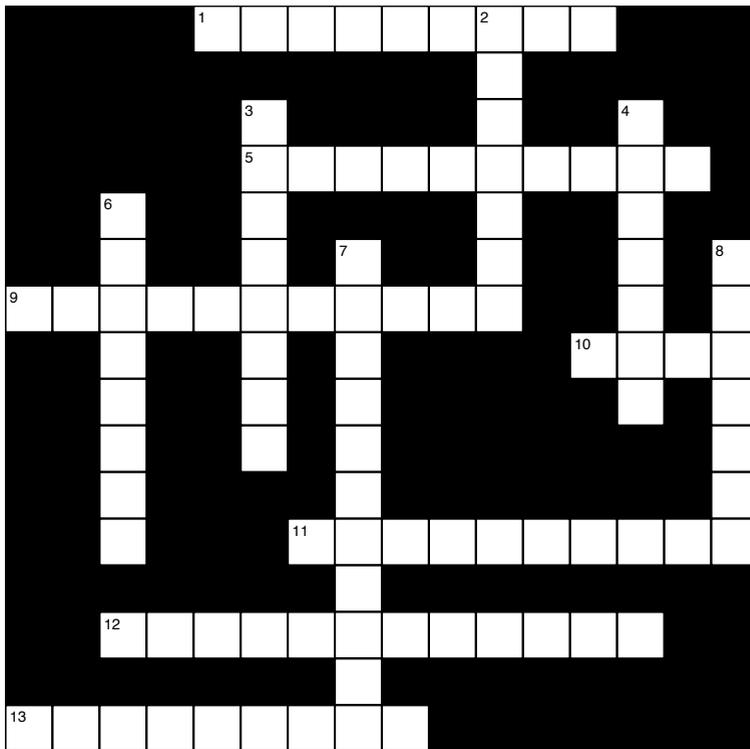
*That's when you put someone in a position they can't handle, just because they're good at another job.*





# Resourcecross

Take some time to sit back and give your right brain something to do. It's your standard crossword; all of the solution words are from this chapter.



Answers on page 523.

## Across

1. The resource \_\_\_\_\_ is a vertical bar chart in the Resource Management plan that tells you the type and number of resources you need.
5. This is a great tool for communicating roles and responsibilities.
9. The main output of the Acquire Project Team process is project staff \_\_\_\_\_.
10. The \_\_\_\_\_ effect causes people with technical expertise to be put in positions for which they're unqualified.
11. The first process you perform in this knowledge area is Plan Resource \_\_\_\_\_.
12. This kind of chart tells you how team members relate to one another in your company.
13. The Manage Team process is part of the \_\_\_\_\_ process group.

## Down

2. A great way to motivate your team.
3. What you provide for a human resource in order to ensure he or she has the skills necessary to do the project.
4. You use \_\_\_\_\_ teams when your team members don't all work in the same location.
6. \_\_\_\_\_ availability is an output that describes when each team member will be available to your project.
7. The most important tool in Acquire Project Team.
8. The \_\_\_\_\_ organization chart shows only the people assigned to your team, including consultants and subcontractors.

## Cubicle conversation



I'M STARTING TO GET A LITTLE CONCERNED WITH THE PACE OF OUR DESIGN WORK. IS EVERYTHING OK?

Looks like Mike's negotiation went well in the end! So now he's got his team...but can he get them motivated?

**Amy:** I haven't noticed anything. What's up?

**Mike:** Well, maybe it's nothing, but a couple of the design team members have been missing some deadlines. Nothing major, but it's starting to concern me.

**Amy:** Well, OK. I can keep an eye on them.

**Mike:** That's not all. One of them hasn't been replying to emails at all, and another scheduled a vacation right in the middle of a huge deadline week. I think we may have a real motivation problem.

**Amy:** You're right, that sounds pretty bad. What can I do about it?

**Mike:** Well, I built a discretionary bonus budget into the plan.

**Amy:** Right, that \$2,500. But should we really be talking about giving bonuses? I thought these were underperformers. Shouldn't we reward only good behavior?

**Mike:** Well, right, but if we tie the bonus to meeting an aggressive deadline or high quality standards, it might help get them energized again.

**Amy:** We can give it a shot, but I'm skeptical.



Do you think Mike's idea will work? Why is it a good idea to make the bonus contingent on meeting specific goals? Can this plan backfire?

## Develop your team



The **Develop Team** process is the most important one in Resource Management. It's the one where you make sure your team is motivated and well managed—and those are some of the most important things that project managers do! You do it throughout the *entire* Executing phase of the project, because you need to keep your team moving toward the goal.



Get the team involved in planning—the more they feel like they're in control, the better they feel about the project!

### Motivation

This makes it more challenging to stay on top of the team and make sure the work is getting done.

### Management

- One of your most important jobs as project manager is keeping the team motivated and constantly monitoring them to make sure they stay motivated.
- A really effective way to motivate your team is to set up a reward system. But make sure that they understand exactly what they're being rewarded for—and it *must* be fair, or it could backfire!
- Training is another great way to keep a team motivated. When people feel that they're growing professionally, they stay more involved and get more excited by their work.

- When the project is being planned, you're directing everything—but by the time it's executing, the project manager is more of a coach and a facilitator.

- That's why it's really important for a project manager to have “soft skills”—you need to really understand what makes your team members tick, and help with their problems.

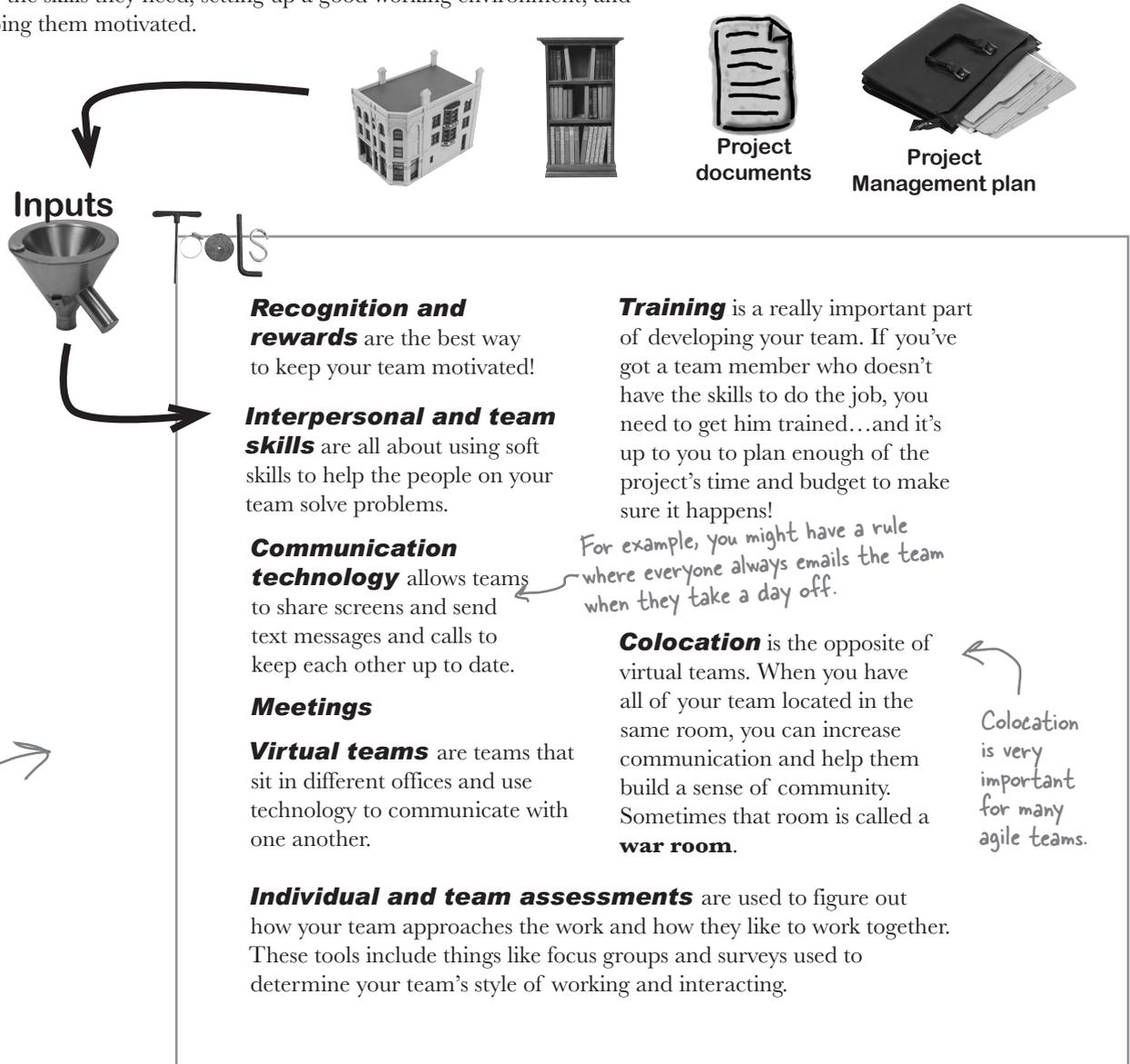
- A really good way to make sure that your project team sticks together is to establish **ground rules** for your project, which set a standard for how everyone works together.

This is one of the tools and techniques for Develop Project Team.

**You develop your team by keeping them motivated, and you do this all the way through your entire project.**

# Develop the team with your management skills

How do you keep your team motivated and up and running? With the tools and techniques for **Develop Team**, that's how. When you're working with your team, you need to be a leader. That means setting the rules for how people interact with one another, making sure they have the skills they need, setting up a good working environment, and keeping them motivated.



## Your interpersonal and team skills can make a big difference for your team

Knowing all of the tools and techniques in the *PMBOK® Guide* will help you learn a lot about your project, but the way you help your team to get the job done is just as important as the steps you take to get it done.

**Leadership** is all about giving the team a goal to shoot for and helping them to see the value in the work they are doing. It's not enough to have a team know the end product that they're building; they need to **understand the value that that product is going to bring to the company**. A project manager needs to constantly remind the team of the vision they're working toward, and make decisions to help keep the team on track toward it.

The team was happy to work on CGW III from the beginning. But when Mike told them that the company saw the game's success as responsible for 70% of their revenue, it really showed them how important the work was.



**Team building** involves helping your team learn to depend on and trust one another. As a project manager, you're responsible for helping the team come to an understanding about how they'll communicate and stay motivated when things go wrong. If you're open about your decision-making processes and communicate often about what you're doing, you can **help your team to bond**. Some people think of team building as going out for pizzas after work, but it's more about how you lead, and how you help to create an environment where your team members can trust one another.

**Motivation** demonstrates to your team the value that the project has for them. It includes making sure that people are compensated and rewarded financially for their work. But that's not the only facet of team motivation that you need to be concerned with. Your team also needs to know how the tasks they're doing contribute to project success, and what's in it for them. Motivating your team is about **helping them to be satisfied with the job they're doing**, recognizing them when they do a good job, and keeping them challenged with new and different problems.

**Communication** is a constant concern when you're leading a team. It's not enough to make the best decisions to get your project done; you've got to make sure that everybody in the team knows why you're making them, and feels like you're being **open and honest** about what's motivating every decision you make. If the people on your team feel like they're always getting the information they need from you and that they're never in the dark, they'll be able to trust you and one another more.



When Mike agreed to consolidate the code reviews for two features into one review, he forgot to tell the team about it. When the first code review was cancelled, the team was confused. They thought Mike didn't care about the quality of the product they were making, and the misunderstanding was really hard on them.

**Influencing** is all about using your relationships with the people on your team to get them to cooperate in making good decisions for the project. When you lead by example, you show your team how you want them to behave by doing it. It may seem subtle, but the way you work as a project manager can **set the standard for your teammates**. Collaborating with your team on the best way of working through your project is a really effective way of making sure that the team members gel, and know that they can rely on one another.

Mike made sure he came to work early as often as he could. After a while he noticed that everybody on the team was doing the same thing.

**Political and cultural awareness** means knowing the people on your team and understanding their backgrounds. Since projects sometimes span more than one culture, it's important to take the time to **understand the similarities and differences in the working environments** across the project team. It's equally important to communicate with your team members and understand what motivates them.



**Negotiation** helps the people on your team come to an agreement about how to work together. It's important when you're negotiating to **listen to both parties** and to make sure that you **make it clear when concessions are made**. That should get everyone to see both sides of the issue and know that you're negotiating a fair resolution to it.

**Trust building, coaching, and conflict management** are also important in managing the interpersonal dynamics on your team. You'll remember trust building and coaching from Chapter 1. We'll talk about conflict management in just a minute.

## Lead the team with your management skills

You've seen tools and techniques that help you set up a great environment for your team to succeed, but you need more than that to get them through a tough project. You need **leadership skills**, those "soft skills" you use to influence your team and keep them directed toward the project's goals.

You use leadership skills throughout the entire project! But they're most important in Develop Team because that's where you lead your team through their work.

WAIT A SECOND! HOW CAN A MULTIPLE-CHOICE TEST QUIZ ME ON MY LEADERSHIP SKILLS?

**You're right, it can't.** What the PMP exam *can* quiz you on is your **knowledge** of leadership skills. There's been a lot of research on how people wield power in companies. The PMP exam concentrates on research done by two social psychology researchers named French and Raven who came up with five different kinds of power that people use to influence others.



### The five kinds of power

There are five kinds of power that a project manager typically uses on a project. The first is called **legitimate power**, which is what you use when you assign work to someone who reports to you.

When you're someone's boss, you have legitimate power to tell them what to do. But when you work in a matrix organization, you don't have direct reports! So you'll need to use the other kinds of power to influence your team.

**Reward power** is what you have when you can award a bonus or another kind of reward in order to motivate team members. Always make sure that rewards are **fair**—you don't want to single out one person who is eligible for a reward without giving others a chance at it! And rewards work best when they're tied to specific goals or project priorities.

Making everyone compete for one single reward isn't fair—it's actually demotivating to force people to compete for an arbitrary prize.

**Expert power** means that the team respects you for your expertise in a specific area, and gives you credibility because of that. Think about it: a team of programmers is more likely to respect you and do what you ask them to do if they know that you're an accomplished software engineer!



EVERYONE ON THE TEAM WILL GET AN EXTRA \$500 BONUS IF WE MEET ALL OF THE QUALITY STANDARDS IN THE SPEC!

Reward and expert power are the most effective kinds of power that a project manager can use.

I SPENT A FEW YEARS LEADING A GAME DESIGN TEAM, AND I GOT THE BEST RESULTS WHEN WE HELD JOINT DESIGN MEETINGS WITH THE PROGRAMMERS.



**Referent power** means that people admire you, are loyal to you, and want to do what you do because you're part of the cool crowd. Often, a project manager might wield referent power because he's trusted by people in authority, and others perceive him as associated with success.

If you buy something because a celebrity does, that's referent power.



I WAS JUST HAVING COFFEE WITH THE CEO AND WE GOT TO TALKING ABOUT OUR PROJECT. HE'S REALLY COUNTING ON US.



**Exercise**

Match each form of power to the scenario where it's being used.

Legitimate power

A project manager sets up an "Accelade Wall" and posts awards for team members who come in ahead of schedule.

Reward power

Everyone always does what Shelly says because everyone knows that senior management loves her.

Expert power

A functional manager assigns a tester to work on the project manager's team.

Referent power

The programmers always listen to the team lead because he's a really good software architect.

Answers on page 522.



# Motivate your team

No matter how good your soft skills are, if your team has a lousy work environment, they're going to have a hard time getting the project done. Luckily, there's been research done over the years to figure out exactly what makes a good working environment. For the PMP exam, you'll be expected to be familiar with the most popular theories of motivation and organization.

This stuff is all part of recognition and rewards—one of the tools and techniques for Develop Project Team.

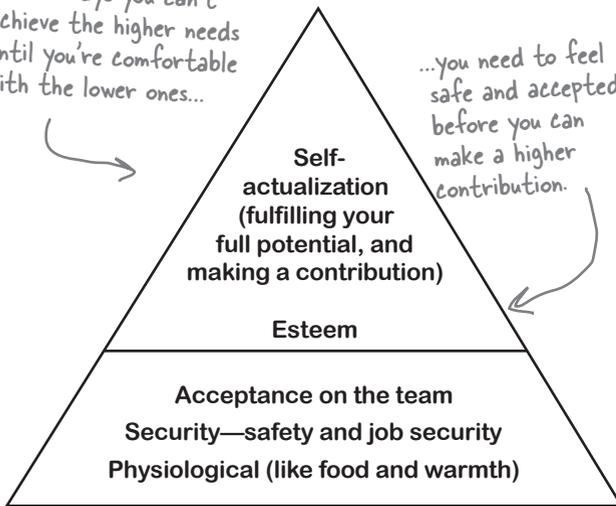


A "hygiene factor" is something like a paycheck or status—stuff that people need in order to do the job. If people don't have this stuff, it's really hard to motivate them!

You might see this in a question about "Maslow's theory," or it might show up on the exam as "Hierarchy of Needs" or "Maslow's Hierarchy."

**Maslow's Hierarchy of Needs** says that people have needs, and until the lower ones are satisfied they won't even begin to think about the higher ones.

Maslow says you can't achieve the higher needs until you're comfortable with the lower ones...



## Herzberg's Motivation-Hygiene Theory

Sure, you love being a project manager. But would you do the job if you weren't getting a paycheck? Of course not!

What Herzberg figured out was that you need things like good working conditions, a satisfying personal life, and good relations with your boss and coworkers—stuff he called "hygiene factors." They don't motivate you, but you need them before you can be motivated. Until you have them, you don't really care about "motivation factors" like achievement, recognition, personal growth, or career advancement.



Herzberg says that people need the stuff they normally expect out of a job—like hot coffee—before you can get them motivated about achievement and personal growth.

## McGregor's Theory X and Theory Y

McGregor tells us that there are two kinds of managers: ones who assume that everyone on the team is selfish and unmotivated, and ones who trust their team to do a good job. He calls the kind of manager who distrusts the team a "Theory X" manager, and the kind who trusts them a "Theory Y" manager. **You could get exam questions where the answer could be "Theory X" or "Theory Y"—or both!**

A Theory X manager will micromanage the team, looking over everyone's shoulder all the time and making them feel like they aren't trusted.

It's much better—and easier—to be a Theory Y manager. If you trust the team to do their jobs, they won't let you down!

Two more theories that might appear on the PMP exam—although they're not nearly as common as the others.

**Expectancy Theory** says that you need to give people an expectation of a reward in order to motivate them—but this works only if that award is achievable. If everyone knows the award is either worthless or impossible to achieve, it will actually demotivate them!

**McClelland's Achievement Theory** says that people need to be motivated. Achievement is when someone performs well and is recognized for it. Power means he or she has a lot of control or influence in the company. And someone feels a strong sense of affiliation from being a part of a working team and having good relationships with coworkers.



**Exercise Solution**

Each of the following scenarios demonstrates one of the motivational theories at work. Write down which theory each scenario describes.

1. Bob is a programmer on the team, but he doesn't really feel like he's "one of the guys." He doesn't really have a lot of control over the work he's assigned. Recently, Bob put in a long weekend to get his work done, but nobody really seemed to take notice.

.....

4. Joe's a functional manager, and his team is very efficient. He spot-checks their work, but for the most part he sets realistic performance goals and trusts them to meet it—he only pulls people aside if he finds that there's a specific problem that has to be corrected.

.....

2. There was a break-in at the office, and now people are really jittery. Plus, the heating system has been broken for weeks, and it's freezing! No wonder nobody's getting any work done.

.....

5. A project manager is having a lot of trouble motivating the team. He tries setting up rewards and a good working environment. But the team remains difficult to motivate—mostly because their paychecks all bounced last week, and everyone is angry at the CEO because they didn't get bonuses.

.....

3. Eric's a functional manager, but his team seems to move really slowly. It turns out that everyone who reports to him has to hand him their work first, before they can give it to anyone else. He goes through it line by line, which sometimes takes hours! He doesn't trust his team to release anything he hasn't seen.

.....

—————> **Answers on page 524.**

## Stages of team development

There's a process for a team to evolve from a group of strangers to a group that creates something good together, and that's what the stages of team development are all about.



Every team goes through these stages during a project.

**Forming:** People are still trying to figure out their roles in the group; they tend to work independently, but are trying to get along.

**Storming:** As the team learns more about the project, members form opinions about how the work should be done. This can lead to temper flare-ups in the beginning, when people disagree about how to approach the project.

**Norming:** As the team learns more about the other members, they begin to adjust their own work habits to help out one another and the team as a whole. Here's where the individuals on the team start learning to trust one another.

**Performing:** Once everyone understands the problem and what the others are capable of doing, they start acting as a cohesive unit and being efficient. Now the team is working like a well-oiled machine.

**Adjourning:** When the work is close to completion, the team starts dealing with the fact that the project is going to be closing soon.

Researcher Bruce Tuckman came up with these five stages as a model for team decision making.

Although this is the normal progression, it's possible that the team can get stuck in any one of the stages. One big contribution you can make, as the project manager, is to help the team get through the initial Storming phase, and into Norming and Performing. It's important to keep in mind that people have a tough time creating team bonds initially, and to try to use your soft skills to help the team to progress through the stages quickly.



How does knowing the five stages of team development change the decisions that you'll make in handling conflicts on your team?



Each of the following scenarios demonstrates one of the stages of team development. Write down which stage each scenario describes.

1. Joe and Tom are both programmers on the Global Contracting project. They disagree on the overall architecture for the software they're building, and frequently get into shouting matches over it. Joe thinks Tom's design is too short-sighted and can't be reused. Tom thinks Joe's design is too complicated and probably won't work. They're at a point right now where they're barely talking to each other.
2. Joan and Bob are great at handling the constant scope changes on the Business Intelligence project. Whenever the stakeholders request changes, they shepherd them through the change control process and make sure the team doesn't get bothered with them unless it's absolutely necessary. That leaves Darrel and Roger to focus on building the main product. Everybody is focusing on their area and doing a great job. It seems like it's all just clicking for the group.
3. Derek just got to the team, and he's really reserved. Folks on the team aren't quite sure what to make of him. Everybody's polite, but it seems like some people are a little threatened by him.
4. Now that the product has shipped, the team is meeting to document all of their lessons learned and write up project evaluations.
5. Danny just realized that Janet is really good at developing web services. He's starting to think of ways to make sure that she gets all of the web service development work and Doug gets all of the client software work. Doug seems really happy about this too—he seems to really enjoy building Windows applications.

—————→ **Answers on page 526.**

## How's the team doing?

There's one major output of Develop Team. It is the **team performance assessment**. Developing the project team means working with them to keep everyone motivated, and training them to improve their skills. The others are **updates to your project documents, Project Management plan, your company's enterprise environmental factors, your company's organizational process assets, and change requests**, to update your company's personnel records and keep your project documentation updated in step with new developments on your team.

Has the team performance improved?  
Are the motivational techniques working? If so, that goes here!

You can measure how motivated and happy the team is by keeping an eye on the turnover rate.

### Outputs



You'll need to keep track of how well the team is performing, so when the team has problems you'll have a good baseline to compare against.

#### Cows Gone Wild IV Team Performance Assessment

##### Competencies / Skills improvements

*Developers: attended three-day training course on new vector graphics coding techniques. Designers: brought in industrial design professor from Ivy College to hold seminar on design techniques.*

##### Team Performance

*There's been a marked improvement in team cohesion, and it's resulted in a lower defect rate. We've awarded 50% of our \$2,500 bonus budget.*

##### Turnover Rate

*Two designers and one developer have left the team, which is an improvement from CGW III.*

## BULLET POINTS: AIMING FOR THE EXAM

- Project managers use their **general management skills** ("soft skills") to motivate and lead the team.
- In a matrix organization, the project manager doesn't have **legitimate** power, because the team doesn't directly report to the project manager.
- The most effective forms of power are **reward power**, where the project manager sets up rewards and recognition for the team, and **expert power**, which means the team respects the project manager's technical expertise.
- Project managers should be familiar with modern **theories of motivation and management**.
- **McGregor's Theories X and Y** state that there are poor Theory X managers who don't trust their teams, and good Theory Y managers who do.
- **Maslow's Hierarchy of Needs** is the theory that says that people can't achieve "self-actualization" (full potential) or esteem (feeling good and important) until lower needs like safety and security are met.
- **Herzberg's Motivation-Hygiene Theory** says that it's difficult to motivate people unless hygiene factors like a paycheck and job security are already in place.
- **Expectancy Theory** holds that people only respond to rewards that are tied to goals they feel they have a realistic chance of achieving.
- Bruce Tuckman's five stages of team development are **forming** (the team still finding their roles), **storming** (the team forming opinions), **norming** (adjusting work habits to help the team), **performing** (working like a well-oiled machine), and **adjourning** (closing down the project).
- **Referent power** is power that's based on identifying with or admiring the power holder.

## Cubicle conversation



WE'VE GOT A PROBLEM, MIKE. MY TEAM NEEDS THE 3D MODEL DESIGNS AND TEXTURE MAPS FROM THE DESIGN TEAM, BUT WE'RE NOT GETTING THEM.

**Amy:** Look, we've been over this, Brian. My team is working on level design, and that's the priority right now.

**Brian:** Mike, is that true?

**Mike:** I checked the schedule, and all three of those things are part of the current activity. It's not really clear which one of them is the priority.

**Brian:** Look, my team will be halted if we don't get those models and textures.

**Amy:** Come on, Brian. You guys have a whole bunch of unit tests that you can write, and I know you're a week behind on code reviews. Can't you just work on those in the meantime?

**Brian:** My team's been reviewing code for two weeks now. They need a break!

**Amy:** Aha! So it's not *really* that you're going to fall behind if you don't get the textures immediately.

**Brian:** Well, no, but I'll be dealing with a team that has motivation problems. And I'm the one who has to clean up that mess!

**Mike:** OK, hold on, guys. Let's see if we can work this out.

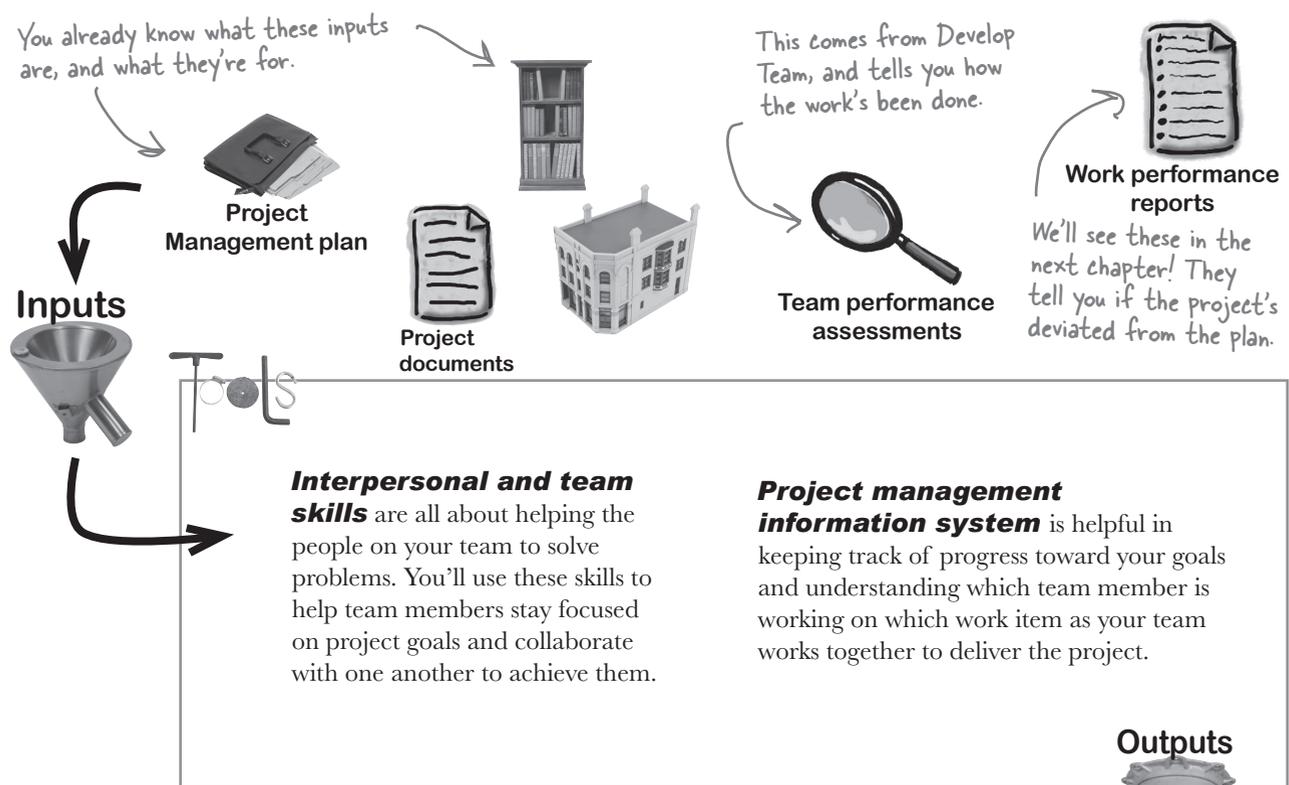
**Amy:** I don't see what there is to work out. He's being unreasonable.



It looks like Brian and Amy are having a serious conflict, and it could have a big impact on the project if Mike doesn't get it under control! What usually causes conflicts in projects, and what can the project manager do about it when those conflicts happen?

# Managing your team means solving problems

Wouldn't it be great if your team members never had any conflicts? Well, we all know that conflicts are a fact of life in any project. A good project manager knows how to handle conflicts so they don't delay or damage the project. And that's what the **Manage Team** process is about.



## Sharpen your pencil



You've seen all of the outputs of Manage Team before. Take an educated guess and write them down. You'll need to handle potential changes that the team discovers, and make updates if they turn out to be required.

.....

.....

.....

.....

Answers on page 523. ↑



## Conflict management up close

It's probably no surprise that over half of conflicts come from priorities, schedules, and people. That's why so many of the processes you're learning about are focused on preventing conflicts. Ground rules, good planning practices, and pretty much anything that has to do with communication are all there to prevent the most common reasons that conflicts happen.

### Some of the common reasons that conflicts happen

**Resources** are scarce—that's why you have to negotiate for them. Have you ever been in a situation where there's a "good" conference room, or top-performing team member, or even that photocopy machine that always seems to be in use? Well, that's a scarce resource. No wonder resources cause so many conflicts.

**Priorities** mean one project or person is more important than another, and gets more budget, resources, time, prestige, or other perks. If the company's priorities aren't crystal clear, then conflicts are definitely going to happen.

**Schedules** decide who gets what, when. Have you ever had a client, sponsor, or stakeholder get upset because your project won't come in as early as he or she wanted it to? Then you've had a conflict over schedules.

These three things are the source of over 50% of all conflicts!

Over half of all conflicts are caused by resources, priorities, and schedules.

Some more sources of conflict

**Personalities** are always clashing. Sometimes two people just don't get along, and you're going to have to find a way to make them work together in order to get your project done.

**Cost** disagreements seem to come up a lot, especially where contracts are involved. Even when the price is agreed upon up front, buyer's remorse will set in, and it will lead to issues.

**Technical opinions** are definitely a reason that conflicts happen, because it's really hard to get an expert to change his mind...so when two of them disagree, watch out!



What's the best way to deal with a conflict between two people on your project team?

## How to resolve a conflict

When you're managing a project, you depend on people to get the work done. But when they have any sort of conflict, your project can grind to a halt...and you're the one who has to face the music when it causes delays and costs money! Since you're on the hook when a conflict threatens your project, **you're the one who has to resolve it.** Luckily, there are some techniques for getting your conflicts resolved.

**The best way to resolve a conflict is to collaborate with others: do your research, figure out what's behind it, and fix the root cause.**

**Collaborating—or problem solving—is the most effective way to resolve a conflict.**

This means working with other people to make sure that their viewpoints and perspectives are taken into account. It's a great way to get a real commitment from everyone while you get to the bottom of what's causing the issue and figure out a solution that works for everybody.



AMY CAME UP WITH A GOOD IDEA, AND BRIAN EXPANDED ON IT. IT SOUNDS LIKE WE'VE GOT A REAL PLAN HERE!

The first thing you do whenever you face a problem is do your research and gather all the information so you can make an informed decision.

**Compromise** sounds good, doesn't it?

But hold on a second—when two people compromise, it means that each person gives up something. That's why a lot of people call a compromise a “lose-lose” solution.

You should always try to solve the problem first—you should forge a compromise only after you've tried every possible way to solve the real problem.



LOOK, EACH OF YOU IS GOING TO HAVE TO GIVE UP SOMETHING IF WE WANT TO GET BACK ON TRACK.

**Smoothing** or accommodating is what you're doing when you try to play down the problem and make it seem like it's not so bad. It's a temporary solution, but sometimes you need to do it to keep tempers from flaring and give people some space to step back and really figure out what's going on.



COME ON, GUYS. I KNOW THIS SEEMS LIKE THE END OF THE WORLD, BUT IT'S REALLY NOT SUCH A BIG DEAL.

**Forcing** means putting your foot down and making a decision. One person wins, one person loses, and that's the end of that.



I'M IN CHARGE HERE, AND I'VE MADE MY DECISION... AND YOU'RE JUST GONNA HAVE TO LIVE WITH IT.

You should really try to avoid forcing and withdrawal if you can.

**Withdrawal** doesn't do much good for anyone. It's when people get so frustrated, angry, or disgusted that they just walk away from the argument. It's almost always counterproductive. If someone withdraws from a problem before it's resolved, it won't go away—and your project will suffer.

YOU GUYS ARE BEING TOTALLY UNREASONABLE, AND WE'RE JUST NOT GOING TO TALK ABOUT IT ANYMORE.

Who's really being unreasonable here?





BUT COLLABORATING  
SOUNDS LIKE A BAD THING!  
SHOULDN'T I SOLVE  
PROBLEMS ON MY OWN?

**No! Collaboration is just another name for problem solving with other people,** because you solve a problem by hearing everybody's viewpoint, doing your research, and fixing whatever is causing it. If you always remember to:

"Collaborating" is another way of saying "problem solving with a group of people." Any time two people have a conflict, you need to step back and figure out what's actually causing the problem and then get everybody to work together to solve it. If you get many different opinions, you're more likely to come up with a solution that works.

**Collaborate with the team  
to solve the problem**

...it will really help you through a bunch of questions on the exam!





Take a look at each of these attempts to resolve a conflict and figure out which conflict resolution technique is being used.

1. "I don't really have time for this—let's just do it your way and forget I ever brought up the problem."

.....

2. "Look Sue, Joe's already filled me in on your issue. I've considered his position, and I've decided that he's right, so I don't need to hear any more about it."

.....

3. "Hold on a second, let's all sit down and figure out what the real problem is."

.....

4. "Joe, you've got a solid case, but Sue really brings up some good points. If you just make two little concessions, and Sue gives up one of her points, we'll all be good."

.....

5. "You guys are almost entirely in agreement—you just differ on one little point! I'll bet we'll be laughing about this next week."

.....

6. "I don't really have time to deal with this right now. Just figure it out and get back to me."

.....

7. "I know this problem seems really big, but I'll bet if we take a long, hard look at it, we can figure out how to fix it permanently."

.....

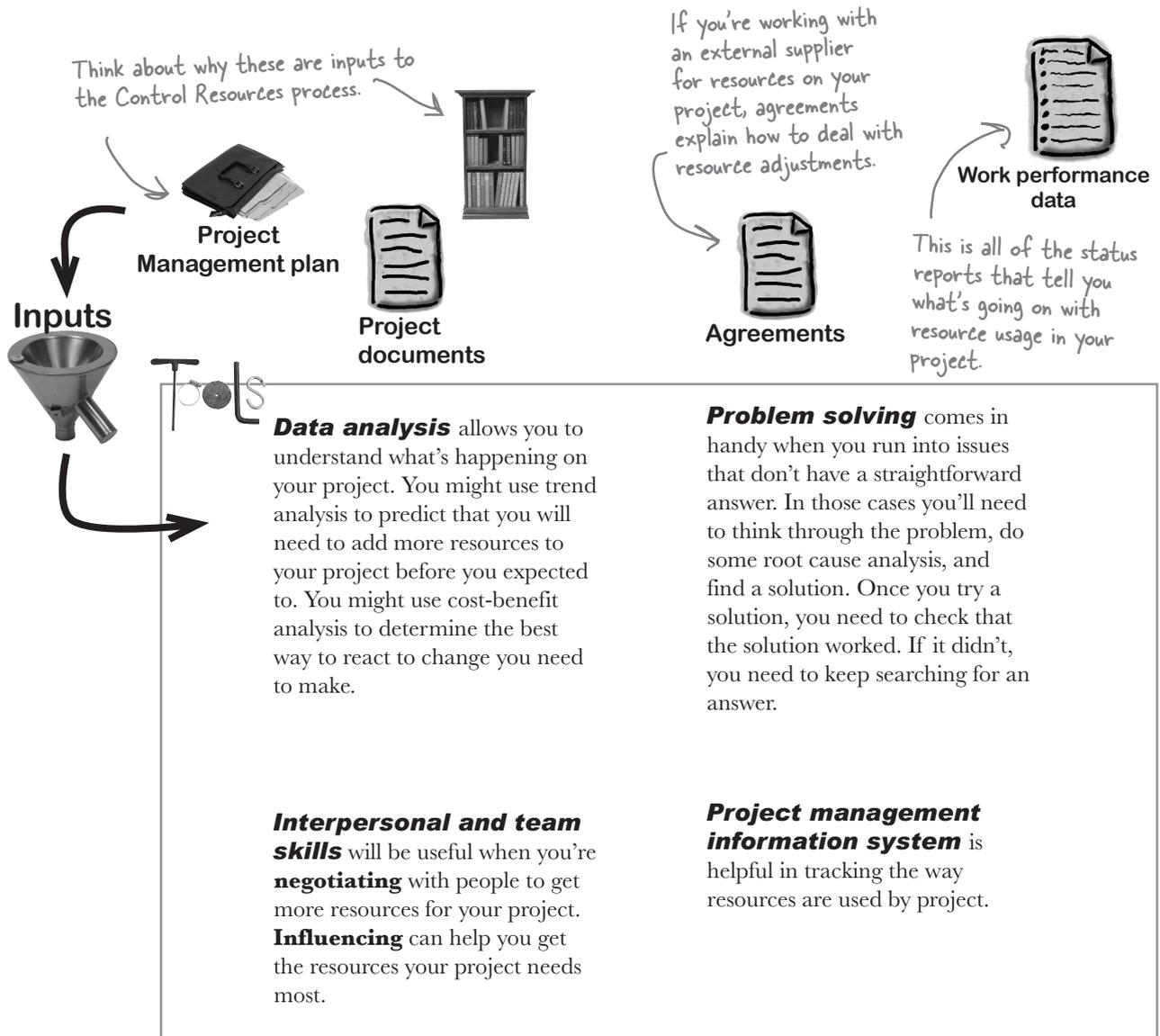
—————> **Answers on page 525.**

# Make sure to control resources to keep your project on track



Monitoring & Controlling process group

We all know that projects don't always happen exactly as planned and that's why you need to make sure your resources are ready when they're needed and released to other teams when they're not needed. **Control Resources** is all about comparing your actual product data to the plan and adapting as you go.



# Outputs of the Control Resources process

Once you find changes to the plan, they need to be proposed as change requests. When those change requests are approved, the Project Management plan and project documents need to be updated to include the change.

## Outputs



When you need to make changes to the Resource Management plan, you make them through a change request.

This is all of the information about how your project is progressing. As you make changes to the resource make-up on your project, those changes are reflected in your work performance information.



Project documents updates

Some of the documents that might be affected by the control resources project are: assumption log, issue log, lessons learned register, physical resource assignments, resource breakdown structure, risk register.



Change requests



Project Management plan updates

Some of the plans affected by this process are Resource Management plan, schedule baseline, cost baseline..



Work performance information

**The Control Resources process lets you adapt your plan to changes that happen during your project.**

## there are no Dumb Questions

**Q:** How do I know what form of power to use?

**A:** You should always try to use expert power or reward power if you can. Expert power is effective because people naturally follow leadership from someone they respect. And reward power is also good because rewards help people motivate themselves.

When you use referent power, you're appealing to a really important psychological tool: the fact that when you like someone or she likes you, you're much more likely to influence her. And when you use punishment, you have to be very careful because it can be highly demotivating to the team. When you use it, always be careful not to punish someone in front of the team or other managers in your company. That can be embarrassing for the person, and just makes you look vindictive. Remember, your goal is to get your project back on track, not to put someone in his place!

**Q:** It sounds like compromise is a bad thing. But I've been told that when people are fighting, I should always look for a middle ground!

**A:** Yes, as little kids a lot of us were told that we should always look for a compromise. And that probably is the right thing to do on the playground. But when you're managing a project, you're judged by the success of your final product, not by how happy your team is. When you forge a compromise instead of really figuring out what's causing the problem, you're usually taking the easy way out.

**Q:** I'm still not quite clear about all of that storming and norming stuff. Do I need to know that to run a project?

**A:** Yes, you do! When Bruce Tuckman published his pioneering research about group development in 1965, he was looking for a model to describe how teams face their challenges, tackle their problems, find solutions to those problems, and deliver results. Since then, it's become the foundation for a lot of modern thinking about how teams form and work. More importantly, if you learn to recognize how teams evolve over the course of a project, it will actually help you in real life when you run your projects. If you understand how group dynamics work, you'll have a much better idea of what's causing conflicts and problems on your team, and you can help everyone work through those problems. Sometimes knowing that groups go through these patterns helps you keep perspective...and realize that it's normal—even healthy!—to have conflicts every now and then.

**Try to avoid using punishment. When you do have to punish someone, make sure to do it in private, and not in front of peers or other managers.**



### BULLET POINTS: AIMING FOR THE EXAM

- **Resources, schedules, and priorities** cause 50% of project problems and conflicts. Personality conflicts are actually the least likely cause.
- The best way to solve a problem is to do your research, figure out what's causing the problem, and **collaborate with your team to solve it**.
- **Withdrawal** happens when someone gives up and walks away from the problem, usually because he's frustrated or disgusted. If you see a team member doing this, it's a warning sign that something's wrong.
- Don't be fooled by questions that make it sound like "collaborating" is a bad thing. **Collaborating is just another word for problem solving with multiple perspectives.**
- **Smoothing** is minimizing the problem, and it can help cool people off while you figure out how to solve it.
- You should **compromise only if you can't solve the problem**.
- **Forcing** means making a decision by simply picking one side. It's a really ineffective way to solve problems.

## The Cows Gone Wild IV team ROCKS!

The odds were against Mike—he had to fight for a whole new team, keep them motivated, and solve some pretty serious problems. But he followed his plan, got a great team together, kept them on track, and got the product out the door!



Mike made sure everyone had a great working environment...

...he set up rewards that kept the team motivated...



...there were conflicts and arguments, but he collaborated with the team and got the project back on track...



...and the team built the best Cows Gone Wild game ever!



PHEW!  
THAT WAS A  
WHOLE LOT OF  
WORK, BUT WE GOT  
A GREAT PRODUCT  
OUT THE DOOR!





Part of any successful project is securing the resources necessary to get the job done. **Project Resource Management** means getting the team together that will be able to collaborate and solve the problems that might come along. It also means getting the tools and physical resources your team needs to produce.



## KEY CONCEPTS

We've talked about the processes you and your team will use when planning, developing, managing, and controlling resources, but it's worth taking a minute to think about how your approach to resource management affects the overall project.

- ★ Although team members have specific roles to play on a project, it's best for the **whole team to work together** on project planning and decision making.
- ★ The team's environment, distance from one another, ability to communicate with stakeholders, and **cultural and political issues within the organization** can all affect their performance.
- ★ Resource management isn't just about working with teams. It's important that a project manager spend time thinking about **necessary infrastructure, software, hardware, or other physical resources** the team will need to do their work. If you get to a critical part of the project and don't have the physical resources lined up, it could delay your project or even cause you to catch defects too late to resolve them.

**RESOURCE MANAGEMENT IS ABOUT MAKING SURE YOUR PROJECT HAS ALL OF THE PEOPLE AND PHYSICAL RESOURCES YOU NEED TO DELIVER.**

## TRENDS

Here are a few trends in Resource Management that might help you to improve and manage the resources for your projects more effectively.

- ★ **Lean thinking** means that project teams are sometimes organized so that work comes to them rather than them being organized around the work. Lean teams **organize resources just-in-time**, and try not to reserve resources for longer than they need them.
- ★ **Self-organizing teams** are able to collaborate toward a specific goal. In teams like these, roles and responsibilities are not strictly defined. Instead, the team members will do whatever is necessary to complete the work, even if that means a developer spends time testing rather than developing, for example. Self-organizing teams care most about getting the work done, and about their own roles secondarily.



## TAILORING

When you make changes to the processes your team will use during the course of your project, there are a few considerations that might influence your decisions:



- ★ Where are the resources and people who need to work on the project in relation to one another?
- ★ Is there special domain knowledge required for this project that is hard to come by?
- ★ How will you add resources to this project if you need to?
- ★ How does the organization manage people? How does it manage physical resources?

## AGILE CONSIDERATIONS

Agile teams focus on collaboration around an elevating goal. They plan as little as possible up front in order to leave themselves more open to change. Agile teams prefer to self-organize and focus on completing work rather than having many work items in progress at the same time.

## Question Clinic: The have-a-meeting question



THERE ARE A WHOLE LOT OF QUESTIONS ON THE EXAM THAT GIVE YOU A SITUATION WHERE THERE'S A CONFLICT, AN ISSUE, OR EVEN A CRISIS, AND ASK YOU WHAT TO DO FIRST. THE TRICK IS THAT IN ALL OF THESE CASES, ONE OF THE OPTIONS IS TO HAVE A MEETING. SOUNDS ODD, RIGHT? BUT THIS IS ACTUALLY REALLY IMPORTANT FOR A PROJECT MANAGER TO KNOW! THAT'S BECAUSE YOU NEED TO GATHER INFORMATION FROM OTHER PEOPLE BEFORE YOU MAKE A DECISION.

Don't be fooled—even though this asks about conflict, that doesn't mean it's asking you for a conflict resolution technique.

It's not always team members who have conflicts. You could have an unhappy client who has a complaint about you or your team members... and that client could be right.

Sounds like these guys are right, and the other person is wrong... right? Well, maybe not.

198. Three people on your project team are having conflicts about priorities. A junior team member wants to do the activities out of order, while two senior members want to follow the schedule that you had originally put together. What's the first step in resolving this conflict?

- A. Tell everyone to work out the problem among themselves.
- B. Tell the junior member that you should always follow the schedule.
- C. Tell them to keep to the original schedule.
- D. Meet with all three people and get all the information.

Never push off your management responsibilities on the team.

That's not true! What if the schedule has a problem and needs change control? The junior team member could be right.

You shouldn't make a unilateral decision without understanding the conflict.

This is the right answer. Get all the facts before you make any move.

REMEMBER HOW YOU ALWAYS LOOK AT THE IMPACT OF A CHANGE BEFORE YOU DECIDE WHETHER OR NOT TO MAKE IT? WELL, THIS IS THE SAME IDEA! YOU ALWAYS WANT TO LOOK AT ALL THE FACTS BEFORE YOU MAKE A MOVE.



# HEAD LIBS



Fill in the blanks to come up with your own have-a-meeting question!

You're managing \_\_\_\_\_ when \_\_\_\_\_  
(description of a project) (two people with a conflict)  
come to you with a disagreement about \_\_\_\_\_ . One team member  
(source of disagreement)  
says \_\_\_\_\_ , while the other says \_\_\_\_\_ .  
(one idea about how to resolve it) (a different idea about how to solve it)  
What's the first thing that you do?

- A. \_\_\_\_\_  
(make a unilateral decision)
- B. \_\_\_\_\_  
(side with one person)
- C. \_\_\_\_\_  
(side with the other person)
- D. \_\_\_\_\_  
(have a meeting)

Here's an additional have-a-meeting exercise to help get you used to this kind of question.

How many different ways can you say "have a meeting"?

Fill in a few more.

Gather information from everyone involved.

\_\_\_\_\_

Talk to the people involved directly.

\_\_\_\_\_

Make sure you know everything you need about the situation.

\_\_\_\_\_

Don't make a move until you've got all the information.

\_\_\_\_\_



**Exercise Solution**

Read the **Resource Management plan** on the facing page and answer these questions about the project.

1. How many designers, developers, and testers are needed in week #7 of the project?

0  
designers

10  
developers

2  
testers

2. Who is responsible for verifying that each team member has the skills appropriate to the project?

Mike, Amy, and Brian

3. Rewards should always be tied to performance goals in order to motivate the team. What performance goal has been set for the team, and what reward will each team member receive if it's achieved?

Each team member will receive \$1,000 if the schedule is met, and \$500 more if all quality control standards are met.



**Exercise Solution**

Match each form of power to the scenario where it's being used.

Legitimate power

Reward power

Expert power

Referent power

A project manager sets up an "Accolade Wall" and posts awards for team members who come in ahead of schedule.

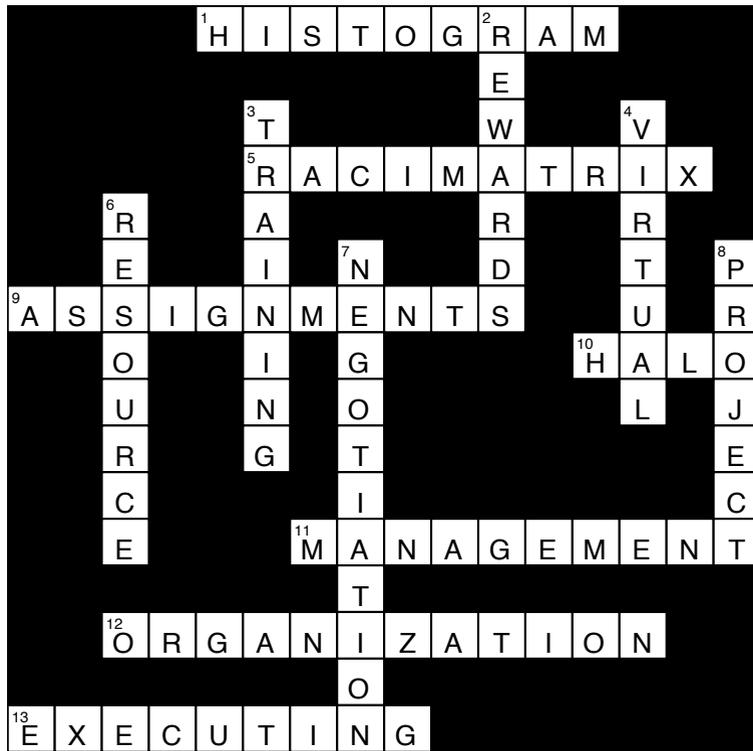
Everyone always does what Shelly says because a senior director assigned her personally.

A functional manager assigns a tester to work on the project manager's team.

The programmers always listen to the team lead because he's a really good software architect.



# Resourcecross Solution



## Outputs



## Sharpen your pencil Solution



You've seen all of the outputs of Manage Team before. Take an educated guess and write them down. You'll need to handle potential changes that the team discovers, and make updates if they turn out to be required.

Change requests .....

Updates to enterprise .....

environmental factors .....

.....

Project documents updates .....

Updates to the Project .....

Management plan .....

.....



## Exercise Solution

Each of the following scenarios demonstrates one of the motivational theories at work. Write down which theory each scenario describes.

1. Bob is a programmer on the team, but he doesn't really feel like he's "one of the guys." He doesn't really have a lot of control over the work he's assigned. Recently, Bob put in a long weekend to get his work done, but nobody really seemed to take notice.

### **McClelland's Achievement Theory**

---

2. There was a break-in at the office, and now people are really jittery. Plus, the heating system has been broken for weeks, and it's freezing! No wonder nobody's getting any work done.

### **Maslow's Hierarchy of Needs**

---

3. Eric's a functional manager, but his team seems to move really slowly. It turns out that everyone who reports to him has to hand him their work first, before they can give it to anyone else. He goes through it line by line, which sometimes takes hours! He doesn't trust his team to release anything he hasn't seen.

### **McGregor's Theory X**

---

4. Joe's a functional manager, and his team is very efficient. He spot-checks their work, but for the most part he sets realistic performance goals and trusts them to meet them—he only pulls people aside if he finds that there's a specific problem that has to be corrected.

### **McGregor's Theory Y**

---

5. A project manager is having a lot of trouble motivating the team. He tries setting up rewards and a good working environment. But the team remains difficult to motivate—mostly because their paychecks all bounced last week, and everyone is angry at the CEO because they didn't get bonuses.

### **Herzberg's Motivation-Hygiene Theory**

---



## Exercise Solution

Take a look at each of these attempts to resolve a conflict and figure out which conflict resolution technique is being used.

1. "I don't really have time for this—let's just do it your way and forget I ever brought up the problem."

### **Withdrawal**

.....

2. "Look Sue, Joe's already filled me in on your issue. I've considered his position, and I've decided that he's right, so I don't need to hear any more about it."

### **Forcing**

.....

3. "Hold on a second, let's all sit down and figure out what the real problem is."

### **Collaborating**

.....

4. "Joe, you've got a solid case, but Sue really brings up some good points. If you just make two little concessions, and Sue gives up one of her points, we'll all be good."

### **Compromise**

.....

5. "You guys are almost entirely in agreement—you just differ on one little point! I'll bet we'll be laughing about this next week."

### **Smoothing**

.....

6. "I don't really have time to deal with this right now. Just figure it out and get back to me."

### **Withdrawal**

.....

7. "I know this problem seems really big, but I'll bet if we take a long, hard look at it, we can figure out how to fix it permanently."

### **Collaborating**

.....



## Exercise Solution

Each of the following scenarios demonstrates one of the stages of team development. Write down which stage each scenario describes.

1. Joe and Tom are both programmers on the Global Contracting project. They disagree on the overall architecture for the software they're building, and frequently get into shouting matches over it. Joe thinks Tom's design is too short-sighted and can't be reused. Tom thinks Joe's design is too complicated and probably won't work. They're at a point right now where they're barely talking to each other.

### Storming

2. Joan and Bob are great at handling the constant scope changes on the Business Intelligence project. Whenever the stakeholders request changes, they shepherd them through the change control process and make sure the team doesn't get bothered with them unless it's absolutely necessary. That leaves Darrel and Roger to focus on building the main product. Everybody is focusing on their area and doing a great job. It seems like it's all just clicking for the group.

### Performing

3. Derek just got to the team, and he's really reserved. Folks on the team aren't quite sure what to make of him. Everybody's polite, but it seems like some people are a little threatened by him.

### Forming

4. Now that the product has shipped, the team is meeting to document all of their lessons learned and write up project evaluations.

### Adjourning

5. Danny just realized that Janet is really good at developing web services. He's starting to think of ways to make sure that she gets all of the web service development work and Doug gets all of the client software work. Doug seems really happy about this too—he seems to really enjoy building Windows applications.

### Norming

## Exam Questions

**1. A RACI matrix is one way to show roles and responsibilities on your project. What does RACI stand for?**

- A. Responsible, Approve, Consult, Identify
- B. Responsible, Accountable, Consulted, Informed
- C. Retain, Approve, Confirm, Inform
- D. Responsible, Accountable, Confirm, Inform

**2. Everybody does what Tom says because he and the president of the company are golfing buddies. What kind of power does he hold over the team?**

- A. Legitimate
- B. Reward
- C. Punishment
- D. Referent

**3. What's the most effective approach to conflict resolution?**

- A. Smoothing
- B. Collaborating
- C. Compromise
- D. Withdrawal

**4. Two of your team members are having a disagreement over which technical solution to use. What's the first thing that you should do in this situation?**

- A. Consult the technical documents.
- B. Tell the team members to work out the problem themselves.
- C. Ask the team members to write up a change request.
- D. Meet with the team members and figure out what's causing the disagreement.

**5. Joe is a project manager on a large software project. Very late in his project, the customer asked for a huge change and wouldn't give him any more time to complete the project. At a weekly status meeting, the client demanded that the project be finished on time. Joe told the client that he wasn't going to do any more status meetings until the client was ready to be reasonable about the situation. Which conflict resolution technique was he using?**

- A. Forcing
- B. Compromise
- C. Withdrawal
- D. Collaborating

## Exam Questions

**6. You've just completed your staffing management plan. What process are you in?**

- A. Acquire Project Team
- B. Develop Project Team
- C. Plan Resource Management
- D. Manage Project Team

**7. Which of the following describes Maslow's Hierarchy of Needs?**

- A. You can't be good at your job if you don't have a nice office.
- B. You need to feel safe and accepted to want to be good at your job.
- C. Your boss's needs are more important than yours.
- D. The company's needs are most important, then the boss's, then the employee's.

**8. Jim and Sue are arguing about which approach to take with the project. Sue makes some good points, but Jim gets frustrated and storms out of the room. What conflict resolution technique did Jim demonstrate?**

- A. Withdrawal
- B. Collaborating
- C. Forcing
- D. Smoothing

**9. Tina is a project manager who micromanages her team. She reviews every document they produce and watches when they come and go from the office. Which kind of manager is she?**

- A. Theory X
- B. Theory Y
- C. Theory Z
- D. McGregor manager

**10. Which of the following is NOT one of the top sources of conflict on projects?**

- A. Resources
- B. Technical opinions
- C. Salaries
- D. Priorities

**11. Which of the following is an example of the "halo effect"?**

- A. When a project manager is good, the team is good, too
- B. The tendency to promote people who are good at technical jobs into managerial positions
- C. When a project manager picks a star on the team and always rewards that person
- D. When a technical person does such a good job that no one can find fault with her

## Exam Questions

12. You are working on a construction project that is running slightly behind schedule. You ask the team to put in a few extra hours on their shifts over the next few weeks to make up the time. To make sure everyone feels motivated to do the extra work, you set up a \$1,500 bonus for everyone on the team who works the extra hours if the deadline is met. What kind of power are you using?

- A. Legitimate
- B. Reward
- C. Expert
- D. Referent

13. Two team members are having an argument over priorities in your project. One thinks that you should write everything down before you start doing any work, while the other thinks you can do the work while you finish the documentation. You sit both of them down and listen to their argument. Then you decide that you will write most of it down first but will start doing the work when you are 80% done with the documentation. What conflict resolution technique are you using?

- A. Forcing
- B. Legitimate Power
- C. Smoothing
- D. Compromise

14. What is a war room?

- A. A place where managers make decisions
- B. A room set aside for conflict management
- C. A room where a team can sit together and get closer communication
- D. A conflict resolution technique

15. You are writing a performance assessment for your team. Which process are you in?

- A. Develop Project Team
- B. Acquire Project Team
- C. Manage Project Team
- D. Plan Resource Management

16. You are working in a matrix organization. You don't have legitimate power over your team. Why?

- A. They don't report to you.
- B. They don't trust you.
- C. They don't know whether or not they will succeed.
- D. You haven't set up a good bonus system.

## Exam Questions

17. Tom is using an organization chart to figure out how he'll staff his project. What process is he performing?

- A. Plan Resource Management
- B. Acquire Team
- C. Develop Team
- D. Manage Team

18. You're a project manager on an industrial design project. You've set up a reward system, but you're surprised to find out that the team is actually less motivated than before. You realize that it's because your rewards are impossible to achieve, so the team doesn't expect to ever get them. What motivational theory does this demonstrate?

- A. Herzberg's Motivation-Hygiene Theory
- B. Maslow's Hierarchy of Needs
- C. McGregor's Theory of X and Y
- D. Expectancy Theory

19. You're managing a software project when two of your programmers come to you with a disagreement over which feature to work on next. You listen to the first programmer, but rather than thinking through the situation and gathering all the information, you decide to go with his idea. Which conflict resolution technique did you use?

- A. Compromise
- B. Forcing
- C. Collaborating
- D. Smoothing

20. Your client comes to you with a serious problem in one of the deliverables that will cause the final product to be unacceptable. Your team members look at his complaint and feel that it's not justifiable, and that the product really does meet its requirements. What's the first thing that you do?

- A. Confront the situation by making the change that needs to be made in order to satisfy the client.
- B. Explain to the client that the solution really is acceptable.
- C. Work with the client and team members to fully understand the problem before making a decision.
- D. Write up a change request and send it to the change control board.

## Answers

~~Exam Questions~~

## 1. Answer: B

When you think about how you organize the work on your project, the RACI chart makes sense. Being **responsible** for a specific task or area of work means you're the one who's on the hook if it doesn't get done. Being **accountable** means you might not be doing it directly, but you have influence over it. Some people need to be **consulted** but don't get involved in the work, while others should just be kept **informed** of status.

## 2. Answer: D

Did you choose punishment? People might be afraid of punishment from the president of the company if they don't agree with Tom. But since Tom isn't the one who would punish them, it's referent power.

The power is here is referent. People are reacting to Tom's relationship to the president of the company, not his own authority.

## 3. Answer: B

If you actually solve the problem by taking everybody's ideas into account, there's no more reason for people to fight at all. That's always the best way to deal with a conflict. Any of the other options could lead to more problems later.

## 4. Answer: D

This is a classic have-a-meeting question! You should always gather the information you need before you make any kind of decision.

## 5. Answer: C

Joe decided that the best tactic was to refuse to talk to the client anymore—that's withdrawing. It's also probably not going to solve the problem.

## 6. Answer: C

You create the staffing management plan as part of the Resource Management plan. It's the main output of the Plan Resource Management process.

## 7. Answer: B

Maslow's Hierarchy of Needs says that your safety and acceptance are a prerequisite for your being able to do your best.

## Exam Questions

**8. Answer: A**

Jim took his ball and went home.  
That's withdrawal.

I GET IT! IT'S  
IMPORTANT TO KNOW  
THE NAMES OF ALL OF THE  
CONFLICT RESOLUTION  
TECHNIQUES, EVEN THE ONES  
LIKE WITHDRAWAL AND FORCING  
THAT DON'T WORK VERY WELL.

**9. Answer: A**

A micromanager is a Theory X manager.  
Tina believes that all employees need to be  
watched very closely, or they will make mistakes.



**10. Answer: C**

You definitely need to know what causes conflicts on projects. Resources, technical opinions, priorities, and personalities all cause people to have conflicts, and there's a good chance you'll get a question on that!

**11. Answer: B**

Just because someone is good at a technical job, it doesn't mean he will be good at management.  
The jobs require very different skills.

**12. Answer: B**

You are motivating the work by offering a reward for it. People might be motivated by the bonus to put in the extra time even if they would not have been motivated by the deadline alone.

**13. Answer: D**

Both of them had to give something up, so that's a compromise.

**14. Answer: C**

War rooms are part of colocation. It's a way to keep your entire team in one room so they don't have any communication gaps.

## Answers

~~Exam Questions~~

## 15. Answer: A

Developing the team is where you evaluate performance and set up motivational factors. Manage Team is where you solve conflicts.

## 16. Answer: A

In matrix organizations, team members usually report to their functional managers. A project manager never has legitimate power over the team in those situations.

Don't forget that there are two org charts—one for the company, and one for the project.

## 17. Answer: A

Tom's project is at the very beginning—he's using the organization chart as a tool to figure out who's going to be assigned to his team.

## 18. Answer: D

Expectancy Theory says that people get motivated only by rewards that they can achieve, and that are fair. If you set up a reward system that selects people who don't deserve rewards, or that has rewards that are unattainable, then it will backfire and cause people to resent their jobs.

## 19. Answer: B

Whenever you choose one side over another without thinking or actually finding the root cause of the problem, you're forcing a solution on it. This is *not* a good way to solve problems!

## 20. Answer: C

Any time there's any sort of conflict, the first thing you need to do is gather all the information. And that's especially true when there's a disagreement between the client and the team! You'd better have your facts straight in such a charged situation.

HE SHOULD  
HAVE SAT DOWN WITH  
BOTH PROGRAMMERS AND  
FIGURED OUT WHAT THE  
REAL PROBLEM WAS. EVEN  
IF THE SOLUTION ISN'T  
PERFECT, AT LEAST IT'S  
MORE FAIR.





## 10 Communications management

# Getting the word out



**Communications management is about keeping everybody in the loop.** Have you ever tried talking to someone in a really loud, crowded room? That's what running a project is like if you don't get a handle on communications. Luckily, there's **Communications Management**, which is the knowledge area that gets everyone talking about the work that's being done, so that they all **stay on the same page**. That way, everyone has the information they need to **resolve any issues** and keep the project **moving forward**.

## Party at the Head First Lounge!

Jeff and Charles want to launch their new retro 1970s-style Head First Lounge, and they're planning a party for the grand opening. They're thinking of all of the things they need to arrange: the DJ, the hors d'oeuvres, the drinks, hula dancing. They need to start contacting caterers, DJs, and suppliers to make sure it all goes off without a hitch.



## But something's not right

When Jeff called the caterer and the DJ to request everything he wanted for the party, his old staticky phone made it hard for everybody to understand what he was asking. Sometimes their taste for retro furniture can make things a little difficult.

**1** MAKE SURE YOU BRING THE GOOD WINE!

This retro phone is old and staticky!!

**2** HI JEFF. THIS IS THE CATERER. WE GOT YOUR MESSAGE. WE'LL BE SURE TO BRING PORK RINDS.

Oops! The caterer couldn't make out what Jeff was saying.

An answering machine from the 1990s?! Jeff's really committed to the retro theme.

**3** MAN, I'VE GOTTA CALL THEM BACK AND MAKE SURE THEY BRING WINE, NOT RINDS!

**4** I WONDER IF I NEED TO CONTACT ANYONE OTHER THAN THE CATERER ABOUT THIS? IS THERE SOMETHING WRONG WITH THE PHONE? HOW CAN WE BE SURE THIS WON'T HAPPEN AGAIN?

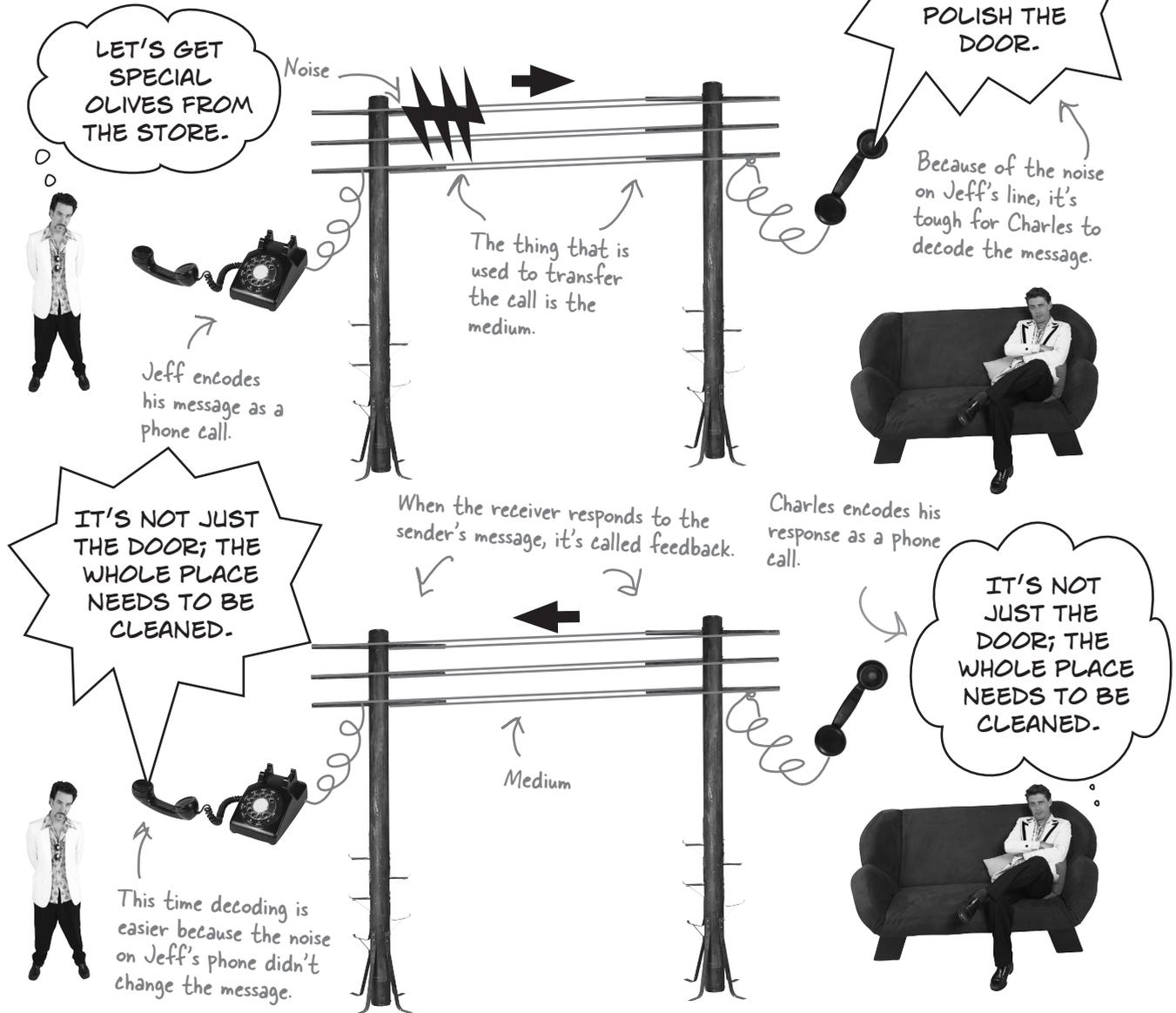
### BRAIN POWER

What can Jeff and Charles do to get a handle on their communication problems?

# Anatomy of communication

When you communicate with your team, you need to **encode** your message into a phone call, a document, an IM chat, or sometimes even a different language for them to understand. Your team then **decodes** that message so they can get its content. If something happens to your message along the way (static on the phone line, your printer inserts garbage characters, your internet connection is spotty, or your translation isn't very good), then your team might not get the intended message. The kind of interference that can alter your message is called **noise**.

When you're talking about messages, encoding, decoding, and noise, you're talking about a communications model.



## \* WHAT'S MY PURPOSE \*

Match each communication element to what it does.

Acknowledge

*Getting the information from one person to the other*

Transmit message

*Letting the sender know that the message was received*

Feedback/response

*Modifying a message that has been sent so that it can be understood*

Encoding

*An answer to a message*

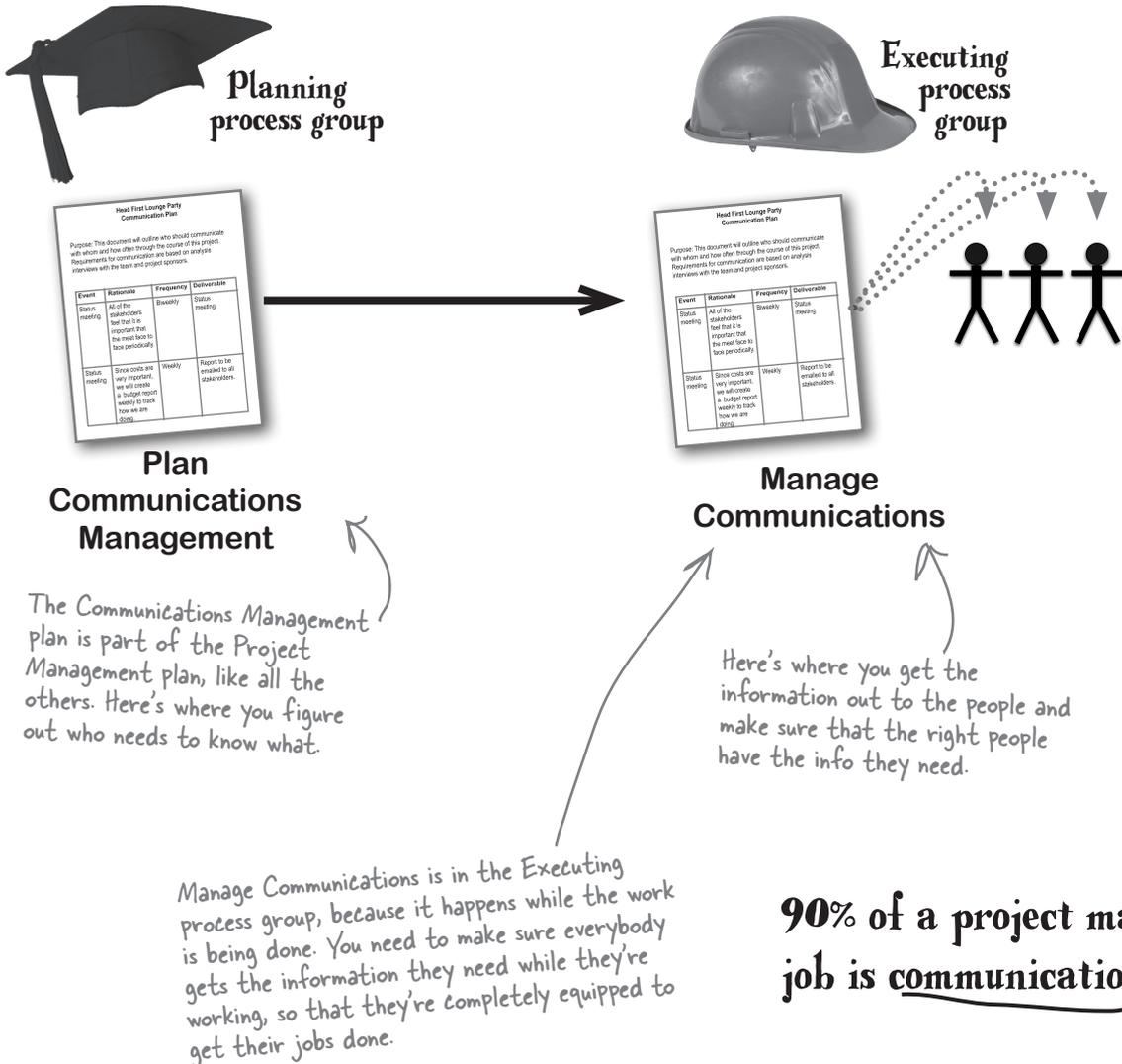
Decoding

*Modifying a message so that it can be sent*

—————▶ **Answers on page 568.**

# Get a handle on communication

Any kind of communication can have interference. The wrong person can get the message; noise can garble the transmission; you can make mistakes decoding or encoding the message. It turns out that 90% of a project manager's job is communication, which is why there's a whole knowledge area devoted to it. The **Communications Management** processes are here to help you avoid these common kinds of errors, by planning and carefully tracking the stakeholder communications on your project. Just like every other knowledge group we've covered so far, it all starts with a plan.



**Head First Lounge Party Communication Plan**

Purpose: This document will outline who should communicate with whom and how often through the course of this project. Requirements for communication are based on analysis interviews with the team and project sponsors.

Event	Rationale	Frequency	Deliverable
Status meeting	All of the stakeholders need to be important that the next face to face periodically.	Biweekly	Status meeting
Budget meeting	Since costs are very important, we will create a budget report weekly to track how we are doing.	Weekly	Report to be created to all stakeholders.

**Head First Lounge Party Communication Plan**

Purpose: This document will outline who should communicate with whom and how often through the course of this project. Requirements for communication are based on analysis interviews with the team and project sponsors.

Event	Rationale	Frequency	Deliverable
Status meeting	All of the stakeholders need to be important that the next face to face periodically.	Biweekly	Status meeting
Budget meeting	Since costs are very important, we will create a budget report weekly to track how we are doing.	Weekly	Report to be created to all stakeholders.

It's not enough to plan and manage the communications on your project. You need to make sure that everybody who has a stake in your project is getting accurate reports of how it's going so they can make good decisions—that's what the **Monitor Communications** process is all about. You use it to monitor the data your project is producing, and control how it is presented to your stakeholders.



**Monitoring  
& Controlling  
process group**



**Monitor  
Communications**

This is where you turn all of that work performance data (like how long it actually took the team to complete tasks, and actual costs of doing the work so far) into work performance information (like forecasted completion dates and budget forecasts) that your stakeholders will use to stay informed.

Monitor Communications is in the Monitoring and Controlling process group. You need to constantly monitor and always stay in control of all of the communication that goes on throughout the project, whether it's to communicate your team's performance, or to keep stakeholders up to date on the project.

**Communications Management  
makes sure everybody gets the  
right message at the right time.**



**Exercise**

This is the **Plan Communications Management** process. You've seen a lot of planning processes now. Can you fill in the inputs and outputs for this one?

**Inputs**



We'll start you off with two inputs.

**Project documents**

.....

.....

.....

**Project charter**

.....

.....

Here's where you plug in all of the planning you've done on your project so far.

**Tools**

**Communication requirements analysis**

means figuring out what kind of communication your stakeholders need from the project so that they can make good decisions. Your project will produce a lot of information; you don't want to overwhelm every member of your project team with all of it. Your job here is to figure out what all of them feel they need to stay informed and to be able to do their jobs properly.

Here's an example: Jeff and Charles will definitely care about the cost of the overall catering contract, but they don't need to talk to the caterer's butcher, liquor supplier, grocer, or other companies they work with.

**Communication models** demonstrate how the various people associated with your project send and receive their information. You've already learned about this—it's the **messages** you send, how you **encode** and **decode** the messages, the **medium** you use to transmit the messages, the **noise** that blocks the messages, and the **feedback** you get.

This one is your company's culture and policies toward project communication.

Here's where your company keeps all of its templates and lessons learned.

The key stakeholders are identified here.

**Tools**

**Interpersonal and team skills**

get the message across in the most effective way.

**Data representation**

shows you who your stakeholders are and how much you need to engage them.

**Expert judgment**

ensures that you get the perspectives and input from the experts who can help you plan.



**Communication technology**

has a major impact on how you can keep people in the loop. It's a lot easier for people to get information on their projects if it's all accessible through a website than it is if all of your information is passed around by paper memos. The technologies available to you will definitely figure into your plan of how you will keep everyone notified of project status and issues.

**Communication methods** are how you actually share the information with your stakeholders. Communications can be **interactive**, where everyone exchanges information with one another. You can **push** information out to your stakeholders by sending out emails, memos, faxes, or other one-way communications. Or, if you need to get a lot of information out to people, they can **pull** it down themselves from intranet websites, e-learning courses, or libraries.

**Meetings** are always great for helping your team to think about communication.

**Outputs**



Are you surprised at how much of this process you can fill in? Looks like you're getting the hang of this stuff!



There are several project documents that get updated when you're planning communications. Can you think of one of them?

Before you turn the page, take a minute and think of three examples of how you used each of these methods on your last project. That'll help you remember them for the exam!

**Head First Lounge Party Communications Management Plan**

Purpose: This document will outline who should communicate with whom and how often through the course of this project. Requirements for communication are based on analysis interviews with the team and project sponsors.

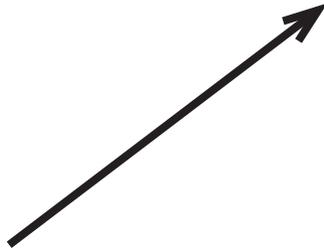
Event	Rationale	Frequency	Deliverable
Stakeholder meeting	All of the stakeholders had their own important part to play, especially those particularly important to the project.	Biweekly	Status meeting
Stakeholder meeting	Stakeholders are very important. We will create a budget report weekly to track how we are doing.	Weekly	Report to be shared to all stakeholders.

There are only three outputs. Can you guess what this one is?



## Exercise Solution

This is the Plan Communications Management process. You've seen a lot of planning processes now. Can you fill in the inputs and outputs for this one?



### Inputs



Project documents

Enterprise environmental factors

Organizational process assets

Project charter

Project Management plan

*This is where you've planned all of the communications taking place in the project.*



### Communication requirements analysis

means figuring out what kind of communication your stakeholders need from the project so that they can make good decisions. Your project will produce a lot of information; you don't want to overwhelm every member of your project team with all of it. Your job here is to figure out what all of them feel they need to stay informed and to be able to do their jobs properly.

Here's an example: Jeff and Charles will definitely care about the cost of the overall catering contract, but they don't need to talk to the caterer's butcher, liquor supplier, grocer, or other companies they work with.

**Communication models** demonstrate how the various people associated with your project send and receive their information. You've already learned about this—it's the **messages** you send, how you **encode** and **decode** the messages, the **medium** you use to transmit the messages, the **noise** that blocks the messages, and the **feedback** you get.

**Communication technology** has a major impact on how you can keep people in the loop. It's a lot easier for people to get information on their projects if it's all accessible through a website than it is if all of your information is passed around by paper memos. The technologies available to you will definitely figure into your plan of how you will keep everyone notified of project status and issues.

### Expert judgment

ensures that you get the perspectives and input from the experts who can help you plan.

**Communication methods** are how you actually share the information with your stakeholders. Communications can be **interactive**, where everyone exchanges information with one another. You can **push** information out to your stakeholders by sending out emails, memos, faxes, or other one-way communications. Or, if you need to get a lot of information out to people, they can **pull** it down themselves from intranet websites, e-learning courses, or libraries.

**Meetings** are always great for helping your team to think about communication.

**Data representation** shows you who your stakeholders are and how much you need to engage them.

**Interpersonal and team skills** get the message across in the most effective way.

The PM's not always responsible for every communication. The plan makes it clear who communicates what on the project.

You'll usually need to update the project schedule, the stakeholder register, or the Stakeholder Management plan when you plan communications for your project.



Document updates



Planning process group



Project Management plan updates

**Outputs**



It's important that everyone involved understands why you are holding these meetings and creating these reports.

**Head First Lounge Party Communications Management Plan**

Purpose: This document will outline who should communicate with whom and how often through the course of this project. Requirements for communication are based on analysis of interviews with the team and project sponsors.

Event	Rationale	Frequency	Deliverable
Status meeting	All of the stakeholders feel that it is important that they meet face to face periodically.	Biweekly	Meeting minutes to be emailed to all stakeholders. Archived in the document repository.
Budget report	Since costs are very important, we will create a budget report weekly to track how we are doing.	Weekly	Report to be emailed to all stakeholders.

# Tell everyone what's going on



Once you have the Communications Management plan completed, it's time to make sure that everybody is getting the information that they need to help your project succeed. The **Manage Communications** process is all about making sure that the right information makes it to the right people.



## Tools

**Communication methods** There are a lot of different ways to get a message across.

For the test you will need to know four different kinds of communication, and when to use them.

### 1 Formal written

Any time you're signing a legal document or preparing formal documentation for your project, that's formal written communication.



Any time you see anything that has to do with a contract, you should always use formal written communication.

### 2 Informal written

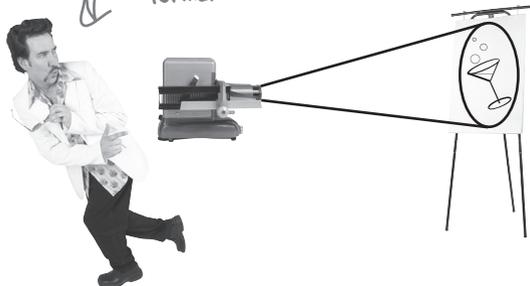
Blueprints, specifications, and all other project documents are examples of formal written communication.



If you drop someone a quick email or leave her a memo or a sticky note, that's informal written communication.

### 3 Formal verbal

If you ever have to give a presentation to update people on your project, that's formal verbal communication.



### 4 Informal verbal

Speeches and prepared talks are formal. Meetings, hallway chats, and planning sessions are informal.



Just calling somebody up to chat about your project is informal verbal communication.



## Exercise

Choose which kind of communication is being used in each situation.

1. You and your business analysts write a requirements specification for your project.

Formal verbal       Informal verbal

Formal written       Informal written

2. You call up a supplier for materials for your project to let him know that you are a week late, so he's got a little flexibility in his delivery schedule.

Formal verbal       Informal verbal

Formal written       Informal written

3. You present your project's status to your company's executive committee.

Formal verbal       Informal verbal

Formal written       Informal written

4. You send an email to some of your team members to get more information about an issue that has been identified on your project.

Formal verbal       Informal verbal

Formal written       Informal written

5. You leave a voicemail message for your test team lead following up on an issue she found.

Formal verbal       Informal verbal

Formal written       Informal written

6. You IM with your team members.

Formal verbal       Informal verbal

Formal written       Informal written

7. You prepare an RFP (request for proposals) for vendors to determine which of them will get a chance to contract a new project with your company.

Formal verbal       Informal verbal

Formal written       Informal written

Hint: We haven't talked about RFPs yet, but you don't need to know what they are to answer this question.

→ Answers on page 569.



Watch it!

### Be careful about when you use different kinds of communication.

Any time you need to get a message to a client or sponsor, you use **formal** communication. Meetings are always **informal verbal**, even if the meeting is to say something really important. And any project document—like a Project Management plan, a requirements specification, or especially a contract—is always **formal written**.

## Get the message?

Communication is about more than just what you write and say. Your facial expressions, gestures, tone of voice, and the context you are in have a lot to do with whether or not people will understand you. **Effective communication** takes the way you act and sound into account. Most of the communication on your project takes place during the Manage Communication process, so you need to know how to communicate effectively. Here are the important aspects to effective communication:

**Nonverbal communication** means your gestures, facial expressions, and physical appearance while you are communicating your message. Imagine what Jeff and Charles would think of the caterer if he negotiated the contract for their party while wearing a chicken suit. They probably wouldn't take him very seriously. You don't always think about it, but the way you behave can say more than your words when you are trying to get your message across.

When you're communicating with other people, you actually do more nonverbal communication than verbal!

**Paralingual communication** is the tone and pitch of your voice when you're talking to people. If you sound anxious or upset, that will have an impact on the way people take the news you are giving. You use paralingual communication all the time—it's a really important part of how you communicate. When your tone of voice makes it clear you're really excited about something, or if you're speaking sarcastically, that's paralingual communication in action.

If someone has dread in his voice when he tells you about a promotion, you get a much different impression than if he'd emailed you about it.

**Feedback** is when you respond to communication. The best way to be sure people know you are listening to them is to give lots of feedback. Some ways of giving feedback are summarizing their main points back to them, letting them know that you agree with them, or asking questions for clarification. When you give a lot of feedback to someone who is speaking, that's called **active listening**.

Like effective communication, effective listening is about taking everything the speaker says and does into consideration and asking questions when you don't understand.



SO IT'S NOT ENOUGH TO SAY THE RIGHT THING. YOU NEED TO SAY IT THE RIGHT WAY, TOO.

That's why active listening is an important part of communication.

**You do most of the project communication when you're performing the Manage Communications process.**



## Exercise

Jeff and Charles are interviewing new bartenders to help with the expanded space. Choose which kind of communication is being used in each situation.

1. One applicant came in 30 minutes late and was dressed unprofessionally. The guys knew that he would not be a good fit for the position.

Paralingual       Nonverbal  
 Feedback

2. Charles asked an applicant about her background. Her tone of voice was really sarcastic, and he got the impression she didn't take the job seriously. Charles and Jeff decided to pass on her, too.

Paralingual       Nonverbal  
 Feedback

3. Charles asked the next applicant if he knew how to make a sidecar. He said "A sidecar? Sure. It's one part brandy or cognac, one part Cointreau, and one part lemon juice."

Paralingual       Nonverbal  
 Feedback

4. Then the applicant told them about his background as a bartender for other retro clubs. As he spoke, he made eye contact with them and made sure to confirm agreement with them.

Paralingual       Nonverbal  
 Feedback

→ Answers on page 568.



## More Manage Communications tools



The tools in this process area are all about getting information from your team and making sure that the information makes it to the people who need it. You'll start your project with a kickoff meeting to get everyone on the same page, and follow your Communications Management plan as your project progresses. As you learn more about your project, you write down decisions you make and everything you learn on the project as lessons learned.

**Communication methods** are the specific methods you use to distribute information to your team...and you've already learned about them!

**Project management information systems** are how you get the information your team needs to do the job. You might have an inbox where everyone puts their status information. If it's printed out on paper, you're doing **hardcopy document distribution**. You could also use **electronic communication**. For example, you might use email, or you could have a software application that gathers information about your project and saves it to a database so that you can make your reports. Or your company might have **electronic tools for project management**, like a timesheet system for tracking hours spent on a project or a budgeting system for tracking expenditures. All of those are information gathering and retrieval systems, because you'll use the data they produce to make decisions about your project.

**Project reporting** is all about gathering information on how your team is progressing through the project. You might create **status reports** that show how close you are to your baseline schedule and highlight issues that your team has run into along the way. You'll always want to keep everybody informed on how your project is tracking risks, any changes that might come up that weren't planned for, and forecasts of what's coming up next for the team.

**Communication technology** is a tool that you use to get the message out. If you need to get a message to someone urgently, it might be hard to wait for a face-to-face meeting. You might choose to use email, phone, or a ticketing system to communicate. There are a lot of factors other than urgency that influence your decision to use a particular technology when communicating, including availability, how easy the technology is to use, whether or not the team can meet to face-to-face because of where they work, and how confidential the information you're communicating is.

**Communication skills** are all about how well people communicate with each other. They're skills that we can—and should!—work on throughout our careers.

**Interpersonal and team skills** are also important. They help you work with a team, and with others in your organization.

**Meetings** are among the most common communication tools found on projects.

## Outputs



### Project communications

Throughout your project, you're creating status reports, presentations, and many other communications to keep your project stakeholders informed. It makes sense that all of these would be outputs of the Manage Communications process.

### Project Management plan updates

As your project progresses, you'll make changes to the Project Management plan as new information is available. All of those project plan updates help to communicate what's going on in your project.

### Project document updates

We've seen in other processes that keeping the project documentation updated is a big part of keeping everyone on the same page. Those project document updates are likewise a big part of how your project is communicated to all of the project stakeholders.

### Organizational process asset updates

You've used lessons learned from all of the other projects your company has done as you've planned out your work. Here's where you get a chance to give your project's experience back to the company and to help future project managers learn from what's happened on your project.



Organizational process assets

## One of your most important outputs

**Lessons learned** are all of the corrective and preventive actions that you have had to take on your project, and anything you have learned along the way. And one of the most valuable things you'll do for future project managers is **write them down and add them to your company's organizational process asset library**. That way, other people can learn from your experience.

**Head First Lounge Party Project**

**Lessons learned:**

1. Don't use 70s phones for calling external vendors.
2. Be sure to hire people with effective communication skills.

Next time they plan a party, Jeff and Charles won't run into the misunderstandings that they had on this one.

It's important to write down the good things you learned on the project, too. That way, you can be sure to repeat your successes next time.

## there are no Dumb Questions

**Q:** What do I do with lessons learned after I write them?

**A:** The great thing about lessons learned is that you get to help other project managers with them. You add them to your company's organizational process asset library, and other project managers then use them for planning their projects.

Since Jeff and Charles learned that they shouldn't use their retro phones for planning parties, no one should ever have to deal with that problem when planning a party for Jeff and Charles again. They wrote down the lesson they learned and filed it away for future planning efforts.

**Q:** I still don't get the different types of communication.

**A:** When you think about it, they are pretty easy to remember. You have formal and informal communication, and verbal and written communication types. The four different ways you can mix those up are all of the communication types. Think of informal verbal as phone calls between different team members. Formal verbal is giving a presentation. Informal written is sending out notes, emails, or memos. Formal written is when you have to write specifications or other formal project documentation.

For the test, you need to be able to identify which is which. If you just think of these examples, it should be a snap for you.

**Q:** Now, who's decoding, who's encoding, and where does feedback come from?

**A:** Think of encoding as making your message ready for other people to hear or read. If you write a book, you are encoding your message into words on pages. The person who buys the book needs to read it to decode it. The same is true for a presentation. When you present, you encode your thoughts into presentation images and text. The people who are listening to your presentation need to read the text, hear your voice, and see the visuals to decode it.

Feedback is all about the person who decodes the message letting the person who encoded it know that she received it. In the case of a book, this could be a reader sending a question or a note to the author or writing a review of it on a website. In a presentation, it could be as simple as nodding your head that you understand what's being said.

**Q:** Do I have to know everything that will be communicated to build a plan?

**A:** No. As you learn more about the project, you can always update the plan to include new information as you learn it. Pretty much all of the planning processes allow for progressive elaboration. You plan as much as you can up front, and then put all changes through change control from then on. So, if you find something new, put in a change request and update the plan when it's approved.

**There are only four communication types; formal written, informal written, formal verbal, and informal verbal. For the test, you need to be able to tell which is which.**

## Let everyone know how the project's going

You spend a lot of time collecting valuable information about how your projects are doing. So what do you do with it? You *communicate* it. And that's what the **Monitor Communications** process is for: taking the information you gathered about how work is being done and distributing it to the stakeholders who need to make decisions about the project.

Remember, the team members are all stakeholders, too—and this information is especially important to them!



Monitoring  
& Controlling  
process group

You created this when you were executing the project—it was where you reported how the project work was going. Now you're using it to report the performance of the team to the stakeholders and the rest of the company.

## It all starts with work performance data

You create one of the most important outputs of your entire project when the team is doing the project work in Direct and Manage Project Work. **Work performance data** tells you the status of each deliverable in the project, what the team's accomplished, and all of the information you need to know in order to figure out how your project's going. But you're not the only one who needs this—your team members and stakeholders need to know what's going on, so they can adjust their work and correct problems early on.

Work performance  
data

Whenever you hear back from a team member about how the job is going, that's work performance data.

HEY,  
WE'RE STILL  
WAITING ON THE  
BAND TO CONFIRM.  
AND DIDN'T THE  
CATERER HAVE SOME  
QUESTIONS?

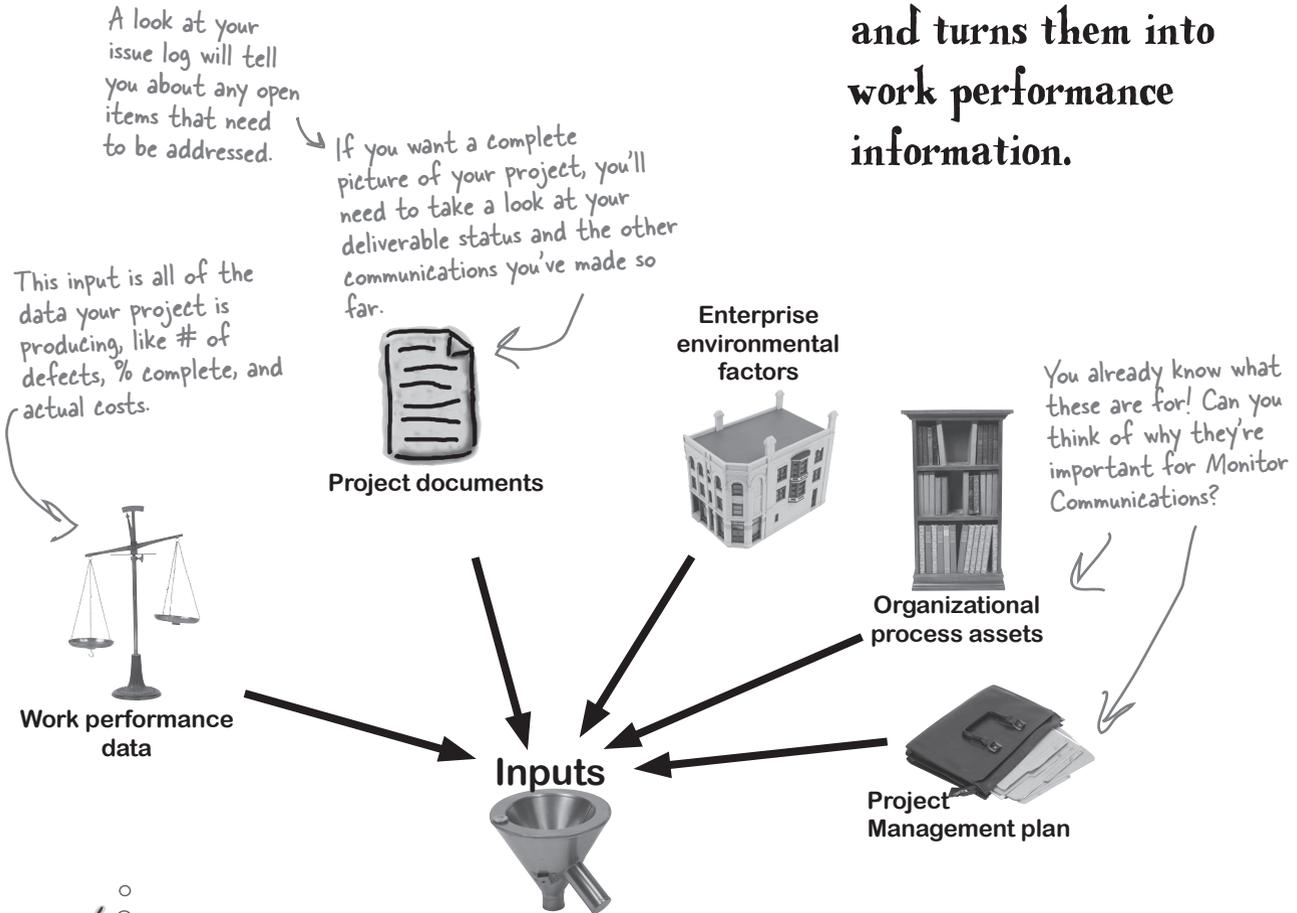


I HAVE NO IDEA!  
I HAVEN'T HEARD  
BACK FROM ANYONE!

## Take a close look at the work being done

Work performance data isn't the only information you need to figure out how the project is going. There are a whole lot of outputs from the Executing processes that you need to look at if you really want to get a clear picture of your project.

**Monitor Communications** takes the outputs from the Executing process in **Manage Communications** and turns them into work performance information.



**The work performance data input is a lot easier than it looks—because you already know all about it!**

Take a minute and flip back to Control Costs in Chapter 7. You learned how to use actual costs and actual % complete numbers to help you calculate EV, CPI, and SPI to measure your project's performance, and you used EAC and ETC to forecast when the project would be complete. Those data points that were actually measured on your project are called work performance data. And those forecasts that you calculated are called work performance information.

## Sharpen your pencil



Monitor Communications is one of those *PMBOK Guide* processes that's really familiar to a lot of project managers. Can you figure out what each of its **tools and techniques** is for just from the name?



**Project management information system**

**Expert judgment**

**Data analysis**

**Interpersonal and team skills**

**Meetings**



Monitor Communications is one of those *PMBOK Guide* processes that's really familiar to a lot of project managers. Can you figure out what each of its **tools and techniques** is for just from the name?

#### **Project management information system**

**Here's where all of the project communication can be found. You'll find all of the current progress reports, risk and issue logs, and other project documents here.**

#### **Expert judgment**

**You might want to rely on expertise from your stakeholders, consultants, your PMO, or others to determine the right information to communicate about your project.**

#### **Data analysis**

**You can look at the data your project is creating to see if your communications methods are effective.**

#### **Interpersonal and team skills**

**Working with the team is the best way to know how things are going.**

#### **Meetings**

**You can hold meetings with your team members to get everyone on the same page about the progress reports on your project.**

## Now you can get the word out

Now that you've gathered up all the information about how the project's being done, it's time to get it out to the people who need it. The **outputs from Monitor Communications** shouldn't be particularly surprising... you're just packaging up the information you collected and turning it all into stuff that's easy to distribute to all the stakeholders. You've got three outputs from the process:

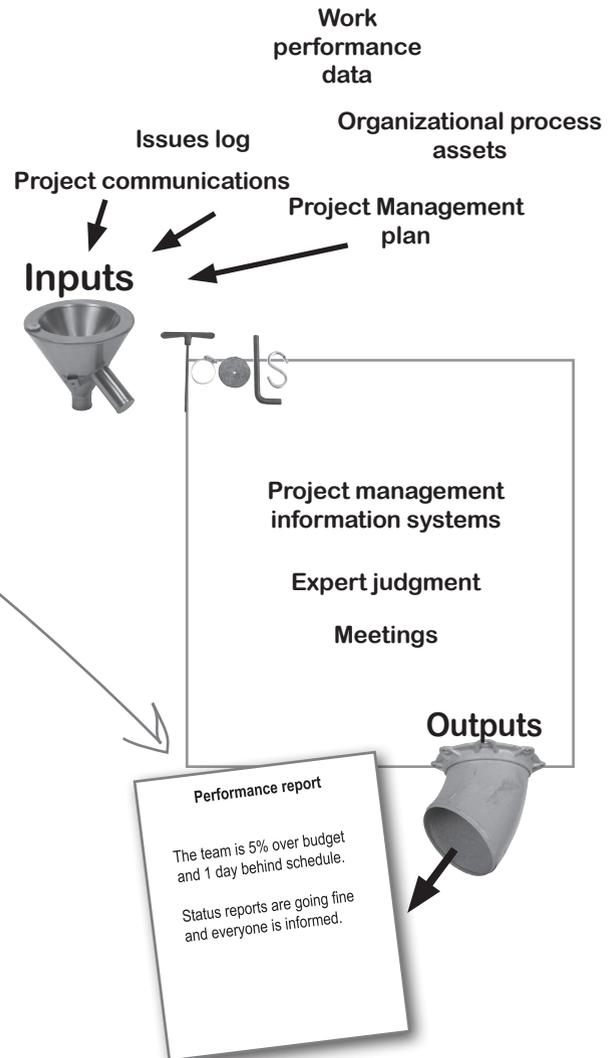
**Work performance information** is the most important output of the process—which shouldn't be a surprise, since the process is called Monitor Communications. Your performance reports tell everyone exactly how the project is doing, and how far off it is from its time, cost, and scope baselines. These include **forecasts**, which are what you turn your EAC and ETC numbers into. That way, everyone has a good idea of when the project is going to finish.

**Change requests** happen when you do Monitor Communications. What do you do if you find out that your forecasts have your project coming in too late or over budget? You put the **change request** in as soon as possible. And if you need the project to change course, you'll need to **recommend corrective actions** to the team.

### Project Management plan updates

need to be done to make sure your plan reflects your project's current status.

**Project documents updates** could mean updates to performance reports, issue logs, or forecasts.

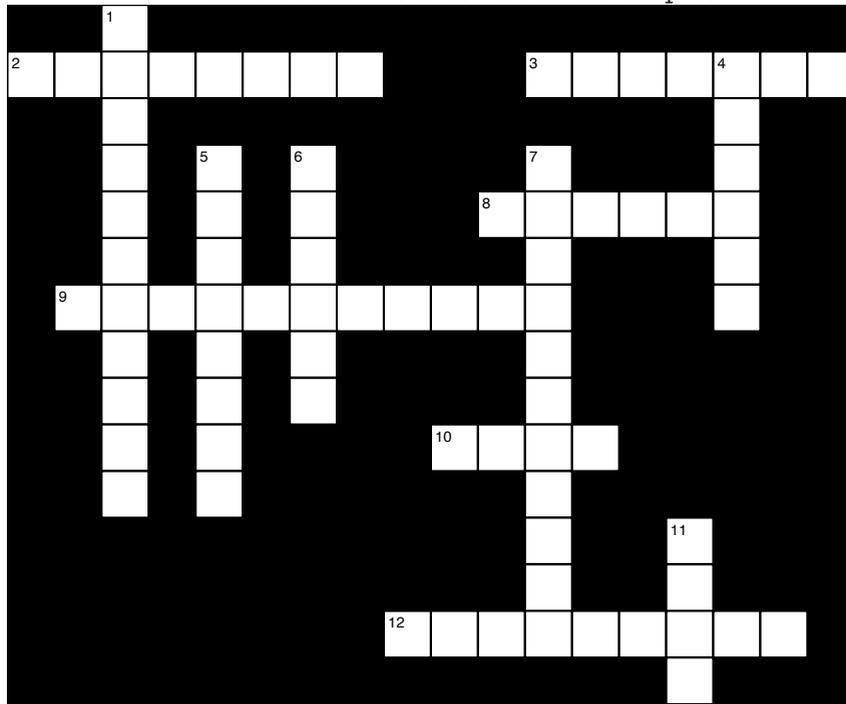


Monitor Communications is about more than just telling people how the project is doing. It's also about finding problems. What kind of problems are you likely to uncover when you sit down with stakeholders and put together your work performance information and forecasts?



# Communicationcross

Take some time to sit back and give your right brain something to do. It's your standard crossword; all of the solution words are from this chapter.



### Across

2. When you move a message from one person to another, you \_\_\_\_\_ the message.
3. One thing you need to consider when choosing a communication technology is the \_\_\_\_\_ of the communication.
8. \_\_\_\_\_ listening is when a listener uses both verbal and nonverbal clues like nodding or repeating the listener's words to communicate that the message has been received.
9. The Monitor Communications process turns work performance data into work performance \_\_\_\_\_.
10. When your stakeholders get information from an intranet website, you're using this communication model.
12. You can use the ETC and EAC calculations from Cost Management to create \_\_\_\_\_.

### Down

1. This kind of communication includes vocal but nonverbal signals, such as changing the pitch and tone of voice.
4. According to the *PMBOK Guide*, \_\_\_\_\_ percent of project management is communication.
5. A conversation in a hallway is an example of \_\_\_\_\_ verbal communication.
6. A contract is always \_\_\_\_\_ communication.
7. When you receive a message and tell the sender that you got it, you \_\_\_\_\_ the communication.
11. The communication method you use when you send email announcements.

—————> **Answers on page 570.**

## People aren't talking!

There's so much information floating around on any project, and if you're not careful it won't get to the people who need it. That's why so much of your job is communication—if you don't stay on top of all of it, your project can run into some serious trouble!

THE FORECAST  
LOOKED GOOD, AND  
EVERYONE WAS ON TOP OF  
THEIR JOBS. WE THOUGHT  
WE WERE ON TRACK FOR  
FRIDAY NIGHT. THEN ALL  
THESE PROBLEMS CAME  
UP...



HOW ARE WE GONNA GET  
A HANDLE ON THIS?

### Problems

- ★ The caterer's serving food that doesn't go with the drinks or theme.
- ★ The DJ and the band want to set up in the same place.
- ★ All the guests are telling us they like different food.
- ★ Has anyone even talked to the neighbors about the noise?
- ★ Three people are bringing friends, but nobody told the caterer.

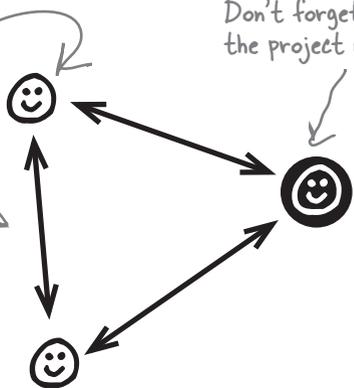
### BRAIN POWER

What's causing all of these problems?  
Will better communication help?

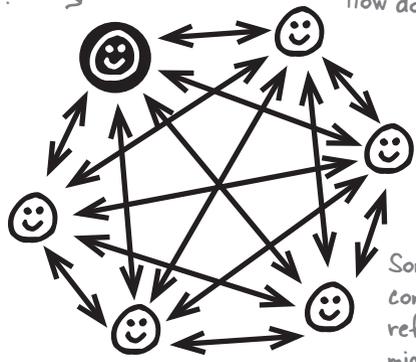
# Count the channels of communication

How many people need to talk to one another? Well, Jeff and Charles need to talk. But what about the DJ and the band? They wanted to set up their equipment in the same place—it looks like they need to talk, too. And the bartender needs to coordinate with the caterer. Wow, this is starting to get complicated. A good project manager needs to get a handle on all this communication, because it's really easy to lose track of it. That's why you need to know how to **count the channels of communication** on any project.

When there are three people on the project, there are three lines of communication.



Don't forget to count the project manager!



But add three more people to the project, and you add a LOT of potential communication to the project! How do you get a handle on it?

Sometimes you'll see communications channels referred to as "lines." You might see it either way on the exam, so we'll use both terms here to get you used to them.

## Counting communication lines the easy way

It would be really easy to get overwhelmed if you tried to count all the lines of communication by hand. Luckily, there's a really easy way to do it by using a simple formula. Take the total number of people on the project—including the project manager—and call that number *n*. Then all you need to do is plug that number into this simple formula:

$$\# \text{ lines for } n \text{ people} = \frac{n \times (n - 1)}{2}$$

You'll need to know this formula on the PMP exam. Just keep using it, though, and you'll get it down in no time.

So, how many more lines of communication were added when three more people joined the three-person project above? You know there were **three lines** to start with. So now just figure out **how many lines** there are **for six people**:

$$\# \text{ lines for } 6 \text{ people} = \frac{6 \times (6 - 1)}{2} = (6 \times 5) \div 2 = 15$$

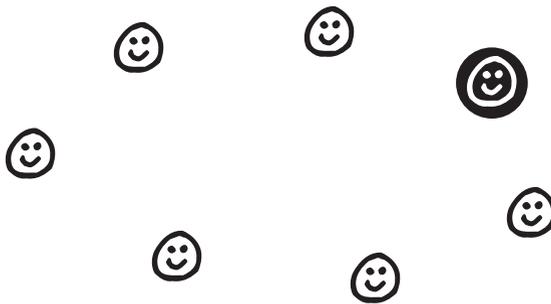
When you added three more people to the three-person project—which had three lines of communication—the new team has 15 lines. So you **added 12 channels of communication**.

## Sharpen your pencil



You'll need to know how to calculate the number of lines of communication for the exam...but don't worry, it's really easy once you get a little practice.

1. You're managing a project with five people on the team, plus one additional stakeholder—the sponsor. Draw in all the channels of communication on this picture.



Don't forget the project manager. There are six people on the team, but the total number of people who need to communicate is seven people, because the PM needs to communicate with the team members and sponsor.

2. Wow, that was a lot of work. Luckily, you won't need to do that again. Now do it the easy way: use the formula to figure out how many lines of communication there are for seven people.

$$\# \text{ lines for } \dots \text{ people} = \frac{\dots \times (\dots - 1)}{2} = (\dots \times \dots) \div 2 = \dots$$

3. OK, now let's say that you've added two team members and two more stakeholders, so there are now 11 people on the project who need to communicate with one another. How many lines did you add?

First figure out how many lines there are for 11 people:

$$\# \text{ lines for } \dots \text{ people} = \frac{\dots \times (\dots - 1)}{2} = (\dots \times \dots) \div 2 = \dots$$

So how many lines were added when four people joined the seven-person project?

$$\# \text{ lines added} = \# \text{ lines for } 11 \text{ people} - \# \text{ lines for } 7 \text{ people}$$

$$= \dots - \dots = \dots$$

—————> Answers on page 571.

## there are no Dumb Questions

**Q:** Some of those communication skills seem like the same thing. What's the difference between active and effective listening?

**A:** Some of the communications ideas do have names that are a little confusing. But don't worry, they're really easy concepts for you to understand.

Active listening just means when you're listening to something, you keep alert and take specific actions that help make sure you understand. It includes both effective listening and feedback. Effective listening is a way that you do active listening—it means paying attention to both verbal and nonverbal communication. Feedback means doing things like repeating back the words that you were told in order to make sure you understood them, and giving your own nonverbal cues to show the speaker that you got the message.

**Q:** OK, so what about nonverbal and paralingual communication? Aren't those the same thing?

**A:** They *are* very similar, but they're not exactly the same. Nonverbal communication is any kind of communication that doesn't use words. That includes things like changing your body language, making eye contact, and using gestures. Paralingual communication is a kind of nonverbal communication—it's changing your tone of voice or intonation, finding ways to communicate things above and beyond just the words that you're saying. For example, the same words mean very different things if you say them sarcastically versus in a normal tone of voice.

**Q:** Why is all that stuff about different kinds of communication important?

**A:** It's important because 90% of project management is communication, so if you want to be the best project manager that you can be, you need to constantly work to improve your communication skills!

**Q:** Should I always have a kickoff meeting?

**A:** Yes, absolutely! You should always have a kickoff meeting for every project. Not only that, but if you're running the kind of project with several phases, and you go through all of the process groups for each phase, then you should have a separate kickoff meeting for each new phase. Kickoff meetings also help you define who's responsible for various communications. Kickoff meetings are really important, because they give the team a chance to meet face-to-face, and give you the opportunity to make sure that everyone really understands all of the ways they can communicate with one another. That's a great way to head off a lot of potential project problems!

**Q:** Why do I need to be able to calculate the number of lines of communication?

**A:** It may seem like the lines of communication formula is something arbitrary that you just need to memorize for the exam, but it's actually pretty useful.

Let's say that you have a project with a whole lot of people on it. You set up a good communication system in your Communication Management plan, but you want to make sure that you really included every line in it, because if you missed one then you could run into communications problems down the line. So what do you do? Well, one thing you can do to check your work is to calculate the total number

of lines of communication in your project, and then make sure that every one of those lines is represented somewhere in your communications plan. It's a little more work up front, but it could really save you a lot of effort down the line!

**Q:** I spent all that time working on performance reports. What do I do with them once I'm done with them?

**A:** The same thing you do with any information that you generate on your project. You add them to your organizational process assets!

Think back to how you came up with your estimates in Time Management and Cost Management. You spent a lot of time doing analogous estimation, right? That's where you use performance from past projects to come up with a rough, top-down estimate for your new project. Well, where do you think the performance information from those past projects came from? You got them from your organizational process assets. And how did they end up there? Project managers from those past projects took their performance reports and added them. So you should add your performance reports, too. That way, project managers on future projects can use your project when they need to look up historical data.

**You should add all of your performance reports to the organizational process assets so that project managers on future projects can use them as historical information.**

## It's party time!

The Head First Lounge party is a big hit! Everything came together beautifully, and Jeff and Charles are the new downtown sensation!





If your team isn't communicating and nobody knows what's going on with your project, you'll have a hard time getting it done. **Project Communications Management** is where everybody on the team gets in sync, resolves issues that might throw the project off track, and keeps stakeholders in the loop about what's happening.



## KEY CONCEPTS

We've talked about the processes you and your team will use when planning, managing, and monitoring communications, but it's worth taking a minute to think about how your approach to Project Communications Management affects the overall project.

- ★ People can communicate in many different ways: in written form, through gestures, in conversation, or even through public media.
- ★ Communications can take a different tone based on their context. You might communicate differently to an external party about a project issue than you would with a team member. You might be more or less formal **depending on your relationship to the person** you are addressing.
- ★ For communication to be successful, you need to have an **effective strategy** that takes project stakeholders into account. Once you've thought through the stakeholders' perspective, you can plan how to communicate timely project information with them in a way that allows them to make decisions in the project's best interest.
- ★ It's not enough to clearly state your message; for a communication to be effective, you need to **actively listen** to the person you're talking to and be aware of cultural context.

**COMMUNICATION MANAGEMENT IS ABOUT FIGURING OUT THE BEST STRATEGY FOR KEEPING YOUR STAKEHOLDERS UP TO DATE AND EXECUTING IT.**

## TRENDS

Here are a few trends in Communications Management that might help you to improve and manage communication for your projects more effectively.

- ★ **Inclusion of stakeholders in project reviews and meetings.** Teams are increasingly opening up internal meetings and project reviews to stakeholders in order to get feedback as soon as possible. This allows for greater stakeholder collaboration in project goal setting and execution.
- ★ **Social media** is used to keep large numbers of stakeholders up to date on interim deliverables in projects and gather feedback about strategic decisions.



## TAILORING

When you make changes to the processes your team will use during the course of your project, there are a few considerations that might influence your decisions:

- ★ Are your stakeholders internal to your team or your organization?
- ★ Where are your stakeholders located? Can they communicate with you face-to-face?
- ★ What technology can you use to communicate?
- ★ Can you find a way to have your project contribute to an organizational knowledge repository?



## AGILE CONSIDERATIONS

Agile teams work to keep all of their communications transparent and freely available to all stakeholders. They include stakeholders in early meetings and review early work products with them in order to incorporate their feedback as early as possible. Agile principles hold that sharing information early and often with team members and external stakeholders helps to keep everyone on the same page about what's being built so they can collaborate in decision making and build a product most efficiently.

## Question Clinic: The calculation question



YOU'LL RUN ACROSS A BUNCH OF QUESTIONS ON THE EXAM ASKING YOU TO USE SOME OF THE FORMULAS THAT YOU LEARNED. LUCKILY, THESE ARE SOME OF THE EASIEST QUESTIONS THAT YOU CAN ANSWER.

This is the wrong answer you'd get if you calculate the number of lines of communication if you include the team and two sponsors, but forget to include the project manager.

This wrong answer is the number of lines of communication BEFORE the team size was increased. You have 13 people (10 team members, 2 client sponsors, and you), so the number of lines is  $13 \times 12 \div 2 = 78$ .

12. You're managing a project with two client sponsors, and you have a 10-person team reporting to you. You've been given a budget increase, which allowed you to increase your team size by 30%. How many lines of communication were added?

- A. 66
- B. 78
- C. 42
- D. 120

This wrong answer is the number of lines of communication AFTER the team size was increased by 30%. You have 16 people (13 team members, 2 client sponsors, and you), so the number of lines is  $16 \times 15 \div 2 = 120$ .

Aha! Here's the right answer. Take the number of lines for 16 people and subtract the number of lines for 13 people:  $120 - 78 = 42$ .

WHEN YOU SIT DOWN TO TAKE AN EXAM AT A COMPUTER TESTING CENTER, YOU'LL BE GIVEN SCRATCH PAPER. YOU'LL ALSO HAVE 15 MINUTES TO GO THROUGH A TUTORIAL THAT SHOWS YOU HOW TO USE THE EXAM SYSTEM. BEFORE YOU FINISH THE TUTORIAL, TAKE A MINUTE AND WRITE DOWN ALL OF THE FORMULAS. WRITE DOWN THE EARNED VALUE FORMULAS AND THE FORMULA TO CALCULATE THE LINES OF COMMUNICATION ON THE SCRATCH PAPER. THAT WILL MAKE ANY CALCULATION QUESTION EASY.



# HEAD LIBS



Try coming up with your own calculation question! But this time, try using one of the earned value formulas from Chapter 7.

You are managing a \_\_\_\_\_ project.

*(kind of project)*

You have \_\_\_\_\_ ,  
*(a value needed for the calculation)* *(another value needed for the calculation)*

and \_\_\_\_\_ .

*(an irrelevant value that is NOT needed for the calculation)*

Calculate \_\_\_\_\_ for your project.

*(name of a formula)*

A. \_\_\_\_\_  
*(the answer you'd get if you plug the wrong value into the formula)*

B. \_\_\_\_\_  
*(the answer you'd get if you used the wrong formula)*

C. \_\_\_\_\_  
*(the correct answer)*

D. \_\_\_\_\_  
*(a totally bizarre answer that comes out of nowhere)*

# \* WHAT'S MY PURPOSE \*

Match each communication element to what it does

- |                   |  |  |
|-------------------|--|--|
| Acknowledge       |  | <i>Getting the information from one person to the other</i>                |
| Transmit message  |  | <i>Letting the sender know that the message was received</i>               |
| Feedback/response |  | <i>Modifying a message that has been sent so that it can be understood</i> |
| Encoding          |  | <i>An answer to a message</i>  |
| Decoding          |  | <i>Modifying a message so that it can be sent</i>                          |



## Exercise Solution

Jeff and Charles are interviewing new bartenders to help with the expanded space. Choose which kind of communication is being used in each situation.

*The candidate repeated the question. That's a great example of feedback.*

- |  |  |
|--|--|
| <p>1. One applicant came in 30 minutes late, and was dressed unprofessionally. The guys knew that he would not be a good fit for the position.</p> <p><input type="checkbox"/> Paralingual      <input checked="" type="checkbox"/> Nonverbal</p> <p><input type="checkbox"/> Feedback</p>   | <p>3. Charles asked the next applicant if he knew how to make a sidecar. He said "A sidecar? Sure. It's one part brandy or cognac, one part Cointreau, and one part lemon juice."</p> <p><input type="checkbox"/> Paralingual      <input type="checkbox"/> Nonverbal</p> <p><input checked="" type="checkbox"/> Feedback</p>      |
| <p>2. Charles asked an applicant about her background. Her tone of voice was really sarcastic, and he got the impression she didn't take the job seriously. Charles and Jeff decided to pass on her too.</p> <p><input checked="" type="checkbox"/> Paralingual      <input type="checkbox"/> Nonverbal</p> <p><input type="checkbox"/> Feedback</p> | <p>4. Then the applicant told them about his background as a bartender for other retro clubs. As he spoke, he made eye contact with them and made sure to confirm agreement with them.</p> <p><input type="checkbox"/> Paralingual      <input checked="" type="checkbox"/> Nonverbal</p> <p><input type="checkbox"/> Feedback</p> |



## Exercise Solution

Choose which kind of communication is being used in each situation.

1. You and your business analysts write a requirements specification for your project.

- Formal verbal       Informal verbal  
 Formal written       Informal written

2. You call up a supplier for materials for your project to let him know that you are a week late, so he's got a little flexibility in his delivery schedule.

- Formal verbal       Informal verbal  
 Formal written       Informal written

3. You present your project's status to your company's executive committee.

- Formal verbal       Informal verbal  
 Formal written       Informal written

4. You send an email to some of your team members to get more information about an issue that has been identified on your project.

- Formal verbal       Informal verbal  
 Formal written       Informal written

5. You leave a voicemail message for your test team lead following up on an issue he found.

- Formal verbal       Informal verbal  
 Formal written       Informal written

6. You IM with your team members.

- Formal verbal       Informal verbal  
 Formal written       Informal written

7. You prepare an RFP (request for proposals) for vendors to determine which of them will get a chance to contract a new project with your company.

- Formal verbal       Informal verbal  
 Formal written       Informal written

*Anything that has to do with a contract is always formal written.*

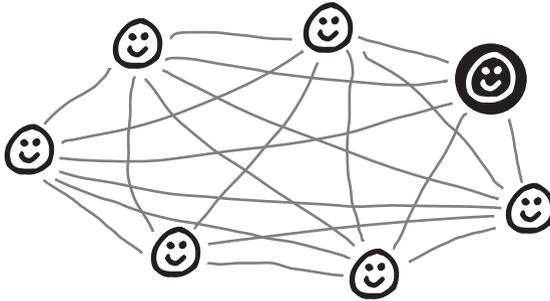


## Sharpen your pencil Solution



You'll need to know how to calculate the number of lines of communication for the exam...but don't worry, it's really easy once you get a little practice.

1. You're managing a project with five people on the team, plus one additional stakeholder—the sponsor. Draw in all the channels of communication on this picture.



2. Wow, that was a lot of work. Luckily, you won't need to do that again. Now do it the easy way: use the formula to figure out how many lines of communication there are for seven people.

$$\# \text{ lines for } 7 \text{ people} = \frac{7 \times (7 - 1)}{2} = (7 \times 6) \div 2 = 21$$

3. OK, now let's say that you've added two team members and two more stakeholders, so there are now 11 people on the project who need to communicate with one another. How many lines did you add?

First, figure out how many lines there are for 11 people:

$$\# \text{ lines for } 11 \text{ people} = \frac{11 \times (11 - 1)}{2} = (11 \times 10) \div 2 = 55$$

So how many lines were added when four people joined the seven-person project?

$$\begin{aligned} \# \text{ lines added} &= \# \text{ lines for } 11 \text{ people} - \# \text{ lines for } 7 \text{ people} \\ &= 55 - 21 = 34 \end{aligned}$$

## Exam Questions

1. Keith, the project manager of a large publishing project, sends an invoice to his client. Which communication type is he using?

- A. Formal verbal
- B. Formal written
- C. Informal written
- D. Informal verbal

2. Which of the following is NOT an input to the Plan Communications Management process?

- A. Enterprise environmental factors
- B. Organizational process assets
- C. Information gathering techniques
- D. Project Management plan

3. You take over for a project manager who has left the company and realize that the team is talking directly to the customer and having status meetings only when there are problems. The programming team has one idea about the goals of the project, and the testing team has another. Which document is the FIRST one that you should create to solve this problem?

- A. Communications Management plan
- B. Status report
- C. Meeting agenda
- D. Performance report

4. You ask one of your stakeholders how things are going on her part of the project and she says, “things are fine” in a sarcastic tone. Which is the BEST way to describe the kind of communication that she used?

- A. Feedback
- B. Active listening
- C. Nonverbal
- D. Paralingual

5. You're managing an industrial design project. You created a Communications Management plan, and now the team is working on the project. You've been communicating with your team, and now you're looking at the work performance data to evaluate the performance of the project. Which of the following BEST describes the next thing you should do?

- A. Use formal written communication to inform the client of the project status.
- B. Compare the work performance data against the time, cost, and scope baselines and look for deviations.
- C. Update the organizational process assets with your lessons learned.
- D. Hold a status meeting.

## Exam Questions

**6. You have five people working on your team, a sponsor within your company, and a client, all of whom need to be kept informed of your project's progress. How many lines of communication are there?**

- A. 28
- B. 21
- C. 19
- D. 31

**7. Which of the following is NOT an example of active listening?**

- A. Nodding your head in agreement while someone is talking
- B. Restating what has been said to be sure you understand it
- C. Asking questions for clarification
- D. Multitasking by checking your email during a conversation

**8. Sue sent a message to Jim using the company's voicemail system. When he received it, Jim called her back. Which of the following is true?**

- A. Sue encoded the voicemail; Jim decoded it, and then encoded his feedback message.
- B. Sue decoded her voicemail message; Jim encoded his phone call and decoded the feedback.
- C. Jim sent feedback to Sue, who encoded it.
- D. Sue decoded her voicemail message and Jim encoded his feedback.

**9. You're managing a construction project. Suddenly the customer asks for some major changes to the blueprints. You need to talk to him about this. What's the BEST form of communication to use?**

- A. Informal written
- B. Informal verbal
- C. Formal written
- D. Formal verbal

**10. Kyle is the project manager of a project that has teams distributed in many different places. In order to make sure that they all get the right message, he needs to make sure that his project plan is translated into Spanish, Hindi, French, and German. What is Kyle doing when he has his communications translated?**

- A. Encoding
- B. Decoding
- C. Active listening
- D. Effective listening

## Exam Questions

11. There are 15 people on a project (including the project manager). How many lines of communication are there?

- A. 105
- B. 112
- C. 113
- D. 52

12. Which communication process is in the Monitoring and Controlling process group?

- A. Manage Communications
- B. None of the communications processes
- C. Plan Communications Management
- D. Monitor Communications

13. You're working at a major conglomerate. You have a 24-person team working for you on a project with 5 major sponsors. The company announces layoffs, and your team is reduced to half its size. How many lines of communication are on your new, smaller team?

- A. 66
- B. 153
- C. 276
- D. 406

14. You've consulted your earned value calculations to find out the EAC and ETC of your project. Which of the following is the BEST place to put that information?

- A. Work performance information
- B. Forecasts
- C. Quality control measurements
- D. Lessons learned

15. Which of the following is an example of noise?

- A. An email that's sent to the wrong person
- B. A project manager who doesn't notice an important clause in a contract
- C. Garbled text and smudges that make a fax of a photocopy hard to read
- D. When the team is not paying attention during a status meeting

## Answers

~~Exam Questions~~

## 1. Answer: B

Any communication that can be used for legal purposes is considered formal written communication. An invoice is a formal document.

See the word "technique"?  
That's a good indication that  
it's a tool and not an input.

## 2. Answer: C

Information gathering techniques are not part of Plan Communications Management.

## 3. Answer: A

The Communications Management plan is the first thing you need to create in this situation. It will help you organize the meetings that are taking place and get everyone on the same page. The Communications Management plan will help you to streamline communications so that the customer can use you as a single point of contact, too.

I GET IT!  
YOU CAN'T DO ANY  
COMMUNICATIONS  
UNLESS YOU'VE GOT A  
GOOD COMMUNICATIONS  
MANAGEMENT PLAN.



## 4. Answer: D

Paralingual communication happens when additional information is conveyed by the tone or pitch of your voice. It's when you use more than just words to communicate.

## 5. Answer: B

When you look at work performance data, you're in the Monitor Communications process. And what do you do with the work performance data? You compare it against the baselines to see if your project is on track! If it isn't, that's when you want to get the word out as quickly as possible.

A lot of people choose B here. Don't forget to include yourself! Look out for questions like this on the exam too.

## 6. Answer: A

The formula for lines of communication is  $n \times (n - 1) \div 2$ . In this problem there were seven people named, plus you.  $(8 \times 7) \div 2 = 28$ .

## Answers

~~Exam Questions~~**7. Answer: D**

All of the other options show the speaker that you understand what is being said. That's active listening.

Active listening sometimes means saying things like "I agree," or "can you explain that a little further?"

**8. Answer: A**

This question is just asking if you know the definitions of encode, decode, and feedback. Encoding is making a message ready for other people to understand, while decoding it involves receiving the message and understanding it. Feedback means letting the sender know that you got the message.

Any time you see anything about a formal document in communication with a client, it's formal written.

**9. Answer: C**

Any time you are communicating with the customer about the scope of your project, it's a good idea to use formal written communication.

**10. Answer: A**

He has to encode his message so that others will understand it.

**11. Answer: A**

$(15 \times 14) \div 2 = 105$ . This one is just asking if you know the formula  $n \times (n-1) \div 2$ .

**12. Answer: D**

Monitor Communications is the only Monitoring and Controlling process in Communications Management.

## Answers

~~Exam Questions~~

## 13. Answer: B

There are now 12 team members, 5 sponsors, and a project manager. That gives you 18 people. Use the formula:  $n \times (n - 1) \div 2$  to calculate this:  $18 \times 17 \div 2 = 153$ .

Did you get one of the other answers?  
Make sure you included the five sponsors  
and the project manager!

## 14. Answer: B

The idea behind forecasts is that you are using the earned value calculations that forecast the completion of the project to set everyone's expectations. That's why you use EAC (which helps you estimate your project's total cost) and ETC (which gives you a good idea of how much more money you think you'll spend between now and when it ends).

## 15. Answer: C

There are plenty of ways that communication can go wrong. When you send email to the wrong person, your communication had trouble—but that's **not** noise. Noise is the specific thing that interferes with the communication. In this case, the garbled text is a great example of noise.

OH, I GET IT. I ALREADY CAME  
UP WITH GOOD COST AND TIME  
FORECASTS USING EAC AND ETC.  
NOW I CAN PACKAGE THEM UP AS  
FORECASTS AND SHARE THEM  
WITH THE TEAM.





## 11 Risk management

# Planning for the unknown

GEE WHIZ, SALLY!  
WHAT IF THESE ROPES  
BREAK?

DON'T WORRY,  
BOBBY! I TOOK  
CARE OF IT WITH RISK  
PLANNING. WE CAN SWING  
AWAY WITHOUT A CARE IN  
THE WORLD!



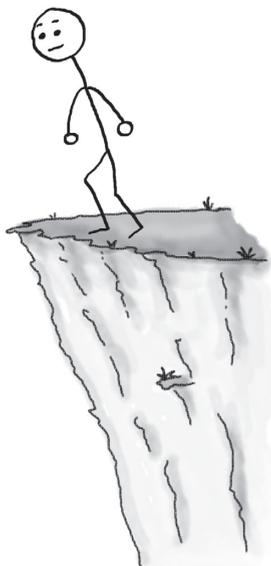
**Even the most carefully planned project can run into trouble.** No matter how well you plan, your project can always run into **unexpected problems**. Team members get sick or quit, resources that you were depending on turn out to be unavailable—even the weather can throw you for a loop. So does that mean that you're helpless against unknown problems? No! You can use **risk planning** to identify potential problems that could cause trouble for your project, **analyze** how likely they'll be to occur, take action to **prevent** the risks you can avoid, and **minimize** the ones that you can't.

## What's a risk?

There are no guarantees on any project! Even the simplest activity can run into unexpected problems. Any time there's anything that **might** occur on your project and change the outcome of a project activity, we call that a **risk**. A risk can be an event (like a fire), or it can be a condition (like an important part being unavailable). Either way, it's something that may or may not happen...but if it does, you will be forced to change the way you and your team work on the project.

If your project requires that you stand on the edge of a cliff, then there's a risk that you could fall.

If it's very windy out or the ground is slippery and uneven, then falling is more likely.



**A risk is any uncertain event or condition that might affect your project. Not all risks are negative.**

### Not all risks are negative

Some events (like finding an easier way to do an activity) or conditions (like lower prices for certain materials) can help your project! When this happens, we call it an **opportunity**...but it's still handled just like a risk.

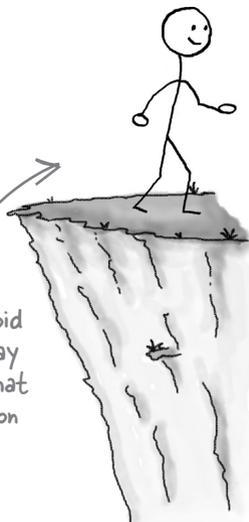
## How you deal with risk

When you're planning your project, risks are still uncertain: they haven't happened yet. But eventually, some of the risks that you plan for *do* happen. And that's when you have to deal with them. There are five basic ways to handle a risk:

### 1 Avoid

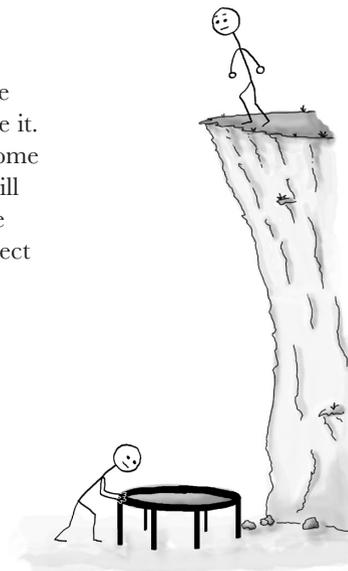
The best thing that you can do with a risk is avoid it—if you can prevent it from happening, it definitely won't hurt your project.

*The easiest way to avoid this risk is to walk away from the cliff...but that may not be an option on this project.*



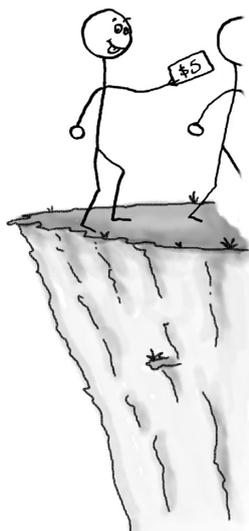
### 2 Mitigate

If you can't avoid the risk, you can mitigate it. This means taking some sort of action that will cause it to do as little damage to your project as possible.



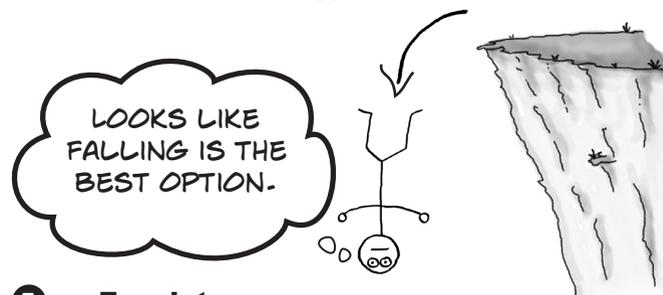
### 3 Transfer

One effective way to deal with a risk is to pay someone else to accept it for you. The most common way to do this is to buy insurance.



### 4 Accept

When you can't avoid, mitigate, or transfer a risk, then you have to accept it. But even when you accept a risk, at least you've looked at the alternatives and you know what will happen if it occurs.



### 5 Escalate

If the risk is not in your project's scope, you might need to tell somebody else about it to find an appropriate response.

# Plan Risk Management



By now, you should have a pretty good feel for how each of the planning processes works. The past few knowledge areas started out with their own planning process, and Risk Management is no different. You start with the **Plan Risk Management** process, which should look very familiar to you.

By the time a risk actually occurs on your project, it's too late to do anything about it. That's why you need to plan for risks from the beginning and keep coming back to do more planning throughout the project.

You'll need to see if there are standard templates, roles and responsibilities, or risk categories that your company uses.



Organizational process assets

Are people at your company risk takers? Do they play it safe? Every company has people with different attitudes about risk.



Enterprise environmental factors

You'll learn more about this one in Chapter 13.



Stakeholder register

## Inputs



Project charter



Project Management plan

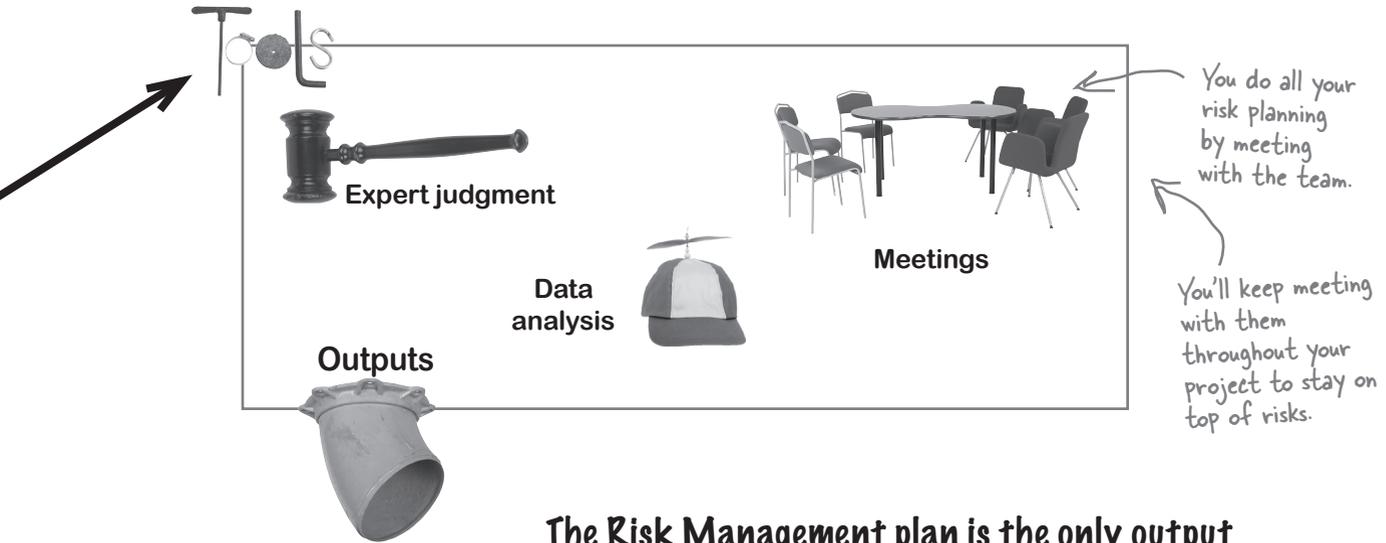


### Watch it!

#### Are you starting to see a pattern here?

You may get a question on the exam that asks which processes use organizational process assets! Think about why you need them for Plan Risk Management and the other planning processes. That should help you remember which processes need them.

You can figure out why you need these Project Management plans and the charter. Take a minute to think it through.

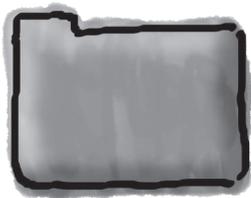


## The Risk Management plan is the only output

It tells you how you're going to handle risk on your project—which you probably guessed, since that's what management plans do. It says how you'll assess risk on the project, who's responsible for doing it, and how often you'll do risk planning (since you'll have to meet about risk planning with your team throughout the project).

The plan has parts that are really useful for managing risk:

The Risk Management plan is your guide to identifying and analyzing risks on your project.



Risk Management plan

It tells you who identifies and analyzes the risks, how they do it, and how often it happens.

- ❑ It has a bunch of **risk categories** that you'll use to classify your risks. Some risks are technical, like a component that might turn out to be difficult to use. Others are external, like changes in the market or even problems with the weather. Risk categories help you to build a **risk breakdown structure (RBS)**.
- ❑ You'll need to describe the methods and approach you'll use for identifying and classifying risks on your project. This section of the document is called the **methodology**.
- ❑ It's important to come up with a plan to help you figure out how big a risk's impact is and how likely a risk is to happen. The impact tells you how much damage the risk will cause to your project. A lot of projects classify impact on a scale from minimal to severe, or from very low to very high. This section of the document is called the **definitions of probability and impact**.

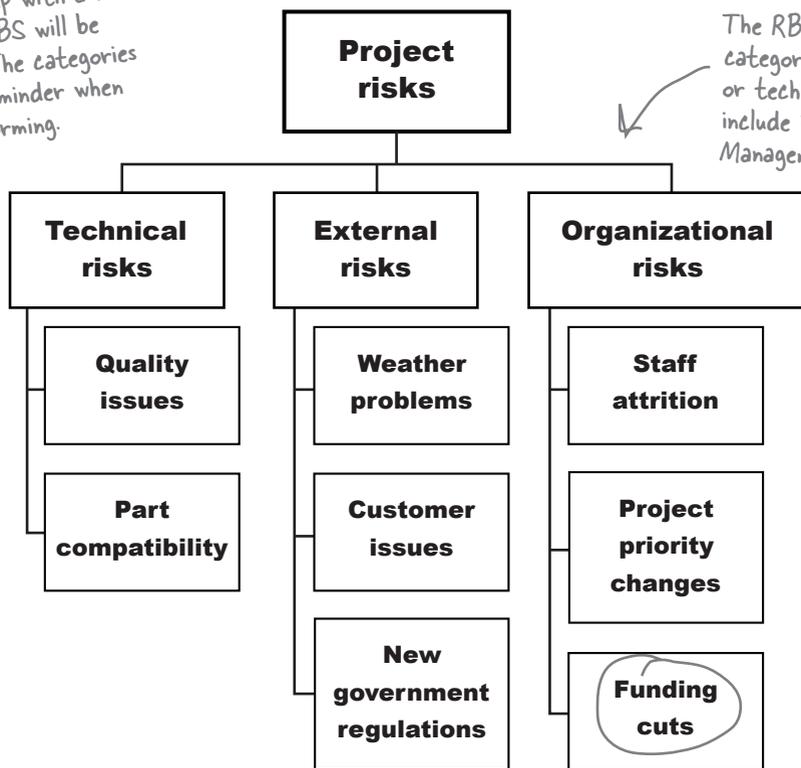
## Use a risk breakdown structure to categorize risks

You should build guidelines for risk categories into your Risk Management plan, and the easiest way to do that is to use a **risk breakdown structure** (RBS). Notice how it looks a lot like a WBS? It's a similar idea—you come up with major risk categories, and then decompose them into more detailed ones.

When you sit down with the team to come up with a list of risks, the RBS will be really useful. The categories are a great reminder when you're brainstorming.

This is what an RBS looks like. The idea here is that you want to come up with a way to take each risk and give it a category.

The RBS is just one way to categorize risks. It's not a tool or technique by itself; you'll include it as part of the Risk Management plan.



Once you come up with a list of risks, you'll label each risk with one of these categories. That will make it easier to figure out how to deal with the risks later.

# Sharpen your pencil



Take a look at how each of these project risks is handled and figure out if the risk is being avoided, mitigated, transferred, or accepted.

1. Stormy weather and high winds could cause very slippery conditions, so you put up a tent and wear slip-resistant footwear to keep from losing your footing.

- Avoided       Mitigated  
 Transferred       Accepted

2. You buy a surge protector to make sure a lightning strike won't blow out all of your equipment.

- Avoided       Mitigated  
 Transferred       Accepted

3. Flooding could cause serious damage to your equipment, so you buy an insurance policy that covers flood damage.

- Avoided       Mitigated  
 Transferred       Accepted

4. The manufacturer issues a warning that the safety equipment you are using has a small but nonzero probability of failure under the conditions that you'll be facing. You replace it with more appropriate equipment.

- Avoided       Mitigated  
 Transferred       Accepted

5. A mud slide would be very damaging to your project, but there's nothing you can do about it.

- Avoided       Mitigated  
 Transferred       Accepted

6. A team member discovers that the location you planned on using is in a county that is considering regulations that could be expensive to comply with. You work with a surveying team to find a new location.

- Avoided       Mitigated  
 Transferred       Accepted

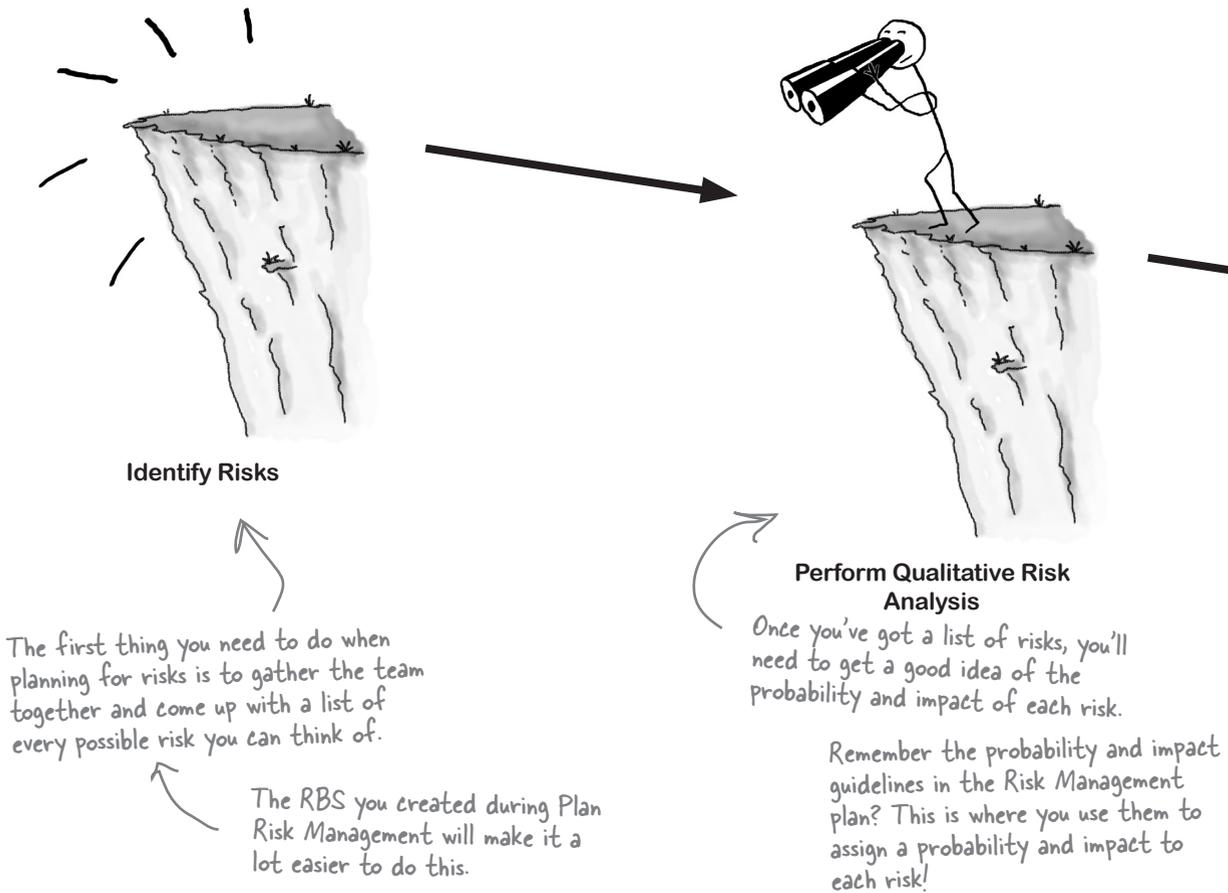
7. Surrounding geological features could interfere with your communications equipment, so you bring a flare gun and rescue beacon in case it fails.

- Avoided       Mitigated  
 Transferred       Accepted

Answers: 1—Mitigated 2—Mitigated 3—Transferred 4—Avoided 5—Accepted 6—Avoided 7—Mitigated

## Anatomy of a risk

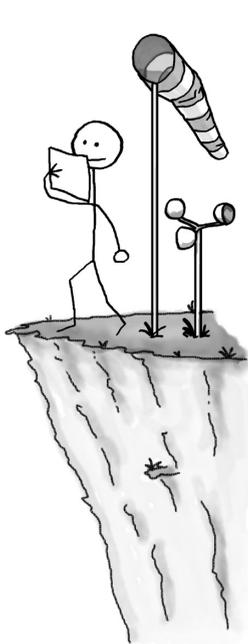
Once you're done with Plan Risk Management, there are four more Risk Management processes that will help you and your team come up with the list of risks for your project, analyze how they could affect it, and plan how you and your team will respond if any of the risks materialize when you're executing it.



There are two more Risk Management processes. You already saw Plan Risk Management. There's also a Monitoring and Controlling process called Monitor Risks that you use when a risk actually materializes.

By the time you get here, you've got a list of risks, with a probability and impact assigned to each. That's a great starting point, but sometimes you need more data if you want to make good decisions...

All four of these Risk Management processes are in the Planning process group—you need to plan for your project's risks before you start executing the project.



**Perform Quantitative Risk Analysis**

You can make better decisions with more precise data. That's what this process is about—assigning numerical values for the probability and impact of each risk.

All that's left now is to plan responses to each risk! This is where you decide whether to avoid, mitigate, transfer, or accept...and how you'll do it!



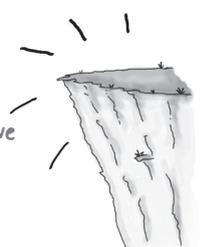
**Plan Risk Responses**



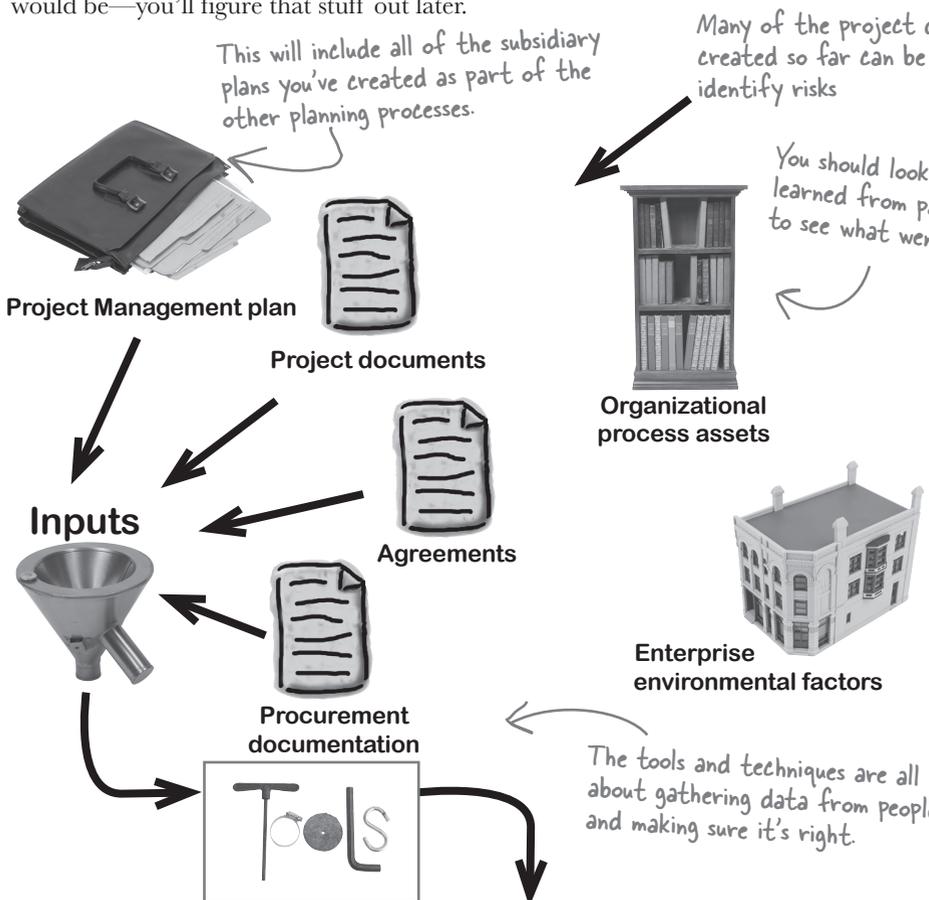
Some teams do Perform Qualitative Risk Analysis first, while others start with Perform Quantitative Risk Analysis. Some do only one or the other. Can you think of reasons they might do this?

# What could happen to your project?

You can't plan for risks until you've figured out which ones you're likely to run into. That's why the next Risk Management process is **Identify Risks**. The idea is that you want to figure out every possible risk that might affect your project. Don't worry about how unlikely the risk is, or how bad the impact would be—you'll figure that stuff out later.



Identify Risks



The goal of all of the risk planning processes is to produce the risk register. That's your main weapon against risk.

Identified Risks	Potential Responses	Root Causes
Landslide caused by loose gravel and dirt on the nearby mountain	Put up barrier or dig trench	Geological data review found loose topsoil nearby
High winds can lead to cliff disaster	Reinforce tent stakes; obtain weatherproof equipment	National Weather Service predicts 35% chance of high winds
Truck rental is unavailable	Pay to reserve equipment at a second company	Higher-than-expected demand for equipment in the area this season
Equipment failure during project	No responses were found by the team	Recent industry report cites higher-than-expected failure rates for critical equipment

Risk register

The risk register is the only output—and it's the most important part of Risk Management. It's a list of all of the risks and some initial ideas about how you'd respond to them.

## Data-gathering techniques for Identify Risks

You probably already guessed that the goal of Identify Risks is to identify risks—seems pretty obvious, right? And the most important way to identify those risks is to gather data from the team. That's why the first—and most important—technique in Identify Risks is called **data-gathering techniques**. These are time-tested and effective ways to get data from your team, stakeholders, and anyone else who might have data on risks.



### Useful data-gathering techniques

There are a lot of different ways that you can find risks on your project. But there are only a few that you're most likely to use—and those are the ones that you will run across on the exam.

**Brainstorming** is the first thing you should do with your team. Get them all together in a room, and start pumping out ideas. Brainstorming sessions always have a **facilitator** to lead the team and help turn their ideas into a list of risks.

*The facilitator is really important—without her, it's just a disorderly meeting with no clear goal.*

*The team usually comes up with risks that have to do with building the product, while the sponsor or someone who would use the product will think about how it could end up being difficult to use.*

**Interviews** are a really important part of identifying risk. Try to find everyone who might have an opinion and ask them about what could cause trouble on the project. The sponsor or client will think about the project in a very different way than the project team.

*The RBS you created in Plan Risk Management is a good place to start for this. You can use all the risks you categorized in it as a jumping-off point.*



**Checklist analysis** means using checklists that you developed specifically to help you find risks. Your checklist might remind you to check certain assumptions, talk to certain people, or review documents you might have overlooked.



What's the big difference between brainstorming and the interviews? Can you think of a situation where one would be more useful than the other?



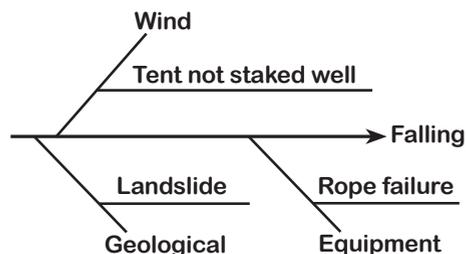
## More Identify Risks techniques

Even though gathering data is the biggest part of Identify Risks, it's not the only part of it. There are other tools and techniques that you'll use to make sure that the risk register you put together lists as many risks as possible. The more you know about risk going into the project, the better you'll handle surprises when they happen. And that's what these tools and techniques are for—looking far and wide to get every risk possible.

### Data analysis tools and techniques

**Document analysis** is when you look at plans, requirements, documents from your organizational process assets, and any other relevant documents that you can find to squeeze every possible risk out of them.

**Root-cause identification** is analyzing each risk and figuring out what's actually behind it. Even though falling off of the cliff and having your tent blow away are two separate risks, when you take a closer look you might find that they're both caused by the **same thing**: high winds, which is the root cause for both of them. So you know that if you get high winds, you need to be on the lookout for *both* risks!



Fishbone or Ishikawa diagram

**SWOT analysis** lets you analyze strengths, weaknesses, opportunities, and threats. You'll start by brainstorming strengths and weaknesses, and then examine the strengths to find opportunities, and the weaknesses to identify threats to the project.

**Assumptions and constraint analysis** is what you're doing when you look over your project's assumptions. Remember how important assumptions were when you were estimating the project? Well, now it's time to look back at the assumptions you made and make sure that they really are things you can assume about the project. Wrong assumptions are definitely a risk.

**Interpersonal and team skills** help the team to get broad participation in risk identification. Specifically, the **facilitation** skill is important to this process.

**Prompt lists** are lists of risk categories that you and the team use to jog your memory when you're identifying risks. You might use the risk categories from the lowest level of the risk breakdown structure to get the team started thinking about risks that could occur on your project as an example.

**Expert judgment** lets you rely on past experience to identify risks.

**Meetings** are where your team gets together to identify risks as a group.



Read each of these scenarios and identify which tool or technique is being used. If a scenario uses a data-gathering technique, specify which one.

1. Your project requires that you set up a campsite on the edge of a cliff. You gather your team members—including a geologist, a meteorologist, a tracker, and three campsite workers—and lead them in a directed discussion where they identify as many risks as possible.
  
2. You look through your company's asset library and discover that two previous projects involved setting up camp in this area. You look through the lessons learned to figure out what went wrong, and what could have been avoided through better planning.
  
3. You meet individually with many different people: the sponsor, stakeholders, team members, and experts. You ask each of them detailed questions about what they think could go wrong on the project.
  
4. You've identified a risk that is very complex, so you try to find out what made it happen. You use an Ishikawa diagram to gain insight into it.
  
5. You've reviewed your estimates and find that you had assumed that seasonal weather patterns would hold. If they change, then it could cause serious problems with the project.

1. Data-gathering techniques—Brainstorming

2. Document analysis

3. Data-gathering techniques—Interviews

4. Data analysis techniques—Root-cause identification

5. Data analysis techniques—Assumptions and constraint analysis

## Where to look for risks

A good way to understand risks for the exam is to know where they come from. If you start thinking about how you find risks on your project, it will help you figure out how to handle them.

Here are a few things to keep in mind when you're looking for risks:

### 1 RESOURCES ARE A GOOD PLACE TO START.

Have you ever been promised a person, equipment, conference room, or some other resource, only to be told at the last minute that the resource you were depending on wasn't available? What about having a critical team member get sick or leave the company at the worst possible time? Check your list of resources. If a resource might not be available to you when you need it, then that's a risk.

### 3 "WHEN YOU ASSUME..."

Have you ever heard that old saying about what happens when you assume? At the beginning of the project, your team had to make a bunch of assumptions in order to do your estimates. But some of those assumptions may not actually be true, even though you needed to make them for the sake of the estimate. It's a good thing you wrote them down—now it's time to go back and look at that list. If you find some of them that are likely to be false, then you've found a risk.

### 2 THE CRITICAL PATH IS FULL OF RISKS.

Remember the critical path method from Chapter 6? Well, an activity on the critical path is a lot riskier than an activity with plenty of float, because any delay in that activity will delay the project.

*If an activity that's not on the critical path has a really small float, that means a small problem could easily cause it to become critical—which could lead to big delays in your project.*

### 4 LOOK OUTSIDE YOUR PROJECT.

Is there a new rule, regulation, or law being passed that might affect your project? A new union contract being negotiated? Could the price of a critical component suddenly jump? There are plenty of things outside of your project that are risks—and if you identify them now, you can plan for them and not be caught off guard.

*Finding risks means talking to your team and being creative. Risks can be anywhere.*



These areas are a good start, but there are plenty of other places on your project where you can find risks. Can you think of some of them?

## Now put it in the risk register

The point of the Identify Risks process is to...well, identify risks. But what does that really give you? You need to know enough about each risk to analyze it and make good decisions about how to handle it. So when you're doing interviews, leading brainstorming sessions, analyzing assumptions, gathering expert opinions, and using the other Identify Risks tools and techniques, you're gathering exactly the things you need to add to the risk register.

### Outputs



Each risk that you and the team come up with should go here.



It's a good idea for your Identify Risks meetings to include a discussion of how to respond to the risks, but you'll really dive into this later in the Plan Risk Responses process.



This is where the results of your root-cause analysis go.



Identified Risks	Potential Responses	Root Causes
Landslide caused by loose gravel and dirt on the nearby mountain	Put up barrier or dig trench	Geological data review found loose topsoil nearby
High winds can lead to cliff disaster	Reinforce tent stakes; obtain weatherproof equipment	National Weather Service predicts 35% chance of high winds
Truck rental is unavailable	Pay to reserve equipment at a second company	Higher than expected demand for equipment in the area this season
Equipment failure during project	No responses were found by the team	Recent industry report cites higher-than-expected failure rates for critical equipment

Risk register

You might discover new risk categories, like Equipment. If you do, you'll go back to the RBS and add them.

You'll get a chance to come up with more complete responses later.

Some risks do not have an obvious response.



Risk report

The other major output of the Identify Risks process is the risk report. As you work through all of the Risk Management process, you'll be compiling a report of the sources of risk to your project and summary-level information.



Project document updates

While you identify risks, you might find changes to your assumption log, issue log, or lessons learned register.

# Rank your risks

It's not enough to know that risks are out there. You can identify risks all day long, and there's really no limit to the number of risks you can think of. But some of them are likely to occur, while others are very improbable. It's the ones that have much better odds of happening that you really want to plan for.

Besides, some risks will cause a whole lot of damage to your project if they happen, while others will barely make a scratch...and you care much more about the risks that will have a big impact. That's why you need the next Risk Management process, **Perform Qualitative Risk Analysis**—so you can look at each risk and figure out how likely it is and how big its impact will be.

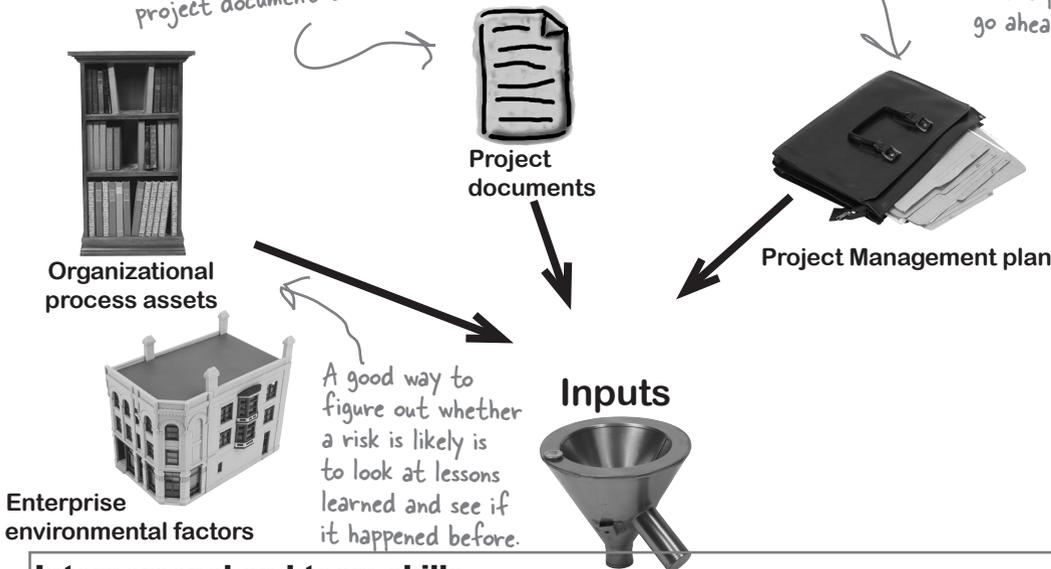


**Perform Qualitative Risk Analysis**

*You need to know what risks you've identified in order to analyze them, so the risk register is an important project document to include.*

*Remember all the stuff you put in here about risk categories and definitions? Those will come in handy.*

*If you didn't put that stuff in the plan, then you should go ahead and do it now.*



**Interpersonal and team skills facilitation**

**Meetings**

*← You already know about these from earlier processes.*

**Expert judgment** definitely comes in handy when you're assessing risks. Who better to help you come up with things that might go wrong than experts who have been through similar projects before?

**Risk categorization** is all about grouping your risks so that you can come up with a better strategy for dealing with them. You might group them by the phase of the project where you'll see them, or by the source of the risk. Or you could come up with a bunch of additional categories that would help you to organize your responses better and be ready for the risk if it should happen.



## Examine each risk in the register

Not all risks are created equal. Some of them are really likely to happen, while others are almost impossible. One risk will cause a catastrophe on your project if it happens; another will just waste a few minutes of someone's time.

### Data gathering

**Interviews** are a great way to get a sense for how important or likely people think a risk is.

### Data analysis

**Risk data quality assessment** means making sure that the data you're using in your risk assessment is accurate. Sometimes it makes sense to bring in outside experts to check out the validity of your risk assessment data. Sometimes you can even confirm the quality of the data on your own, by checking some sample of it against other data sources.

#### Assessment of other risk parameters

is about urgency and criticality of risks. One way to assess these parameters is to check out how soon you're going to need to take care of a particular risk. If a risk is going to happen soon, you'd better have a plan for how to deal with it soon, too.

### Data representation

**A Probability and Impact matrix** is a table where all of your risks are plotted out according to the values you assign. It's a good way of looking at the data so you can more easily make judgments about which risks require a response. The ones with the higher numbers are more likely to happen and will have a bigger impact on your project if they do. So you'd better figure out how to handle those.

**Hierarchical charts** show how risks relate to each other. Most charts are organized by risk category so that teams can plan risk responses by category as well.

#### Risk probability and impact assessment

is one of the best ways to be sure that you're handling your risks properly by examining how likely they are to happen, and how bad (or good) it will be if they do. This process helps you assign a probability to the likelihood of a risk occurring, and then figure out the actual cost (or impact) if it does happen. You can use these values to figure out which of your risks need a pretty solid mitigation plan, and which can be monitored as the project goes on.

Sometimes you'll find that some risks have obviously low probability and impact, so you won't put them in the main section of your register. Instead, you can add them to a separate section called the **watch list**, which is just a list of risks. It'll include risks you don't want to forget about, but which you don't need to track as closely. You'll check your watch list from time to time to keep an eye on things.

Probability	P&I				
	.9	.09	.27	.45	.63
.7	.07	.21	.35	.49	.63
.5	.05	.15	.25	.35	.45
.3	.03	.09	.15	.21	.27
.1	.01	.03	.05	.07	.09
Impact	.1	.3	.5	.7	.9

# Sharpen your pencil



Here are some facts about the cliff project that were uncovered during qualitative analysis. Update the risk register on the facing page with the appropriate information.

Risk	Probability	Impact
1. Landslide	.1	.9
2. Winds	.7	.9
3. No truck	.3	.7
4. Storms	.5	.3
5. Supplies	.1	.5
6. Illness	.1	.7

During the Perform Qualitative Risk Analysis sessions, the team assigned a probability and impact number to each of the risks on the facing page.



	.9	.09	.27	.45	.63	.89
Probability	.7	.07	.21	.35	.49	.63
	.5	.05	.15	.25	.35	.45
	.3	.03	.09	.15	.21	.27
	.1	.01	.03	.05	.07	.09
		.1	.3	.5	.7	.9
	Impact					

This gives you a good picture of the threshold the company has set for evaluating risks.

You can figure out the priority of each risk based on its probability and impact. Low-priority risks have no shading, medium ones are light gray, and high ones are dark gray.

1. The organizational process assets at your company set a high-priority risk as any risk with a probability and impact score higher than 0.20. Medium-priority risks are those between 0.10 and 0.19, and low-priority are those between 0 and 0.09. Low-priority risks can be monitored on a watch list, but high and medium ones must have a response strategy.

**Fill in the missing values in the Priority and Probability columns in the risk register on the right, using the Probability and Impact matrix to figure out which ones are low, medium, or high. For example, we filled in "High" under Priority for row #3 by looking up risk ("No truck") in the first table, finding the probability and impact values, and then using the Probability and Impact matrix. The probability is .3 and the impact is .7, so you can find the corresponding box in the matrix. Since it's dark gray, its priority is high.**

2. After analyzing your data, you came up with three risk categories for the project: natural, equipment, and human.

**Fill in the missing values in the Category column of the risk register with either "Natural," "Equipment," or "Human." We started you out by filling in a few of them.**

3. For this particular project, you'll need the equipment at the start of the project, so any equipment risks are considered high urgency. Natural and human risks are all medium urgency, except for ones that have to do with storms, which you consider low urgency for this project because of limited mitigation potential.

**Figure out the whether the urgency for each risk is low, medium, or high and fill in the Urgency column in the risk register.**

It's OK for some responses to be blank—you'll fill them in later during the Plan Risk Responses process.



	<b>Identified risks</b>	<b>Potential response</b>	<b>Root cause</b>	<b>Category</b>	<b>Priority</b>	<b>Urgency</b>
1.	Landslide caused by loose gravel and dirt on the nearby mountain	Put up barrier or dig trench	Geological data review found loose topsoil nearby			
2.	High winds can lead to cliff disaster	Reinforce tent stakes; obtain weatherproof equipment	National Weather Service predicts 35% chance of high winds	<b>Natural</b>		<b>Medium</b>
3.	Truck rental is unavailable		Higher-than-expected demand for equipment this season	<b>Equipment</b>	<b>High</b>	
4.	Storms predicted through the first two weeks of project schedule time	Create reserves to account for time lost due to storms	El Niño weather pattern		<b>Medium</b>	<b>Low</b>
5.	Supply shortage if we don't accurately predict food needs		Nearest store is 30 miles away	<b>Equipment</b>		
6.	If someone gets sick, it could be a problem getting medical care	Bring a doctor with us on the project	Nearest hospital is 50 miles away			

## Outputs



Qualitative analysis helps you figure out which risks are most important to your project's success. When you've finished your analysis, you should have a risk register that tells you a lot more about what could go wrong.

The only output of Perform Qualitative Risk Analysis is project documents updates—including updates to the risk register.

	Identified risks	Potential response	Root cause	Category	Priority	Urgency
1.	Landslide caused by loose gravel and dirt on the nearby mountain	Put up barrier or dig trench	Geological data review found loose topsoil nearby	Natural	Low	Medium
2.	High winds can lead to cliff disaster	Reinforce tent stakes; obtain weatherproof equipment	National Weather Service predicts 35% chance of high winds	Natural	High	Medium
3.	Truck rental is unavailable		Higher-than-expected demand for equipment this season	Equipment	High	High
4.	Storms predicted through the first two weeks of project schedule time	Create reserves to account for time lost due to storms	El Niño weather pattern	Natural	Medium	Low
5.	Supply shortage if we don't accurately predict food needs		Nearest store is 30 miles away	Equipment	Low	High
6.	If someone gets sick, it could be a problem getting medical care	Bring a doctor with us on the project	Nearest hospital is 50 miles away	Human	Low	Medium

## there are no Dumb Questions

**Q:** Who does Perform Qualitative Risk Analysis?

**A:** The whole team needs to work on it together. The more of your team members who are helping to think of possible risks, the better off your plan will be. Everybody can work together to think of different risks to their particular part of the work, and that should give an accurate picture of what could happen on the project.

**Q:** What if people disagree on how to rank risks?

**A:** There are a lot of ways to think about risks. If a risk has a large impact on your part of the project or your goals, you can bet that it will seem more important to you than the stuff that affects other people in the group. The best way to keep the right perspective is to keep everybody on the team evaluating risks based on how they affect the overall project goals. If everyone focuses on the effect each risk will have on your project's constraints, risks will get ranked in the order that is best for everybody.

**Q:** Where do the categories come from?

**A:** You can create categories however you want. Usually, people categorize risks in ways that help them come up with response strategies. Some people use project phase. That way, they can come up with a risk mitigation plan for each phase of a project, and they can cut down on the information they need to manage throughout. Some people like to use the source of the risk as a category. If you do that, you can find mitigation plans that can help you deal with each source separately. That might come in handy if you are dealing with a bunch of different contractors or suppliers and you want to manage the risks associated with each separately.

**Q:** How do I know if I've got all the risks?

**A:** Unfortunately, you never know the answer to that one. That's why it's important to keep monitoring your risk register throughout the project. It's important that you are constantly updating it and that you never let it sit and collect dust. You should be looking for risks throughout all phases of your project, not just when you're starting out.

**Q:** What's the point in even tracking low-priority risks? Why have a watch list at all?

**A:** Actually, watch lists are just a list of all of the risks that you want to monitor as the project goes on. You might be watching them to see if conditions change and make them more likely to happen. By keeping a watch list, you make sure that all of the risks that seem low priority when you are doing your analysis get caught before they cause serious damage if they become more likely later in the project.

The conditions that cause a risk are called **triggers**. So, say you have a plan set up to deal with storms, and you know that you might track a trigger for lightning damage, such as a thunderstorm. If there's no thunderstorm, it's really unlikely that you will see lightning damage, but once the storm has started, the chance for the risk to occur skyrockets.

**Q:** I still don't get the difference between priority and urgency.

**A:** Priority tells you how important a risk is, while urgency tells you when you need to deal with it. Some risks could be high priority but low urgency, which means that they're really important, but not time-critical. For example, you might know that a certain supplier that provides critical equipment will go out of business in six months, and you absolutely need to find a new supplier. But you have six months to do it. Finding a new supplier is a high priority, because your project will fail if it's not taken care of. But it's not urgent—even if it takes you four months to find a new supplier, nothing bad will happen.

**The conditions that cause a risk are called triggers. You use a watch list to stay on top of them.**

## Qualitative vs. quantitative analysis

Let's say you're a fitness trainer, and your specialty is helping millionaires get ready for major endurance trials. You get paid the same for each job, but the catch is that you get paid only if they succeed. Which of these clients would you take on?

### Running a marathon



One client wants you to help him train so that he can finish a marathon. He doesn't have to win, just get to the finish line.

vs.

### Climbing Mount Everest



Another client wants you to help him get to the top of Mount Everest. He won't be satisfied unless he gets to the summit.

***It's much more likely that you can get even an out-of-shape millionaire to finish a marathon than it is that you can get one to climb Mount Everest successfully.***

In fact, since the 1950s, 10,000 people have attempted to climb Mount Everest, and only 1,200 have succeeded, while 200 have died. Your qualitative analysis probably told you that the climbing project would be the *riskier* of the two. But having the numbers to back up that judgment is what quantitative analysis is all about.

# Perform Quantitative Risk Analysis

Once you've identified risks and ranked them according to the team's assessment, you need to take your analysis a little further and make sure that the numbers back you up. Sometimes you'll find that your initial assessment needs to be updated when you look into it further.



Perform Quantitative Risk Analysis

This includes nearly all of the documents you've created with quantitative data: assumption log, basis of estimates, cost estimates, cost forecasts, duration estimates, milestone list, resource requirements, risk register, risk report, and schedule forecasts.



Project documents

This includes the cost baseline, schedule baseline, and Risk Management plan.



Project Management plan



Organizational process assets



Inputs



The tools for this process are all about gathering data and analyzing it to determine probability of risks occurring.



Enterprise environmental factors

	Identified Risks	Potential Response	Root Cause	Category	Priority	Urgency
1	Lack of quality control on the newly installed equipment.	Put on hold or do later.	Delayed delivery from the supplier.	Weather	Low	Low
2	Key staff are on leave for 2 weeks.	Perform key activities with other staff.	Human resource shortage.	Weather	High	Medium
3	Key vendor is unreliable.	Find an alternative supplier.	High risk equipment for the project.	Equipment	Low	High
4	Storm forecast for the project location.	Check weather & consider alternative location.	Climate-related factors.	Weather	High	High
5	Equipment failure due to poor maintenance.	Replace equipment.	Equipment failure.	Equipment	Low	High
6	Construction site safety issues.	Stop work until safe.	Human resources.	Human	Low	Medium

Project document updates

Once you're done analyzing, you update the risk register and risk report with the data you've gathered.

## First gather the data...

Quantitative tools are broken down into three categories: the ones that help you get more data about risks, the ones that help you to analyze the data you have, and expert judgment to help you put it all together. The tools for gathering data focus on gathering numbers about the risks you have already identified and ranked. These tools are called **data gathering and representation techniques**.



### Interviewing

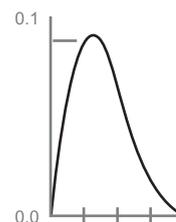
Sometimes the best way to get hard data about your risks is to interview people who understand them. In a risk interview, you might focus on getting three-point cost estimates so that you can come up with a budget range that will help you mitigate risks later. Another good reason to interview is to establish ranges of probability and impact, and document the reasons for the estimates on both sides of the range.



### Representations of uncertainty

Sometimes taking a look at your time and cost estimate ranges in terms of their distribution will help you generate more data about them. You probably remember these distribution curves from your probability and statistics classes in school. Don't worry: you won't be asked to remember the formal definition of probability distributions or even to be able to create them. You just need to know that they are another way of gathering data for quantitative analysis.

Beta Distribution



Triangular Distribution



### Expert judgment

It's always a good idea to contact the experts if you have access to them. People who have a good handle on statistics or risk analysis in general can be helpful when you are doing quantitative analysis. Also, it's great to hear from anybody who has a lot of experience with the kind of project you are creating.



### Interpersonal and team skills: facilitation

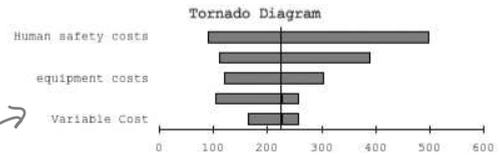
You'll need to be skilled at facilitation to help the team come to its quantitative representations of risk. Working with the team while they model out uncertainty and use it to drive decisions is an important part of this process.

## ...then analyze it

Now that you have all the data you can get about your risk register, it's time to analyze that data. Most of the tools for analyzing risk data are about figuring out how much the risk will end up costing you. There are four tools that fall under the category of **data analysis**: sensitivity analysis, decision tree analysis, simulations, and influence diagrams.

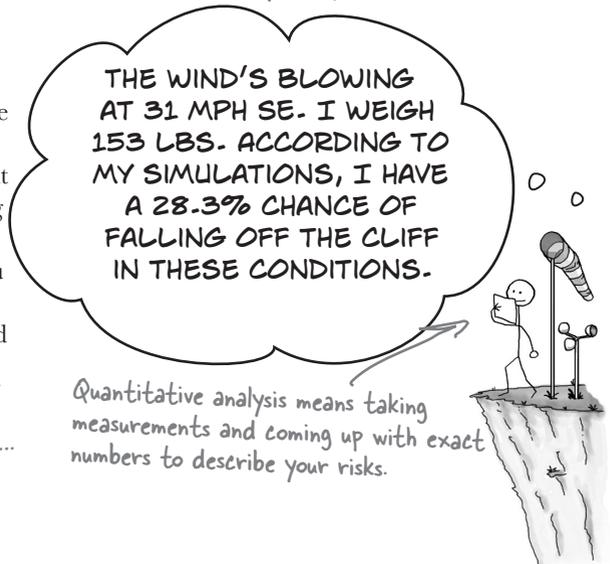


**Sensitivity analysis** is all about looking at the effect one variable might have if you could completely isolate it. You might look at the cost of a windstorm on human safety, equipment loss, and tent stability without taking into account other issues that might accompany the windstorm (like rain damage or possible debris from nearby campsites). People generally use tornado diagrams to look at a project's sensitivity to just one risk factor.



The tornado diagram lets you look at just one uncertain factor while assuming that all other data will stay where you expect it to.

**Decision tree analysis** lets you examine costs of all of the paths you might take through the project (depending on which risks occur) and assign a monetary value to each decision. So, if it costs \$100 to survey the cliff and \$20 to stake your tent, choosing to stake your tent *after* you've looked at the cliff has an expected monetary value of \$120. To perform a decision tree analysis, you just diagram out all of the decisions you think you will need to make to deal with risks. Then you add up all that you would need to spend to make each decision.



We'll talk about this more in a couple of pages...

**Simulation** refers to running your project risks through modeling programs. Monte Carlo analysis is one tool that can randomize the outcomes of your risks and the probabilities of them occurring to help you get a better sense of how to handle the risks you have identified.

### Influence diagrams

It's valuable to understand the relationships between entities, outcomes, and influences in your project. Influence diagrams show these relationships graphically.



Monte Carlo analysis lets you run a lot of simulations to come up with data about what could happen on your project.

# Calculate the expected monetary value of your risks



OK, so you know the probability and impact of each risk. How does that really help you plan? Well, it turns out that if you have good numbers for those things, you can actually figure out how much those risks are going to cost your project. You can do that by calculating the **expected monetary value** (or EMV) of each risk:

- 1 Start with the probability and impact of each risk.

You can find these in your risk register.

Risk	Probability	Impact
High winds	35%	costs \$48 to replace equipment
Mudslide	5%	loses \$750 in damage costs
Wind generator is usable	15%	saves \$800 in battery costs
Truck rental unavailable	10%	costs \$350 for last-minute rental

- 2 Take the first risk and multiply the probability by the impact. For opportunities, use a positive cost. For threats, use a negative one. Then do the same for the rest of the risks.

Even though the impact of a mudslide is big, the probability is low so the EMV is small.

High winds:  $35\% \times -\$48 = -\$16.80$

Mudslide:  $5\% \times -\$750 = -\$37.50$

Wind generator:  $15\% \times \$800 = \$120.00$

Truck rental:  $10\% \times -\$350 = -\$35.00$

The wind generator risk is an opportunity because you'll save money if it happens. So when you do the EMV calculation, you use a positive number for the impact.

- 3 Now that you've calculated the EMV for each of the risks, you can add them up to find the total EMV for all of them.

$$EMV = -\$16.80 + -\$37.50 + \$120.00 + -\$35.00 = \$30.70$$

If you add \$30.70 to the budget, then it should be enough to account for these risks.



## Sharpen your pencil

You'll need to know how to do EMV calculations for the test. Give them a shot now—they're pretty easy once you get the hang of them.

Take a look at this table of risks.

Risk	Probability	Impact
Navigation equipment failure	15%	costs \$300 due to getting lost
Unseasonably warm weather	8%	saves \$500 in excavation costs
Wild animals eat rations	10%	costs \$100 for replacements

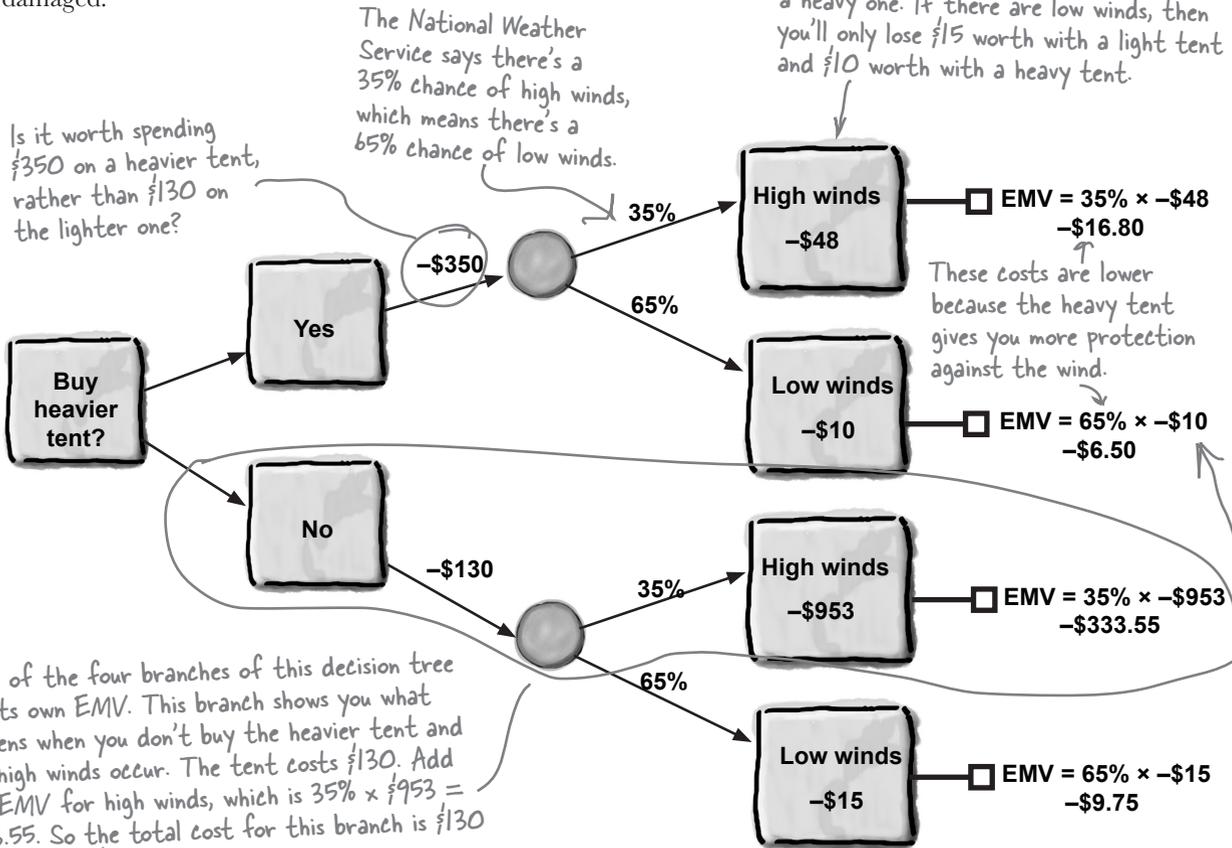
1. Calculate the EMV for each of these three risks.
2. If these are the only risks on the project, calculate the total EMV.
3. The latest weather report came out, and there is now a 20% chance of unseasonably warm weather. What's the new EMV for the project?
4. Now the cost of replacement rations goes up to \$150. What's the new EMV for the project?

—————> **Answers on page 628.**

# Decision tree analysis uses EMV to help you make choices

There's another way to do EMV—as we mentioned earlier, you can do it visually using a **decision tree**. This decision tree shows the hidden costs of whether or not you buy a heavier tent. The tent is more expensive—it costs \$350, while the lighter tent costs \$130. But the heavier tent has better protection against the wind, so if there are high winds, your equipment isn't damaged.

If you buy a heavy tent, then it protects your equipment better, but it'll cost more. You figure that if there are high winds, you'll lose \$48 worth of equipment with a light tent, but only \$15 worth if you have a heavy one. If there are low winds, then you'll only lose \$10 worth with a light tent and \$10 worth with a heavy tent.



Each of the four branches of this decision tree has its own EMV. This branch shows you what happens when you don't buy the heavier tent and the high winds occur. The tent costs \$130. Add the EMV for high winds, which is  $35\% \times \$953 = \$333.55$ . So the total cost for this branch is  $\$130 + \$333.55 = \$463.55$

What's the EMV—or how much it's likely to cost you—of choosing the heavier tent?

If we add the EMV for high winds plus the EMV for low winds to the cost of the tent, we'll figure out the "real" cost of choosing the heavier tent. So that's  $-\$16.80 + -\$6.50 + -\$350 = -\$373.30$ .

Compare that with the EMV of choosing the lighter tent. Which decision makes sense?

We can do the same thing for the bottom two branches of the tree. The "cheaper" tent costs  $-\$130 + -\$333.55 + -\$9.75 = -\$473.30$ . So it's actually more expensive!

This is just the EMV of the low winds if you buy the heavier tent. The probability of low winds is 65%, and the cost is \$10. So it's just like the other EMV calculations:  $65\% \times -\$10 = -\$6.50$ .



## Exercise

Looking at the decision tree on the facing page, see if you can figure out the expected monetary value depending on the decisions the team makes.

*Hint: Figure out the new EMV for each branch—that will tell you if the decision makes sense.*

1. You hear a weather report that says there's now a 45% chance of high winds. Does it still make sense to buy the heavier tent?
2. If you don't buy the heavier tent, then you have room to take along a wind generator that can power your equipment, and that will save you \$1,100 in portable batteries if there's a heavy wind. If there's still a 45% chance of high winds, does it still make sense to buy the heavier tent?

→ **Answers on page 629.**

*This is an opportunity. So it should have a POSITIVE value when you do the EMV calculation.*

## there are no Dumb Questions

**Q:** I still don't get this Monte Carlo stuff. What's the deal?

**A:** All you really need to know about Monte Carlo analysis for the test is that it's a way that you can model out random data using software. In real life, though, it's a really cool way of trying to see what could happen on your project if risks do occur. Sometimes modeling out the data you already have about your project helps you to better see the real impact of a risk if it did happen.

**Q:** I can figure out how much the risk costs using EMV, or I can do it with decision tree analysis. Why do I need two ways to do this?

**A:** That's a good question. If you take a really careful look at how you do decision tree analysis, you might notice something... it's actually doing exactly the same thing as EMV. It turns out that those two techniques are really similar, except that EMV does it using numbers and decision tree analysis spells out the same calculation using a picture.

**Q:** I understand that EMV and decision trees are related, but I still don't exactly see how.

**A:** It turns out that there are a lot of EMV techniques, and decision tree analysis is just one of them. But it's the one you need to know for the test, because it's the one that

helps you make decisions by figuring out the EMV for each option. You can bet that you'll see a question or two that asks you to calculate the EMV for a project based on decision tree like the one on the facing page. As long as you remember that risks are negative numbers and that opportunities are positive ones, you should do fine.

**Q:** So are both quantitative analysis and qualitative analysis really just concerned with figuring out the impact of risks?

**A:** That's right. Qualitative analysis focuses on the impact as the team judges it in planning. Quantitative analysis focuses on getting the hard numbers to back up those judgments.

## Update the risk register based on your quantitative analysis results

When you've finished gathering data about the risks, you change your priorities, urgency ratings, and categories (if necessary), and you update your risk register. Sometimes modeling out your potential responses to risk helps you to find a more effective way to deal with them. That's why the only output of the **Perform Quantitative Risk Analysis** is **project documents updates**.

### Outputs



Analysis showed us that this would be the most expensive risk if it were to occur. So it got upgraded to a high priority.

	Identified risks	Potential response	Root cause	Category	Priority	Urgency
1.	Landslide caused by loose gravel and dirt on the nearby mountain	Put up barrier or dig trench	Geological data review found loose topsoil nearby	Natural	High	Medium
2.	High winds can lead to cliff disaster	Reinforce tent stakes; obtain weatherproof equipment	National Weather Service predicts 35% chance of high winds	Natural	High	Medium
3.	Truck rental is unavailable	Pay to reserve equipment at a second company	Higher-than-expected demand for equipment this season	Equipment	High	High
4.	Storms predicted through the first two weeks of project schedule time	Create reserves to account for time lost due to storms	El Niño weather pattern	Natural	Medium	Low
5.	Supply shortage if we don't accurately predict food needs		Nearest store is 30 miles away	Equipment	Low	High
6.	If someone gets sick, it could be a problem getting medical care	Bring a doctor with us on the project	Nearest hospital is 50 miles away	Human	Low	Low

This one got downgraded when quantitative analysis showed that it was not very likely to happen on such a short-term project.



## BULLET POINTS: AIMING FOR THE EXAM

- The main output of all of the Risk Management planning processes is **updated project documents**, and the main document that gets updated is the **risk register**.
- The first step in Risk Management is **Identify Risks**, where you work with the whole team to figure out what risks could affect your project.
- Qualitative and quantitative analysis are all about **ranking risks** based on their probability and impact.
- Qualitative analysis is where you take the **categories** in your risk plan and **assign** them to each of the risks that you've identified.
- Quantitative analysis focuses on **gathering numbers** to help evaluate risks and **making the best decisions** about how to handle them.
- **Decision tree analysis** is one kind of **expected monetary value** analysis. It focuses on adding up all of the costs of decisions being made on a project so that you can see the overall value of risk responses.
- To calculate EMV, be sure to **treat all negative risks as negative numbers** and all **opportunities as positive ones**. Then add up all of the numbers on your decision tree.
- Don't forget **watch lists**. They let you monitor lower-priority risks so that you can see if triggers for those risks occur and you need to treat them as higher priorities.
- All of the processes in Risk Management are **Planning or Monitoring and Controlling processes**. There are **no Executing** processes here. Since the goal is to plan for risks, there is no need to focus on actually doing the work. By then, it's too late to plan for risks.

**Your risk register should include both threats and opportunities. Opportunities have positive impact values, while threats have negative ones. Don't forget the plus or minus sign when you're calculating EMV.**



How would you handle the risks listed in the risk register so far?

# How do you respond to a risk?

After all that analysis, it's time to figure out what you're going to do if a risk occurs. Maybe you'll be able to keep a reserve of money to handle the cost of the most likely risks. Maybe there's some planning you can do from the beginning to be sure that you avoid it. You might even find a way to transfer some of the risk with an insurance policy.

However you decide to deal with each individual risk, you'll update your risk responses in the risk register to show your decisions when you're done. When you're done with **Plan Risk Responses**, you should be able to tell your change control board what your response plans are and who will be in charge of them so they can use them to evaluate changes.



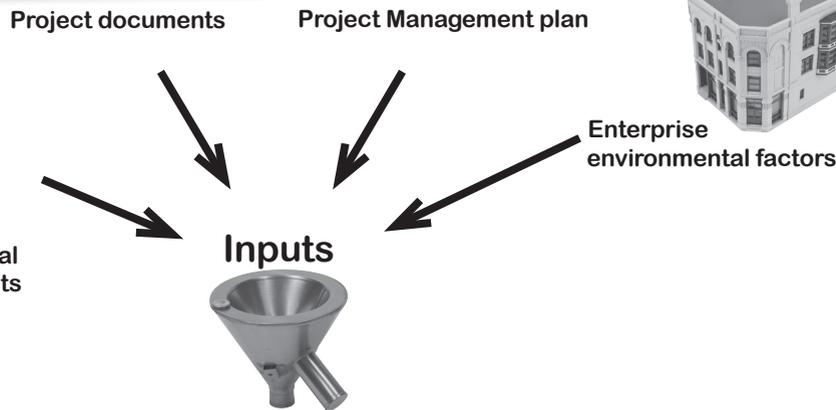
## Plan Risk Responses is figuring out what you'll do if risks happen.

You've updated your risk register so far. It should contain everything you know about the risks facing your project, and even some preliminary responses you might have thought of along the way.

Some other documents you might use for this process: lessons learned register, project schedule, project team assignments, resource calendars, risk report, and the stakeholder register.

This includes the Resource Management plan, Risk Management plan, and cost baseline.

Identified Risks	Planned Responses	Next Steps	Category	Priority	Owner
1. Risk of budget overruns due to inflation.	Allocate a contingency reserve.	Review monthly.	Weather	Low	John
2. Risk of key personnel leaving the project.	Identify backup resources.	Review weekly.	Weather	High	Jane
3. Risk of delayed delivery of critical components.	Identify alternative suppliers.	Review weekly.	Weather	High	John
4. Risk of poor quality control.	Implement rigorous testing.	Review daily.	Weather	Low	Jane
5. Risk of regulatory changes.	Monitor industry news.	Review quarterly.	Storm	Low	Malina





### Expert judgment

You might need to reach out to somebody who has dealt with a risk you've identified before to understand the best way to respond to it.

### Contingent response strategies

Sometimes you need to make contingency plans in case an event occurs in your project. Say you miss an important milestone or a vendor you're depending on goes out of business. You might put together a plan that would be triggered by that event to keep your project on track.

### Data gathering: interviews

Interviewing stakeholders to get their opinions on the best way to respond to specific risks is a great way to put together a risk response plan.

### Decision making

#### Interpersonal and team skills: facilitation

#### Data analysis: alternatives analysis and cost-benefit analysis

You know these data analysis techniques already. They can help you figure out the best way to respond to the risks you've identified.

## It isn't always so bad

Remember the strategies for handling negative risks—avoid, mitigate, transfer, accept, and escalate—from earlier? Well, there are strategies for handling positive risks, too. The difference is that **strategies for opportunities** are all about how you can try to get the most out of them. The strategies for handling negative and positive risks are the tools and techniques for the Plan Risk Responses process.

The strategies for threats are also tools and techniques for this process. They're the ones you already learned: avoid, mitigate, transfer, accept, and escalate.

### 1 Exploit

This is when you do everything you can to make sure that you take advantage of an opportunity. You could assign your best resources to it. Or you could allocate more than enough funds to be sure that you get the most out of it.

### 3 Enhance

This is when you try to make the opportunity more probable by influencing its triggers. If getting a picture of a rare bird is important, then you might bring more food that it's attracted to.

### 5 Escalate

If you found an opportunity that might help your overall company strategy beyond what your project set out to do, you might escalate that opportunity to people who could take advantage of it.

### 2 Share

Sometimes it's harder to take advantage of an opportunity on your own. Then you might call in another company to share in it with you.

### 4 Accept

Just like accepting a negative risk, sometimes an opportunity just falls in your lap. The best thing to do in that case is to just accept it!

which response strategy?

In this exercise, you'll explore strategies for overall project risk, an important tool/technique of Plan Risk Responses.



## \* WHAT'S MY PURPOSE \*

Another tool of Plan Risk Responses is strategies for overall project risk, and it involves planning different risk responses based on the risk potentially faced by the project. Each of the techniques below is a different way project teams can handle risk. Can you figure out which risk response technique is being used in these situations? Match each technique to its scenario.

Mitigate

If the weather's good, then there's a chance you could see a meteor shower. If the team gets a photo that wins the meteor photo contest, you can get extra funding. You have your team stay up all night with their telescopes and cameras ready.

Avoid

You hear that it's going to rain for the first three days of your trip, so you bring waterproof tents and indoor projects for the team to work on in the meantime.

Accept

You read that there's a major bear problem in the spring on the cliff where you are planning to work. You change your project start date to happen in the fall.

Transfer

On your way up the cliff, you meet another team that is looking to survey the area. You offer to do half of the surveying work while they do the other half and then trade your findings with each other.

Exploit

There's a high probability of water damage to some of your equipment, so you buy insurance to avoid losses.

Share

There's always the chance that someone could make a mistake and fall off the cliff. No matter how much you plan for the unexpected, sometimes mistakes happen.

Enhance

About 10 years ago a really rare bird, the black-throated blue warbler, was seen on this cliff. If you could get a picture of it, it would be worth a lot of money. So, you bring special seeds that you have read are really attractive to this bird, and you set up lookout points around the cliff with cameras ready to get the shot.

—————> **Answers on page 630.**

# Add risk responses to the register

## Outputs



It's time to add—you guessed it—more updates to project documents, including the risk register. All of your risk responses will be tracked through change control. Changes that you need to make to the plan will get evaluated based on your risk responses, too. It's even possible that some of your risk responses will need to be added into your contract.

Every risk needs to have one person who owns the response plan.

	Identified risks	Response strategy	Root cause	Risk owner	Cat	Priority	Urgency
1.	Landslide caused by loose gravel and dirt on the nearby mountain	Put up barrier or dig trench	Geological data review found loose topsoil nearby	Joe S.	Natural	High	Medium
2.	High winds can lead to cliff disaster	Reinforce tent stakes; obtain weatherproof equipment	National Weather Service predicts 35% chance of high winds	Tanya I.	Natural	High	Medium
3.	Truck rental is unavailable	Pay to reserve equipment at a second company	Higher-than-expected demand for equipment this season	Joe S.	Equipment	High	High
4.	Storms predicted through the first two weeks of project schedule time	<b>Buy storm insurance in case the equipment is damaged</b>	El Niño weather pattern	Michael R.	Natural	Medium	Low
5.	Supply shortage if we don't accurately predict food needs		Nearest store is 30 miles away	James S.	Equipment	Low	High
6.	If someone gets sick, it could be a problem getting medical care	Bring a doctor with us on the project	Nearest hospital is 50 miles away	Tanya I.	Human	Low	Low
7.	Someone could fall in the landslide trench	Set up a trench patrol to make sure no one gets hurt	Dig trench for landslides	Joe S.	Human	Low	Low

During Plan Risk Responses, the team agreed to buy insurance for this one.



Project Management plan updates

The PM plan needs to be updated so that integrated change control can include the risk responses.



Project documents updates



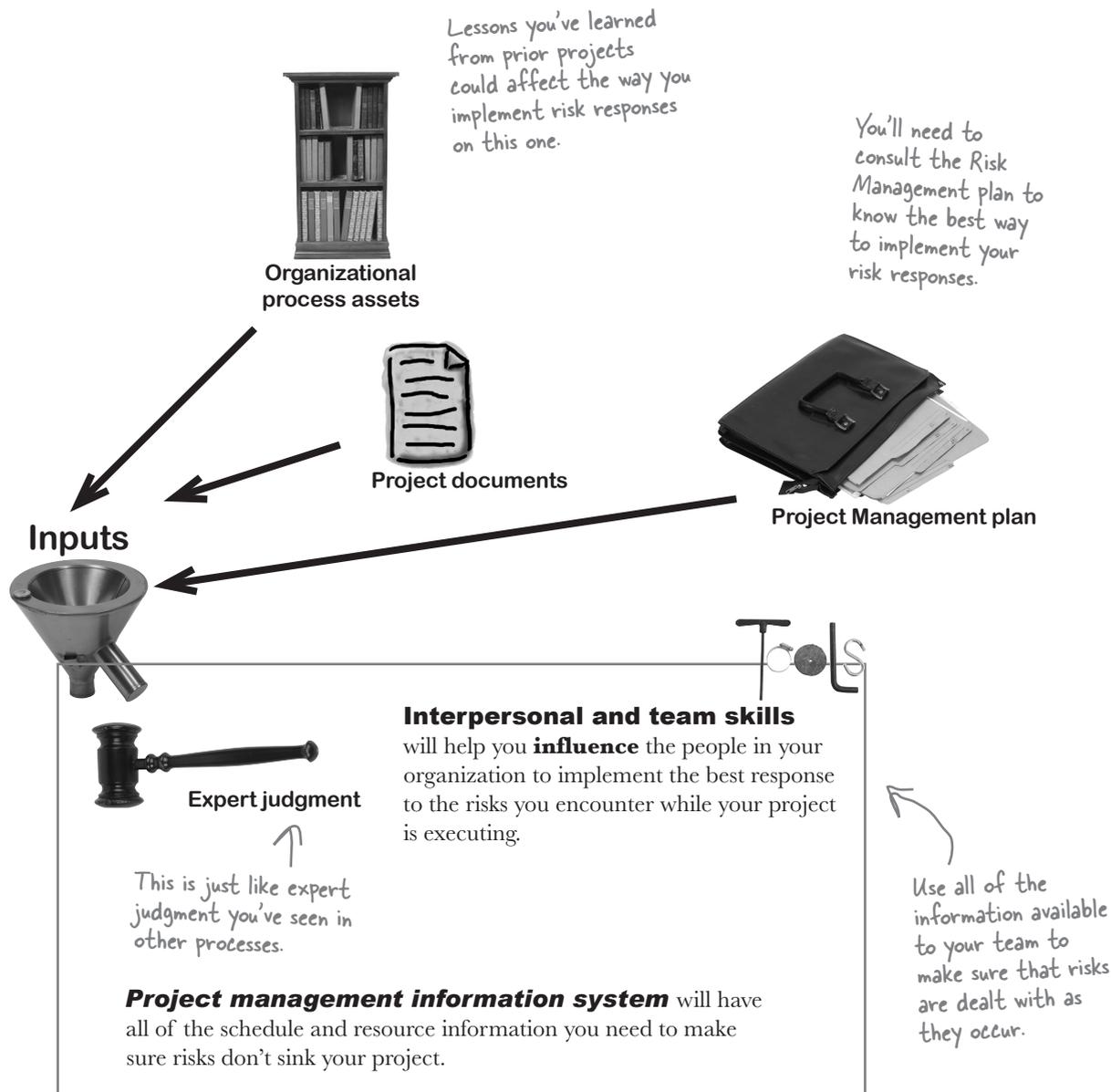
Change requests

## Implement Risk Responses

Now that you've planned responses to risk, you're ready to put that plan into action. The next process, **Implement Risk Responses**, is all about what you do when you run into an occurrence of the risks you've identified. This is where you actually respond to the risk by doing what's in your plan.



Executing  
process  
group



## Outputs



Changes to the plan will always need to go through change control.



Change requests



Project documents updates

*As you implement your risk responses, make sure project documents are updated to include the new information you uncover.*

## As you respond to risk, you update your project documents

Think about all of the documents that might need to change as you put your risk responses into action. You might identify new issues that need to be added to the issue log. Or, you could learn something new from a risk that you encounter and need to make an update to the lessons learned register. You could need to change the way your team is assigned in order to respond to a risk that happens. There's always the possibility that you could need to change the risk register and the risk report themselves as you learn more about the risks you've planned for.

## Risk response can find even more risks

**Secondary risks** come from a response you have to another risk. If you dig a trench to stop landslides from taking out your camp, it's possible for someone to fall into the trench and get hurt.

**Residual risks** remain after your risk responses have been implemented. So even though you reinforce your tent stakes and get weatherproof gear, there's still a chance that winds could destroy your camp if they are strong enough.



Why do you think expert judgment is a tool for the Implement Risk Responses process?



## Risk Management Exposed

This week's interview:  
Stick figure who hangs out on cliffs

**Head First:** We've seen you hanging out on cliffs for a while now. Apparently, you've also been paying people to stand on the cliff for you, or getting a friend to hold a trampoline at the foot of the cliff; we've even seen you jump off of it. So now that I've finally got a chance to interview you, I want to ask the question on everyone's mind: "Are you insane? Why do you spend so much time up there?"

**Stick Figure:** First off, let me dispel a few myths that are flying around out there about me. I'm not crazy, and I'm not trying to get myself killed! Before Risk Management entered my life I, like you, would never have dreamed of doing this kind of thing.

**Head First:** OK, but I'm a little skeptical about your so-called "Risk Management." Are you trying to say that because of Risk Management you don't have to worry about the obvious dangers of being up there?

**Stick Figure:** No. Of course not! That's not the point at all. Risk Management means you sit down and make a list of all of the things that could go wrong. (And even all the things that could go right.) Then you really try to think of the best way to deal with anything unexpected.

**Head First:** So you're doing this Risk Management stuff to make it less dangerous for you?

**Stick Figure:** Yes, exactly! By the time I'm standing up there on that cliff, I've really thought my way through pretty much everything that might happen up there. I've thought through it both qualitatively and quantitatively.

**Head First:** Quantitatively?

**Stick Figure:** Yes. You don't think I'd go up there without knowing the wind speed, do you? Chance of landslides? Storms? The weight of everything I'm carrying? How likely I am to fall in weather conditions? I think about all of that and I measure it. Then I sit down and come up with risk response strategies.

**Head First:** OK, so you have strategies. Then what?

**Stick Figure:** Then I constantly monitor my risks while I'm on the cliff. If anything changes, I check to see if it might trigger any of the risks I've come up with. Sometimes I even discover new risks while I'm up there. When I do, I just add them to the list and work on coming up with responses for them.

**Head First:** I see. So you're constantly updating your list of risks.

**Stick Figure:** Yes! We call it a **risk register**. Whenever I have new information, I put it there. It means that I can actually hang out on these cliffs with a lot of confidence. Because, while you can't guarantee that nothing will go wrong, you can be prepared for whatever comes your way.

**Head First:** That's a lot of work. Does it really make a difference?

**Stick Figure:** Absolutely! I'd never be able to sleep at night knowing that I could fall off the cliff at any time. But I've planned for the risks, and I've taken steps to stay safe...and I sleep like a baby.



# You can't plan for every risk at the start of the project

Even the best planning can't predict everything—there's always a chance that a new risk could crop up that you hadn't thought about. That's why you need to constantly monitor how your project is doing compared to your risk register. If a new risk happens, you have a good chance of catching it before it causes serious trouble. When it comes to risk, the earlier you can react, the better for everybody. And that's what the **Monitor Risks** process is all about.



The park ranger's come by to let you know about some recent bear sightings on this cliff.

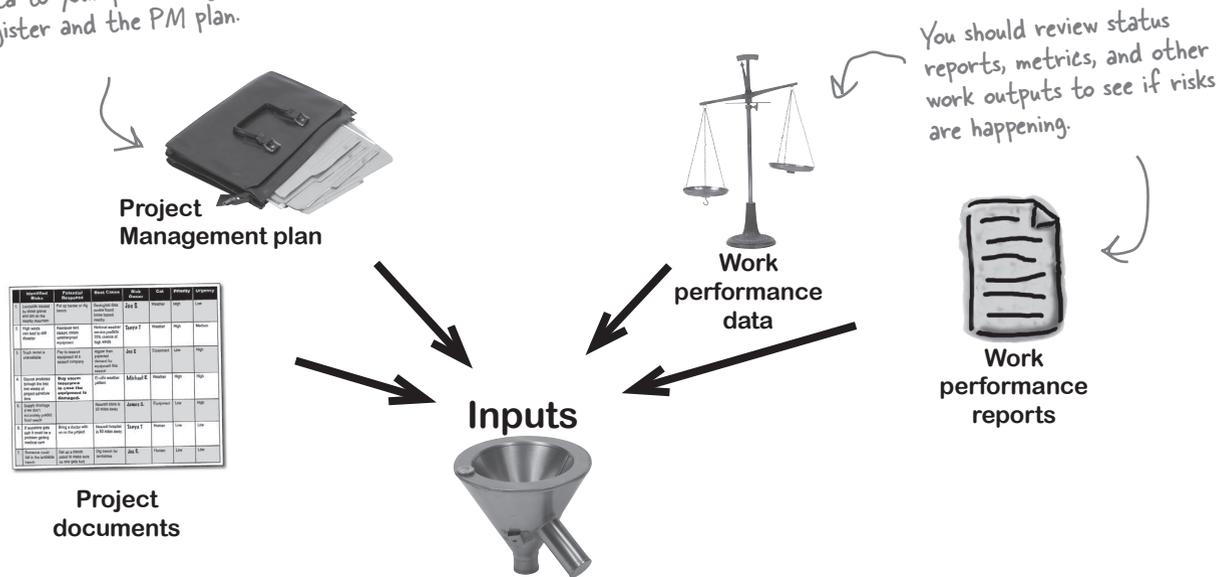
Identified Risks	Potential Response	Root Cause	Risk Owner	Cat	Priority	Urgency
1. Limited resources to build phase and get on the risky duration	Full on resource or do	Geological data review found some loose rubble	Joe S	Weather	High	Low
2. High winds	Reinforce tent fabric, obtain weatherproof equipment	Extreme weather service predicts 25% chance of high winds	Tanya T	Weather	High	Medium
3. Truck rental is unavailable	Pay to reserve equipment at a second company	Higher than expected demand for equipment this season	Joe S	Equipment	Low	High
4. Items not packed through the first two weeks of project schedule time	Buy storm insurance, the chance the equipment is damaged	Unstable weather pattern	Michael R	Weather	High	High
5. Supply shortage if we don't accurately predict fuel needs		Hazardous items in 20 miles away	James S	Equipment	Low	High
6. If someone gets sick it could be a problem getting medical care	Bring a doctor with us on the project	Nearest hospital is 10 miles away	Tanya T	Human	Low	Low
7. Someone could fall in the unstable trench	Set up a trench post to make sure no one gets hurt	Clay trench for landslides	Joe S	Human	Low	Low

The risk register doesn't say anything about handling bears. Looks like this is a new risk altogether...

# Monitor Risks is another change control process

Risk responses are treated just like changes. You monitor the project in every status meeting to see how the risks in the risk register are affecting it. If you need to implement a risk response, you take it to your change control board, because it amounts to a change that will affect your project constraints.

You compare all of your actual data to your plans using the risk register and the PM plan.



You should keep monitoring your risks at every meeting until the project is closed.

That's why the tools and techniques include status meetings.

- Weekly Meeting Agenda
1. Review work performance information and earned value numbers
  2. Examine performance reports.
    - What have people gotten done?
  3. Review risk register.
    - Have any risks occurred that require implementation of a risk response strategy?
    - Have we identified any new risks that need to be analyzed?

**Risk monitoring should be done at every status meeting.**

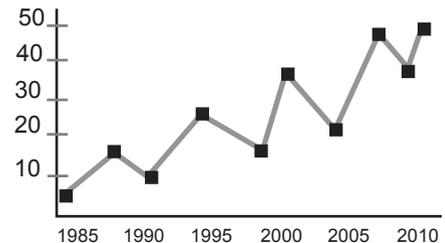


## How to monitor your risks

Monitoring risks means keeping your finger on the pulse of the project. If you are constantly reviewing all of the data your project is producing, you will be able to react quickly if a new risk is uncovered, or if it looks like one of your response strategies needs to spring into action. Without careful monitoring, even your best plans won't get implemented in time to save your project if a risk happens. Here are the **data analysis techniques** you'll need to use when you monitor your risks.

### Technical performance analysis

Comparing the actual project performance to the plan is a great way to tell if a risk might be happening. If you find that you're significantly over budget or behind schedule, a risk could have cropped up that you didn't take into account. Looking for trends in your defects or schedule variance, for example, might show patterns that indicate that risks have occurred before you would have found that out on your own.



### Reserve analysis

Just like you keep running tabs on your budget, you should always know how much money you have set aside for risk response. As you spend it, be sure to subtract it so you know if you have enough to cover all of your remaining risks. If you start to see that your reserves are running low and there are still a lot of risks being identified, you might be in trouble. Keeping tabs on your reserves means that you will always know if you need to set aside more funds or make different choices about how to handle risks as they come up.



Sometimes this kind of reserve is called a "contingency"—because its use is contingent on a certain risk happening.

**Analyze the data you gather in project status meetings to determine how your project is managing risk.**

## More control risk tools and techniques

There are just a few more tools in the **Monitor Risks** process. They're all focused on finding new risks if they crop up, dealing with changes to the risks you've already planned for, and responding quickly to risks you know how to handle.



**Audits** are when you have an outside party come in and take a look at your risk response strategies to judge how effective they are. Sometimes risk audits will point out better ways of handling a specific risk so that you can change your response strategy going forward.

Auditors will also look at how effective your overall processes for risk planning are.

**Meetings** are the most important way to keep the team up to date on risk planning—so important that **they should happen throughout the entire project**. The more you talk about risks with the team, the better. Every single status meeting should have risk review on the agenda. Status meetings are a really important way of noticing when things might go wrong, and of making sure that you implement your response strategy in time. It's also possible that you could come across a new opportunity by talking to the team.



## Never stop looking for new risks and adapting your strategies for dealing with them.



**Exercise**

Here are some risk monitoring and control activities. Can you determine which of the tools is being used in each one?

1. At every milestone, you do a new round of Identify Risks and make sure that the risks in your risk register still apply to the project.

- Meetings
- Audit
- Technical performance analysis
- Reserve analysis

2. You check to make sure that you have all of the features developed in your project that you had planned when you reach the “feature complete” milestone. When you find that you are missing one of the planned features, you realize that a new risk has shown up—you missed one of the required features in your functional specification.

- Meetings
- Audit
- Technical performance analysis
- Reserve analysis

3. You take a look at the number of defects you have found in your project per phase and find that it is higher in your project than it has been in most other projects that the company is doing. You dig a little deeper and find some previously unplanned risks that have been causing trouble on your project.

- Meetings
- Audit
- Technical performance analysis
- Reserve analysis

4. Your company sends a risk expert in to take a look at your risk response strategies. She finds that you are missing a few secondary risks that might be caused by the responses you have planned. So you update your risk register to include the secondary risks.

- Meetings
- Audit
- Technical performance analysis
- Reserve analysis

5 You decide to implement a risk response that costs \$4,000. You check to make sure that you have enough money to cover the rest of the risks that might happen from here on out in the project.

- Meetings
- Audit
- Technical performance analysis
- Reserve analysis

Answers:  
 1—Meetings  
 2—Technical performance analysis  
 3—Technical performance analysis  
 4—Audit  
 5—Reserve analysis

## there are no Dumb Questions

**Q:** Why do I need to ask about risks at every status meeting?

**A:** Because a risk could crop up at any time, and you need to be prepared. The better you prepare for risks, the more secure your project is against the unknown. That's also why the triggers and watch lists are really important. When you meet with your team, you should figure out if a trigger for a risk response has happened. And you should check your watch list to make sure none of your low-priority risks have materialized.

For the test, you need to know that status meetings aren't just a place for you to sit and ask each member of your team to tell you his or her status. Instead, you use them to figure out decisions that need to be made to keep the project on track or to head off any problems that might be coming up. In your status meetings, you need to discuss all of the issues that involve the whole team and come up with solutions to any new problems you encounter. So, it makes sense that you would use your status meetings to talk about your risk register and make sure that it is always up to date with the latest information.

**Q:** I still don't get technical performance analysis. How does it help me find risks?

**A:** It's easy to miss risks in your project—sometimes all the meetings in the world won't help your team see some of them. That's why a tool like trend analysis can be really useful. Remember the control chart from Chapter 8? This is really similar, and it's just as valuable. It's just a way to see if things are happening that you did not plan for.

**Q:** Hey, didn't you talk about risks back in the Project Schedule Management chapter too?

**A:** Wow—it's great that you remembered that! The main thing to remember about risks from Chapter 6 is that having a very long critical path or, even worse, multiple critical paths, means you have a riskier project. The riskiest is when all of the activities are on the critical path. That means that a delay to even one activity can derail your whole project.

**Q:** Shouldn't I ask the sponsor about risks to the project?

**A:** Actually, the best people to ask about risks are the project team itself. The sponsor knows why the project is needed and how much money is available for it, but from there, it's really up to the team to manage risks. Since you are the ones doing the work, it makes sense that you would have a better idea of what has gone wrong on similar projects and what might go wrong on this one. Identify Risks, Perform Qualitative and Quantitative Risk Analysis, and Plan Risk Responses are some of the most valuable contributions the team makes to the project. They can be the difference between making the sponsor happy and having to do a lot of apologizing.

**Q:** Why do we do risk audits?

**A:** Risk audits are when you have someone from outside your project come in and review your risk register—your risks and your risk responses—to make sure you got it right. The reason we do it is because risks are so important that getting a new set of eyes on them is worth the time.

**Q:** Hold on, didn't we already talk about reserves way back in the Cost Management chapter? Why is it coming up here?

**A:** That's right, back in Chapter 7 we talked about a **management reserve**, which is money set aside to handle any unknown costs that come up on the project. That's a different kind of reserve than the one for controlling risks. The kind of reserve used for risks is called a **contingency reserve**, because its use is *contingent* on a risk actually materializing.

Project managers sometimes talk about both kinds of reserves together, because they both have to show up on the same budget. When they do, you'll sometimes hear talk of “known unknowns” and “unknown unknowns.” The management reserve is for unknown unknowns—things that you haven't planned for but could impact your project. The contingency reserve is for known unknowns, or risks that you know about and explicitly planned for and put in your risk register.

**The better you  
prepare for risks,  
the more secure  
your project  
is against the  
unknown.**

# Sharpen your pencil

## Outputs



By now, you know what comes out of a typical Monitoring and Controlling process. Draw in the missing outputs for Monitor Risks.

Identified Risk	Potential Response	Root Cause	Risk Owner	Cell	Priority	Urgency
1. Low-level issues in long group not set at the ready location	Put up banner of fly	Ecological data	Joe S	Weather	High	Low
2. High winds on road in old theater	Fluctuate last	Historical weather	Esaya T	Weather	High	Medium
3. Truck used as a conference	Pay to repair	Higher than	Joe S	Equipment	Low	High
4. Errors produced through the first	Buy new	25% chance of	Michael		High	High
5. Supply shortage	Buy new	20 miles away				
6. A customer gets	Bring to stock	20 miles away				
7. Someone says	Set up a bench	20 miles away	Joe E.			

You'll find all sorts of things that need to be fixed. But you can't just go update the plan—you need this as an input to kick off change control.

This one's all about helping others to learn from what's happened on your project.

### Monitor Risks



Work performance information

This set of documents needs to be updated any time your plans change.

For this one, think about what you do once you have evaluated work performance information and found that something needs to happen.

# Sharpen your pencil Solution

## Outputs

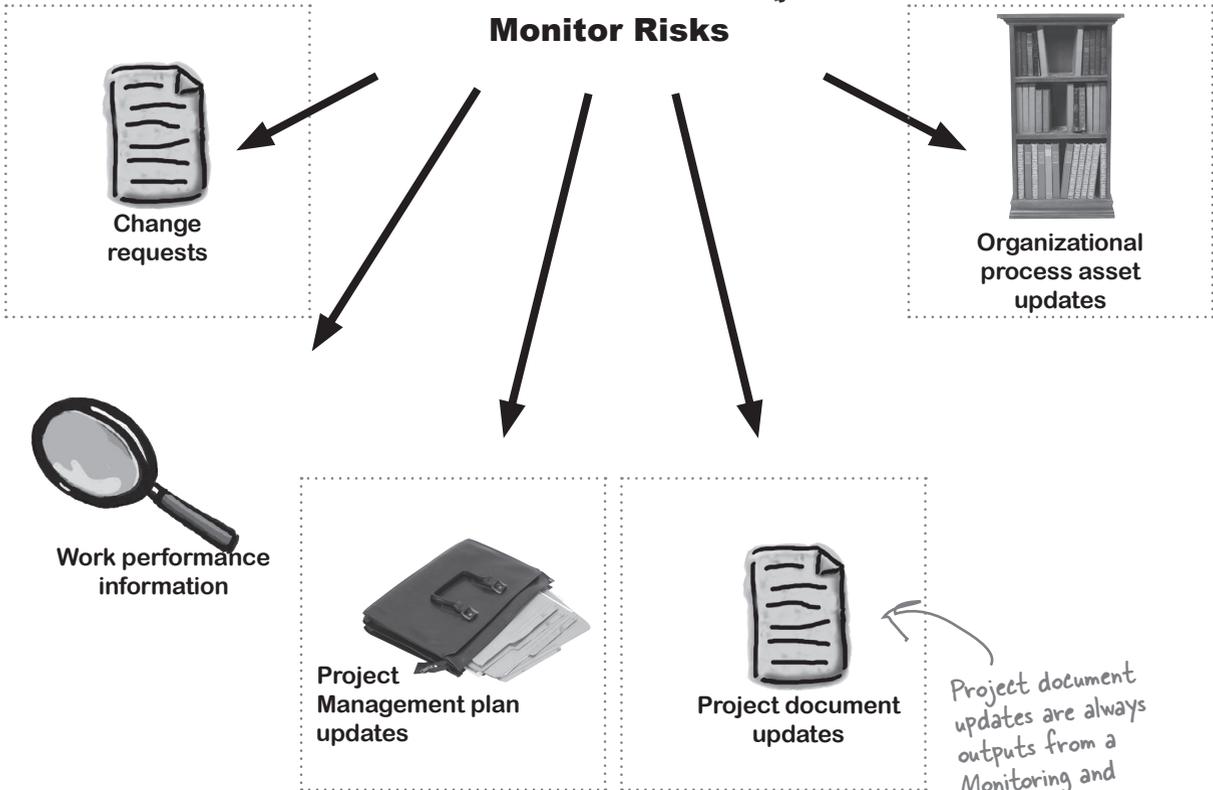


By now, you know what comes out of a typical Monitoring and Controlling process. Draw in the missing outputs for Monitor Risks.

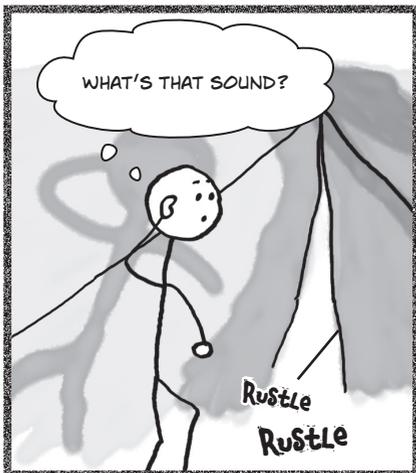
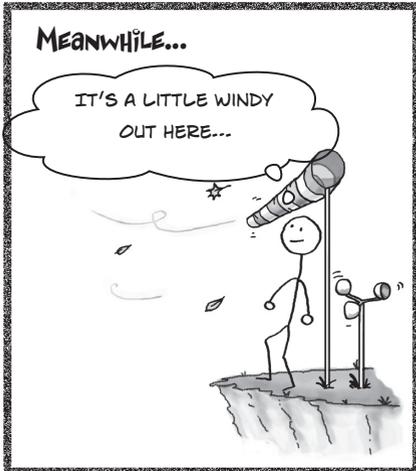
Risk monitoring and controlling is exactly like the other change control processes.

Identified Risk	Potential Response	Root Cause	Risk Owner	Cell	Priority	Urgency
1. Low-level threat to long-term goal due to the weather forecast.	Put up barrier of fly mesh.	Ecological data is not being used to track trends.	Joe S.	Weather	High	Low
2. High winds on road to city threaten.	Practice test about safety weatherproof equipment.	National weather service predicts 25% chance of high winds.	Elena T.	Weather	High	Medium
3. Truck needs a maintenance.	Pay to repair equipment of second company.	Higher than expected demand for equipment this season.	Joe S.	Equipment	Low	High
4. Events predicted through the first two weeks of project schedule that developments be damaged.	Buy additional insurance to cover the developments be damaged.	25 mph weather pattern.	Michelle		High	High
5. Supply shortage (one day) could threaten project lead time.		Recent storm 20 miles away.				
6. A customer gets sick if food is a certain grade medical unit.	Bring in stock with 48 hr in the project.	Recent flu season is 50 miles away.	Recent flu season			
7. Someone could fall in the bathtub.	Put up a fence around the area to prevent falls.	City health inspection.	Joe E.			

### Monitor Risks



Project document updates are always outputs from a Monitoring and Controlling process.



\* Note from the authors: We're not exactly sure why he feels his mission was accomplished after spraying a bear in the face and then jumping off of a cliff. But it seems to work!

## Question Clinic: The which-is-NOT question



YOU'LL SEE SOME QUESTIONS ON THE EXAM THAT LIST INPUTS, OUTPUTS, TOOLS, OR CONCEPTS AND ASK YOU TO DETERMINE WHICH ONE OF THEM IS NOT PART OF THE GROUP. USUALLY, YOU CAN FIGURE THEM OUT BY GOING THROUGH THE ANSWER CHOICES ONE BY ONE AND ELIMINATING THE ONE THAT DOESN'T BELONG.

This is the one with tornado diagrams. It's got to be part of the group.

This one is definitely a quantitative analysis technique. Multiplying probability with the value of positive and negative outcomes of the project is all about putting numbers to risk.

Remember reading something about Monte Carlo back in Chapter 6? It might be right...right? But wait, it's also a tool for using random numbers to model out possible risks on the project. It's definitely part of quantitative analysis.

117. Which of the following is not a quantitative analysis technique?

- A. Sensitivity analysis
- B. Expected monetary value
- C. Monte Carlo analysis
- D. Reserve analysis

D's definitely the right answer. It's about numbers, but it isn't concerned with assigning numbers to the risk. It's about keeping tabs on the contingency reserve when risks materialize, so it's a Monitoring and Controlling process. This has to be it!

TAKE YOUR TIME AND THINK YOUR WAY THROUGH IT. ALL OF THEM WILL HAVE SOMETHING IN COMMON BUT ONE. AS LONG AS YOU REMEMBER THE GROUP YOU'RE FITTING THEM INTO, YOU WON'T HAVE ANY TROUBLE.



**Take your time answering which-is-NOT questions.**

# HEAD LIBS



Fill in the blanks to come up with your own which-is-NOT question!

Which of the following is NOT a \_\_\_\_\_ ?  
(input, output, tool, process, or concept)

A. \_\_\_\_\_  
(input, output, tool, or process that is in the group)

B. \_\_\_\_\_  
(input, output, tool, or process that is in the group)

C. \_\_\_\_\_  
(input, output, tool, or process that is in the group)

D. \_\_\_\_\_  
(the right answer)

**Sharpen your pencil**  
**Solution**



You'll need to know how to do EMV calculations for the test. Give them a shot now—they're pretty easy once you get the hang of them.

Take a look at this table of risks.

Risk	Probability	Impact
Navigation equipment failure	15%	costs \$300 due to getting lost
Unseasonably warm weather	8%	save \$500 in excavation costs
Wild animals eat rations	10%	costs \$100 for replacements

1. Calculate the EMV for each of these three risks.

**Navigation equipment failure:  $15\% \times -\$300 = -\$45.00$**

**Unseasonably warm weather:  $8\% \times \$500 = \$40.00$**

**Wild animals eat rations:  $10\% \times -\$100 = -\$10.00$**

Don't forget to use a positive value here because it's an opportunity, not a threat.

2. If these are the only risks on the project, calculate the total EMV.

**Total EMV =  $-\$45.00 + \$40.00 + -\$10.00 = -\$15.00$**

You get the total EMV by adding up the EMV for each risk.

3. The latest weather report came out, and there is now a 20% chance of unseasonably warm weather. What's the new EMV for the project?

**Unseasonably warm weather:  $20\% \times \$500 = \$100.00$**

**The new total EMV =  $-\$45.00 + \$100.00 + -\$10.00 = \$45.00$**

The EMV is now positive, which means the project should cost less than you originally budgeted.

4. Now the cost of replacement rations goes up to \$150. What's the new EMV for the project?

**Wild animals eat rations:  $10\% \times -\$150 = -\$15.00$**

**The new total EMV =  $-\$45.00 + \$100.00 + -\$15.00 = \$40.00$**



## Exercise Solution

Looking at the decision tree on the facing page, see if you can figure out the expected monetary value depending on the decisions the team makes.

When the probability of high winds changed to 45%, then the probability of low winds also changed: to 55%.

1. You hear a weather report that says there's now a 45% chance of high winds. Does it still make sense to buy the heavier tent?

$$\text{EMV of choosing the heavier tent: } -\$350 \text{ plus } (45\% \times -\$48) \text{ plus } (55\% \times -\$10) = -\$377.10$$

$$\text{EMV of choosing the lighter tent: } -\$130 \text{ plus } (45\% \times -\$953) \text{ plus } (55\% \times -\$15) = -\$567.10$$

**It still makes sense to choose the heavier tent.**

2. If you don't buy the heavier tent, then you have room to take along a wind generator that can power your equipment, and that will save you \$1,100 in portable batteries if there's a heavy wind. If there's still a 45% chance of high winds, does it still make sense to buy the heavier tent?

$$\text{EMV of choosing the heavier tent: } -\$350 \text{ plus } (45\% \times -\$48) \text{ plus } (55\% \times -\$10) = -\$377.10$$

$$\text{EMV of choosing the lighter tent: } -\$130 \text{ plus } (45\% \times \$147) \text{ plus } (55\% \times -\$15) = -\$72.10$$

**Now it makes sense to choose the lighter tent.**

So where did this \$147 come from? Well, if there's a heavy wind, then the generator turns this into an opportunity. You'll still see \$953 in equipment damage, but that's offset by the \$1,100 in savings for portable batteries. That puts you ahead by \$147—but only if there's a heavy wind!

# \* WHAT'S MY PURPOSE \*

Which risk response technique is being used in these situations? Match each technique to its scenario.

Mitigate	—	If the weather's good, then there's a chance you could see a meteor shower. If the team gets a photo that wins the meteor photo contest, you can get extra funding. You have your team stay up all night with their telescopes and cameras ready.
Avoid	—	You hear that it's going to rain for the first three days of your trip, so you bring waterproof tents and indoor projects for the team to work on in the meantime.
Accept	—	You read that there's a major bear problem in the spring on the cliff where you are planning to work. You change your project start date to happen in the fall.
Transfer	—	On your way up the cliff, you meet another team that is looking to survey the area. You offer to do half of the surveying work while they do the other half and then trade your findings with each other.
Exploit	—	There's a high probability of water damage to some of your equipment, so you buy insurance to avoid losses.
Share	—	There's always the chance that someone could make a mistake and fall off the cliff. No matter how much you plan for the unexpected, sometimes mistakes happen.
Enhance	—	About 10 years ago a really rare bird, the black-throated blue warbler, was seen on this cliff. If you could get a picture of it, it would be worth a lot of money. So, you bring special seeds that you have read are really attractive to this bird, and you set up lookout points around the cliff with cameras ready to get the shot.

## Exam Questions

1. The project manager for a construction project discovers that the local city council may change the building code to allow adjoining properties to combine their sewage systems. She knows that a competitor is about to break ground in the adjacent lot and contacts him to discuss the possibility of having both projects save costs by building a sewage system for the two projects.

**This is an example of which strategy?**

- A. Mitigate
- B. Share
- C. Accept
- D. Exploit

**2. Which of the following is NOT a risk response technique?**

- A. Exploit
- B. Transfer
- C. Mitigate
- D. Collaborate

**3. You are using an RBS to manage your risk categories. What process are you performing?**

- A. Plan Risk Management
- B. Identify Risks
- C. Perform Qualitative Risk Analysis
- D. Perform Quantitative Risk Analysis

**4. Which of the following is used to monitor low-priority risks?**

- A. Triggers
- B. Watch lists
- C. Probability and Impact matrix
- D. Monte Carlo analysis

## Exam Questions

5. You're managing a construction project. There's a 30% chance that weather will cause a three-day delay, costing \$12,000. There's also a 20% chance that the price of your building materials will drop, which will save \$5,000. What's the total EMV for both of these?

- A. -\$3,600
- B. \$1,000
- C. -\$2,600
- D. \$4,600

6. Joe is the project manager of a large software project. When it's time to identify risks on his project, he contacts a team of experts and sends them a list of questions to help them all come up with a list of risks and send it in. What technique is Joe using?

- A. SWOT
- B. Ishikawa diagramming
- C. Interviews
- D. Brainstorming

7. Susan is the project manager on a construction project. When she hears that her project has run into a snag due to weeks of bad weather on the job site, she says "No problem, we have insurance that covers cost overruns due to weather." What risk response strategy did she use?

- A. Exploit
- B. Transfer
- C. Mitigate
- D. Avoid

8. You're performing Identify Risks on a software project. Two of your team members have spent half of the meeting arguing about whether or not a particular risk is likely to happen on the project. You decide to table the discussion, but you're concerned that your team's motivation is at risk. The next item on the agenda is a discussion of a potential opportunity on the project in which you may be able to purchase a component for much less than it would cost to build.

Which of the following is NOT a valid way to respond to an opportunity?

- A. Exploit
- B. Transfer
- C. Share
- D. Enhance

## Exam Questions

9. Risks that are caused by the response to another risk are called:

- A. Residual risks
- B. Secondary risks
- C. Cumulative risks
- D. Mitigated risks

10. What's the main output of the Risk Management processes?

- A. The Risk Management plan
- B. The risk breakdown structure
- C. Work performance information
- D. The risk register and project documents updates

11. Tom is a project manager for an accounting project. His company wants to streamline its payroll system. The project is intended to reduce errors in the accounts payable system and has a 70% chance of saving the company \$200,000 over the next year. It has a 30% chance of costing the company \$100,000.

What's the project's EMV?

- A. \$170,000
- B. \$110,000
- C. \$200,000
- D. \$100,000

12. What's the difference between management reserves and contingency reserves?

- A. Management reserves are used to handle known unknowns, while contingency reserves are used to handle unknown unknowns.
- B. Management reserves are used to handle unknown unknowns, while contingency reserves are used to handle known unknowns.
- C. Management reserves are used to handle high-priority risks, while contingency reserves are used to handle low-priority risks.
- D. Management reserves are used to handle low-priority risks, while contingency reserves are used to handle high-priority risks.

## Exam Questions

**13. How often should a project manager discuss risks with the team?**

- A. At every milestone
- B. Every day
- C. Twice
- D. At every status meeting

**14. Which of the following should NOT be in the risk register?**

- A. Watch lists of low-priority risks
- B. Relative ranking of project risks
- C. Root causes of each risk
- D. Probability and Impact matrix

**15. Which of the following is NOT true about Risk Management?**

- A. The project manager is the only person responsible for identifying risks.
- B. All known risks should be added to the risk register.
- C. Risks should be discussed at every team meeting.
- D. Risks should be analyzed for impact and priority.

**16. You're managing a project to remodel a kitchen. You find out from your supplier that there's a 50% chance that the model of oven that you planned to use may be discontinued, and you'll have to go with one that costs \$650 more. What's the EMV of that risk?**

- A. \$650
- B. -\$650
- C. \$325
- D. -\$325

**17. Which risk analysis tool is used to model your risks by running simulations that calculate random outcomes and probabilities?**

- A. Monte Carlo analysis
- B. Sensitivity analysis
- C. EMV analysis
- D. Delphi technique

## Exam Questions

18. A construction project manager has a meeting with the team foreman, who tells him that there's a good chance that a general strike will delay the project. They brainstorm to try to find a way to handle it, but in the end decide that if there's a strike, there is no useful way to minimize the impact to the project. This is an example of which risk response strategy?

- A. Mitigate
- B. Avoid
- C. Transfer
- D. Accept

19. You're managing a project to fulfill a military contract. Your project team is assembled, and work has begun. Your government project officer informs you that a supplier that you depend on has lost the contract to supply a critical part. You consult your risk register and discover that you did not plan for this. What's the BEST way to handle this situation?

- A. Consult the Probability and Impact matrix
- B. Perform Quantitative and Qualitative Risk Analysis
- C. Recommend preventive actions
- D. Look for a new supplier for the part

20. Which of the following BEST describes risk audits?

- A. The project manager reviews each risk on the risk register with the team.
- B. A senior manager audits your work and decides whether you're doing a good job.
- C. An external auditor reviews the risk response strategies for each risk.
- D. An external auditor reviews the project work to make sure the team isn't introducing a new risk.

## Answers

~~Exam Questions~~**1. Answer: B**

Sharing is when a project manager figures out a way to use an opportunity to help not just her project but another project or person as well.

It's OK to share an opportunity with a competitor; that's a win-win situation.

**2. Answer: D**

Collaborating is a conflict resolution technique.

**3. Answer: A**

You use an RBS to figure out and organize your risk categories even before you start to identify them. Then you decompose the categories into individual risks as part of Identify Risks.

**4. Answer: B**

Your risk register should include watch lists of low-priority risks, and you should review those risks at every status meeting to make sure that none of them have occurred.

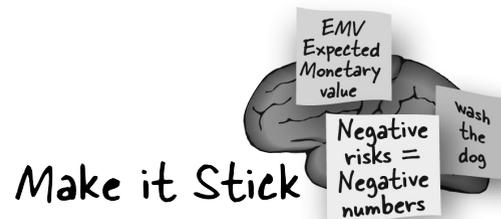
**5. Answer: C**

The expected monetary value (or EMV) of the weather risk is the probability (30%) times the cost (\$12,000), but don't forget that since it's a risk, that number should be negative. So its EMV is  $30\% \times -\$12,000 = -\$3,600$ . The building materials opportunity has an EMV of  $20\% \times \$5,000 = \$1,000$ . Add them up and you get  $-\$3,600 + \$1,000 = -\$2,600$ .

When you're calculating EMV, negative risks give you negative numbers.

**6. Answer: C**

Using the Interview technique, experts supply their opinions of risks for your project so that they each get a chance to think about the project.



# Answers

## Exam Questions

### 7. Answer: B

Susan bought an insurance policy to cover cost overruns due to weather. She transferred the risk from her company to the insurance company.

### 8. Answer: B

Wow, did you see that huge red herring?

You wouldn't want to transfer an opportunity to someone else! You always want to find a way to use that opportunity for the good of the project. That's why the response strategies for opportunities are all about figuring out ways to use the opportunity to improve your project (or another, in the case of sharing).

### 9. Answer: B

A secondary risk is a risk that could happen because of your response to another risk.

### 10. Answer: D

The processes of Risk Management are organized around creating the risk register, and updating it as part of project documents updates.

### 11. Answer: B

The key to this one is to remember that the money the project makes is positive, and the money it will cost is negative.

$\$200,000 \times 0.70 = \$140,000$  savings, and  $\$100,000 \times 0.30 = -\$30,000$  expenses. Add them together and you get  $\$110,000$ .

That's why it's useful to figure out the EMV for a risk—so you know how big your contingency reserve should be.

### 12. Answer: B

Contingency reserves are calculated during Perform Quantitative Risk Analysis based on the risks you've identified. You can think of a risk as a "known unknown"—an uncertain event that you know about, but which may not happen—and you can add contingency reserves to your budget in order to handle them. Management reserves are part of Cost Management—you use them to build a reserve into your budget for any unknown events that happen.

## Exam Questions

**13. Answer: D**

Risk monitoring and response is so important that you should go through your risk register at every status meeting!

**14. Answer: D**

The Probability and Impact matrix is a tool that you use to analyze risks. You might find it in your Project Management plan, but it's not included in the risk register.

**15. Answer: A**

It's really important that you get the entire team involved in the Identify Risks process. The more people who look for risks, the more likely it is that you'll find the ones that will actually occur on your project.

**16. Answer: D**

Even though this looks a little wordy, it's just another EMV question. The probability of the risk is 50%, and the cost is  $-\$650$ , so multiply the two and you get  $-\$325$ .

**17. Answer: A**

This is just the definition of Monte Carlo analysis. That's where you use a computer simulation to see what different random probability and impact values do to your project.

**18. Answer: D**

There are some risks that you just can't do anything about. When that happens, you have to accept them. But at least you can warn your stakeholders about the risk, so nobody is caught off guard.

## Answers

~~Exam Questions~~**19. Answer: D**

You've got an unplanned event that's happened on your project. Is that a risk? No. It's a project problem, and you need to solve that problem. Your Probability and Impact matrix won't help, because the probability of this happening is 100%—it's already happened. No amount of risk planning will prevent or mitigate the risk. And there's no sense in trying to take preventive actions, because there's no way you can prevent it. So the best you can do is start looking for a new part supplier.

**20. Answer: C**

It's a good idea to bring in someone from outside of your project to review your risks. The auditor can make sure that each risk response is appropriate and really addresses the root causes of each risk.

I SEE...THIS WASN'T  
A RISK AT ALL, IT WAS  
JUST A PROBLEM THAT CAME  
UP DURING THE PROJECT. I  
BET BETTER RISK PLANNING  
MIGHT HAVE HELPED THE  
TEAM PREPARE FOR THIS!





## 12 Procurement management

# *Getting some help*



**Some jobs are just too big for your company to do on its own.** Even when the job isn't too big, it may just be that you don't have the expertise or equipment to do it. When that happens, you need to use **Procurement Management** to find another company to **do the work for you**. If you find the **right seller**, choose the **right kind of relationship**, and make sure that the **goals of the contract are met**, you'll get the job done, and your project will be a success.

## Victim of her own success

Kate's last project went really well. In fact, maybe a little too well. The company's customer base grew so much that now the IT department's technical support staff is overwhelmed. Customers who call up looking for technical support have to spend a long time on hold, and that's not good for the company.



## Calling in the cavalry



WE'VE GOT A NEW PROJECT FOR YOU, KATE. WE FIGURE IT'S GOING TO TAKE ABOUT 18 MONTHS TO RAMP UP THE NEW TECH SUPPORT CALL CENTER. CAN YOU HANDLE IT?

**Kate:** No problem. The hard part will be figuring out how to manage the transition. Are we going to try to expand the team immediately, or call in a supplier to help us out?

**Ben:** Whoa, hold on there! Is going outside the company even an option?

**Kate:** Look, our tech support team is already at full capacity, and it'll take months to upgrade the facilities to handle more people...not to mention to hire and train the staff. We may be able to handle it ourselves, but there's a good chance that the easiest way to get the job done is to go outside our company to find a vendor to do the work.

**Ben:** But isn't it kind of risky thinking about working with another company? I mean, what if it goes out of business during our project? Or what if it costs too much?

**Kate:** Well, we'll need to make sure that we answer those questions. But this isn't the first time our company's brought on a contractor like this. The legal department has done this kind of thing before. I'll set up a meeting with somebody over there and see if they can help us out.

**Ben:** OK, you can follow up on that. But I'm still not sure about this.

**Sometimes you need to hire an outside company to do some of your project work. That's called procurement, and the outside company is called the seller.**

WAIT A MINUTE. I'M  
NOT A LAWYER. WHY SHOULD I  
HAVE TO KNOW A BUNCH OF DETAILS  
ABOUT CONTRACTING?



***You need to be involved because it's your project, and you're responsible for it.***

One of the most common mistakes people make on the exam (and in real life) is to assume that if another company is selling products or services for your project and they don't deliver, it's not your problem. After all, you've got a contract with the company, right? So if they don't deliver, they won't get paid.

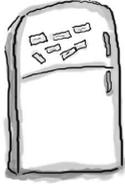
Well, it's not that simple. Yes, there are plenty of sellers who fail to deliver on their agreements. But for each seller that doesn't deliver, there's a frustrated project manager whose project ran into trouble because of it. That's why a lot of the Procurement Management tools and techniques are focused on selecting the *right* seller and communicating exactly what you'll need to the people doing the work.



**Watch it!**

***The PMP exam is based on contracting laws and customs in the United States.***

*Are you used to working in a country that ISN'T the US? Then you should be especially careful about these processes. You may be used to working with agreements in a way that isn't exactly the same as how they'll work on the exam questions. Luckily, the US government publishes a lot of information on contracting at <http://www.acquisition.gov>. Take a look at the site if you want a little more background.*



## Agreement Process Magnets

There are three Procurement Management processes. They're pretty easy to understand—you can probably guess which ones are which from their descriptions. Connect the description of each process with its name, and then try to guess which process group it's in.

### Descriptions of each process

### Process names

### Process groups

Plan out what you'll purchase, and how and when you will need the contracts to be negotiated for your project.

.....

.....

Decide on the seller (or sellers) you are going to work with, and finalize and sign the contract.

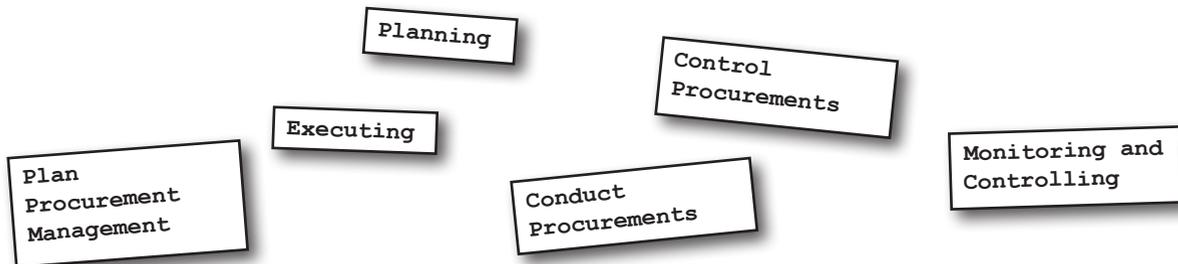
.....

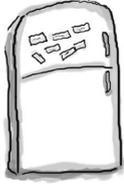
.....

Keep tabs on the contract. Make sure your company is getting what you paid for.

.....

.....





## Agreement Process Magnets Solutions

There are three Procurement Management processes. They're pretty easy to understand—you can probably guess which ones are which from their descriptions. Connect the description of each process with its name, and then try to guess which process group it's in.

### Descriptions of each process

Plan out what you'll purchase, and how and when you will need the contracts to be negotiated for your project.

Decide on the seller (or sellers) you are going to work with, and finalize and sign the contract.

Keep tabs on the contract. Make sure your company is getting what you paid for.

### Process names

Plan Procurement Management

Conduct Procurements

Control Procurements

### Process groups

Planning

Executing

Monitoring and Controlling

*This process is for making changes to the contract, and correcting any problems with the seller's work.*

## Ask the legal expert



HI KATE. I'M STEVE FROM LEGAL. BEN SAID YOU NEEDED TO TALK TO ME. DO YOU HAVE A MINUTE?

**Kate:** Thanks for coming by, Steve. We're looking for a contractor to handle tech support while we bring on more people in our call center. How do we normally handle this stuff?

**Steve:** Here's how it usually works. I'll actually write the contract and do the negotiation. But before I do that, I'll need to sit down with you to understand what the contract has to accomplish.

**Kate:** So I'm not involved at all?

**Steve:** Oh, you're definitely involved. You need to help with the negotiations, because you're the only person who really understands what we're trying to accomplish with the contract.

**Kate:** OK, that makes sense. So when do we get started?

**Steve:** Well, not so fast. We need to be really sure that the way we pick our vendors is absolutely fair. We've got some company guidelines that you'll need to follow. And once we've got the contract signed and the work is under way, we'll need to meet to make sure the contract is really being followed. And if there's a problem and we need to negotiate a change to the contract, you'll need me to do it.

**Kate:** OK, I can handle that. So should I start working on something to send out to sellers?

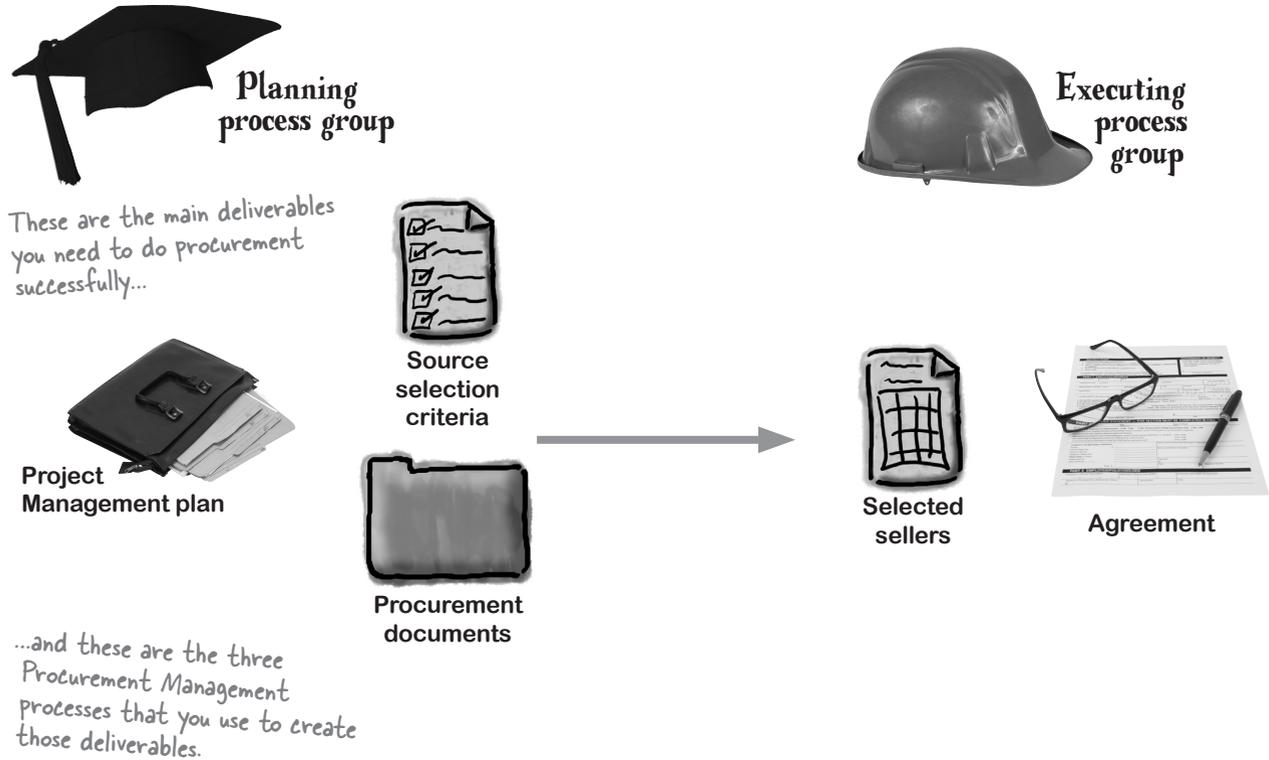
**Steve:** Not quite. Before we even get started with all of that, are you sure we really need to contract this work?



What should Kate do to figure out if it's really a good idea to contract the work?

## Anatomy of an agreement

Procurement is pretty intuitive, and the **Procurement Management processes** follow a really sensible order. First you plan what you need to contract; then you plan how you'll do it. Next, you send out your contract requirements to sellers. They bid for the chance to work with you. You pick the best one, and then you sign the contract with them. Once the work begins, you monitor it to make sure the contract is being followed.



### Plan Procurement Management

Here's where you take a close look at your needs, to be sure that you really need to create a contract. You figure out what kinds of contracts make sense for your project, and you try to define all of the parts of your project that will be contracted out.

You'll need to plan out each individual contract for the project work and work out how you'll manage it. That means figuring out what metrics it will need to meet to be considered successful, how you'll pick a seller, and how you'll administer the contract once the work is happening.

### Conduct Procurements

This process is all about getting the word out to potential agreement or contract partners about the project and how they can help you. You hold **bidder conferences** and find qualified sellers that can do the work.

Next, you evaluate all of the responses to your procurement documents and find the seller that suits your needs the best. When you find them, you sign the contract, and then the work can begin.

## You can have several contracts for a single project

The first Procurement Management process is **Plan Procurement Management**. It's a familiar planning process, and you use it to plan out all of your procurement activities for the project. The other processes are done separately for every contract. Here's an example. Say you're managing a construction project, and you've got one contract with an electrician and another one with a plumber. That means you'll go through those processes two separate times, once for each contractor.



*The work performance information tells you if there are problems with your agreement, so Control Procurements is just like any other Monitoring and Controlling process.*

### **Control Procurements**

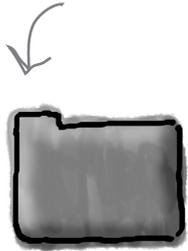
When the contract is under way, you stay on top of the work and make sure the contract is adhered to. You monitor what the contractor is producing and make sure everything is running smoothly. Occasionally, you'll need to make changes to the contract. Here's where you'll find and request those changes.



# Start with a plan for the whole project

You need to think about all of the work that you will contract out for your project before you do anything else. The **Plan Procurement Management process** is all about figuring that out, and writing up a plan for how you'll do it.

You'll need to make sure that your contracts match your business case and benefits management plan.



Business documents



Project documents

To plan procurements you'll need to consult the following project documents: milestone list, project team assignments, requirements documentation, requirements traceability matrix, resource requirements, risk register, and the stakeholder register.

## Inputs



Project Management plan



Organizational process assets

Past contracts can be a useful resource in setting up a new procurement.



## Data analysis: make-or-buy analysis

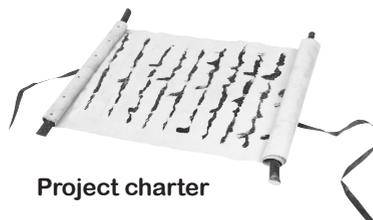
means figuring out whether or not you should be contracting the work or doing it yourself. It could also mean deciding whether to build your own solution to your problem or buy one that is already available. Most of the same factors that help you make every other major project decision will help you with this one. How much does it cost to build it versus buy it? How will this decision affect the scope of your project? How about your project schedule? Do you have time to do the work and still meet your commitments? As you plan out what you will and won't contract, you need to have thought through your reasoning pretty carefully.

There are some resources (like heavy equipment) that your company can buy, rent, or lease depending on the situation. You'll need to examine leasing versus buying costs and determine the best way to go forward.

You need to consider the level of expertise your company has with the product or work you're thinking of contracting, as well as the job and contracting markets you operate in.



Enterprise environmental factors

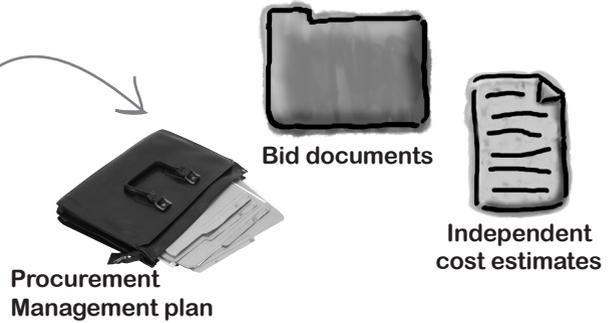


Project charter

The project charter contains the information needed to frame the contract's goals: the project objectives, description, summary milestones, and preapproved financial resources.

This plan will have:

- The planned delivery dates for the work or products you are contracting
- The company's standard documents you will use
- The contract types you plan to use, and any metrics that will be used to measure the contractor's performance
- Any constraints or assumptions you need to know about all of the contracts you plan to create for your project

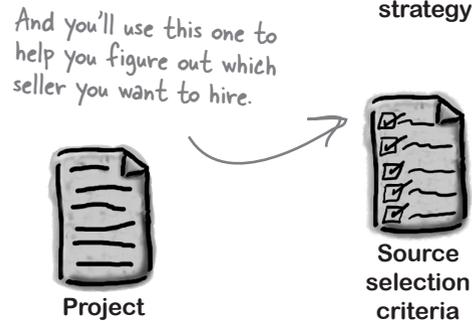
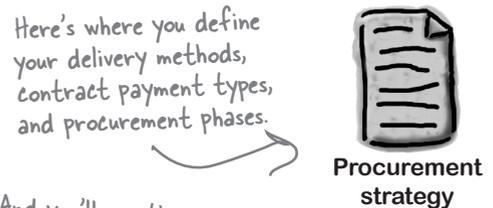
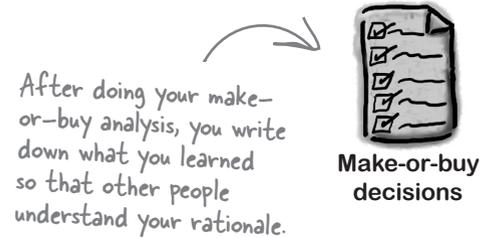
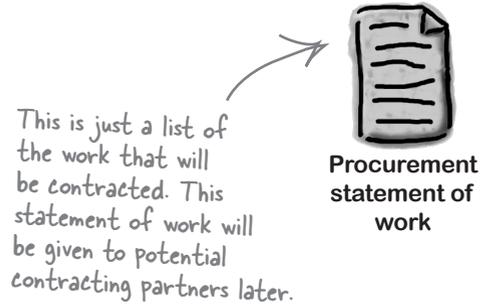


**Expert judgment** means asking someone who's made the same kind of decision before to help you look at all the information you have for your project and make the right decision. Experts can be really helpful in evaluating technology, or providing insight into how your work might be done in different sourcing scenarios.

**Data gathering: market research** means checking out reviews of possible vendors to work with. Sometimes procurement teams will go to conferences or read published reports that evaluate vendors doing similar contracts to help make decisions.

**Source selection analysis** is how you determine which supplier to choose.

**Meetings** help your team put their heads together and make sure they're covering all of the project's needs when setting up a procurement.



Outputs



I STILL DON'T BUY IT. WHY SHOULD I GO OUTSIDE OF MY COMPANY? WHY CAN'T I JUST HAVE MY TEAM DO ALL THE WORK?



**Because sometimes it's not worth having your team do part of the job.**

If your company needed to renovate your office, would you hire the carpenter, electrician, and builders? Would you buy the power tools, cement mixer, trucks, and ladders? Of course not. You'd hire a contractor to do the work, because it would cost too much to buy all that stuff for one job, and you wouldn't want to hire people just for the job and then fire them when it was done. Well, the same goes for a lot of jobs on your projects. You don't always want to have your company build everything. There are a lot of jobs where you want to hire a **seller**.

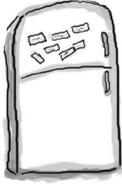
There are a lot of words for the company you're hiring: contractor, consultant, external company...but for the PMP exam, you'll typically see the term "seller."



Relax

**It's natural to feel a little nervous about this contracting stuff.**

A lot of project managers have only ever worked with teams inside their own companies. All this talk of contracts, lawyers, proposals, bids, and conferences can be intimidating if you've never seen it before. But don't worry. Managing a project with a contractor is really similar to managing one that uses your company's employees. There are just a few new tools and techniques that you need to learn...but they're not hard, and you'll definitely get the hang of them really quickly.



## Make or Buy Magnets

Figure out whether or not Kate and Ben should contract out the tech support work by organizing these facts about the project into Make or Buy columns. The first few have been done for you.

This really is how a lot of people handle make-or-buy decisions: by looking at all of the information they have for the project and using it to determine whether the facts line up under "Make" or "Buy."

### Make

### Buy

The next big product release is six months away.

We think the procurement process will take around three months, and ramping up staff in the call center will take eight months.

Training the contractor's employees will be less valuable because we won't be able to use their knowledge when the contract is up.

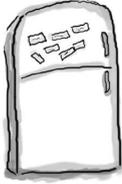
It might be hard to control the quality of the contractor's work.

The contract team can have a staff trained and ready within a month from the signed contract.

The cost for equipment and training for a 10-person team is around \$50,000. Contracts could be drawn up to cut that cost down a lot.

Our estimate is that it will cost around \$30,000 per month to hire an additional 10 people and reduce wait time to 10 minutes per call. The cheapest contract for this is around \$40,000 per month.

Contracting companies who specialize in tech support have access to a lot of information and best practices that could make the project go more smoothly.



## Make or Buy Magnets Solutions

Figure out whether or not Kate and Ben should contract out the tech support work by organizing these facts about the project into Make or Buy columns. The first few have been done for you.

**Make**

It might be hard to control the quality of the contractor's work.

Our estimate is that it will cost around \$30,000 per month to hire an additional 10 people and reduce wait time to 10 minutes per call. The cheapest contract for this is around \$40,000 per month.

Training the contractor's employees will be less valuable because we won't be able to use their knowledge when the contract is up.

There's no way they are going to be able to support even more customers with a new product in six months if they don't have the staff then.

**Buy**

The next big product release is six months away.

We think the procurement process will take around three months and ramping up staff in the call center will take eight months.

The cost for equipment and training for a 10-person team is around \$50,000. Contracts could be drawn up to cut that cost down a lot.

The contract team can have a staff trained and ready within a month from the signed contract.

Contracting companies who specialize in tech support have access to a lot of information and best practices that could make the project go more smoothly.

Even though the staff costs will be higher with the contractor, not having to pay for equipment and training could offset the higher labor cost.

Sometimes contractors can bring their expertise from running lots of similar projects and make everything run more smoothly than it would if you did it yourself.

## The decision is made

Doing make-or-buy analysis just means understanding the reasons for the contract and deciding whether or not to contract out the work. Once you've done that, if you still think contracting is an option, then you should have a good idea of what you need to get out of the contracting process.



STEVE, I'VE TAKEN A REALLY CLOSE LOOK AT THIS, AND I THINK IT MAKES SENSE TO FIND A SELLER TO HANDLE SOME OF OUR TECHNICAL SUPPORT FOR US. IF THEY TAKE OVER THE SECOND SHIFT FOR A FEW MONTHS, THAT'LL GIVE US TIME TO RAMP UP OUR OWN TEAM AND ADD PHONE CAPACITY.

SOUNDS GOOD. WHAT KIND OF CONTRACT ARE WE LOOKING AT?



## Types of contractual agreements

It's a good idea to know a little bit about the most commonly used contract types. They can help you come up with a contract that will give both you and the seller the best chance of success.

If you want to see a really thorough overview of the different types of contracts, check out the US Federal Acquisition Regulation website:

<http://www.acquisition.gov/far/>

### Fixed price contracts

← This is a category of contracts, sometimes referred to as "lump sum" contracts.

Some PMP exam questions might just refer to a contract type by its acronym (FP, CPFF, etc.).

**Firm fixed price (FFP)** means that you are going to pay one amount regardless of how much it costs the contractor to do the work. A fixed-price contract only makes sense in cases where the scope is very well known. If there are any changes to the amount of work to be done, the seller doesn't get paid any more to do it.

**Fixed price plus incentive fee (FP/IF)** means that you are going to pay a fixed price for the contract and give a bonus based on some performance goal. You might set up a contract where the team gets a \$50,000 bonus if they manage to deliver an acceptable product before the contracted date.

**Fixed price with economic cost adjustments (FPEPA)** is a fixed-price contract with special provisions to deal with a very long term—say, 50 years—or different currencies, or other economic conditions that require specialized language.

### Cost-reimbursable contracts

Don't worry about trying to cram these into your head right now—you'll get a lot of practice with them throughout the chapter.

**Costs plus fixed fee (CPFF)** means what it says. You pay the seller back for the costs involved in doing the work, plus you agree to an amount that you will pay on top of that.

**Costs plus award fee (CPAF)** is similar to the CPFF contract, except that instead of paying a fee on top of the costs, you agree to pay a fee based on the buyer's evaluation of the seller's performance.

**Costs plus incentive fee (CPIF)** means you'll reimburse costs on the project and pay a fee if some performance goals are met. Kate could set up her project using this contract type by suggesting that the team will get a \$50,000 bonus if they keep the average wait time for the calls down to seven minutes per customer for over a month. If she were on a CPIF contract, she would pay the team their costs for doing the work, and also the \$50,000 bonus when they met that goal.

### Time and materials

← A lot of people say that the T&M contract is a lot like a combination of a cost-plus and fixed-price contract, because you pay a fixed price per hour for labor, but on top of that you pay for costs like in a cost-plus contract.

**Time and materials (T&M)** is used in labor contracts. It means that you will pay a rate for each of the people working on your project plus their materials costs. The "time" part means that the buyer pays a fixed rate for labor—usually a certain number of dollars per hour. And the "materials" part means that the buyer also pays for materials, equipment, office space, administrative overhead costs, and anything else that has to be paid for. The seller typically purchases those things and bills the buyer for them. This is a really good contract to use if you don't know exactly how long your contract will last, because it protects both the buyer and seller.

# Sharpen your pencil



*This is a tough one—take your time and think about each kind of contract.*

There are advantages and disadvantages to every kind of contract. Different kinds of contracts carry different risks to both the buyer and seller. Can you think of some of them?

*Here's a hint: fixed-price contracts don't have much risk for the buyer.*

**Firm fixed price (FFP)**

Risks to the buyer .....

Risks to the seller .....

**Fixed price plus incentive fee (FPIF)**

Risks to the buyer .....

Risks to the seller .....

**Cost plus fixed fee (CPFF)**

Risks to the buyer .....

Risks to the seller .....

**Cost plus award fee (CPAF)**

*CPAF contracts are really risky for the seller, not the buyer. Can you figure out why?*

Risks to the buyer .....

Risks to the seller .....

**Cost plus incentive fee (CPIF)**

Risks to the buyer .....

Risks to the seller .....

**Time and materials (T&M)**

Risks to the buyer .....

Risks to the seller .....

# Sharpen your pencil Solution



There are advantages and disadvantages to every kind of contract. Different kinds of contracts carry different risks to both the buyer and seller. Can you think of some of them?

*There are a lot of right answers—even if yours aren't here, it doesn't mean that they're wrong.*

*A firm fixed-price contract has a lot more risk for the seller than the buyer.*

## Firm fixed price (FFP)

Risks to the buyer **The only risk is if the seller doesn't deliver because of costs.**

Risks to the seller **Unexpected costs could be bigger than the contract itself.**

## Fixed price plus incentive fee (FPIF)

Risks to the buyer **There's still not much risk to the buyer in fixed-price contracts.**

Risks to the seller **The seller still has the same risks as FFP, but may make more.**

## Cost plus fixed fee (CPFF)

*CPFF contracts have risks for both the buyer and the seller.*

Risks to the buyer **If the costs are too high, the buyer will have to pay a lot more.**

Risks to the seller **A fixed fee on top of costs might not be worth it for the seller.**

## Cost plus award fee (CPAF)

*CPAF contracts are risky for the sellers, because the buyer subjectively determines their performance, and can decide they didn't perform well enough.*

Risks to the buyer **There aren't many risks to the buyer.**

Risks to the seller **If the buyer determines the seller underperformed, he can withhold the fee.**

## Cost plus incentive fee (CPIF)

*Incentive fees are a really good way to reduce the risk to the buyer on a cost-plus contract.*

Risks to the buyer **There's still a risk of cost overruns, but it's not as bad.**

Risks to the seller **The incentive fee isn't guaranteed, so it might not be paid.**

## Time and materials (T&M)

*A lot of T&M contracts include a "cost not to exceed" clause to make sure this doesn't happen. If the contract doesn't have this, it can get really risky for the buyer!*

Risks to the buyer **If costs are too high, the contract could get expensive.**

Risks to the seller **The contract might not cover high overhead costs.**

*Take a minute and try to figure out why the T&M contract is a really good choice if you don't know how long the job will last.*

## More about contracts

There are just a few more things you need to know about any contract to do procurement work.

### **Every contract needs to outline the work to be done and the payment for that work.**

- You might see an exam question that mentions **consideration**—that’s just another word for the payment.
- Remember in Risk Management how you used insurance to transfer risk to another company? You did that using a special kind of contract called an insurance policy.
- You might get a question that asks about ***force majeure***. This is a kind of clause that you’ll see in a contract. It says that if something like a war, riot, or natural disaster happens, you’re excused from the terms of the contract.

### **Always pay attention to the point of total assumption.**

- The **point of total assumption** is the point at which the seller assumes the costs. In a fixed-price contract, this is the point where the costs have gotten so large that the seller basically runs out of money from the contract and has to start paying the costs.

### **You should always make sure both the buyer and seller are satisfied.**

- When you negotiate a contract, you should make sure that the buyer and the seller **both** feel comfortable with the terms of the contract. You don’t want the people at the seller’s company to feel like they got a raw deal—after all, you’re depending on them to do good work for your project.



### Sharpen your pencil

You might see this kind of question about whether to make or buy. Here’s a chance to get a little more practice with making contract decisions.

Kate has **18 months** to build up the capacity her company needs to handle all the technical support calls. See if you can figure out whether it’s a better deal for Kate to make or buy.

1. If they handle the extra work within the company instead of finding a seller, it will cost an extra \$35,000 in overtime and \$11,000 in training costs in total, on top of the \$4,400 per person per month for the five-person team needed to do the extra support work. What’s the total cost of keeping the work within the company?
2. Kate and Ben talked to a few companies and estimate that it will cost \$20,000 per month to hire another company to do the work, but they’ll also need to spend \$44,000 in setup costs. What will contracting the work cost?
3. So does it make more sense to make or buy? Why?

→ **Answers on page 680.**

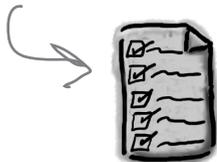
## Figure out how you'll sort out potential sellers

The two big outputs of Plan Procurement Management are the **bid documents** and **source selection criteria**. The procurement documents are what you'll use to find potential sellers who want your business. The **source selection criteria** are what you'll use to figure out which sellers you want to use.



Bid documents

A big part of Procurement Management is making sure that both the buyers and sellers are treated fairly. Writing out source selection criteria beforehand is a good way to make sure each seller gets a fair shake.



Source selection criteria

You'd be amazed at how many sellers respond to bids that they have no business responding to. You definitely need to make sure the seller has the skill and capacity to do the work you need.

### **There are a bunch of different documents you might want to send to sellers who want to bid on your work.**

You'll usually include the **procurement statement of work (SOW)** so that sellers know exactly what work is involved.

You need a way to tell sellers that you want them to give you a quote on a fixed-price contract to do the work—this is called a **request for quotation (RFQ)**, and it tells sellers exactly what you want them to submit proposals for. You'll also hear of people using **requests for information (RFI)** to get more information on goods and services that need to be acquired, and **requests for proposals (RFP)** when there's a problem in the project and you're looking for sellers to propose solutions.

A **purchase order** is something you'll send out to a seller whom you know you want to work with. It's an agreement to pay for certain goods or services.

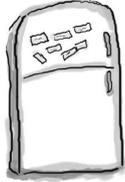
In some cases you'll want to allow for more flexibility in your contract. If you're hiring a seller to build something for you that you've never built before, you'll often encourage them to help you set the scope instead of locking it down.

### **Decide in advance on how you want to select the sellers.**

There are a lot of ways you can select a potential seller. Figuring out if a seller is appropriate for your work is something that takes a lot of talking and thinking—and there's no single, one-size-fits-all way of selecting sellers. But there are some things that you should definitely look for in any seller:

- Can the seller actually do the work you need done?
- How much will the seller charge?
- Can the seller cover any costs and expenses necessary to do the job?
- Are there subcontractors involved that you need to know about?
- Does the seller really understand everything in the SOW and contract?
- Is the seller's project management capability up to the task?

**You always put together procurement documents and source selection criteria before you start talking to individual sellers who want your business.**



## Contract Magnets

Which of the magnets are part of the procurement documents, and which of them are part of the source selection criteria?



Bid documents

Get a financial statement or credit report and verify that the seller is insured

Meet with the project manager and review project processes

Notification to sellers requesting a quotation for fixed-price work

Request for more information about goods being acquired

Go over final pricing plan and contract terms

Request for proposals

Review the SOW with the seller to make sure it's understood



Source selection criteria

→ Answers on page 681.

## WHAT'S MY PURPOSE

Here are some of the proposals that Kate is evaluating. Match each one up to the contract type that's most important for the proposal.

The buyer will pay for the cost of phone service, rent on the facilities, and employees, plus an additional \$2,500 per month.

Firm fixed price

The buyer will pay the seller a total of \$285,000 for 18 months of technical support services.

Fixed-price incentive fee

The buyer will pay for the cost of phone service and rent on the facilities, plus \$4,500 per month for employees' time. Costs will not exceed \$14,500 per month.

Cost plus fixed fee

The buyer will pay for the cost of phone service, rent on the facilities, and employees. An additional \$2,750 will be awarded each month that the seller provides an average of 10 issues resolved per person per day and an average wait time of under 3 minutes.

Cost plus incentive fee

The buyer will pay for the cost of phone service, rent on the facilities, and employees. An additional \$5,000 will be paid for exceptional performance.

Cost plus award fee

The buyer will pay the seller a total of \$285,000 for 18 months of technical support services. An additional \$2,750 will be awarded each month that the seller provides an average of 10 issues resolved per person per day and an average wait time of under 3 minutes.

Time and materials

—————> **Answers on page 668**

## Get in touch with potential sellers

The next step in procurement is pretty straightforward. You use the **Conduct Procurements process** to, well, get the word out to sellers and see what kind of responses you get. Once you narrow down your list of sellers to a few who look like they might be good candidates, you evaluate all of their responses against your source selection criteria and choose the vendor you're going to work with. All that's left to do after that is to get it all on paper...and then you award the contract!

## Use outputs from the Plan Procurement Management process to find the right seller

When you perform the Conduct Procurements process, you'll start with some of the outputs you created in Plan Procurement Management. Here's how you'll use them:



**Make-or-buy decisions**

The make-or-buy decisions you made will come in handy because they'll tell you what you need to find a contractor to help out with and what you'll do yourself.



**Source selection criteria**

Use the source selection criteria to evaluate the sellers that respond to you. By evaluating all of your sellers using the same criteria, you'll be sure that you evaluate everyone fairly and find the right seller for your company.



**Bid documents**

Bid documents will have all of the information that you'll actually give to potential sellers to help them bid on your contract. Two of the most commonly used bid documents are the RFI and the RFP.

### **RFI: Request for information**

documents are sent to potential sellers to ask for information about their capability to do the work.

**RFP: Request for proposal** is when you give a seller the opportunity to examine your procurement documents and write up a proposal of how they'd do the work.



**Procurement statement of work**

The procurement statement of work is where you write out all of the work that needs to be done by a contractor. It tells you the scope of the work that you're going to contract to another company.



**Procurement strategy**

The procurement strategy is where you decide whether it's OK for a contractor you're working with to hire subcontractors and how you'll work with them. You'll determine the terms you'll use to pay for contracted work, and the phases of your contract.

## Pick a partner

You've figured out what services you want to procure, and you've gone out and found a list of potential sellers. Now it's time to choose one of them to do the project work—and that's exactly what you do in **Conduct Procurements**.



### Inputs



Procurement documentation



Project documents



Seller proposals



Procurement Management plan



Organizational process assets



### Advertising

Sometimes the best way to get in touch with sellers is to place an ad. Also, sometimes you are **required** to take out an ad (like for some government-funded projects), in order to give all sellers full notice.

### Bidder conferences

It's really important that you make sure all of the bidders can compete in a fair, unbiased way. And the best way to do that is to get them all in a room together, so that they can ask questions about your contract. That way, you don't give any one seller an advantage by providing inside information that the other sellers don't have access to.

### Expert judgment

Here's another case where it's really good to bring in someone from outside your project to help evaluate each proposal. You should bring in someone with a lot of specific expertise in the work being done to make sure the seller is up to the job.

You need to consider the level of expertise your company has with the product or work you're thinking of contracting, as well as the job and contracting markets you operate in.



Enterprise environmental factors

The whole point of the Conduct Procurements process is, well, to conduct procurements...and here they are. Along with the contract, this is the most important output of the process.



Selected sellers



Agreements

Finally! Everyone's signed on the dotted line, and you've got your contract.



Organizational process assets updates

**Interpersonal and team skills: negotiation**

When you send out a package of procurement documents to a potential seller, it usually has some information about the contract you want to sign: the type of contract, some of the terms, maybe some rough calculations and estimates of the total costs, and other numbers. But not all sellers will want to sign that particular contract, even ones who you'll eventually want to work with. That's why you need to negotiate the terms of the contract.

This is one of those times where your company's lawyers will probably do most of the talking—but that doesn't mean you're not a critical part of the process. Your job is to provide the expertise and in-depth understanding. After all, you're the one who understands your project and your project's needs better than anyone else.

**Data analysis: proposal evaluation**

You're going to have to work closely with the seller to figure out if his proposal really is appropriate for the work. You need to be very careful before you choose someone to do the work. That's what this tool is for—it's a kind of "catch-all" that's there to remind you that there's no single way to evaluate a proposal. You need to look at the whole picture—the seller, your needs, and the job.

**Outputs**



In the course of selecting a source, you might find changes that need to be made to your requirements or other documents.



Project documents updates

Any time you do negotiations, you usually end up making some adjustments to your plans—so you'll need to use these for change control.



Change requests



Project Management plan updates



## Sharpen your pencil

Kate is putting out an RFP to find a seller to provide technical support for her company. Can you figure out which Conduct Procurements tool she's using?

1. Kate works with her company's seller evaluation committee, which follows a documented, formal evaluation review process to determine which seller should be selected for the contract.

.....

2. Kate contacts an IT trade journal and places a classified ad to try to find sellers.

.....

—————▶ **Answers on page 680**

3. The CEO's brother-in-law runs a company that's bidding on the contract. Kate needs to make sure he gets fair—not preferential—treatment. She doesn't want to give him an unfair advantage, but she also doesn't want to exclude him from the bidding process. So she gathers representatives from all sellers into a room where they can ask questions about the contract out in the open and hear the responses to each question.

.....

4. Kate's company takes part in an equal-opportunity program in which seller companies owned by minorities must be given notice of any RFPs. Her firm employs specific people in a department who are experienced in navigating the specific rules and regulations related to the equal-opportunity arena.

.....

**Q:** Do I always need to hold a bidder conference whenever I do procurement?

**A:** No, you don't always need a bidder conference. Sometimes your company has a preferred supplier it always deals with, so you don't have to advertise for sellers. And sometimes there's a **sole source** for a particular service or part—there may be only one company that provides it. In that case, advertising and bidder conferences would be pointless.

The bidder conference has two goals. The first is to make sure that you answer all of the questions from potential sellers. But the other is to make sure that all potential sellers are treated equally and have access to the same information.

**Q:** I'm still not clear on why I'd want to use a cost-plus contract.

## there are no Dumb Questions

**A:** One of the best reasons to use a cost-plus contract is to make sure that the seller you're working with doesn't end up getting a raw deal. A fixed-price contract can be pretty risky for a seller. When the seller uses a cost-plus contract—like a cost plus incentive fee, or cost plus fixed fee—it means that there's a built-in guarantee that the seller won't have to swallow cost overruns. If you're reasonably certain that the costs can be contained, or if you set up a good incentive system, then a cost-plus contract can be a really good one for making sure that both the buyer and seller are treated fairly.

**Q:** Why all this talk about treating the seller fairly? I'm trying to get the best deal I can. Doesn't that mean I should try to get as many concessions from sellers as possible?

**A:** One of the most important parts of procurement is that both the buyer and seller should feel like they're getting a good deal. You should never expect a seller to have to take on a bad contract. After all, you're depending on the seller to deliver a necessary piece of your project. That's why the goal in any procurement should always be for the buyer and seller to both feel like they were treated fairly.

**Q:** How do I use organizational process assets to find a seller?

**A:** When you're conducting procurements, you need to actually find sellers to do the work. Many companies have a list of sellers that they consider qualified to work for them because of past project performance. You'll usually find a list like this on file, and that's what the **qualified seller list** is.

## Sharpen your pencil

Kate needs to use most of the tools and techniques in Conduct Procurements. Which technique is Kate using in each of these scenarios?

1. Kate and her company's legal team sit down with the sellers and work out the terms of the contract. There's a lot of back and forth, but they settle on an agreement that everyone is comfortable with.

.....

2. Kate sets up criteria for each seller. Before sellers can submit a bid, they must show that they have handled technical support contracts before and have facilities that can handle over 150 simultaneous calls.

.....

3. The CIO and the director of the IT department at Kate's company spent a lot of time setting up the company's existing technical support department, so Kate meets with them to get their technical opinions.

.....

4. Kate sent a notification out to all potential sellers who responded to her RFP, informing them that she was calling a meeting with all of them. She made sure that all prospective sellers had a clear understanding of the work that needed to be done, and she answered all questions from each seller out in the open.

.....

—————> **Answers on page 669**



When Kate selects a seller, she'll need to help her company's legal team negotiate the terms of the contract. Which type of contract do you think is right for Kate's project?

# \* WHAT'S MY PURPOSE \*

Here are some of the proposals that Kate is evaluating. Match each one up to the contract type that's most important for the proposal.

The buyer will pay for the cost of phone service, rent on the facilities, and employees, plus an additional \$2,500 per month.

*The contract lays out the costs, and then adds a dollar amount fee on top of that. That's a fixed fee, so it's a CPFF contract.*

The buyer will pay the seller a total of \$285,000 for 18 months of technical support services.

*Since a preset price will be paid, this is a firm fixed price (or lump sum) contract.*

The buyer will pay for the cost of phone service and rent on the facilities, plus \$4,500 per month for employees' time. Costs will not exceed \$14,500 per month.

*A lot of T&M contracts will have a "not to exceed" clause to limit risk for the buyer.*

The buyer will pay for the cost of phone service, rent on the facilities, and employees. An additional \$2,750 will be awarded each month that the seller provides an average of 10 issues resolved per person per day and an average wait time of under 3 minutes.

*Notice how the incentive fee was tied to specific quality measurements. That's a great way to motivate the seller to do a good job.*

The buyer will pay for the cost of phone service, rent on the facilities, and employees. An additional \$5,000 will be paid for exceptional performance.

*This is the same agreement from the fixed-price contract, but it's got the incentive fee from the CPIF contract. So it's fixed-price incentive fee.*

The buyer will pay the seller a total of \$285,000 for 18 months of technical support services. An additional \$2,750 will be awarded each month that the seller provides an average of 10 issues resolved per person per day and an average wait time of under 3 minutes.

Firm fixed price

Fixed-price incentive fee

Cost plus fixed fee

Cost plus incentive fee

Cost plus award fee

Time and materials



## Sharpen your pencil Solution

Kate needs to use most of the tools and techniques in Conduct Procurements. Which technique is Kate using in each of these scenarios?

1. This is the first time that Kate's company has contracted out technical support services, so she hires a consultant to help her and the legal team estimate a fair price for the contract.

**Interpersonal and team skills: negotiation** .....

Project managers don't usually do the negotiation themselves. They'll get involved and provide expertise and knowledge, but usually rely on a lawyer or legal department to work out the actual terms of the contract.

2. Kate sets up criteria for each seller. Before sellers can submit a bid, they must show that they have handled technical support contracts before and have facilities that can handle over 150 simultaneous calls.

**Data analysis: proposal evaluation** .....

When you screen out potential sellers, it makes the job of selecting a seller a lot easier.

3. The CIO and the director of the IT department at Kate's company spent a lot of time setting up the company's existing technical support department, so Kate meets with them to get their technical opinions.

**Expert judgment** .....

You've seen a whole lot of other processes that have this same technique. Expert judgment always means getting an opinion from someone outside your project.

4. Kate sent a notification out to all potential sellers who responded to her RFP, informing them that she was calling a meeting with all of them. She made sure that all prospective sellers had a clear understanding of the work that needed to be done, and she answered all questions from each seller out in the open.

**Bidder conferences** .....

## Two months later...

Kate's procurement project had been going really well...or so she thought. But it turns out there's a problem.



KATE, THE CEO CALLED ME AT 3 A.M. THERE'S A JANITOR'S STRIKE AT THE SELLER'S TECHNICAL SUPPORT OFFICE, AND THAT'S CAUSING ALL SORTS OF HAVOC. NOW OUR WAIT TIMES ARE EVEN LONGER THAN THEY WERE THREE MONTHS AGO. WHAT ARE YOU GOING TO DO ABOUT THIS?

Kate never even thought to ask about the janitors union when the legal team was negotiating the contract.



Watch it!

**Keep an eye out for questions that ask about unions, even when they don't have to do with contracts or Procurement Management.**

*When you work with a union, even if it's through a seller, then the union contract (also called a **collective bargaining agreement**) can have an impact on your project. That means you need to consider the union itself a stakeholder, and when you do your planning you need to make sure any union rules and agreements are considered as constraints.*



What could Kate have done to prevent this problem? Could she have detected it sooner? What should she do now?

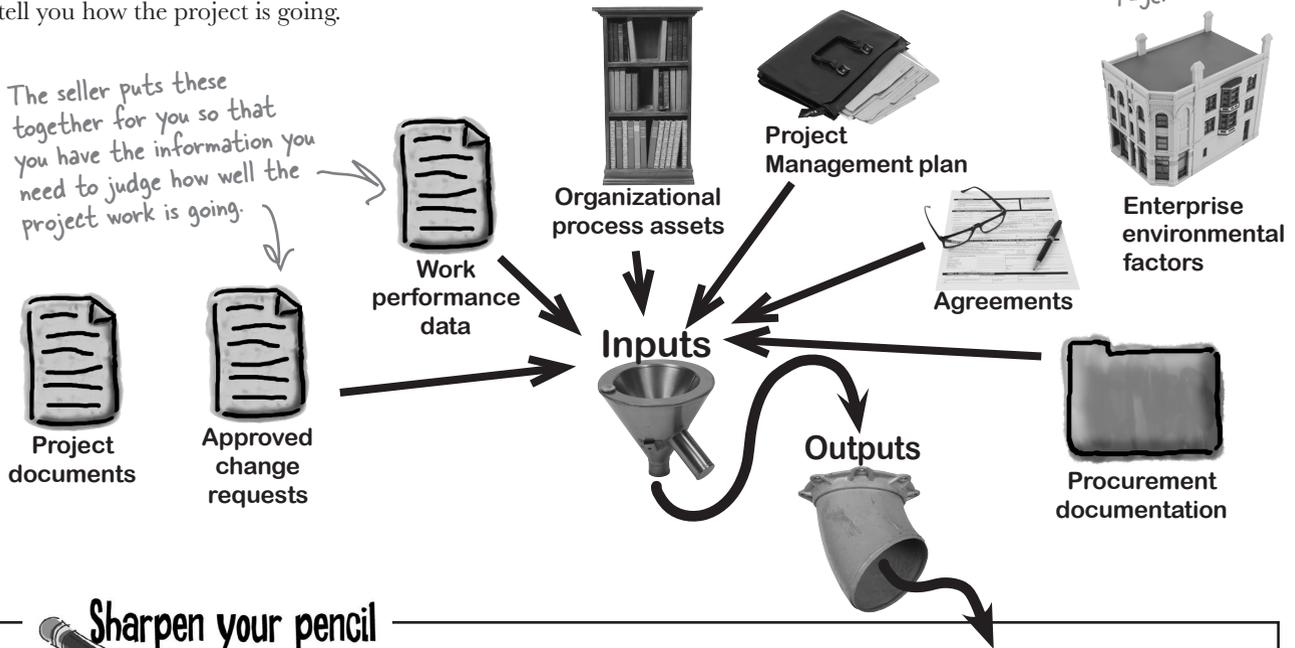
# Keep an eye on the contract



You wouldn't just start off a project and then assume everything would go perfectly, would you? Well, you can't do that with a contract either. That's why you use the **Control Procurements process**.

The idea behind the Control Procurements process is that staying on top of the work that the seller is doing is more difficult than working with your own project. That's because when you hire a seller to take over part of your project, the team who's doing the work doesn't report to you. That's why **the first three inputs are especially important**. The approved change requests are the way that you change the terms of the contract if something goes wrong, and the work performance data contains reports the seller uses to tell you how the project is going.

*The tools and techniques for the Control Procurements process are on the next page.*



## Sharpen your pencil

Control Procurements is a typical Monitoring and Controlling process, which means you should be able to figure out most of the outputs. The first few are filled in—can you fill in the others?

- |  |                      |
|--|----------------------|
| 1. <b>Closed procurements</b> .....          | 5. Updates to: ..... |
| 2. <b>Work performance information</b> ..... | 6. Updates to: ..... |
| 3. <b>Change requests</b> .....              | 7. Updates to: ..... |
| 4. Updates to: .....                         |                      |

→ Answers on page 682.

## Stay on top of the seller



The **tools and techniques for Control Procurements** are all there to help you work with the seller. Some of them help you look for any potential problems with the seller and make changes to correct them. Others help you with the day-to-day administration work that you need to do in order to keep your project running.

### **Expert judgment**

You're going to need to rely on experts to make sure that the contract is going smoothly. You might need to consult functional experts for the product you are building or financial or law experts to help you understand complexities of the contract itself.

### **Claims administration**

When there's a dispute between a buyer and a seller, that's called a **claim**. Most contracts have some language that explains exactly how claims should be resolved—and since it's in the contract, it's legally binding, and both the buyer and seller need to follow it.

## Data analysis tools

### **Performance reviews**

Most contracts lay out certain standards for how well the seller should do the job. Is the seller doing all the work that was agreed to? Is the work being done on time? The buyer has the right to make sure this is happening, and the way to do this is to go over the performance of the seller's team.

### **Earned value analysis**

You can analyze the performance of the contracted team in relation to expectations using earned value calculations in the same way that you use them on projects you are managing within your organization. Earned value gives you a good sense of whether or not a project is delivering as planned.

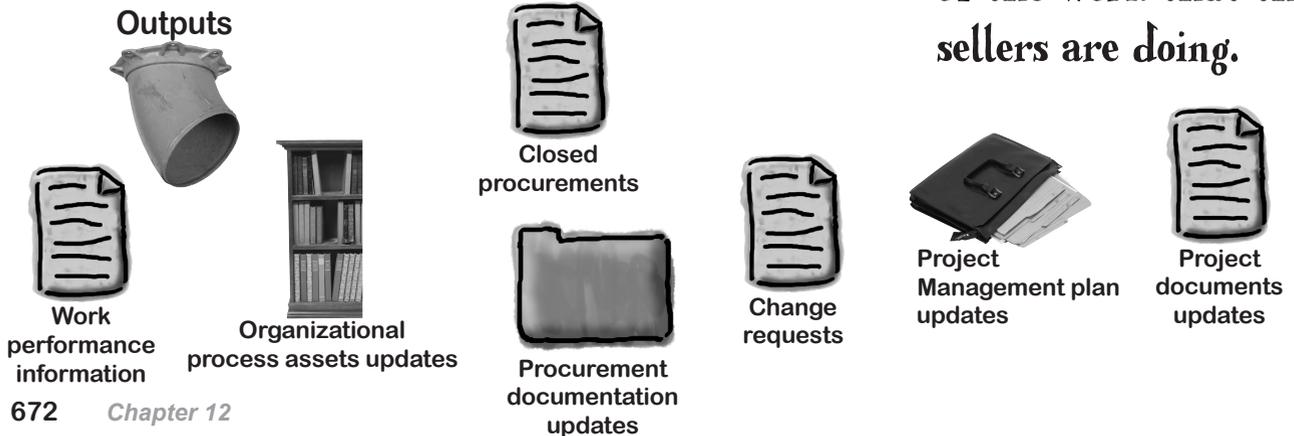
### **Trend analysis**

As the project is progressing you can measure how close or far away the actual progress is from the progress you had planned. Then you can take a look at all of the measurements together to understand if contract performance is getting better or worse over time.

### **Inspections and audits**

This tool is how the buyer makes sure that the product that the seller produces is up to snuff. An **inspection** is where you'll check up on the actual product or service that the project is producing to make sure that it meets your needs and the terms of the contract. An **audit** is where you check to make sure that both the buyer and the seller are following the procurement process in the way that they agreed.

**Buyer-conducted performance reviews let buyers check all of the work that the sellers are doing.**





## Exercise

Which of the tools and techniques from Control Procurements should Kate use for each situation?

1. An important client calls technical support, but ends up spending two hours waiting on hold. Kate doesn't find out until the seller calls her directly. She takes a look at the quality metrics for the contract so far to understand whether or not the seller is meeting the standards defined in the agreement.

.....

2. The CEO's mother calls technical support, but spends two hours waiting for him to answer. Kate needs to make sure the seller is delivering the quality it promised.

.....

3. Kate makes a report that pulls together all of the reporting from the past six months of the contract. If the project keeps going like this, they'll run out of money before it's delivered!

.....

4. According to the statement of work, the seller is supposed to have weekly training sessions with technical support staff, but Kate isn't sure they're being conducted as often as they should be.

.....

5. A manager at the seller says that it's not responsible for training sessions, but Kate thinks it is.

.....



## Watch it!

### ***Inspections and audits are similar—but not the same thing.***

*When you're performing Control Procurements, the most important part of your job is to figure out if the products that the seller is producing meet the agreement, and that is what inspections are for. Audits, on the other hand, are all about understanding whether the contract is following the procurement process as you would expect.*



## Exercise Solution

Which of the tools and techniques from Control Procurements should Kate use for each situation?

1. An important client calls technical support, but ends up spending two hours waiting on hold. Kate doesn't find out until the seller calls her directly. She takes a look at the quality metrics for the contract so far to understand whether or not the seller is meeting the standards defined in the agreement.

### **Data Analysis: Performance reviews**

A records management system can help Kate by giving her a place to store all the reports from the seller.

2. The CEO's mother calls technical support, but spends two hours waiting for them to answer. Kate needs to make sure the seller is delivering the quality it promised.

### **Data Analysis: Inspections and audits**

You use inspections and audits when you want to review the quality of the product or service being produced.

3. Kate makes a report that pulls together all of the reporting from the past six months of the contract. If the project keeps going like this, they'll run out of money before it's delivered!

### **Data Analysis: Trend analysis**

4. According to the statement of work, the seller is supposed to have weekly training sessions with technical support staff, but Kate isn't sure they're being conducted as often as they should be.

### **Data Analysis: Performance reviews**

If you need to check whether work is being done well, you can use a procurement performance review.

5. A manager at the seller says that it's not responsible for training sessions, but Kate thinks it is.

### **Claims administration**

## there are no Dumb Questions

**Q:** Should I only care about unions when I'm working with contracts?

**A:** Unions come up in procurement and contracts whenever a seller has an existing contract with a union. That contract is called a **collective bargaining agreement**, and if that agreement impacts the work that the seller is going to do for you, then you need to make sure that your legal department considers it when they work out the terms of the contract.

But unions are also important when you're doing Project Resource Management. If your company has a collective bargaining agreement with a union, then you need to consider the terms of that contract as **external constraints** to your project plan. Here's an example: let's say you're managing a construction project, and your workers are all union members. Then you need to make sure that you consider any overtime rules and other restrictions on resource availability when you put together your team, your budget, and your plan.

**Whenever you see "inspection" or "audit," it means that you're looking at the products that the seller delivered to see if they meet your standards.**

**Q:** Once a contract is signed, does that mean it's never allowed to change?

**A:** No. This confuses some people, because when you sign a contract, it's legally binding—which means you must abide by the terms of the contract. But that doesn't mean those terms can't change. If both the buyer and the seller agree to make a change to the contract, then they have every right to do so. That's why you have a contract change control system—so you can make sure these changes are made properly.

But you can't always assume that you have the ability to change a contract that you're not happy with. Once your company has agreed to a contract, then you're absolutely required to meet its terms and complete your side of it. If you want to make a change to it, you need to negotiate that change, and it's possible that the seller won't agree to it—just like you have every right to refuse an unreasonable change that the seller requests.

**Q:** Does the type of contract make a difference in how changes are handled?

**A:** No, it doesn't. While the type of contract definitely affects a lot of things, changes are always handled the same way. You always use the contract change control system to handle the changes.

That's why the contract change control system is so important. It tells you the exact rules that you need to go through in order to make a change to a contract. No contract is perfect, and most of the time there are little tweaks that both the buyer and seller want to make. This gives them the tools they need to make only the changes that they need, without either team agreeing to a change that they don't want included in the contract.

**Q:** I still don't get the difference between a performance review and an audit.

**A:** The difference is that performance reviews are about the **work**, while inspections and audits are about the **deliverables and products**.

You'll use a performance review when you want to make sure that the team at the seller is doing every activity that they should. For example, if you have a contract that requires the seller to perform certain quality control or project management tasks, you might conduct a performance review where you observe the team and verify that they do those tasks. On the other hand, if you want to make sure that the products that the team is producing meet your requirements and standards, you'll send out an auditor to inspect the products that the seller is making to verify that they meet the requirements.

**Q:** So do project managers usually get involved in contract negotiations?

**A:** Project managers don't usually do the negotiating themselves, but they do often get involved in contract negotiations. Remember, nobody knows more about the project than the project manager—you know what work needs to be done, what requirements the product must meet, and what kind of budget you need to stay within. So even though a lawyer or legal department will do the actual negotiation, they won't know if the seller is capable of doing the job without the project manager's help.



Complex projects often employ expertise from many different organizations. **Project Procurement Management** is all about how those organizations work together.



## KEY CONCEPTS

We've talked about the processes you and your team will use when planning, conducting, and monitoring contracts. Now let's talk about how your approach to Procurement Management can affect the way your team delivers.

- ★ Contracts should be written so that both parties understand the deliverables and results that the buyer expects, and should be legally enforceable.
- ★ Your organization probably has documented processes and procedures surrounding the creation of contractual agreements. You should follow those guidelines.

## TAILORING

Here are some factors to consider when tailoring your approach to Procurement Management:

- ★ Does the project contain multiple contracts with one seller? Or multiple contracts with multiple sellers?
- ★ Where are the sellers located? Can they communicate with you face-to-face?
- ★ What regulatory or legal considerations do you need to think about?



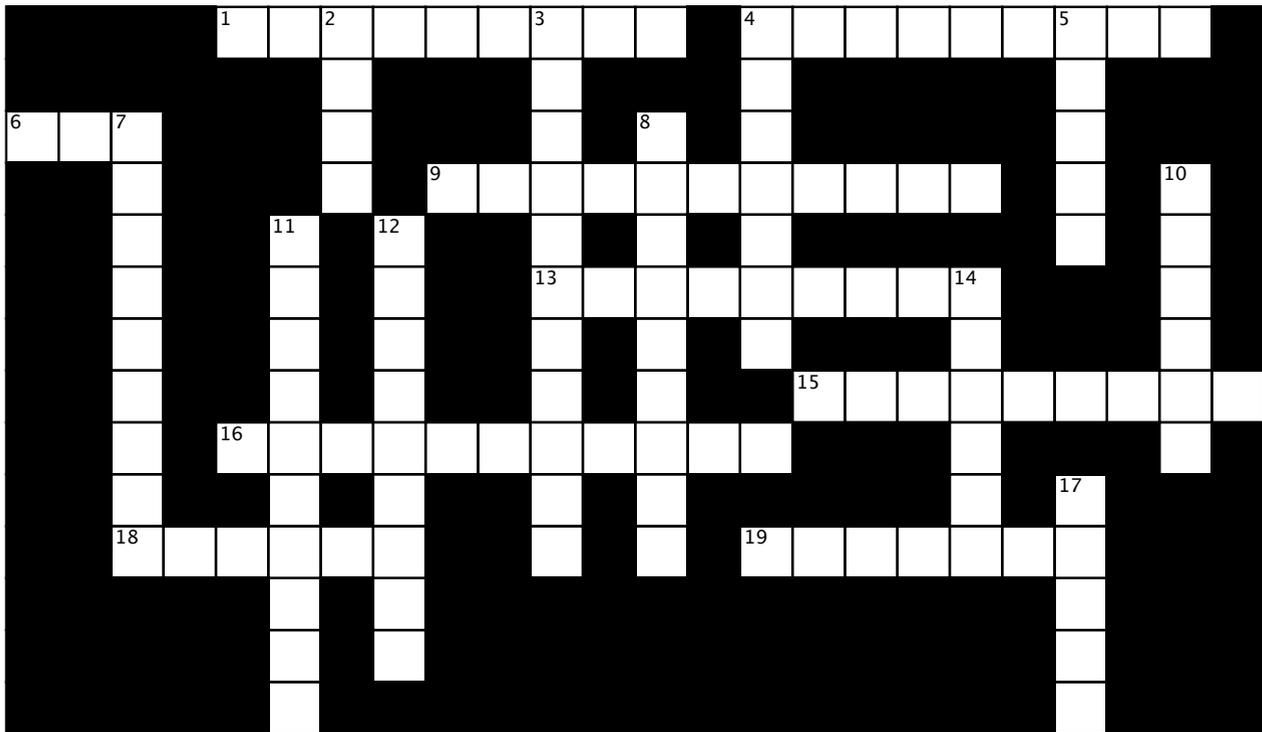
## AGILE CONSIDERATIONS

Staff augmentation contracts based on time and materials are common ways of managing contracts in agile environments. Because agile teams try to adapt their scope and methods based on changes encountered during development, traditional contracts that measure performance versus known scope at the time of planning often fall short of encouraging the collaboration necessary between buyer and seller. All project teams recognize that there are risks of scope changes. But some Agile teams find a way to share that risk between buyer and seller by adding terms to their agreements that encourage the teams to adapt to change and increase collaboration.



# Contractercross

Give your right brain something to do. It's your standard crossword; all of the solution words are from this chapter.



## Across

1. This kind of fee is used in cost plus contracts to encourage the seller to increase performance.
4. This kind of analysis is used to determine whether to procure a service or stay within the company.
6. The \_\_\_ contract has high risk to the seller because the seller must cover costs that go beyond the price.
9. \_\_\_\_\_ documents contain all of the information the seller wants to communicate to potential buyers.
13. In a T&M contract, the buyer pays for \_\_\_\_\_, which includes equipment, office space, administrative overhead costs, and anything else (other than labor) that has to be paid for.
15. Some organizations maintain a \_\_\_\_\_ seller list consisting of sellers pre-screened based on past experience with them.
16. A buyer is sometimes required to use \_\_\_\_\_ in order to announce a project to all potential sellers.
18. The buyer selects the \_\_\_\_\_ selection criteria before contacting potential sellers.
19. The contract-related process in the Monitoring and Controlling group is called \_\_\_\_\_ Procurements.

## Down

2. In this kind of contract, the seller is paid the costs as well as a fee that's determined based on the buyer's evaluation of performance.
3. The purpose of a request for \_\_\_\_\_ is to get more information on goods and services that need to be acquired.
4. A force \_\_\_\_\_ clause protects both the buyer and seller from things like war and natural disasters preventing the completion of the contract.
5. The company or organization that's procuring services.
7. The potential sellers submit seller \_\_\_\_\_ to a buyer to explain how the contract will be fulfilled.
8. A request for \_\_\_\_\_ is a document that asks sellers for the price of the work.
10. \_\_\_\_\_ Procurements is the output of Control Procurements that is created after the contracts are completed.
11. The kind of contract where the buyer pays a lump sum.
12. The procurement \_\_\_\_\_ of work defines the portion of the project's scope that the seller will work on for the contract.
14. The company or organization that's performing services for the contract.
17. A disagreement between the buyer and seller is called a \_\_\_\_\_.

→ **Answers on page 682.**

## Kate closes the contract

The 18-month contract's ready to close! The seller did a great job handling technical support, and that gave Kate and Ben the time they needed to ramp up their own company's team and facilities.

WELL, THE CONTRACT'S DONE, AND WE'VE MOVED TECH SUPPORT BACK INTO THE COMPANY.



AND IT GAVE US ENOUGH TIME TO TRAIN OUR OWN TEAM TO TAKE OVER. GREAT WORK!



We saw that closed procurements are an output of Control Procurements. The buyer—Kate!—provides formal written notice to the seller that the contract has been completed. This usually means all deliverables were delivered, and they pass all of the required quality checks.

HELLO, THIS IS TECHNICAL SUPPORT. HOW CAN I HELP YOU?



### Outputs



Closed procurements

## Question Clinic: **BYO** questions

SEE IF YOU CAN COME UP WITH QUESTIONS ON YOUR OWN! GIVE IT A SHOT:



See page 208.

Write a which-is-BEST question about Perform Qualitative Risk Analysis.

See page 370.

Write a red herring question about Conduct Procurements.

Write a calculation question about CPI.

See page 566.

See page 294.

Write a which-comes-next question about the Scope Management processes.

HERE'S A GREAT STUDY TOOL. ANY TIME YOU GET A PRACTICE QUESTION WRONG, OR DON'T UNDERSTAND A PARTICULAR CONCEPT, WRITE A QUESTION ABOUT IT! THAT'S A GREAT WAY TO HELP YOU REMEMBER STUFF FOR THE EXAM.



## Sharpen your pencil Solution



Kate has **18 months** to build up the capacity her company needs to handle all the technical support calls. See if you can figure out whether it's a better deal for Kate to make or buy.

1. If they handle the extra work within the company instead of finding a seller, it will cost an extra \$35,000 in overtime and \$11,000 in training costs in total, on top of the \$4,400 per person per month for the five-person team needed to do the extra support work. What's the total cost of keeping the work within the company?

The total cost for keeping the work is the monthly cost ( $\$4,400$  per person  $\times$  5 people  $\times$  18 months =  $\$396,000$ ) plus the extra costs ( $\$35,000$  overtime and  $\$11,000$  training costs).  $\$396,000 + \$35,000 + \$11,000 = \$442,000$  total costs for keeping the work inside the company ("making").

2. Kate and Ben talked to a few companies and estimate that it will cost \$20,000 per month to hire another company to do the work, but they'll also need to spend \$44,000 in setup costs. What will contracting the work cost?

The cost for hiring another company to do the work is  $\$20,000$  per month  $\times$  18 months plus the  $\$44,000$  in setup costs.  $(\$20,000 \times 18) + \$44,000 = \$404,000$  total costs for contracting out the work ("buying").

3. So does it make more sense to make or buy? Why?

In this case, it makes more sense to buy because the costs of making ( $\$442,000$ ) are greater than the costs of buying ( $\$404,000$ ).

## Sharpen your pencil Solution



Kate is putting out an RFP to find a seller to provide technical support for her company. Can you figure out which Conduct Procurements tool she's using?

1. Kate works with her company's seller evaluation committee, which follows a documented, formal evaluation review process to determine which seller should be selected for the contract.

### Data analysis: proposal evaluation

2. Kate contacts an IT trade journal and places a classified ad to try to find sellers.

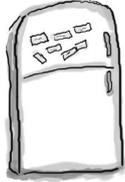
### Advertising

3. The CEO's brother-in-law runs a company that's bidding on the contract. Kate needs to make sure he gets fair—not preferential—treatment. She doesn't want to give him an unfair advantage, but she also doesn't want to exclude him from the bidding process. So she gathers representatives from all sellers into a room where they can ask questions about the contract out in the open and hear the responses to each question.

### Bidder conference

4. Kate's company takes part in an equal-opportunity program in which seller companies owned by minorities must be given notice of any RFPs. Her firm employs specific people in a department who are experienced in navigating the specific rules and regulations related to the equal-opportunity arena.

### Expert judgment



## Contract Magnets Solution

Which of the magnets are part of the procurement documents, and which of them are part of the source selection criteria?



### Bid documents

Request for proposals

Request for more information  
about goods being acquired

Notification to sellers  
requesting a quotation  
for fixed-price work



### Source selection criteria

Review the SOW with the seller  
to make sure it's understood

Meet with the project manager  
and review project processes

Go over final pricing  
plan and contract terms

Get a financial statement or  
credit report and verify that  
the seller is insured

## Sharpen your pencil

1. **Closed procurements**

2. **Work performance information**

3. **Change requests**

4. Updates to:

**Procurement documentation**

5. Updates to:

**Project Management plan**

6. Updates to:

**Project documents**

7. Updates to:

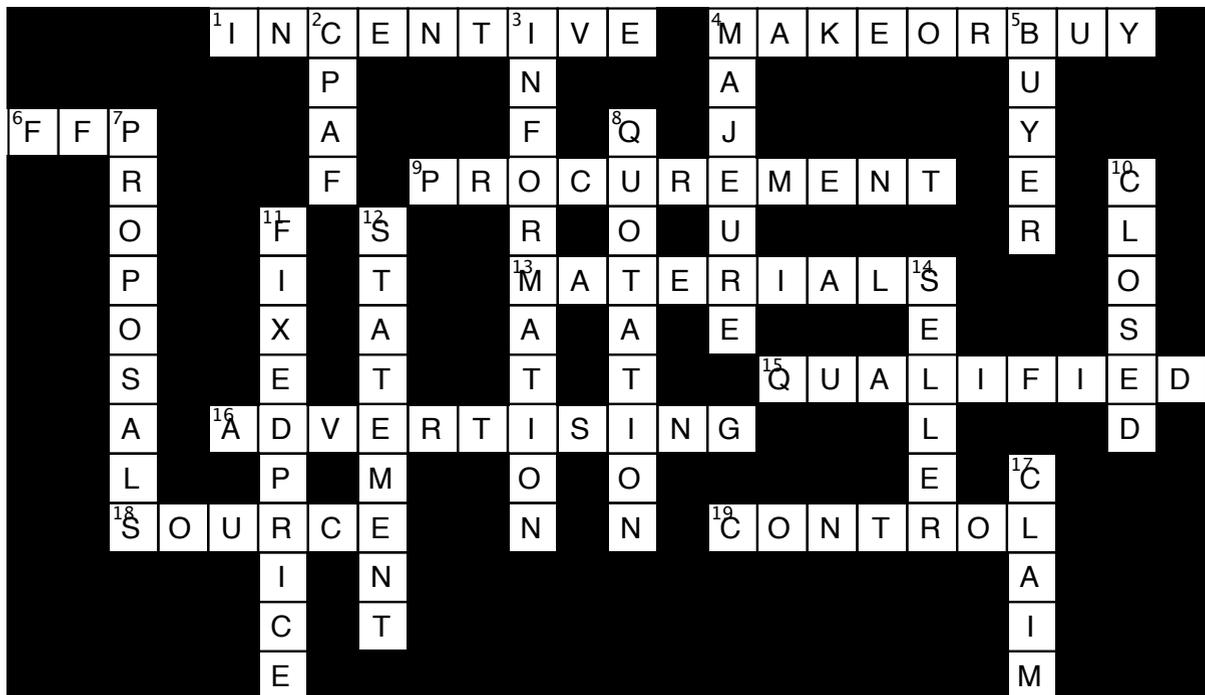
**Organizational process assets**

Control Procurements is a typical Monitoring and Controlling process, which means you should be able to figure out most of the outputs. The first one's filled in—can you fill in the others?



## Contractcross Solutions

Give your right brain something to do. It's your standard crossword; all of the solution words are from this chapter.



## Exam Questions

1. Tom is a project manager for a software company. He is contracting a long-term software project with an external company. That company charges him \$20/hour per employee and \$300 overhead per month. What kind of contract is he using?

- A. FP
- B. CPAF
- C. CR
- D. T&M

2. Which of the following is NOT true about bidder conferences?

- A. All potential sellers should meet separately with the buyer.
- B. Potential sellers should ask questions in an open forum so other sellers can hear the answers.
- C. Bidder conferences are a good way to make sure sellers are treated fairly.
- D. All sellers are given the same procurement documents.

3. You work for a seller that is bidding on a contract. Which type of contract has the MOST risk for your company?

- A. CPIF
- B. T&M
- C. FP
- D. CPAF

4. Which of the following BEST describes the “point of total assumption” for a contract?

- A. The point in a cost-plus contract where the buyer assumes that the seller will need to be paid
- B. The total cost of a T&M contract
- C. The point in a fixed-price contract where the seller has to assume all costs going forward
- D. The total number of resources required for a contract

5. You're trying to decide whether or not to contract out a construction job. To do it within your company, you will have to hire an engineer for \$35,000 and pay a construction team \$15,000 per week. A contractor quotes you a price of \$19,000 per week, and your expert agrees that you won't find a lower price than that. The job will take 16 weeks. What's the BEST way to proceed?

- A. Pay the contractor to do the job.
- B. Select a T&M contract.
- C. Don't contract out the work; hire the engineer and pay the construction team to do the work.
- D. Make sure the contract has a force majeure clause.

## Exam Questions

**6. You're managing a project that might have to contract out work, and you're comparing the relative advantages and disadvantages of finding a seller versus having your company do the work itself. Which process are you in?**

- A. Plan Procurement Management
- B. Plan Contracting
- C. Conduct Procurements
- D. Request Seller Responses

**7. You're using a qualified seller list. Which process are you in?**

- A. Plan Procurement Management
- B. Plan Contracting
- C. Conduct Procurements
- D. Request Seller Responses

**8. You've been contracted by an industrial design firm to manage its contracting. Your client asks you to take over the negotiations for an important contract to design a new remote-control lighting system. You've narrowed it down to one seller, and now you're working with the legal department at the buyer to negotiate the terms of the contract. Which of the following BEST describes your goal?**

- A. You want to get the best deal for your client by making sure the seller's price is as low as possible, no matter what it costs them.
- B. You want to get a fair deal for both the buyer and the seller.
- C. You want to make sure that the seller gets as much money as possible.
- D. You want to prolong the negotiation so that you earn a higher fee.

**9. You've been contracted by a construction company to manage its contracting. It has a choice of either buying an excavator or renting it. To buy it, the company would have to pay \$105,000. The price to rent the excavator is \$5,000 per month, with a one-time service charge of \$2,000. What's the minimum number of months the company needs to use the excavator in order for it to make sense to buy it rather than rent?**

- A. 8 months
- B. 16 months
- C. 21 months
- D. 25 months

**10. Which of the following contracts has the MOST risk for the buyer?**

- A. FP
- B. CPAF
- C. CPIF
- D. T&M

## Exam Questions

**11. You're managing a project that is difficult to estimate, so you don't have a good idea of when the project will end. Which of the following contracts is BEST?**

- A. FP
- B. CPAF
- C. CPIF
- D. T&M

**12. You're looking for a seller to do work for your project. When do you send out an RFP?**

- A. After you create the procurement documents, but before you select the seller
- B. Before you plan contracting, but after you Plan Procurement Management
- C. After the bidder conference, but before you select the seller
- D. During Control Procurements

**13. You're creating source selection criteria for your contract. What process are you in?**

- A. Conduct Procurements
- B. Control Procurements
- C. Monitor Procurements
- D. Plan Procurement Management

**14. You're managing a project when you and the seller both agree that you need to have the seller add more resources to the project in order to finish on time. The number of resources is written into the contract. What's the BEST way to proceed?**

- A. Your project will be late because you can't change the contract once it's signed.
- B. You need to convince the buyer to sign a new contract.
- C. You need to use the contract change control system to make the change to the contract.
- D. You need to use claims administration to resolve the issue.

**15. Which of the following BEST explains the difference between an audit and an inspection during Control Procurements?**

- A. The inspection reviews the products being created, while the audit reviews the procurement process.
- B. The inspection reviews the quality, schedule, and cost performance versus the initial contract, while the audit reviews how well the procurement process is going.
- C. The audit reviews the products being created, while the inspection is used to examine which resources should be assigned to which tasks.
- D. The audit reviews the products being created, while the inspection is used to examine successes and failures and gather lessons learned.

## Answers

~~Exam Questions~~**1. Answer: D**

This contract is a time and materials contract. It's charging a rate for labor and overhead for materials.

← Eliminating the wrong answers works really well with questions like this.

**2. Answer: A**

One of the most important things about a bidder conference is that no one seller is given better access to the buyer. They should all have the same opportunity to gather information, so that no single seller is given preferential treatment.

← Sellers should meet in the same room, and any time one of them asks the question, everyone else should hear the answer.

**3. Answer: C**

A fixed-price contract is the riskiest sort of contract for the seller. That's because there's one price for the whole contract, no matter what happens. So if it turns out that there's a lot more work than expected, or the price of parts or materials goes up, then the seller has to eat the costs.

**4. Answer: C**

This is just the definition of the point of total assumption.

**5. Answer: C**

This is a simple make-or-buy decision, so you can work out the math. The contractor's quote of \$19,000 per week for a 16-week job means that buying will cost you  $\$19,000 \times 16 = \$304,000$ . On the other hand, if you decide to keep the work in-house, then it will cost you \$35,000 for the engineer, plus \$15,000 per week for 16 weeks:  $\$35,000 + (16 \times \$15,000) = \$275,000$ . It will be cheaper to make it rather than buy it!

OH, I GET IT. I JUST HAVE TO FIGURE OUT HOW MUCH IT COSTS TO MAKE IT OR BUY IT, AND CHOOSE THE LOWER NUMBER!



## Answers

~~Exam Questions~~**6. Answer: A**

This question describes make-or-buy analysis, which is part of the Plan Procurement Management process.

**7. Answer: C**

One of the most important things that you do when you're finding sellers during the Conduct Procurements process is to select the sellers that will do the work. And the qualified seller list is an input that you use for that.

*Your company should already have a qualified seller list on file.*

**8. Answer: B**

One of the most important parts of Procurement Management is that both the buyer and the seller want to feel like they're getting a good deal. Every procurement should be a win-win situation for both parties!

**9. Answer: C**

This may look like a tough problem, but it's actually pretty easy. Just figure out how much the rental would cost you for each of the answers:

- |              |   |
|--------------|---|
| A. 8 months  | $8 \text{ months} \times \$5,000 \text{ per month} + \$2,000 \text{ service charge} = \$42,000$   |
| B. 16 months | $16 \text{ months} \times \$5,000 \text{ per month} + \$2,000 \text{ service charge} = \$82,000$  |
| C. 21 months | $21 \text{ months} \times \$5,000 \text{ per month} + \$2,000 \text{ service charge} = \$107,000$ |
| D. 25 months | $25 \text{ months} \times \$5,000 \text{ per month} + \$2,000 \text{ service charge} = \$127,000$ |

Now look at what the excavator would cost for 25 months. It would cost \$105,000 plus \$20,000 for the maintenance costs, for a total of \$125,000. So at 25 months, the excavator is worth buying—but before that, it makes more sense to rent.

*If this seems a little out of place, remember that renting equipment is a kind of contract, and the same kind of make-or-buy decision is necessary.*

**10. Answer: D**

The time and materials (T&M) contract is the riskiest one for the buyer, because if the project costs are much higher than the original estimates, the buyer has to swallow them, while the seller keeps getting paid for the time worked.

## Answers

~~Exam Questions~~**11. Answer: D**

Both cost-plus and fixed-price contracts are based on the idea that you know how long the contract is going to last. A seller would only agree to a fixed-price contract if there's a good idea of how much it's going to cost. And a cost-plus contract will hurt the buyer if it goes over. Only the time and materials contract will give both the buyer and seller a fair deal if neither has a good idea of how long the work will take.



That's the only time you really should use a T&M contract.

**12. Answer: A**

Contracting is a pretty linear process—first you plan the contract, then you put together a package of procurement documents to send to potential sellers, and then you select a seller and start the work. So you send out a request for proposals after you've put together the procurement document package so that you can select a seller for the job.

**13. Answer: D**

You put together the source selection criteria as part of the Plan Procurement Management process. That way, you can use the criteria when you're looking at the responses you get from sellers.

**14. Answer: C**

You can always change a contract, as long as both the buyer and the seller agree to it. When you do that, you need to use the contract change control system—just like with any other change.



This is not what claims administration is for. Since the buyer and seller agree, there is no claim.

**15. Answer: B**

It's easy to get mixed up with all of these tools for controlling procurements, but if you think about how they're used, it gets less confusing. Remember, inspections are for figuring out if the seller is meeting your agreements. Audits are about making sure the contract is following the procurement process as you would expect.

## 13 Stakeholder management

# Keeping everyone engaged

BUT IT WASN'T UNTIL I MAPPED OUT ALL OF THE PARTY GUESTS IN A POWER/INTEREST GRID THAT I REALLY KNEW HOW TO KEEP THEM SATISFIED.



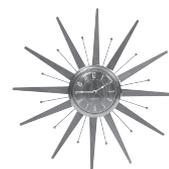
**Project management is about knowing your audience.** If you don't get a handle on the people who are affected by your project, you might discover that they have needs you aren't meeting. If your project is going to be successful, you've got to satisfy your stakeholders. Luckily, there's the **Stakeholder Management** knowledge area, which you can use to understand your stakeholders and figure out what they need. Once you really understand how important those needs are to your project, it's a lot easier to **keep everyone satisfied.**

## Party at the Head First Lounge (again)!

When we last saw Jeff and Charles in Chapter 10, they were just about to have their grand opening party. How's that going for them?



**Head First  
Lounge**



Look at those retro clothes  
and hairstyles! They really  
put a lot of effort into it.

# Not everybody is thrilled

There were a few people who weren't quite as enthused about the opening party for Head First Lounge as Jeff and Charles were. Can you use the four **Stakeholder Management** processes to help them get their party on track?

**THAT WAS THE BEST PARTY IN TOWN, AND WE DIDN'T KNOW ABOUT IT UNTIL THE NEXT DAY.**

*Mark and Laura are really into the downtown nightlife scene.*

**WHAT MAKES HF LOUNGE BETTER THAN EVERY OTHER DOWNTOWN PARTY SPOT?**

*Mike writes a column on downtown nightlife.*

**THE MUSIC LAST TIME WAS TOO COMMERCIAL. I'VE GOT TO PLAY SOMETHING MORE INTERESTING IF PEOPLE ARE GOING TO REMEMBER ME.**

*Tom's been DJing for a couple of years around town, and he's really starting to take off.*

**THE LAST PARTY GOT A LITTLE LOUD. I'M JUST HOPING THEY'LL KEEP IT DOWN IN THE FUTURE.**

*Adam lives next door to the Lounge.*

## BRAIN POWER

What can Jeff and Charles do to get a handle on their stakeholder problems?

# Understanding your stakeholders

When you think about it, there are a lot of people who have an interest in your project. That obviously includes the sponsor who's paying for it, the team who's making it, and the people who will support it. But there are people who aren't so obvious who have a stake in your project as well. If you don't pay attention to all of your stakeholders, you could find that you don't meet their needs, and that can cause your project to run off the rails. The **Stakeholder Management** processes are here to help you figure out who your stakeholders are, plan how you'll keep them engaged, and manage your project to keep them satisfied.



**Identify Stakeholders**

*You need to spend a little time figuring out who your stakeholders are before you can do anything else. That's why this one is an Initiating process.*

Stakeholder Management Plan				
Stakeholder	Unaware	Resistant	Supportive	Leading
Jill - HFL employee			Current	Desired
Charles-HFL employee			Current	Desired
DJ Tom-HFL employee		Current		Desired
Adam-Neighbor	Current		Desired	
Mike de Colomaz		Current		Desired
Mark and Laura-partners	Current			Desired

Stakeholder Communication Requirements		
Stakeholder	Type of information required	Frequency
Jill -HFL employee	Status meetings Issue Reviews	Daily
Charles-HFL employee	Status meetings Issue Reviews	Daily
DJ Tom-HFL employee	Status meetings Issue Reviews	Weekly
Adam-Neighbor	Party announcements	1 month prior to party
Mike de Colomaz	Party announcements Special invitations	1 Month prior to party Follow up one week prior to party
Mark and Laura-partners	Party announcements Special invitations	1 Month prior to party

**Plan Stakeholder Engagement**

*Here's where you figure out what your stakeholders' current level of engagement is, and plan how you'll get them to support your project.*

**Stakeholder Management makes sure you know who you need to engage to keep your project on track.**

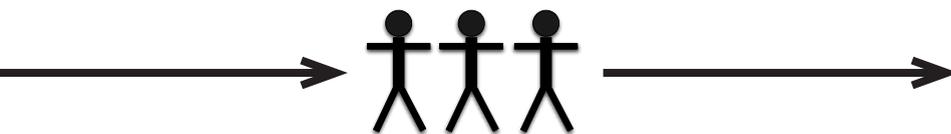
**Stakeholder requirements and expectations sometimes change over the course of the project. **Monitor Stakeholder Engagement** makes sure you stay on top of those changes and adjust your plans accordingly.**



**Executing  
process  
group**



**Monitoring  
and Controlling  
process group**



**Manage  
Stakeholder  
Engagement**

**Monitor  
Stakeholder  
Engagement**

*This process is all about working with your stakeholders to understand their needs and keep them involved in all of the decisions that affect them as the project progresses.*

*This is where you keep track of all of the stakeholder relationships you've built and adjust your plans and actions to keep their needs in mind.*

## Find out who your stakeholders are

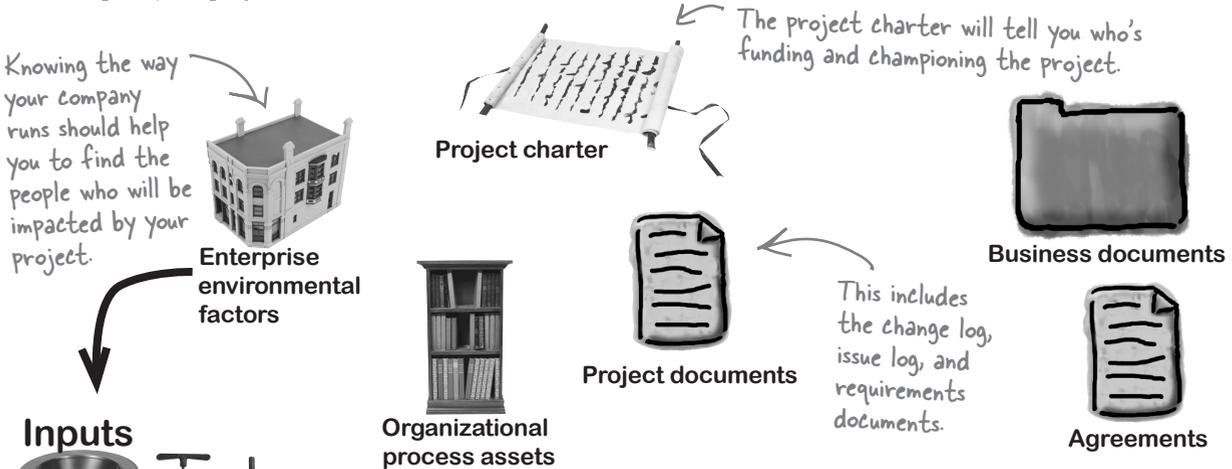
One of the first things you need to do when you start a project is to figure out who your stakeholders are and what you need to do to keep them all in the loop. The **Identify Stakeholders** process is all about writing down your stakeholders' names along with their goals, expectations, and concerns in a document called the **stakeholder register**. Most projects succeed or fail based on how well the project manager knows and manages stakeholder expectations. Writing them down up front will help you to come up with a strategy to identify the people who could impact your project, but still need to be convinced of its value.



Initiating process group



Project Management plan



Inputs

Enterprise environmental factors

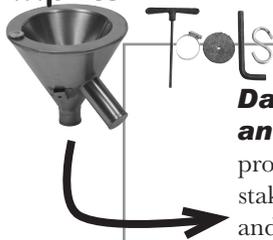
Project charter

Organizational process assets

Project documents

Business documents

Agreements



### Data analysis: stakeholder analysis

**Data analysis: stakeholder analysis** is a critical tool in this process. You need to interview all of the stakeholders you can find for your project, and determine the value the project has for them. As you sit with stakeholders, you'll identify more people to interview.

During stakeholder analysis, you can divide your stakeholders into groups based on their level of involvement and need for communication. When you understand what motivates all of your stakeholders, you can come up with a strategy to make sure that they're told about the things they find important, and that they're not bored with extraneous details.

**Meetings** are...well, they're ordinary meetings. You know how meetings work.

### Data analysis: document analysis

**Data analysis: document analysis** is about looking at the project documents to find the stakeholders for your project.

**Expert judgment** in this process means talking to all of the experts on your project to identify more stakeholders, and learn more about the ones you've identified.

### Data gathering: questionnaires, surveys, and brainstorming

are the ways you get your team to think of people who should be added to the stakeholder register.

### Data representation: stakeholder mapping/representation

You'll see examples of this in the next few pages.



## Behind the Scenes

Stakeholders are really important when you're initiating a project. In Chapter 4 we learned about the business case document, which determines why the benefits of the project are worth the cost. How do you build that document? By working with stakeholders to analyze the benefits of the project, because the stakeholders are the people who understand the organization's strategy, and can evaluate the expected business value of the project.

So what happens after the project charter is approved? The charter contains project requirements, milestones, and other important information about what the team will deliver. But it's not enough to simply write it down. You need to communicate with the stakeholders to make sure they understand what's in the charter, and their responsibilities.



### Stake-hold-er, noun

A person who has an interest or concern about something.

*Tom was a stakeholder in the Little League game since his son was playing in it.*

The PMBOK® Guide defines the term stakeholder a little more specifically than its everyday use: "An individual, group, or organization that may affect, be affected, or perceive itself to be affected by a decision, activity, or outcome of a project, program, or portfolio." (PMBOK® Guide, 6th edition, page 723)

Stakeholders have a lot of influence over project deliverables, and often provide business requirements when you're identifying the key deliverables for the project. And you already know how important deliverables are to achieving the project's goals...and managing customer expectations, too.



Project documents updates



Change requests



Deliverables

Outputs



The register should tell you what individual stakeholders get out of the project so that you can help them to see the value in the project.

The classification tells you whether the stakeholder is internal or external, but also whether he's a supporter, resistor, or neutral participant in the project.

### Stakeholder Register

**Name:** Mike the Columnist

**Role:** Press

**Responsibilities:**

- Attend the party
- Write a column about it

**Requirements:**

- Compare this party with the other lounge parties in town
- Get free drinks

**Expectations:**

- Head First Lounge will have a first-rate sound system

**Classification:**

- External/Neutral

Project Management plan updates

\*\*Flip the page to learn more about the stakeholder register.



## Stakeholder analysis up close

When you get started on your project, the first thing you should do is examine the charter and any contract information you have to figure out who will be impacted by it. Once you have a preliminary list of stakeholders, you should sit down with each one of them and figure out their responsibilities, goals, expectations, and concerns. These interviews will be the basis for the stakeholder profiles in your stakeholder register. As you interview people, you'll likely find more stakeholders to include in the list.

It's useful to group stakeholders together, because stakeholders in a particular group tend to have similar needs and project interests.

**Name:** Adam

**Group:** Neighbors

**Responsibilities:**

- None

**Requirements**

- Peacefully coexist with Head First Lounge
- Read a book on the stoop
- Drink some coffee

**Expectations:**

- Head First Lounge will not be so loud as to disrupt normal activities.

**Classification:**

**Name:** DJ Tom

**Group:** Head First Lounge Employees

**Responsibilities:**

- Play the music for the the lounge party
- Keep up with the crowd's mood and make sure everybody has fun
- Play new and interesting music that the group will like

**Requirements:**

- Build a reputation as a good DJ
- Get hired back for another gig later

**Expectations:**

- Head First Lounge will have a first-rate sound system
- Head First Lounge will advertise the event and have a full house

At first, it may sound like "requirements" and "expectations" are the same thing, but it's useful to make a distinction. Requirements are what someone needs to get out of your project, while expectations are what they think will actually happen.

**Name:** Mike the columnist

**Group:** Press

**Responsibilities:**

- Attend the party
- Write a column about it

**Requirements:**

- Compare this party with the other lounge parties in town
- Get free drinks

**Expectations:**

- Head First Lounge will have a first-rate sound system
- Head First Lounge will be different from the rest of the downtown nightlife spots

**Classification:**

- External/Resistant

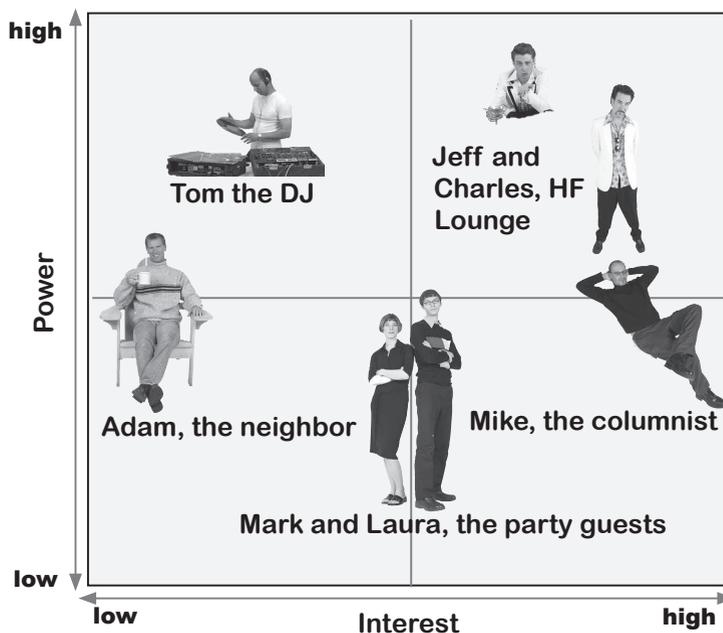
It's easy to imagine a stakeholder with high hopes but little actual expectation of seeing them realized.

Once you've got a handle on your stakeholders' concerns, you can start making headway addressing them. That's how you turn a negative stakeholder into an advocate!

One way to get a handle on how to communicate with your stakeholders is to create a **power/interest grid**. When you plot your stakeholders on a power/interest grid, you can determine who has high or low power to affect your project, and who has high or low interest. People with high power need to be kept satisfied, while people with high interest need to be kept informed. When a stakeholder has both, make sure you manage her expectations very closely!

People with **high power and low interest** need to be kept in the loop. You need these people to be **kept satisfied** with the project, even if they aren't interested in it.

The people who are **high power and high interest** are the decision makers who have the biggest impact on project success, so **closely manage** their expectations.



You shouldn't have to worry too much about the people with **low interest and low power**, so you simply monitor them.

Folks with **high interest and low power** should be kept in the loop as the project progresses. If they're **kept informed**, your project will get good buzz.



What effect would a **resistant** stakeholder have on your project? What about a **neutral** one?



## Exercise

This is the Plan Stakeholder Engagement process. You've seen a lot of planning processes now. Can you fill in the inputs and outputs for this one?

### Inputs



Here's where your company keeps all of its templates and lessons learned.

This one is your company's culture and policies toward project communication.

.....

.....

.....

.....

.....

.....

.....

Here's where you use all of the planning you've done for all of the knowledge areas in your project so far.

This one will help you manage stakeholder engagement if your project includes contracting work.

### Tools

**Data gathering: benchmarking** means taking stock of how other organizations have managed stakeholder engagement for successful projects.

**Data analysis: assumption and constraint analysis, and root-cause analysis**, means understanding what you already know and can assume about the stakeholders in your stakeholder register and their levels of support for the project. It also means figuring out the reasons that might be behind the level of support you're getting from the stakeholders you've identified.

**Data representation: mind mapping and the stakeholder engagement assessment matrix** are all about visualizing the relationships between stakeholders and their interests.

**Decision making** includes (but isn't limited to) voting, and also the same kind of multicriteria decision analysis we talked about in Chapter 8.

You need to know who you're going to communicate with. Here's where you'll find all of the work you've written down for the project so far.

Here's where you'll find the project's purpose and objectives.



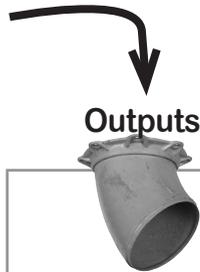
**Expert judgment**

**Expert judgment** in this process means talking to all of the experts on your project to identify more stakeholders, and learn more about the ones you've identified.



**Meetings**

**Meetings** are a great tool for getting everyone together to think through the stakeholders who might be impacted by your project.



**Outputs**

Are you surprised at how much of this process you can fill in? Looks like you're getting the hang of this stuff!



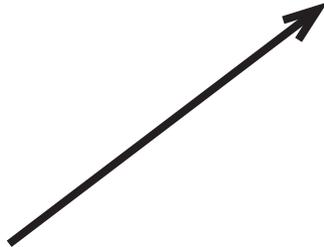
Before you turn the page, take a minute and think of three examples of how you used each of these methods on your last project. That'll help you remember them for the exam!

There is only one output. Can you guess what it is?



## Exercise Solution

This is the Plan Stakeholder Engagement process. You've seen a lot of planning processes now. Can you fill in the inputs and outputs for this one?



### Inputs



Enterprise environmental factors

Organizational process assets

Project Management plan

Project documents

Project Charter

Agreements

### Tools

**Data gathering: benchmarking** means taking stock of how other organizations have managed stakeholder engagement for successful projects.

**Data analysis: assumption and constraint analysis, and root-cause analysis**, means understanding what you already know and can assume about the stakeholders in your stakeholder register and their levels of support for the project. It also means figuring out the reasons that might be behind the level of support you're getting from the stakeholders you've identified.

**Data representation: mind mapping and the stakeholder engagement assessment matrix** are all about visualizing the relationships between stakeholders and their interests.

**Decision making** includes (but isn't limited to) voting, and also the same kind of multicriteria decision analysis we talked about in Chapter 8.



Meetings

**Meetings** are a great tool for getting everyone together to think through the stakeholders who might be impacted by your project.



Planning process group



Expert judgment

**Expert judgment** in this process means talking to all of the experts on your project to identify more stakeholders, and learn more about the ones you've identified.



The levels of engagement Jeff and Charles used to understand their stakeholders are:

**Unaware:** The stakeholder doesn't know that the project is happening.

**Resistant:** The stakeholder doesn't want the project or decision you're making to happen.

**Neutral:** The stakeholder is fine with the project or decision no matter how it turns out.

**Supportive:** The stakeholder wants your project or decision to succeed.

**Leading:** The stakeholder is actively helping the project to succeed.

Outputs



Think about everyone who's involved in the project, and try to come up with a plan for how to engage them.

The plan says how you will distribute the information, to whom, and how often.

### Stakeholder Management Plan

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Jeff—HFL employee				Current	Desired
Charles—HFL employee				Current	Desired
DJ Tom—HFL employee			Current	Desired	
Adam—Neighbor	Current		Desired		
Mike—Columnist		Current		Desired	
Mark and Laura—party guests	Current			Desired	

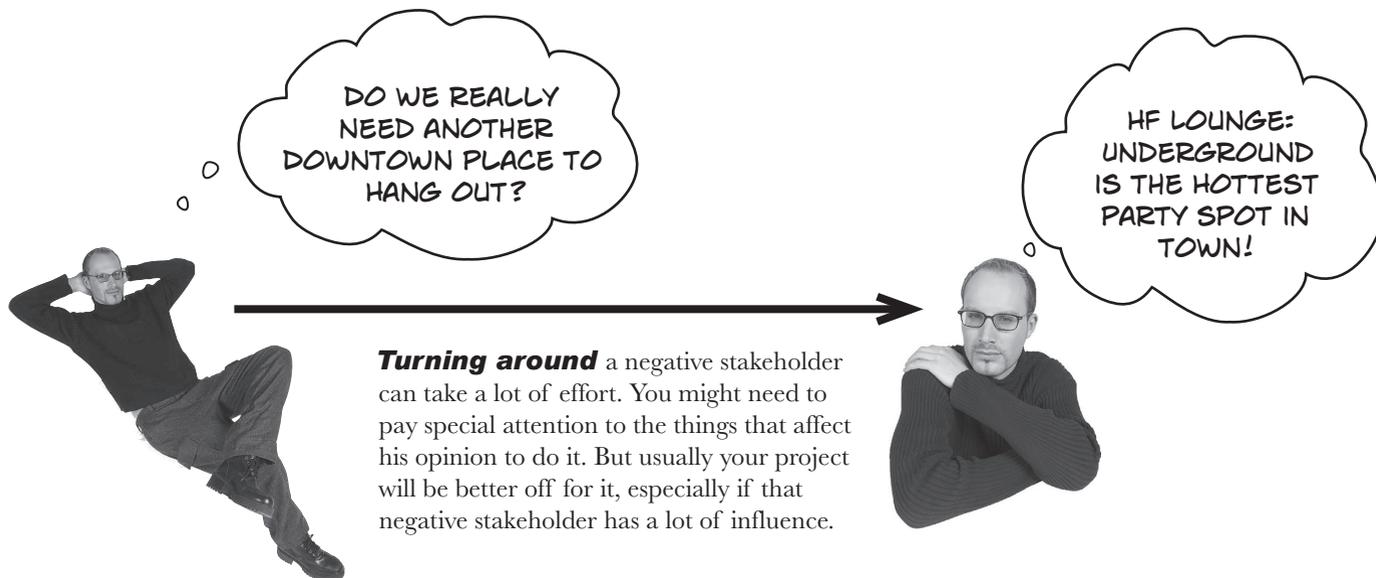
### Stakeholder Communication Requirements

Stakeholder	Type of information required	Frequency
Jeff—HFL employee	Status meetings Issue reviews	Daily
Charles—HFL employee	Status meetings Issue reviews	Daily
DJ Tom—HFL employee	Status meetings Issue reviews	Weekly
Adam—Neighbor	Party announcement	One month prior to party
Mike—Columnist	Party announcement Special invitation	One month prior to party Follow up one week prior to party
Mark and Laura—party guests	Party announcement Special invitation	One month prior to party

## How engaged are your stakeholders?

It's not enough to know who your stakeholders are—you need to understand what motivates them, and what it will take to make the project a success for each of them. That's where the **stakeholder engagement assessment matrix** comes in. Jeff and Charles sat down and worked to come up with one for their upcoming party. Here's what it looked like:

Stakeholder	Unaware	Resistant	Neutral	Supportive	Leading
Jeff—HFL employee				Current	Desired
Charles—HFL employee				Current	Desired
DJ Tom—HFL employee			Current	Desired	
Adam—Neighbor	Current		Desired		
Mike—Columnist		Current		Desired	
Mark and Laura—party guests	Current			Desired	





## Exercise

Choose which engagement level applies in each situation.

1. Jeff and Charles haven't reached out to the caterer yet, but they hope to get his help at a discount.

Unaware    Resistant    Neutral

Supportive    Leading

2. The sound engineers are already booked for that night. They're going to charge an extra fee if you want them to come help out.

Unaware    Resistant    Neutral

Supportive    Leading

3. The liquor distributor usually has no trouble accommodating double and triple orders.

Unaware    Resistant    Neutral

Supportive    Leading

4. The neighborhood business association asked about a place to celebrate the past year's successful programs, and a Head First Lounge party sounds like just the thing for them.

Unaware    Resistant    Neutral

Supportive    Leading

5. A local event magazine was so happy with the last Head First Lounge party that they've offered to partially sponsor this one.

Unaware    Resistant    Neutral

Supportive    Leading

6. The neighbors haven't been told that HFL is planning another party. We probably ought to let them know way in advance.

Unaware    Resistant    Neutral

Supportive    Leading

—————> **Answers on page 718.**



Think about a major project you've worked on where there were a large number of stakeholders. Where was their engagement level at the beginning of the project? Where did it end up?

## there are no Dumb Questions

**Q:** How do I figure out who all of my stakeholders are?

**A:** The short answer is: *look around*. You probably can name the majority of the stakeholders on your project right off the top of your head. You'll surely know who the sponsor is; you can point to her name right on the charter. Then there's the team that's doing the work; you'll know who they are because you work with them every day. From there, it gets a little harder. Any business partners (like trainers or support people for software packages) that your company has contracted to help out with the project are also stakeholders. Consultants or other vendors you might've contracted to help you deliver your product will also be stakeholders. Then you'll have to think about how the product of your project will affect the rest of your company. Will it change the way people work when it's complete? How will those people who need to change their work feel about the project if you asked them today? They're stakeholders, too. If you're thorough, the list might get pretty long, but it's much better to think about your stakeholders up front than it is to ignore them. A stakeholder you don't plan for today could cause a lot of turbulence in your project later.

**Q:** Explain the point of that power/interest grid again.

**A:** Different people have different perspectives on your project. Some of them will put a lot of time and effort into making your project succeed, while others will not have the spare cycles to give. And some people might even actively work against your project if they don't understand it. The power/interest grid is there to help you understand how you should approach the stakeholders for your project. If someone without a lot of power to influence your project doesn't have the time or the will to help you with it, that's less of a problem than when someone with a lot of power to affect your project is resistant to it. It's a tool to help you figure out the best approach to managing all of the stakeholders on your project. It will help you choose the right way to influence the people who can help you succeed.

**Q:** How do I turn around resistant stakeholders?

**A:** In many cases, they're resistant for a good reason. The best approach is really to try to understand why they're resistant and help them to see the benefits of your project. Many times, stakeholders who are resistant to change have good suggestions that can make the project better in the long run.

**Q:** What does it mean to have a stakeholder in a leading role?

**A:** When a stakeholder takes on a leading role, he is actively involved in making sure your project is a success. He may go to meetings and convince others to support the project, and help you to clear any obstacles that might jeopardize your project's goals. When a stakeholder has a leading role in the project, he has a stake in seeing it succeed. Leading stakeholders are willing to put time and energy into making sure that others support the project.

**There are five engagement levels for stakeholders; unaware, resistant, neutral, supportive, and leading.**

## Managing stakeholder engagement means clearing up misunderstandings

As your project progresses, you'll need to check in with your stakeholders regularly so that misunderstandings don't develop. Your job is to help them to take part in the decisions the team is making, so that they can be supportive. When a stakeholder is resistant to change, you'll need to negotiate with her and understand her resistance so that you can take her perspective into account.

Sometimes a stakeholder you don't always talk to might have a good suggestion for an improvement that can help the whole team. It's also possible that there are some facts about the project that the stakeholder hasn't considered, and you can help him to be better informed. The key to success in Stakeholder Management is being inclusive, and sharing information with everyone who's impacted by the project's outcome.



Jeff and Charles didn't realize that they scheduled their party on the same day as another music event that was happening in the city. The sound engineers needed to bring in extra help to handle both events, and that's why they were charging a bigger fee. Once you found out what the issue was and communicated it back to the Head First Lounge team, they understood the cost and approved it.



The **Manage Stakeholder Engagement** process is a typical Executing process. You already know the inputs, tools and techniques, and outputs! See if you can figure out what they do just from their names. Write down a description for each of them, and then flip the page to see if you're right.

### Inputs



Project Management plan



Enterprise environmental factors



Organizational process assets



Project documents

This includes a log of changes that happen on your project. You need to make sure your stakeholders are aware of them, because they really don't like being blindsided by changes.

We just covered this in Chapter 10.

### Communication skills

### Interpersonal and team skills

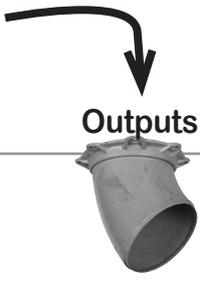


Since the Manage Stakeholder Engagement process is all about resolving issues that the stakeholders experience, the tools are focused on communicating with the stakeholders about those issues.

**Expert judgment** means using expert knowledge in politics, communication strategies, and managing people's interests.

**Ground rules** are set to let everyone know what's expected from project team members and other stakeholders throughout the project.

**Meetings** are a way to get everyone together to make decisions and respond to changes that occur during the project.



Outputs



Change requests

**Project document updates**

.....  
.....  
.....

**Project Management plan updates**

.....  
.....

How will the outputs be used to communicate with stakeholders? Don't forget that every team member is a stakeholder!



## Exercise Solution

The **Manage Stakeholder Engagement** process is a typical Executing process. You already know the input, tools and techniques, and outputs! See if you can figure out what they do just from their names. Write down a description for each of them.

### Inputs



Project Management plan



Enterprise environmental factors



Project documents



Organizational process assets



### Communications skills

This is where you decide how you'll keep people in the loop using push methods, interactive methods, or pull methods.

### Interpersonal and team skills

This is where you use your "soft skills" to keep everybody on track and working toward the same goal.

When your stakeholders have a high degree of influence over your project, it's extremely important to maintain a good relationship with them. The Stakeholder Management plan is a valuable tool for this, and following it will help you manage your stakeholders' expectations so that you can receive continued support from them.



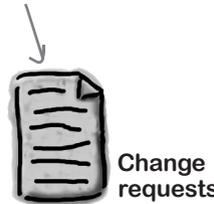
An important part of a project manager's job is helping to manage the flow of information, and keeping stakeholders engaged and informed is a large part of how the project manager does that. Following the Communications Management plan is an effective tool for keeping information flowing to stakeholders.

**Expert judgment** means using knowledge in politics, communication strategies, and managing people's interests.

**Ground rules** are set to let everyone know what's expected from project team members and other stakeholders throughout the project.

**Meetings** are a way to get everyone together to make decisions and respond to changes that occur during the project.

These are any changes to the project plan or other documents that involve stakeholder communication.



Outputs



**Project document updates**

These are any updates to previously written project documents that come from the Manage Stakeholder Engagement process.

**Project Management plan updates**

Approved changes actually need to be made to the project plan.

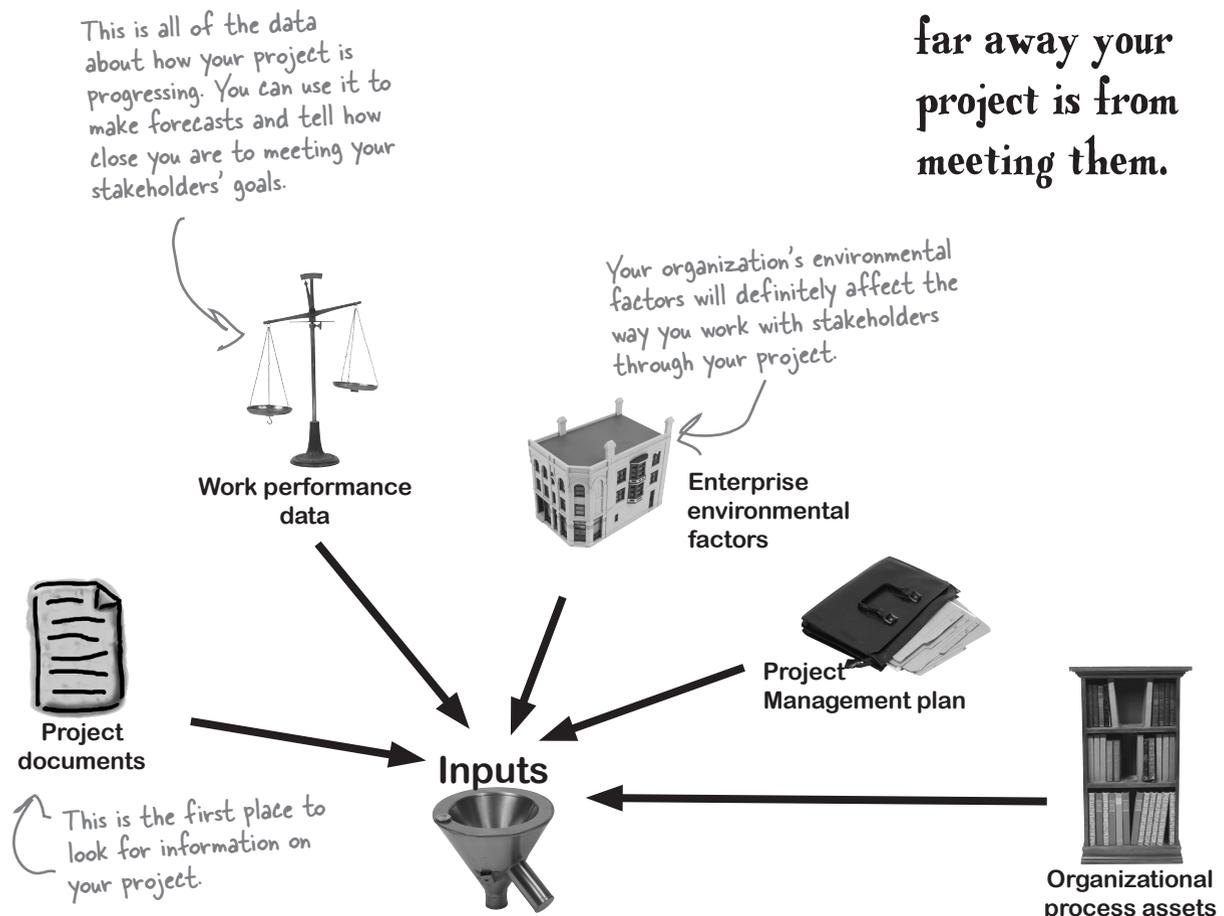
## Monitor your stakeholders' engagement

Now that you've got a great framework set up for managing the way your stakeholders interact with your project, you need to monitor those interactions to make sure that everybody stays in the loop. When you run into a problem or find a place where you might be able to bring the project closer to meeting a stakeholder's goal, you can make course corrections and changes to keep as many of your stakeholders satisfied as possible—and that's what the **Monitor Stakeholder Engagement** process is all about.



Monitoring and Controlling process group

Once you know what your stakeholders' requirements are, you can monitor how close or far away your project is from meeting them.





Can you figure out what each of the **Monitor Stakeholder Engagement** tools and techniques is for, just from the name?



**Data analysis**

**Decision making**

**Data representation**

**Communication skills**

**Interpersonal and team skills**

**Meetings**

—————> **Answers on page 715.**

## Now you can tell when you need to change the way you deal with stakeholders



Now that you've taken a look at all of the data coming from your project, you're in a better position to tell if you need to make changes to the way you're managing stakeholder engagement. The **outputs from Control Stakeholder Engagement** are all about making changes to the documents you've been using to keep them engaged all along.

**Work performance information** is the analyzed work performance data, changed from raw data into reports that are understood in context and can be used to make project decisions. Where work performance data was the raw outputs of the various controlling processes, the work performance information is consolidated. Think of work performance data as your raw budget performance data (this month, we're over budget by \$1,000) and work performance information as that data in context (the project budget forecast is currently \$10,000 under budget, even though we're over by \$1,000 this month).

**Project Management plan updates** might be needed as you work with your stakeholders to ensure successful delivery. Your stakeholders might request changes to your overall strategy for any of the knowledge areas you've planned as part of your Project Management plan. You'll need to go back and make updates to those plans if you want to keep everyone in the loop about the change in approach.

**Change requests** happen as part of controlling stakeholder engagement. What do you do if you find out that one of your stakeholders' requirements has been missed? You put the **change request** in as soon as possible.

**Project documents updates** happen as you work with your stakeholders to monitor and control their engagement. You might find new stakeholders along the way who make you update your **stakeholder register**. You could also run into issues that need to be added to the **issue log**. This also includes updates to **lessons learned**.

You already know how important lessons learned are for helping your team and your company continue to improve, and stakeholders are a really valuable source for them. That's why it's critical to work with stakeholders to capture, analyze, and manage lessons learned. And it's why the communication techniques in Chapter 10 are so valuable to project managers for gathering and documenting lessons learned.

# Pool Puzzle



Here's a chance to test your knowledge while getting some insight into how the exam works. Here are seven tasks from the specification PMI created for the PMP exam that have to do with Stakeholder Management with some words or phrases blanked out. Your **job** is to take words or phrases from the pool at the bottom of the page and place them into the blank lines in the tasks. You may **not** use the same word or phrase more than once, and you won't need to use all of them. Can you use everything you've learned to reproduce part of the PMP exam specification?

- ★ Identify key \_\_\_\_\_ based on business \_\_\_\_\_ in order to manage customer \_\_\_\_\_ and direct the achievement of project \_\_\_\_\_. ( \_\_\_\_\_ process group)
- ★ Conduct benefit analysis with relevant \_\_\_\_\_ to validate project alignment with organizational \_\_\_\_\_ and expected \_\_\_\_\_. ( \_\_\_\_\_ process group)
- ★ Inform \_\_\_\_\_ of the approved \_\_\_\_\_ to ensure common understanding of the key \_\_\_\_\_, milestones, and their roles and \_\_\_\_\_. ( \_\_\_\_\_ process group)
- ★ Develop the stakeholder \_\_\_\_\_ by analyzing needs, interests, and potential impact in order to effectively manage stakeholders' \_\_\_\_\_ and engage them in project decisions. ( \_\_\_\_\_ process group)
- ★ Manage the flow of information by following the \_\_\_\_\_ in order to keep stakeholders \_\_\_\_\_ and \_\_\_\_\_. ( \_\_\_\_\_ process group)
- ★ Maintain stakeholder relationships by following the stakeholder \_\_\_\_\_ in order to receive continued \_\_\_\_\_ and manage \_\_\_\_\_. ( \_\_\_\_\_ process group)
- ★ Capture, analyze, and manage \_\_\_\_\_, using lessons learned management techniques in order to enable continuous \_\_\_\_\_. ( \_\_\_\_\_ process group)

This is all review! All of the missing information is somewhere in this chapter.

**Note: each thing from the pool can only be used once!**

- |                          |                 |              |                |                  |
|--------------------------|-----------------|--------------|----------------|------------------|
| communications plan      | scope           | deliverables |                |                  |
| Monitoring & Controlling | stakeholders    | deliverables |                |                  |
| management plan          | stakeholders    | communicate  | support        |                  |
| management plan          | supportive      | improvement  | informed       |                  |
|                          | lessons learned | Executing    | requirements   | project charter  |
|                          | leading         | Executing    | Initiating     | responsibilities |
|                          | expectations    | performance  | Initiating     | Planning         |
|                          | expectations    | strategy     | Initiating     | engaged          |
|                          | expectations    |              | business value | goals            |
|                          |                 |              |                | requests         |



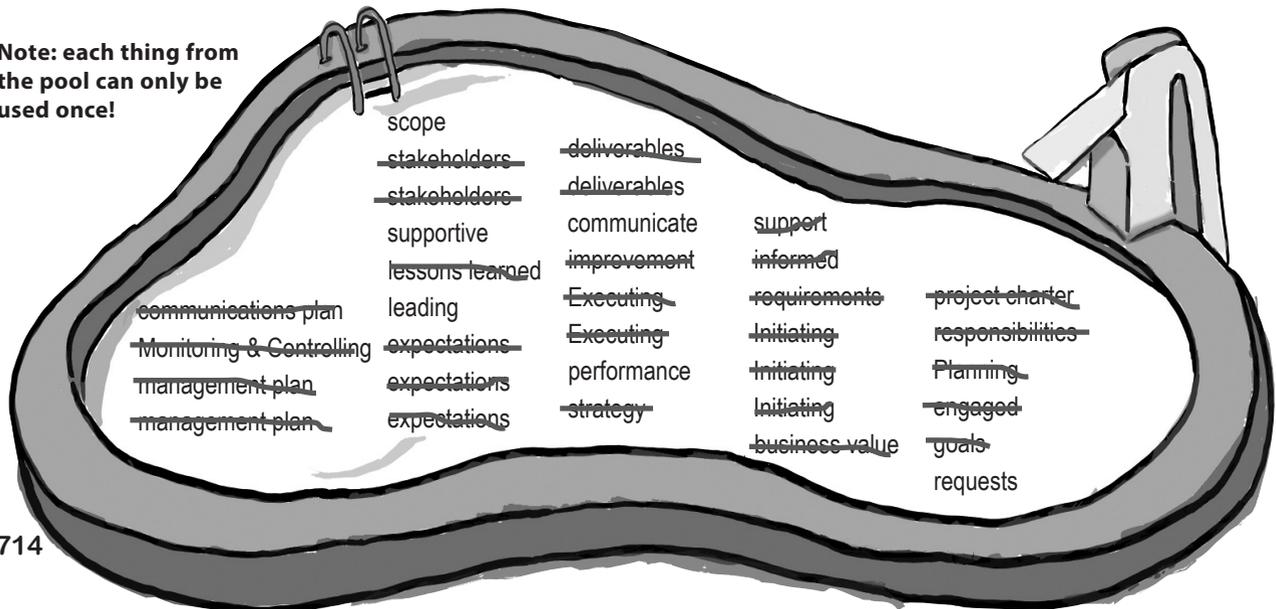
# Pool Puzzle Solution

Were you able to figure these tasks from the PMP exam specification? They all have to do with Stakeholder Management. This is a really good way to prepare for the PMP exam, because the exam questions typically don't use exactly the same wording as the *PMBOK® Guide*. This puzzle helps you learn to use different wording to describe concepts that will appear on the exam.

You can find the complete PMP exam specification by searching for "PMP examination content outline" on the Project Management Institute website: <https://www.pmi.org>.

- ★ Identify key deliverables based on business requirements in order to manage customer expectations and direct the achievement of project goals. (Initiating process group)
- ★ Conduct benefit analysis with relevant stakeholders to validate project alignment with organizational strategy and expected business value. (Initiating process group)
- ★ Inform stakeholders of the approved project charter to ensure common understanding of the key deliverables, milestones, and their roles and responsibilities. (Initiating process group)
- ★ Develop the stakeholder management plan by analyzing needs, interests, and potential impact in order to effectively manage stakeholders' expectations and engage them in project decisions. (Planning process group)
- ★ Manage the flow of information by following the communications plan in order to keep stakeholders engaged and informed. (Executing process group)
- ★ Maintain stakeholder relationships by following the stakeholder management plan in order to receive continued support and manage expectations. (Executing process group)
- ★ Capture, analyze, and manage lessons learned, using lessons learned management techniques in order to enable continuous improvement. (Monitoring & Controlling process group)

**Note: each thing from the pool can only be used once!**





## Sharpen your pencil Solution

Can you figure out what each of the **Monitor Stakeholder Engagement** tools and techniques is for, just from the name?

## TOOLS

This one includes alternatives analysis, root-cause analysis, and stakeholder analysis.

### Data analysis

**Understanding the data that is being produced by the team during project delivery.**

### Decision making

**Determining the best course of action when stakeholder engagement doesn't go as planned.**

### Data representation

**Showing stakeholder engagement in a visual way so that it's easier to make decisions about it.**

### Communication skills

**Understanding how stakeholder engagement is going by communicating with all of the stakeholders.**

### Interpersonal and team skills

**Listening to the team and understanding the context of communications to make good decisions.**

### Meetings

**Keeping all of the stakeholders in the loop about project progress, and providing a place for everyone to share their opinions on how to keep the project on track.**

## It's party time!

The Head First Lounge party is a big hit! Thanks to your Stakeholder Management skills, Jeff and Charles are the reigning kings of downtown nightlife!



I'M SO GLAD I SPOKE UP, AND I'M PLAYING WHAT I WANT TONIGHT.

Tom the DJ told you that he wanted to play different music at the next party, and you took that suggestion to Jeff and Charles. Now he's playing what he wants!



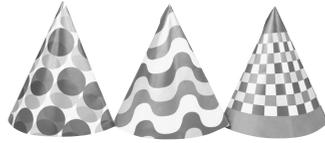
THANKS TO THE EARLY INVITE, WE MADE IT TO THIS GREAT PARTY. THE MUSIC IS PERFECT.

By reaching out early to potential party-goers who'd missed the last event, you made sure the lounge was stocked with people who'd really appreciate the party.

HF LOUNGE: UNDERGROUND IS THE HOTTEST PARTY SPOT IN TOWN!

You paid special attention to Mike the columnist, gave him a VIP invitation, and made sure he knew about the event way in advance. You knew he cared about sound systems, so you made it a point to show him the work the sound engineers had done for the event. Looks like it paid off!





Thanks to diligent planning, Adam the neighbor was given ample notice about the evening's events and took his family on a weekend vacation.



THANKS TO ALL OF OUR STAKEHOLDERS, WE DID IT AGAIN!



Jeff and Charles learned a lot about how to manage stakeholders from watching the way you managed this project.



## Exercise

Choose which engagement level applies in each situation.

1. Jeff and Charles haven't reached out to the caterer yet, but they hope to get his help at a discount.

- Unaware     Resistant     Neutral  
 Supportive     Leading

2. The sound engineers are already booked for that night. They're going to charge an extra fee if you want them to come help out.

- Unaware     Resistant     Neutral  
 Supportive     Leading

3. The liquor distributor usually has no trouble accommodating double and triple orders.

- Unaware     Resistant     Neutral  
 Supportive     Leading

4. The neighborhood business association asked about a place to celebrate the past year's successful programs, and a Head First Lounge party sounds like just the thing for them.

- Unaware     Resistant     Neutral  
 Supportive     Leading

5. A local event magazine was so happy with the last Head First Lounge party that they've offered to partially sponsor this one.

- Unaware     Resistant     Neutral  
 Supportive     Leading

6. The neighbors haven't been told that HFL is planning another party. We probably ought to let them know way in advance.

- Unaware     Resistant     Neutral  
 Supportive     Leading

## Exam Questions

1. Matt, the sponsor of a large publishing project, meets with all of the stakeholders on the project to ask for their support in an upcoming testing event. Which engagement level is he displaying?
  - A. Unaware
  - B. Resistant
  - C. Supportive
  - D. Leading
2. Which of the following is NOT an input to the Plan Stakeholder Engagement process?
  - A. Enterprise environmental factors
  - B. Organizational process assets
  - C. Work performance data
  - D. Stakeholder register
3. You take over for a project manager who has left the company, and realize that there are stakeholders in the project who haven't been included in any of the status meetings so far. Some upper managers think the project is not going to succeed, and others are actively thinking of canceling it. Which document is the FIRST one that you should create to solve this problem?
  - A. Stakeholder register
  - B. Status report
  - C. Budget forecast
  - D. Performance report
4. In a monthly steering meeting, you ask one of the stakeholders on your project if she has reviewed the latest document updates you've made since the last meeting. She says, "I'm not working on that; I'm not even sure what it is." How would you BEST describe her level of engagement?
  - A. Unaware
  - B. Resistant
  - C. Supportive
  - D. Leading
5. You're managing a construction project. You created a stakeholder register and Stakeholder Management plan, and now the team is working on the project. You've been managing the work, and now you're looking at the work performance data to keep your stakeholders informed of the status of the project. You've discovered a change in the way your stakeholders look at the budget for your project. Which of the following BEST describes the next thing you should do?
  - A. Update the risk register to include any changes to risk strategy.
  - B. Compare the work performance information against the time, cost, and scope baselines and look for deviations.
  - C. Create a change request and update the issue log and Cost Management plan to reflect the approved change.
  - D. Hold a status meeting.

## Exam Questions

**6. Joe, a stakeholder on your project, has been plotted on the power/interest grid as high interest with low power. What's the BEST approach for managing his engagement?**

- A. Make him responsible for a deliverable on the project.
- B. Keep him informed of all of the decisions that might affect the project's outcome.
- C. Closely manage his requirements and expectations.
- D. Ignore his requirements and expectations, since he doesn't have the power to affect the project's outcome.

**7. Which Stakeholder Management process is in the Initiating process group?**

- A. Manage Stakeholder Engagement
- B. Identify Stakeholders
- C. Plan Stakeholder Engagement
- D. Register Stakeholders

**8. Sue, the sponsor of the industrial design project you're managing, is plotted on your power/interest grid as high power, high interest. Which is the BEST approach for managing her requirements and expectations?**

- A. Keep her informed of all project decisions.
- B. Manage her requirements and expectations closely.
- C. Keep her satisfied by inviting her to all of the team meetings.
- D. Understand her goals and expectations, but don't do anything with them.

**9. Which is NOT an input of the Identify Stakeholders process?**

- A. Agreements
- B. Enterprise environmental factors
- C. Project charter
- D. Project Management plan

**10. Kyle is the project manager of a project that has teams distributed in many different places. One of the stakeholders in his project has asked that all formal communications from the project be shared with all of the teams, regardless of their location. Which of the following is NOT a tool that Kyle's team will use to monitor this stakeholder requirement:**

- A. Data analysis
- B. Data representation
- C. Meetings
- D. Inspection

## Exam Questions

11. Which information is NOT included in the stakeholder register?

- A. Stakeholder name and group
- B. Stakeholder requirements
- C. Stakeholder expectations
- D. Stakeholder deliverables

12. Which Stakeholder Management process is in the Monitoring and Controlling process group?

- A. Distribute Information
- B. Manage Stakeholder Engagement
- C. Plan Communications
- D. Monitor Stakeholder Engagement

# Exam Questions

**1. Answer: D**

Since Matt is working to bring other stakeholders to support the project, he's in a leading engagement role.

**2. Answer: C**

Work performance data is an input of some Stakeholder Management processes, but not an input to Plan Stakeholder Engagement.

**3. Answer: A**

The stakeholder register is the first thing you need to create here. It looks like some of the upper managers who might be thinking of canceling the project need to have their ideas taken into account. Once you've identified them as stakeholders, you can work to bring their perspective into account on your project and include them in project management decisions.

RIGHT. YOU NEED TO KNOW WHO YOUR STAKEHOLDERS ARE BEFORE YOU CAN GET THEM INVOLVED.

**4. Answer: A**

It sounds like this stakeholder is completely unaware of her responsibilities on the project. The next step here is to spend some time bringing her up to speed on what's expected.

**5. Answer: C**

When you look at work performance data and discover a new stakeholder requirement, you're doing the Monitor Stakeholder Engagement process. Some of the outputs of that process are change requests, project document updates, and Project Management plan updates.

Once you recognize the process that's being described, try to think of the outputs of the process to figure out which answer is best.

**6. Answer: B**

Stakeholders in the low power/high interest quadrant of the power/interest grid need to be kept informed of all project decisions.

## Answers

~~Exam Questions~~**7. Answer: B**

Identify Stakeholders is the only process in Stakeholder Management that is part of the Initiating process group.

Flip back to Chapter 3 for a quick refresher on the Initiating process group, now that you've studied Stakeholder Management. It's a good way to review.

**8. Answer: B**

Stakeholders in the high power/high interest quadrant of the power/interest grid need to have their expectations and requirements closely managed by the project manager.

It can get confusing because Identify Stakeholders is discussed at the end of the PMBOK® Guide, but it's part of the Initiating processes and done before you get to the Planning processes.

**9. Answer: D**

The Project Management plan is not an input to the Identify Stakeholders process. Since the Identify Stakeholders process is part of the Initiating process group, the stakeholders are identified as an input to the Planning processes that create the Project Management plan.

**10. Answer: D**

Inspection is not a tool or technique of Monitor Stakeholder Expectations. (It's part of Procurement Management.)

**11. Answer: D**

Not all stakeholders have deliverables on a project. Some are sponsors, vendors, or others who might be involved in the project but not actually producing deliverables. When a stakeholder does have deliverables that she's accountable for, she'll be documented in the Scope Management plan.

**12. Answer: D**

Monitor Stakeholder Engagement is the only Monitoring and Controlling process in Stakeholder Management.



## 14 Professional responsibility

# Making good choices

KNOWING THE PMI  
CODE OF ETHICS AND  
PROFESSIONAL CONDUCT HAS  
MADE ME A **BETTER PROJECT  
MANAGER**...AND A BETTER  
ROOMMATE!

OH, REALLY? WELL,  
DOES IT SAY ANYTHING  
ABOUT LEAVING HALF-EATEN  
BURRITOS IN THE SINK?



**It's not enough to just know your stuff. You need to make good choices to be good at your job.** Everyone who has the PMP credential

agrees to follow the **Project Management Institute Code of Ethics and Professional Conduct**, too. The Code helps you with **ethical decisions** that aren't really covered in the body of knowledge—and it's a big part of the PMP exam. Most of what you need to know is **really straightforward**, and with a little review, you'll do well.

## Doing the right thing

You'll get some questions on the exam that give you situations that you might run into while managing your projects and then ask you what to do. Usually, there's a clear answer to these questions: ***it's the one where you stick to your principles.*** Questions will make the decisions tougher by offering rewards for doing the wrong thing (like money for taking a project shortcut), or they will make the infraction seem really small (like photocopying a copyrighted article out of a magazine). If you stick to the principles in the PMP Code of Professional Conduct regardless of the consequences, you'll **always** get the answers right.

The PMP exam categorizes ethics and professional conduct as part of a project manager's cross-cutting knowledge and skills. This means that there will be questions about ethics and professional conduct scattered throughout the exam alongside questions about each of the process groups. You should expect to see questions about specific ethical situations for each of the process groups. When you come across a question about ethics and professional conduct, you're likely to see it in the context of initiating, planning, executing, or monitoring and controlling a project.

## The main ideas

**In general, there are a few kinds of problems that the code of ethics prepares you to deal with:**

- 1. Follow all laws and company policies.**
- 2. Treat everybody fairly and respectfully.**
- 3. Have respect for the environment and the community you're working in.**
- 4. Give back to the project management community by writing, speaking, and sharing your experience with other project managers.**
- 5. Keep learning and getting better and better at your job.**
- 6. Respect other people's cultures.**
- 7. Respect copyright laws.**
- 8. Always be honest with everyone on the project.**
- 9. If you find that another person has done something to damage the PMP credential in any way, you must report it to PMI.**

So if you find out that someone has stolen questions from the PMP exam, cheated on the PMP exam, falsely claimed to have a PMP certification, or lied about anything related to the PMP certification process, then you **MUST** report that to PMI.

**Ethics and professional responsibility questions make up 10% of the exam. That's good news because these questions are really easy if you understand the ideas behind the PMP Code of Professional Conduct.**



COME ON. IS THIS REALLY ON THE TEST? I KNOW HOW TO DO MY JOB. DO I REALLY NEED A MORALITY LESSON?

**Being a PMP-certified project manager means that you know how to do your job and that you will do it with integrity.**

It might seem like it doesn't really matter how you will handle these situations, but think about it from an employer's perspective for a minute. Because of the PMI Code of Ethics and Professional Conduct, employers know that when they hire a PMP-certified project manager, they are hiring someone who will follow company policies and do everything aboveboard and by the book. That means that you'll help to protect their company from litigation and deliver on what you promise, which is actually pretty important.

So you should definitely expect to see questions about ethics and professional responsibility on the exam. Not only that, but you won't necessarily see them as straightforward, black-and-white questions, either. Since the questions on this topic are combined into the other questions for the process groups, you're likely to get questions about situations that might occur on real projects. A question about ethics or professional responsibility might look at first like a question about, say, a particular tool or technique in planning. Keep your eye out for "red herring" questions that turn out to be about ethics and social responsibility. They'll lay out a situation that sounds like a normal project management problem, but requires you to use one of the principles in the PMI Code of Ethics and Professional Conduct.



Can you think of some situations where you might need to make decisions using these principles in your own projects?

## Keep the cash?

A lot of ethics questions on the PMP exam concern bribery. It is never, under any circumstances, OK to accept a bribe—even if your company and customer might benefit from it somehow. And bribes aren't always cash. They can be anything from free trips to tickets to a ball game. Any time you're offered anything to change your opinion or the way you work, you must decline the offer and disclose it to your company.

↖ In some countries, even though you may be "expected" to pay a bribe, it's not OK to do it—even if it's customary or culturally acceptable.

AWESOME. I'VE BEEN WANTING TO GO SHOPPING FOR A WHILE. AND WHAT ABOUT THAT VACATION? ACAPULCO, HERE WE COME!

↗ The easy way



I WOULD NEVER ACCEPT A GIFT LIKE THAT. DOING A GOOD JOB IS ITS OWN REWARD!



↖ The right way

I'M SORRY, I CAN'T ACCEPT THE GIFT. I REALLY APPRECIATE THE GESTURE, THOUGH.



## Fly business class?

Any time there's a policy in your company, you need to follow it. Even if it seems like no harm will be done if you don't follow the policy, and even if you will be able to get away with it, you should not do it. And that goes double for laws—under no circumstances are you ever allowed to break a law, no matter how much good it “seems” to do you or your project.

And if you ever see someone in your company breaking the law, you need to report it to the authorities.

WE'VE GOT SOME EXTRA MONEY IN THE BUDGET! I KNOW THE TRAVEL POLICY SAYS WE ALWAYS FLY COACH. BUT I BET WE CAN GET THEM TO APPROVE BUSINESS CLASS TICKETS. WHAT DO YOU THINK?

DID YOU KNOW THAT THOSE CHAIRS GO INTO TOTALLY FLAT BEDS? THIS IS SO COOL. I'VE WORKED SO HARD, I'VE TOTALLY EARNED IT!



THERE'S NO EXCUSE FOR NOT FOLLOWING THE RULES. THE TRAVEL POLICY SAYS FLY COACH. NO EXCEPTIONS!

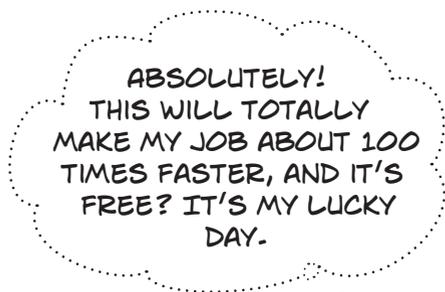
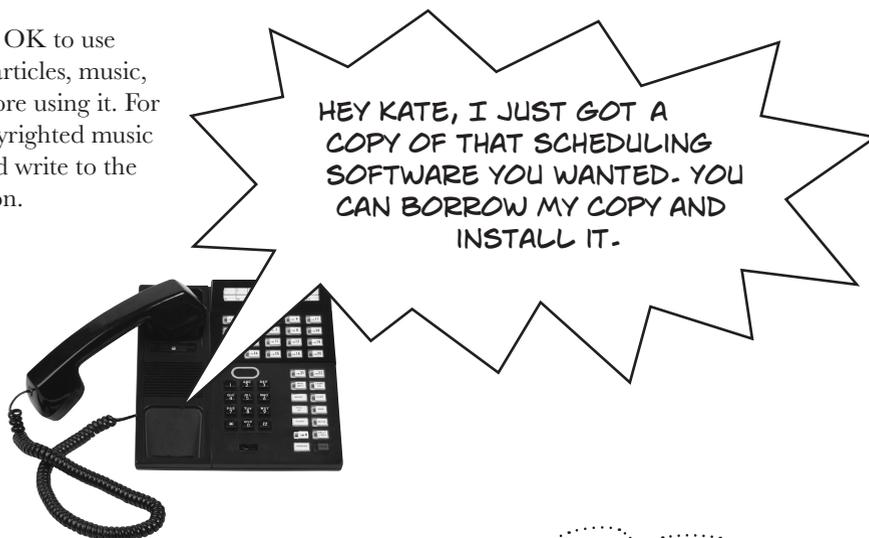


I KNOW WE COULD GET IT APPROVED, BUT THE ECONOMY FARE WILL BE FINE.



## New software

When it comes to copyright, it's never OK to use anything without permission. Books, articles, music, software...you always need to ask before using it. For example, if you want to use some copyrighted music in a company presentation, you should write to the copyright owner and ask for permission.



## Shortcuts

You might see a question or two that asks if you really need to follow all of the processes. Or you might be asked by your boss to keep certain facts about your project hidden from stakeholders or sponsors. You have a responsibility to make sure your projects are run properly, and to never withhold information from people who need it.



WE DON'T HAVE TIME FOR ALL OF THIS PLANNING. LET'S CUT OUT A COUPLE OF THESE PLANNING PROCESSES. DO WE REALLY NEED COST MANAGEMENT?

ALL RIGHT, LESS WORK FOR ME! LET'S FACE IT, IT'S NOT LIKE I HAVE ALL THE TIME IN THE WORLD FOR WRITING PLANS!

THE PMBOK® GUIDE LAYS OUT THESE PROCESSES FOR A REASON. WE WON'T TAKE ANY SHORTCUTS!



I KNOW WE DON'T HAVE MUCH TIME, BUT TAKING THIS SHORTCUT COULD ACTUALLY COST US MORE TIME THAN IT SAVES IN THE END.

## A good price or a clean river?

Being responsible to the community is even more important than running a successful project. But it's more than being environmentally aware—you should also respect the cultures of everyone else in your community, and the community where your project work will be done.

That means even though languages, customs, holidays, and vacation policies might be different from country to country, you need to treat people the way they are accustomed to being treated.



WE JUST FOUND OUT THAT ONE OF OUR SUPPLIERS DUMPS HARMFUL CHEMICALS IN THE RIVER. THEY'VE ALWAYS GIVEN US GREAT RATES, AND OUR BUDGET WILL GO THROUGH THE ROOF IF WE SWITCH SUPPLIERS NOW. THE WHOLE THING GIVES ME A HEADACHE. WHAT SHOULD WE DO?

WE CAN'T LET THE PROJECT FAIL FOR A BUNCH OF STUPID FISH.



THE EARTH IS OUR HOME AND IS SO MUCH MORE IMPORTANT THAN THIS PROJECT. WE HAVE TO DO WHAT'S RIGHT---



BEN, I KNOW IT COULD CAUSE US PROBLEMS, BUT WE'RE GONNA HAVE TO FIND ANOTHER SUPPLIER.

## We're not all angels

We know that the choices you make on your project are not always black and white. Remember that the questions on the exam are designed to test your knowledge of the PMP Code of Professional Conduct and how to apply it. A lot of situations you will run into in real life have a hundred circumstances around them that make these decisions a little tougher to make than the ones you see here. But if you know what the Code would have you do, you're in a good position to evaluate those scenarios as well.

Seriously, it's a quick read—and it'll help you on the exam.

Now, go read the PMP Code of Professional Conduct before you take these exam questions. Go to this URL and you can download the code from PMI.

<https://www.pmi.org/about/ethics/code>

I MAY NOT BE THE LIFE OF THE PARTY, BUT THINK LIKE ME, AND YOU'LL NAIL THE ETHICS PART OF THE EXAM.



## Exam Questions

**1. You read a great article over the weekend, and you think your team could really benefit from it. What should you do?**

- A. Photocopy the article and give it to the team members.
- B. Type up parts of the article and email it to the team.
- C. Tell everyone that you thought of the ideas in the article yourself.
- D. Buy a copy of the magazine for everyone.

**2. You find out that a contractor that you're working with discriminates against women. The contractor is in another country, and it's normal in that country. What should you do?**

- A. Respect the contractor's culture and allow the discrimination to continue.
- B. Refuse to work with the contractor, and find a new seller.
- C. Submit a written request that the contractor no longer discriminate.
- D. Meet with your boss and explain the situation.

**3. You're a project manager at a construction company that's selling services to a client. You are working on a schedule and a budget when the CEO at the client demands that you do not produce those things. Instead, he wants you to begin work immediately. What the BEST thing that you can do?**

- A. Meet with the CEO to explain why the budget and schedule are necessary.
- B. Stop work immediately and go into claims administration.
- C. Don't produce the schedule and budget.
- D. Ask the buyer to find another company to work with.

**4. You're working on a project when the client demands that you take him out to lunch every week if you want to keep his business. What's the BEST thing to do?**

- A. Take the client out to lunch and charge it to your company.
- B. Refuse to take the client out to lunch because it's a bribe.
- C. Take the client out to lunch, but report him to his manager.
- D. Report the incident to PMI.

**5. You are working on one of the first financial projects your company has attempted, and you have learned a lot about how to manage the project along the way. Your company is targeting financial companies for new projects next year. What's the BEST thing for you to do?**

- A. Talk to your company about setting up some training sessions so that you can teach others what you have learned on your project.
- B. Keep the information you've learned to yourself so that you'll be more valuable to the company in the next year.
- C. Decide to specialize in financial contracts.
- D. Focus on your work with the project and don't worry about helping other people to learn from the experience.

## Exam Questions

**6. You find out that you could save money by contracting with a seller in a country that has lax environmental protection rules. What should you do?**

- A. Continue to pay higher rates for an environmentally safe solution.
- B. Take advantage of the cost savings.
- C. Ask your boss to make the decision for you.
- D. Demand that your current contractor match the price.

**7. You overhear someone on your team using a racial slur. This person is a critical team member and you are worried that if he leaves your company it will cause project problems. What should you do?**

- A. Pretend you didn't hear it so that you don't cause problems.
- B. Report the team member to his boss.
- C. Bring it up at the next team meeting.
- D. Meet in private with the team member and explain that racial slurs are unacceptable.

**8. You've given a presentation for your local PMI chapter meeting. This is an example of what?**

- A. A PDU
- B. Contributing to the Project Management Body of Knowledge
- C. Donating to charity
- D. Volunteering

**9. You are about to hold a bidder conference, and a potential seller offers you great tickets to a baseball game for your favorite team. What should you do?**

- A. Go to the game with the seller but avoid talking about the contract.
- B. Go to the game with seller and discuss the contract.
- C. Go to the game, but make sure not to let him buy you anything because that would be a bribe.
- D. Politely refuse the tickets.

**10. Your company has sent out an RFP, and your brother wants to bid on it. What's the BEST thing for you to do?**

- A. Give your brother inside information to make sure that he has the best chance at getting the project.
- B. Publicly disclose your relationship with him and excuse yourself from the selection process.
- C. Recommend your brother but don't inform anyone of your relationship.
- D. Don't tell anyone about your relationship, but be careful not to give your brother any advantage when evaluating all of the potential sellers.

Answers

## ~~Exam Questions~~

**1. Answer: D**

You should never copy anything that's copyrighted. Make sure you always respect other people's intellectual property!

**2. Answer: B**

It's never OK to discriminate against women, minorities, or others. You should avoid doing business with anyone who does.

**3. Answer: A**

This is a difficult situation for any project manager. But you can't cut corners on the project management processes, and you certainly can't tell the client that you're refusing their business. The best thing you can do is meet with the CEO to explain why you need to follow the rules.

**4. Answer: B**

The client is demanding a bribe, and paying bribes is unethical. You should not do it. If your project requires you to bribe someone, then you shouldn't do business with that person.

**5. Answer: A**

You should always try to help other people learn about managing projects.

 This is called contributing to the Project Management Body of Knowledge.

**6. Answer: A**

You should never contract work to a seller who pollutes the environment. Even though it costs more to use machinery that doesn't damage the environment, it's the right thing to do.

Answers

## Exam Questions

**7. Answer: D**

You should make sure that your team always respects other people.

**8. Answer: B**

Any time you help share your knowledge with others, you are contributing to the Project Management Body of Knowledge, and that's something you should do as a certified project manager!

**9. Answer: D**

You have to refuse the tickets even if the game sounds like a lot of fun. The tickets amount to a bribe, and you shouldn't do anything that might influence your decision in awarding your contract.

**10. Answer: B**

You have to disclose the relationship. It's important to be up front and honest about any conflict of interest that could occur on your projects.



## 15 A little last-minute review

# Check your knowledge

BOY, EXAM DAY IS MY FAVORITE DAY OF THE YEAR! I ONLY WISH WE COULD HAVE SCHOOL ALL SUMMER, TOO.



**Wow, you sure covered a lot of ground in the last 14 chapters!** Now it's time to take a look back and drill in some of the most important concepts that you learned. That'll keep it all fresh and give your brain a final workout for exam day!

which process goes where?



## Process Magnets

Can you put all of the processes in the right knowledge areas? Give it a shot—and while you're at it, see if you can put them inside each knowledge area in the order that they're typically performed on a project.

Integration	Scope	Schedule	Cost	Quality
1	1	1	1	
2	2	2	2	
3	3	3	3	
4	4	4	4	
5	5	5	1	
6	6	6	2	
7			3	

Process Magnets (Project Management Processes):

- Plan Resource Management
- Develop Team
- Control Procurements
- Manage Communications
- Develop Schedule
- Monitor Risks
- Plan Cost Management
- Acquire Resources
- Sequence Activities
- Perform Quantitative Risk Analysis
- Estimate Activity Durations
- Estimate Activity Resources
- Manage Project Knowledge
- Manage Quality
- Collect Requirements
- Conduct Procurements
- Develop Project Charter
- Monitor and Control Project Work
- Plan Scope Management
- Identify Stakeholders
- Monitor Stakeholder Engagement
- Validate Scope
- Define Activities

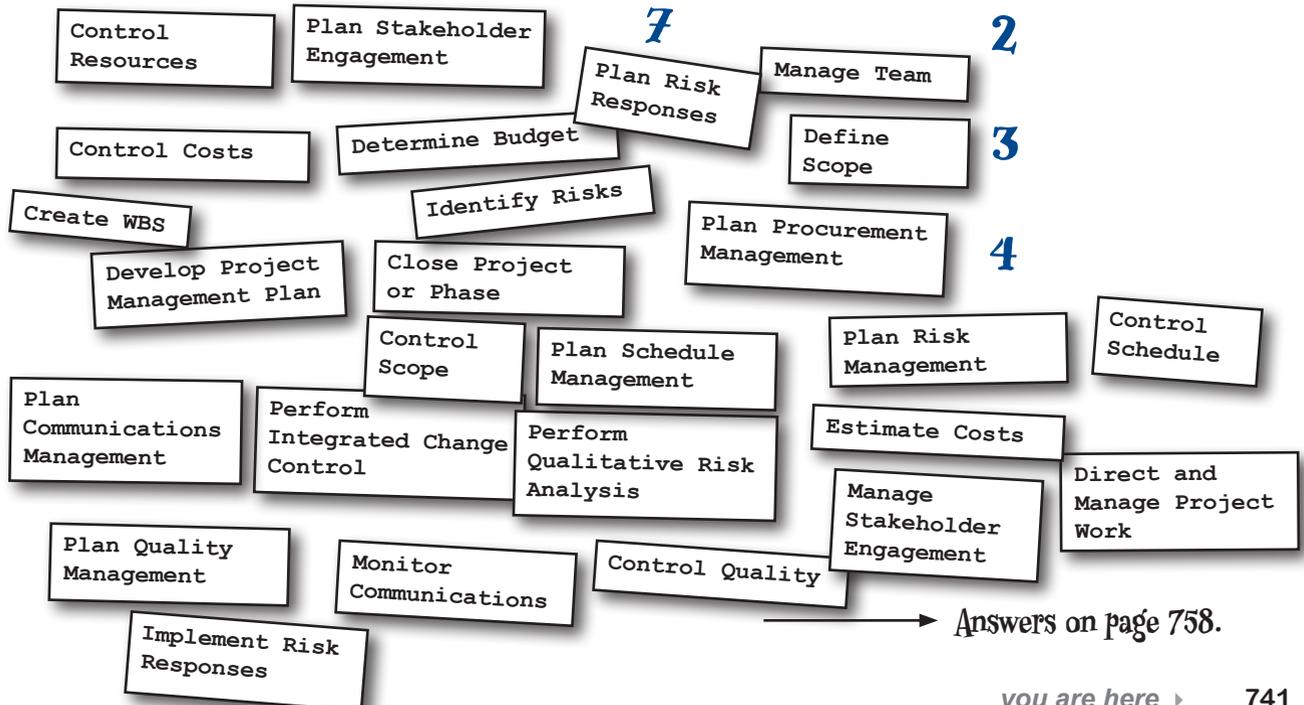
**Resource**

**Communications**

**Risk**

**Procurement**

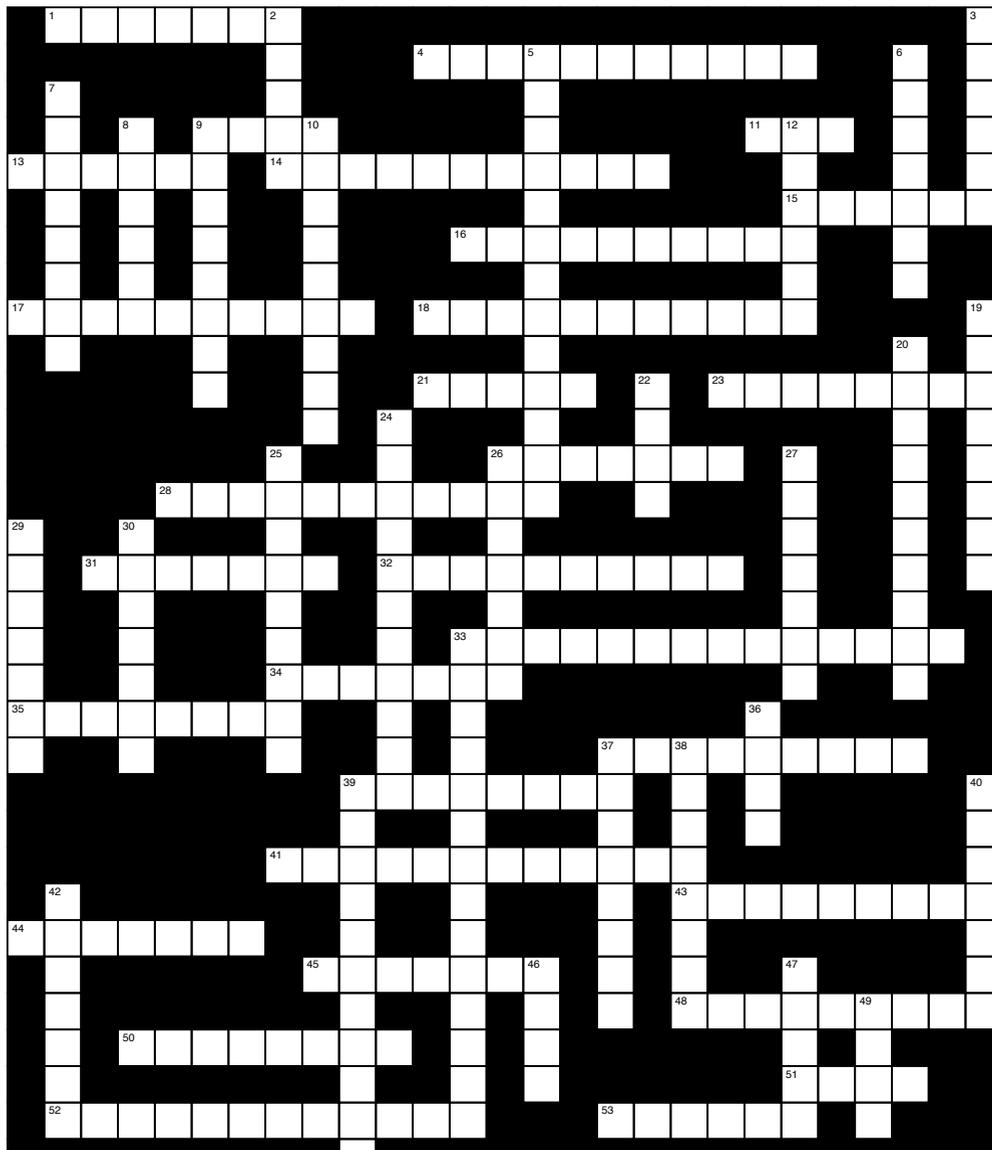
<b>1</b>	<b>1</b>	<b>1</b>	<b>1</b>
<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>
<b>4</b>		<b>4</b>	
<b>5</b>		<b>5</b>	
<b>6</b>		<b>6</b>	<b>Stakeholder</b>





# Processcross

How well do you know the 49 processes in the PMBOK® Guide? Let's find out!



Answers on page 760.

**Across**

- 1. In the \_\_\_\_ Schedule process, you build a bar chart, milestone list, calendar, or other document out of all of your estimates.
- 4. In the \_\_\_\_ Management knowledge area, you contract with sellers to do project work.
- 9. The \_\_\_\_ Management knowledge area is where you plan for the unknown.

**Down**

- 2. The Close Project or \_\_\_\_ process is where you make sure the project is finished, and all of the lessons learned are documented.
- 3. In the \_\_\_\_ Quality process, you make sure the entire project and quality processes meet your company's quality standards.
- 5. \_\_\_\_ Management is the knowledge area where you figure out who's talking to whom, and how.

**Across**

11. The Create \_\_\_\_\_ process is where you create a graphical, hierarchical document that describes all work packages.
13. The \_\_\_\_\_ Communications process gets the right information to the right people. It's where most of the communication on the project happens.
14. You manage all communication for the people who are affected by your project in the Manage Stakeholder \_\_\_\_\_ process.
15. The \_\_\_\_\_ Scope process is where you write down exactly what the team will do to produce the product.
16. The \_\_\_\_\_ and Controlling process group is concerned with finding and dealing with changes.
17. You work with sponsors and stakeholders to decide whether or not to make changes during the Perform \_\_\_\_\_ Change Control process.
18. In the Plan \_\_\_\_\_ Management process, you decide what work you'll contract out to a seller.
21. The Estimate \_\_\_\_\_ process is where you figure out how much money you'll spend on each activity in the schedule.
23. The \_\_\_\_\_ Scope process is where you make sure all of the work has been done, and you get formal approval from the stakeholders.
26. The \_\_\_\_\_ Procurements process is the Monitoring and Controlling process for procurements, where you look for changes in your contracts.
28. \_\_\_\_\_ Management is the knowledge area where you bring all of the work and project plans together.
31. The \_\_\_\_\_ Stakeholder Engagement process is the process of tracking stakeholder engagement through the project and making corrections and changes based on project information.
32. The \_\_\_\_\_ process group is where you make sure the project starts out right.
33. The Plan \_\_\_\_\_ Management process is where you'll figure out how you'll handle messages, channels of communication, meetings, and reporting.
34. In the \_\_\_\_\_ Quality process, your team looks for defects in deliverables.
35. The Plan \_\_\_\_\_ Management process is where you create a plan for how you will assign and manage your staff and equipment.
37. The Plan Risk \_\_\_\_\_ process is where you decide how your team will react to each risk, should it occur.
39. The \_\_\_\_\_ Activities process is where you put the list of activities in order and create network diagrams.
41. In the Perform \_\_\_\_\_ Risk Analysis process, you assign numerical values to your risks in order to more accurately assess them.
43. The Estimate Activity \_\_\_\_\_ process is where you generate an estimate of how long each activity will take.
44. The \_\_\_\_\_ Procurements process is where you determine which sellers will do the work.
45. The document that authorizes you to do the work is built in the Develop Project \_\_\_\_\_ process.
48. The \_\_\_\_\_ process group is where the team does the project work.
50. In the \_\_\_\_\_ Management knowledge area, you determine how long the work will take.
51. The \_\_\_\_\_ Stakeholder Engagement Process is where you plan all of the activities you'll do to keep stakeholders satisfied through the project.
52. The Collect \_\_\_\_\_ process is where you gather the needs of the stakeholders and document them.
53. The \_\_\_\_\_ Communications process gets the right information to the right people. It's where most of the communication on the project happens.

**Down**

6. You make sure your deliverables conform to their requirements using the \_\_\_\_\_ Management knowledge area processes.
7. The \_\_\_\_\_ process group is where you do the most work. It's where you build a document to guide you through each of the knowledge areas.
8. The \_\_\_\_\_ Team process is where you track your team members' performance, provide feedback, and resolve issues.
9. The \_\_\_\_\_ Management knowledge area is where you put together and manage your team.
10. The Manage Project \_\_\_\_\_ process is where you put together everything you've learned while executing the project and use that information to solve problems that come up.
12. In the Determine \_\_\_\_\_ process, you add up all of your estimated costs and figure out how much money your project will spend in total.
19. The \_\_\_\_\_ Risks process is where you create a risk register that contains a list of risks that might affect your project.
20. You create a document that defines how you'll handle every aspect of the project in the Develop Project \_\_\_\_\_ Plan process.
22. The deliverables and work performance information are created in the Direct and Manage Project \_\_\_\_\_ process.
24. The Perform \_\_\_\_\_ Risk Analysis is where you categorize each risk.
25. The Estimate Activity \_\_\_\_\_ process is where you figure out what people, equipment, and other things you'll need for the project, and when you'll need them.
26. You track your work closely and manage your costs in the \_\_\_\_\_ Costs process.
27. The Plan \_\_\_\_\_ Management process is where you create a plan to ensure that your deliverables conform to requirements, and are fit for use.
29. You assign your team to the project in the \_\_\_\_\_ Resources process.
30. The \_\_\_\_\_ Scope process is where you look for changes to scope, and make only those changes that are necessary.
33. Monitor \_\_\_\_\_ is where you figure out how your project is doing, and let everyone else know.
36. The \_\_\_\_\_ Management knowledge area is all about figuring out your budget.
37. The Monitor Risks process is where you look for any new risks and changes to the risk \_\_\_\_\_.
38. The Control \_\_\_\_\_ process is where you look for changes to the planned dates for performing activities and meeting milestones.
39. The \_\_\_\_\_ Management knowledge area is where you figure out who is impacted by your projects and work to keep them satisfied.
40. The \_\_\_\_\_ process group is where you shut down the project.
42. In the \_\_\_\_\_ and Control Project Work process, you constantly look for changes or problems that occur.
46. You create a plan that tells you how you manage unexpected events in the Plan \_\_\_\_\_ Management process.
47. The \_\_\_\_\_ Management knowledge area helps you figure out the work that needs to be done for your project.
49. The Develop \_\_\_\_\_ process is where you keep your team motivated, and set goals and rewards for them.



These questions are all about specific things that you're likely to see on the exam. They're drawn from many different knowledge areas. Take some time and try to answer all of them—remember, these are a little harder than questions you'll see on the exam, since they're not multiple choice!

1. When you're developing a project charter, what do you use to understand the reasons why it makes sense for your business to take on the project?  
.....
2. What do you call the point in a fixed-price contract where the seller assumes the rest of the cost?  
.....
3. Which conflict resolution technique is most effective?  
.....
4. What's the range for a rough order of magnitude estimate?  
.....
5. Which contract type is best when you don't know the scope of the work?  
.....
6. What are you doing when you add resources to the critical path in order to shorten the schedule?  
.....
7. Which management theory states that employees can't be trusted and need to be constantly monitored?  
.....
8. What are the top three causes of conflict on projects?  
.....
9. Customer satisfaction is part of which knowledge area?  
.....
10. Which type of power is typically unavailable to project managers in a matrix organization?  
.....
11. Which form of communication is **always** necessary whenever you are performing procurement processes?  
.....
12. What's it called when you add up the costs of inspection, test planning, testing, rework (to repair defects discovered), and retesting?  
.....
13. What are the three characteristics of a project that differentiate it from a process?  
.....
14. Where would you find out details about a specific work package, such as an initial estimate or information about what account it should be billed against?  
.....
15. What do you do when you and your team can't identify a useful response to a risk that you've identified?  
.....
16. What do you decompose work packages into before you can build your schedule?  
.....
17. What's the float for any activity on the critical path?  
.....
18. Research shows that project managers spend approximately how much of their time communicating?  
.....
19. What should you do with the factors that cause change?  
.....
20. Which two types of estimate require historical information?  
.....

—————> **Answers on page 761**

 **Sharpen your pencil**

You'll definitely get a bunch of calculation questions on the exam. Luckily, you've got a handle on them! Here's your chance to get a little more practice.

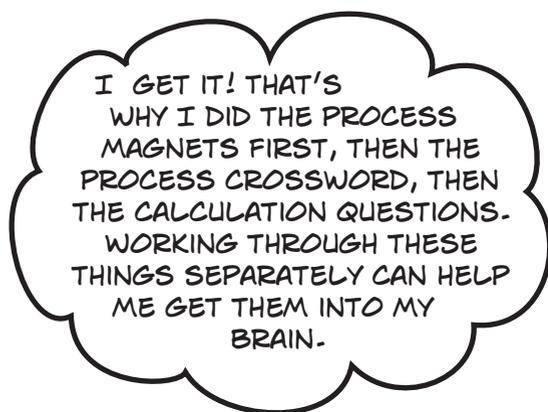
1. How many lines of communication are there on a project with nine people (including the project manager)?
2. Your project has a budget at completion of \$250,000. You've completed half of the work, but your schedule says you should have completed 60% of the work. Calculate PV and EV.
3. Your project has a BAC of \$7,500. Your scheduled % complete is 35%, but your actual % complete is 30%. Calculate the SPI. What does that SPI tell you about your project?
4. You were managing a project with a team of eight people, plus you (as the project manager), when you added four team members. How many lines of communication were added?
5. You've got a project with a budget of \$500,000. Your project is 75% complete, and you have spent \$400,000 so far. Calculate the EAC and ETC. What does that tell you about the project?
6. You've identified two risks and an opportunity for your project. Risk A has a probability of 35% and a cost of \$500. Risk B has a probability of 60% and a cost of \$750. Opportunity C has a probability of 10% and a value of \$1,000. What's the total EMV of Risk A, Risk B, and Opportunity C?
7. Your project has a CPI of 1.2 and an EV of \$150,000. Calculate the actual cost of the project so far.

—————▶ **Answers on page 762.**

## A long-term relationship for your brain

Take a minute and think back over everything you've just learned. Does it seem a little...well, overwhelming? Don't worry, that's absolutely normal. You've got all of this information that's floating around in your brain, and your brain is still trying to organize it.

Your brain is an amazing machine, and it's really good at organizing information. Luckily, when you feed it so much new data, there are ways that you can help make it "stick." That's what you've been doing in this chapter. Your brain wants its new information to be categorized. That's why it helps to first review how the processes are organized, and then review what the processes do.



Yes! Cognitive psychologists call it *chunking*, and it's a really effective way of getting information into your long-term memory. When you have a collection of things that are strongly associated with one another, it gives your brain a sort of guideline for storing it. And the weaker associations with the other "chunks" give it a bigger framework for managing this large amount of information, so that it's all mutually reinforcing.

## Here's how to do this next section

This next section consists of a series of questions grouped together by knowledge area. To make this as effective as possible:

- \* **Make this the only PMP study activity you do today.**
- \* **Give yourself plenty of time to do it.**
- \* **Make sure you drink lots of water while you're answering the questions.**
- \* **As you're answering the questions, think about each answer and only mark down one response, even if you're not 100% sure.**
- \* **After you do each section, read through each question again.**
- \* **Don't look at the answers until you've gone through all of the knowledge areas.**
- \* **Make sure you get plenty of sleep the night after you do these questions.**



COGNITIVE  
PSYCHOLOGISTS  
RECOGNIZE THAT SLEEP PLAYS  
A REALLY IMPORTANT ROLE IN  
HELPING YOUR BRAIN ORGANIZE AND  
CONSOLIDATE INFORMATION INTO  
YOUR LONG-TERM MEMORY.

## Integration and Overall PMBOK® Questions

**1. You're managing a project for a military subcontractor to modify the software for a missile guidance system. You're planning the project, and need to take into account information about the company's operating environment. Which of the following is not an example of the factors you are looking at?**

- A. Marketplace conditions
- B. The forecast for project completion, including ETC and TCPI
- C. Government standards you need to comply with
- D. The political climate that can affect your project

**2. The CFO of a company tells you that you need to include a new feature in software that's being produced by a project you are managing. The deadline for the project is tight, and if you take on the extra work then the project will come in late. What best describes the first thing that you should do?**

- A. Update the Project Management plan to make sure the new feature is included in the project.
- B. Tell the CFO that he needs to wait until you're working on the next version, and then submit a change request to the change control board.
- C. Tell the CFO that the deadline is too tight, and the feature can't be included.
- D. Evaluate the impact that the change will have on the project.

**3. Which of the following best describes the role of the project sponsor?**

- A. Assigning work to the project team
- B. Paying for the project
- C. Politically supporting the project inside the organization
- D. Defining the type of organization (matrix, functional, etc.)

**4. Which of the following is not a part of the Project Management plan?**

- A. The lifecycle selected for the project
- B. The level of implementation for each of the processes
- C. The organization's staffing and retention guidelines
- D. Techniques used to communicate with stakeholders

## Scope Questions

**5. You're managing an architecture project to design an extension on an existing building. One of the stakeholders has been adamant that the plans should not include an interior supporting wall, because she wants to be able to reconfigure the floorplan. Where do you document this information?**

- A. Project scope statement
- B. Scope Management plan
- C. Work breakdown structure
- D. WBS dictionary

**6. You're in the process of working with the project stakeholders, figuring out what they need, and writing it down. Which of the following is a tool or technique that you would use?**

- A. Decomposition
- B. Observations
- C. Variance analysis
- D. Inspection

**7. A project manager is analyzing deliverables and subdividing them into smaller, more manageable components. This project manager is performing which process?**

- A. Control Scope
- B. Define Scope
- C. Collect Requirements
- D. Create WBS

**8. A software project team lead is working with stakeholders to make sure that there's formal, documented acceptance of every one of the project deliverables. Which of the following best describes the work that she's doing?**

- A. Performing variance analysis on the cost baseline
- B. Updating the traceability matrix
- C. Structuring and organizing the WBS
- D. Running the software and walking through it with the stakeholders

## Time Questions

9. You're working on an IT project to set up a development environment, including designing and building a computer room, installing the operating systems and software, and performing a security evaluation. You need at least two weeks to order the hardware before you can configure it and install the operating systems. Which of the following best describes this relationship?

- A. Lead
- B. Lag
- C. Finish-to-Start (FS)
- D. Start-to-Start (SS)

10. You're planning an IT project to set up a development environment, including designing and building a computer room, installing the operating systems and software, and performing a security evaluation. Your project includes three different activities that involve three different network technicians splicing ends onto wires in order to build their own ethernet cables, because that's less expensive than buying prepackaged ones. Every ethernet cable must be tested with a qualification tester. That's an expensive piece of equipment, and there are only a few of them that must be shared among all of the technicians in the company. You need to plan your schedule based on the availability of the testing equipment. What's the best place to find that information?

- A. Staffing requirements
- B. Activity network diagram
- C. Resource calendar
- D. Activity resource requirements

11. You're working on an IT project to set up a development environment, including designing and building a computer room, installing the operating systems and software, and performing a security evaluation. Once the operating system on a machine is installed, it needs to be imaged and copied to three identical boxes. Which of the following best describes this relationship?

- A. Lead
- B. Lag
- C. Finish-to-Start (FS)
- D. Start-to-Start (SS)

12. You're working on an IT project to set up a development environment, including designing and building a computer room, installing the operating systems and software, and performing a security evaluation. Your team comes up with a best-case scenario for the activity that involves ordering and installing the equipment. If everything goes perfectly, they feel it will take five weeks. However, they think it's much more likely to take nine. A team member points out that on his last project, there was a major equipment delivery delay that cost the project an extra four weeks, and the rest of the team agrees that this is a possibility in a worst-case scenario. Use a three-point estimate to calculate how long you should expect this activity to take.

- A. 5 weeks
- B. 9 weeks
- C. 12 weeks
- D. 13 weeks

## Cost Questions

13. Which of the following best describes funding limit reconciliation?

- A. Comparing your project's budget against the project's reserves
- B. Comparing your project's planned expenditures against the funding constraints
- C. Comparing your project's planned value against the actual costs
- D. Comparing your project's net present value against the internal rate of return

14. Your project has a budget at completion (BAC) of \$75,000, and you need to figure out if you're on track to meet it. You know that you've already spent \$56,000, and you're 70% done with the project. If your project continues expenditures at the current rate, what calculation do you need to perform to find the lowest that you can allow your CPI to go before you've exceeded your project's budget?

- A. TCPI
- B. SV
- C. SPI
- D. CV

15. You're managing a construction project to install 7,500 light switches in a new high-rise building. You've installed 3,575 of them so far, and you've spent \$153,500 of your total budget of \$245,000. Which of the following is true?

- A. The AC is \$153,500, so I'm ahead of schedule.
- B. The ETC is \$168,995, so I'm within my budget.
- C. The CV is \$36,880, so I've exceeded my budget.
- D. The CPI is .7597, so I've exceeded my budget.

16. You're managing a construction project, and you're estimating your project's activities using a spreadsheet that a consulting company created for you. You have to fill in the dry weight of the materials, the number of people required to do the work, the type of building you're working on, and other information about the project. Which best describes what you are doing?

- A. Parametric estimation
- B. Analogous estimation
- C. Bottom-up estimation
- D. Top-down estimation

## Quality Questions

**17. Which of the following is not considered when you are calculating cost of quality?**

- A. How much it costs to repair deliverables when they don't meet requirements
- B. The cost of training the team to perform inspections
- C. The cost of working with customers who find problems with the work delivered to them
- D. The cost of gaining formal acceptance of project deliverables

**18. Which of the following is not an example of quality assurance?**

- A. Examining the way deliverables are produced to see if processes are being followed
- B. Examining deliverables to see if they meet requirements
- C. Examining a group of deliverables to figure out why they all had the same defect
- D. Examining the company's documentation on how processes are to be performed

**19. Which of the following best describes a situation where statistical sampling is appropriate?**

- A. You just got a shipment of 50,000 parts, and you need to figure out if enough of them are within tolerances to be used on your project.
- B. You need to figure out which defects are critical, and which can be delivered to your customer and repaired later.
- C. You need to use the rule of seven on a control chart.
- D. You need to determine if your project is ahead of schedule and within budget.

**20. You're planning your project's quality activities. You know that as you go through your project, your team will find lots of ways to improve how your company does work in the future. You need a way to handle that information in a systematic manner. What document is best used to plan for this?**

- A. Quality checklist
- B. Process Improvement plan
- C. Quality Management plan
- D. Quality metrics

## Human Resource Questions

**21. A project manager working in a project-based organization is putting a team together to perform a project. Which of the following is not a tool or technique that might be used to do this?**

- A. Colocation
- B. Virtual teams
- C. Preassignment
- D. Negotiation

**22. A project manager is building her team. She notices that team members are not collaborating efficiently, and she is concerned that this is leading to a destructive environment. Which of the following best describes the state that the team is in?**

- A. Norming
- B. Forming
- C. Storming
- D. Performing

**23. A project manager is running into trouble with his team, because they always come to meetings late. Which of the following is most likely to be the cause of this problem?**

- A. The team resents the work that they're doing.
- B. The project manager needs to schedule meetings later in the day.
- C. The project manager was late to meetings himself, and this influenced the team.
- D. The team is in the storming phase of team development.

**24. A project manager for a software project is well regarded by people in her company as an expert programmer. She has an especially good reputation among the senior managers of the company. The CTO of the company tells her that any time she runs into trouble, he'll back up any decision that she makes—and everyone on the team admires the CTO, and they have a lot of loyalty to him. Which best describes the power the project manager is exerting?**

- A. Reward power
- B. Expert power
- C. Punishment power
- D. Referent power

## Communications Questions

**25. Bob and Sue are stakeholders in your project. Sue is in the high-power, low-interest quadrant of the power/interest grid. Bob is in the low-power, high-interest quadrant. Which of the following best describes the approach you should take:**

- A. Sue needs to participate in every important meeting, while Bob needs to have his opinion heard in those meetings.
- B. You need to make sure that Bob is on the change control board, but Sue requires only minimum effort.
- C. You need to go out of your way to satisfy all of Sue's needs, while Bob has to be kept in the loop on important decisions.
- D. Sue needs to be managed closely, and you must satisfy Bob by making sure he feels his needs are being met.

**26. A project manager is analyzing the communications requirements for a project. There are six team members, four stakeholders, and two subcontractors. He needs to find the number of potential communication channels. How many channels are there?**

- A. 13
- B. 55
- C. 66
- D. 78

**27. You're about to close your project when you are surprised to get an email from someone you've never spoken to before. He is very angry, because he's directly impacted by your project, and there are specific things he needs from it and you aren't delivering those things. Which best describes the communications process you are in?**

- A. You did not manage communications effectively.
- B. You did not identify a project stakeholder.
- C. You did not encode your communications.
- D. You did not have a Stakeholder Management strategy.

**28. You are in the process of making relevant information available to your project's stakeholders. Which of the following is not a tool or technique that you would use?**

- A. Hard copies of documents interoffice-mailed to stakeholders
- B. Power/interest grid that includes all stakeholders
- C. Conference calls with stakeholders
- D. An online folder that contains project documents

## Risk Questions

**29. A project manager is analyzing project risks by using quantitative techniques to assign a numeric value to each of those risks. Which of the following tools and techniques is not used for this?**

- A. EMV analysis that uses a decision tree
- B. Sensitivity analysis to determine which risks pose the biggest threat
- C. A Probability and Impact matrix that assigns numeric values to each risk priority
- D. A simulation that runs through many different project scenarios

**30. One of your construction project team members warns you that your concrete supplier caused serious delays in his last project because he delivered the wrong kind of concrete. You discuss it with the team, and decide that you need to accept the possibility that this will happen. But you make back-up plans with an alternate provider by putting a down payment on an emergency shipment, just in case. This is an example of:**

- A. Avoidance
- B. Transferrance
- C. Mitigation
- D. Acceptance

**31. A project manager is forced to dip into his management reserve. Which of the following is the most likely cause of this?**

- A. One of the risks on the risk register caused a budget overrun.
- B. The project went over budget because the project manager miscalculated his forecast.
- C. A risk that was never planned for occurred.
- D. The team's estimates were incorrect.

**32. Your software project team informs you that another team working at the company built a tool that will save three weeks on the project. You ask the other team's project manager to have his team members share the tool with your team members. Which best describes this strategy?**

- A. Exploiting
- B. Sharing
- C. Enhancing
- D. Accepting

## Procurement Questions

**33. A seller is in trouble because she took on a contract that overran its budget, and now her company has to eat the cost out of their own budget. Which of the following best describes his contract?**

- A. Time and materials (T&M)
- B. Firm fixed price (FFP)
- C. Cost plus incentive fee (CPIF)
- D. Cost plus fixed fee (CPFF)

**34. A project manager for a software project hires a subcontractor to build a module that will be used in the rest of the project. When it's time to integrate that module into the rest of the code, there are serious quality problems. The subcontractor claims that the module meets its requirements, but the project manager's lead developer says that the requirements have clearly been violated. The contract is unclear about how to handle the situation. It's clear that the contract needs to be amended to indicate a solution, but there is no agreement on the exact wording of the change. What best describes the next step for the project:**

- A. The buyer and seller must proceed to claims administration.
- B. The buyer should file a lawsuit against the seller.
- C. The buyer should conduct an audit of the seller.
- D. The buyer and seller must adhere strictly to the wording of the contract.

**35. A buyer and seller have a teaming agreement. Which of the following best describes their relationship?**

- A. The seller and buyer both have team members on every project team.
- B. The buyer can dictate the structure of the seller's project teams.
- C. The seller is free to dictate deliverables and contract terms.
- D. The seller has input into project decisions, and representation in the buyer's management structure.

**36. You're a project manager planning a project that requires that you hire a contractor. Before you can find sellers, you need to develop a document that defines the portion of the work that the contractor will do. Which of the following is not true about this document?**

- A. It's based on the project scope baseline.
- B. It includes exact specifications for the deliverables the contract will produce.
- C. Its terms are either fixed price or cost reimbursable.
- D. It must completely define the work that the contractor must do.

## Stakeholder Questions

37. Tom, a stakeholder in an IT project, has asked to be included in all of the status meetings and team communications. While he is not actually on the team or accountable for any deliverables, he cares about the outcome of the project and wants to be kept in the loop. Where would you plot him on a power/interest grid?

- A. High power, high interest
- B. High power, low interest
- C. Low power, high interest
- D. Low power, low interest

38. A project manager for an industrial design project is reviewing the work performance data that's being produced by his project team to determine whether or not changes need to be made in Stakeholder Management. When he finds a change, he writes up a request and incorporates all approved requests into the Project Management plan, project documents, and lessons learned. What process is he performing?

- A. Plan Stakeholder Management
- B. Identify Stakeholders
- C. Manage Stakeholder Engagement
- D. Control Stakeholder Engagement

39. Joanne, the sponsor for a software project, has been working with the senior management team in her company to cancel the project even though it's only just begun its planning processes. Which is the best classification for Joanne's engagement with the project?

- A. Unaware
- B. Resistant
- C. Supportive
- D. Leading

## Great job! It looks like you're almost ready

If you've read all the chapters, done all the exercises, and taken all of the practice questions, then you have a solid grasp on the material for the PMP exam. You're *almost ready* to get certified! By the way, don't worry if you didn't get some of the questions on the past few pages. This was really hard stuff—some of it was even harder than the PMP exam. Remember, a great way to prepare is to write your own Question Clinic-style questions for anything that's giving you trouble.

So if you did get them, you should feel very proud of yourself!



# Process Magnets Solutions

Can you put all of the processes in the right knowledge areas? Give it a shot—and while you're at it, see if you can put them inside each knowledge area in the order that they're typically performed on a project.

<b>Integration</b>	<b>Scope</b>	<b>Schedule</b>	<b>Cost</b>
<p><b>1</b> Develop Project Charter</p> <p><b>2</b> Develop Project Management Plan</p> <p><b>3</b> Direct and Manage Project Work</p> <p><b>4</b> Manage Project Knowledge</p> <p><b>5</b> Monitor and Control Project Work</p> <p><b>6</b> Perform Integrated Change Control</p> <p><b>7</b> Close Project or Phase</p>	<p><b>1</b> Plan Scope Management</p> <p><b>2</b> Collect Requirements</p> <p><b>3</b> Define Scope</p> <p><b>4</b> Create WBS</p> <p><b>5</b> Validate Scope</p> <p><b>6</b> Control Scope</p>	<p><b>1</b> Plan Schedule Management</p> <p><b>2</b> Define Activities</p> <p><b>3</b> Sequence Activities</p> <p><b>4</b> Estimate Activity Durations</p> <p><b>5</b> Develop Schedule</p> <p><b>6</b> Control Schedule</p>	<p><b>1</b> Plan Cost Management</p> <p><b>2</b> Estimate Costs</p> <p><b>3</b> Determine Budget</p> <p><b>4</b> Control Costs</p>
			<b>Quality</b>
			<p><b>1</b> Plan Quality Management</p> <p><b>2</b> Manage Quality</p> <p><b>3</b> Control Quality</p>

## Resource

- 1 Plan Resource Management
- 2 Estimate Activity Resources
- 3 Acquire Resources
- 4 Develop Team
- 5 Manage Team
- 6 Control Resources

## Communications

- 1 Plan Communications Management
- 2 Manage Communications
- 3 Monitor Communications

## Risk

- 1 Plan Risk Management
- 2 Identify Risks
- 3 Perform Qualitative Risk Analysis
- 4 Perform Quantitative Risk Analysis
- 5 Plan Risk Responses
- 6 Implement Risk Responses
- 7 Monitor Risks

## Procurement

- 1 Plan Procurement Management
- 2 Conduct Procurements
- 3 Control Procurements

## Stakeholder

- 1 Identify Stakeholders
- 2 Plan Stakeholder Engagement
- 3 Manage Stakeholder Engagement
- 4 Monitor Stakeholder Engagement





These questions are all about specific things that you're likely to see on the exam. They're drawn from many different knowledge areas. Take some time and try to answer all of them—remember, these are a little harder than questions you'll see on the exam, since they're not multiple choice!

1. When you're developing a project charter, what do you use to understand the reasons why it makes sense for your business to take on the project?

**Business case document**

2. What do you call the point in a fixed-price contract where the seller assumes the rest of the cost?

**Point of total assumption**

3. Which conflict resolution technique is most effective?

**Problem solving or collaborating**

4. What's the range for a rough order of magnitude estimate?

**-25% to +75%**

5. Which contract type is best when you don't know the scope of the work?

**Time and materials**

6. What are you doing when you add resources to the critical path in order to shorten the schedule?

**Crashing the schedule**

7. Which management theory states that employees can't be trusted and need to be constantly monitored?

**McGregor's Theory X**

8. What are the top three causes of conflict on projects?

**Resources, priorities, and schedules**

9. Customer satisfaction is part of which knowledge area?

**Quality Management**

10. Which type of power is typically unavailable to project managers in a matrix organization?

**Legitimate power**

11. Which form of communication is **always** necessary whenever you are performing procurement processes?

**Formal written**

12. What's it called when you add up the costs of inspection, test planning, testing, rework (to repair defects discovered), and retesting?

**Cost of quality**

13. What are the three characteristics of a project that differentiate it from a process?

**Temporary, unique, and progressively elaborated**

14. Where would you find out details about a specific work package, such as an initial estimate or information about what account it should be billed against?

**WBS dictionary**

15. What do you do when you and your team can't identify a useful response to a risk that you've identified?

**Accept it**

16. What do you decompose work packages into before you can build your schedule?

**Activities**

17. What's the float for any activity on the critical path?

**Zero**

18. Research shows that project managers spend approximately how much of their time communicating?

**90%**

19. What should you do with the factors that cause change?

**Try to influence them**

20. Which two types of estimate require historical information?

**Analogous and parametric**



## Sharpen your pencil Solution

You'll definitely get a bunch of calculation questions on the exam. Luckily, you've got a handle on them! Here's your chance to get a little more practice.

1. How many lines of communication are there on a project with nine people (including the project manager)?

The formula for # lines of communication is:  $\# \text{ lines} = n \times (n - 1) \div 2$

So  $\# \text{ lines} = 9 \times (9 - 1) \div 2 = 9 \times 8 \div 2 = 36 \text{ lines of communication}$

2. Your project has a budget at completion of \$250,000. You've completed half of the work, but your schedule says you should have completed 60% of the work. Calculate PV and EV.

The formulas are:  $PV = BAC \times \text{scheduled \% complete}$        $EV = BAC \times \text{actual \% complete}$

So the answers are:  $PV = \$250,000 \times 60\% = \$150,000$        $EV = \$250,000 \times 50\% = \$125,000$

3. Your project has a BAC of \$7,500. Your scheduled % complete is 35%, but your actual % complete is 30%. Calculate the SPI. What does that SPI tell you about your project?

The formula is:  $SPI = EV \div PV$ . So first calculate EV and PV:  $EV = \$7,500 \times 30\% = \$2,250$   
 $PV = \$7,500 \times 35\% = \$2,625$

Now calculate SPI:  $SPI = \$2,250 \div \$2,625 = .86$  Since SPI is lower than 1, your project is behind schedule.

4. You're managing a project with a team of eight people, plus you (as the project manager), when you added four team members. How many lines of communication were added?

We already figured out the team of 9 people in question 1—you have 36 lines of communication. The new team has four more team members, or a total of 13, so  $\# \text{ lines} = 13 \times (13 - 1) \div 2 = 13 \times 12 \div 2 = 78 \text{ lines}$   
So the number of lines added is  $78 \text{ lines} - 36 \text{ lines} = 42 \text{ lines of communication}$

5. You've got a project with a budget of \$500,000. Your project is 75% complete, and you have spent \$400,000 so far. Calculate the EAC and ETC. What does that tell you about the project?

The formulas are:  $EV = BAC \times \% \text{ complete}$        $CPI = EV \div AC$        $EAC = BAC \div CPI$  and  $ETC = EAC - AC$   
First calculate  $EV = \$500,000 \times 75\% = \$375,000$ , and then calculate  $CPI = \$375,000 \div \$400,000 = .94$

Now you can calculate  $EAC = \$500,000 \div .94 = \$531,915$  and  $ETC = \$531,915 - \$400,000 = \$131,915$   
This means that you should expect to spend about \$131,915 before the project ends.

6. You've identified two risks and an opportunity for your project. Risk A has a probability of 35% and a cost of \$500. Risk B has a probability of 60% and a cost of \$750. Opportunity C has a probability of 10% and a value of \$1,000. What's the total EMV of Risk A, Risk B, and Opportunity C?

To calculate EMV, add up the individual probabilities multiplied by costs (negative) or values (positive).

$EMV = (.35 \times -\$500) + (.60 \times -\$750) + (.10 \times \$1,000) = -\$525$

7. Your project has a CPI of 1.2 and an EV of \$150,000. Calculate the actual cost of the project so far.

The formula is:  $CPI = EV \div AC$ . First fill in what we know:  $1.2 = \$150,000 \div AC$

Now flip it around:  $AC = \$150,000 \div 1.2 = \$125,000$

## Integration Questions

1. B.

Since this question is asking about the company's operating environment, it's really asking you to figure out which of the answers is not an enterprise environmental factor. Marketplace conditions, government standards, and political climate are enterprise environmental factors, but forecasts aren't—that's a Cost Management output.

2. D.

Whenever your project's scope changes, that means you need to put your project through change control. That doesn't necessarily mean that you need to have your team change the way they'll work, or reject the change outright. The first step in evaluating any change is understanding the impact that it will have on the project.

3. B.

The main role of the sponsor is to provide funding for the project. That's why the sponsor is an important stakeholder. However, the sponsor does not necessarily have a specific role on the project beyond paying for it.

That doesn't mean that the sponsor can't also be involved in other things. A sponsor who's paying for a project also wants it to succeed, and will often fill other roles on the project as well.

4. C.

When you put together your Project Management plan, one of the first things that you do is select a project methodology (or lifecycle), and determine exactly how each of the processes will be implemented. Your Communications Management plan will definitely have specifics about how you communicate with your stakeholders, because that's a really important part of managing a project. But your Project Management plan doesn't typically include your company's policies. For example, guidelines about how your company hires and retains staff are usually set by an HR department, and they generally don't vary from project to project.

Staffing and retention guidelines are an example of one of your company's policies, and policies are enterprise environmental factors.

Answers

~~Scope Questions~~

5. A.

This stakeholder wants to exclude something from the scope, and project exclusions—which identify what is out of scope for the project—should always be documented in the project scope statement. (You might also consider it a constraint—technically, it's both—but constraints are also documented in the project scope statement.)

*This will also be a project requirement, so it will end up in a requirements document as well. But that wasn't one of the choices in the question!*

6. B.

When you're talking to project stakeholders and documenting their needs, you're collecting requirements. "Observations" is a technique used in the Collect Requirements process. And that makes sense—you often need to observe people doing their jobs in order to figure out how they'll use your project's deliverables.

7. D.

When a project manager analyzes deliverables and subdivides them into smaller components, he is using decomposition, which is the only tool or technique in the Create WBS process.

8. D.

When a project team lead—who, in this case, is acting as the project manager—is gathering formal acceptance of deliverables, she is performing the Validate Scope process. That process's tools and techniques include inspection, and a walkthrough is a very common way to inspect a deliverable.

## Answers

~~Time Questions~~

9. A.

When one activity (such as ordering hardware) must take place a certain amount of time before another activity (installing the operating systems), that's called a lead.

10. C.

The resource calendar has information on which resources—which includes equipment and material, as well as people—are available at specific times. You'll typically use it to estimate resource utilization, which you'll need to do when you're building the schedule for this project.



Did you think that the resource calendar applied only to human resources? Any scarce piece of equipment is also a resource, and you can use a resource calendar to make sure it's available when your team needs it.

11. C.

A Finish-to-Start (FS) relationship is the most common sort of predecessor that you'll see in a project schedule. That's what you call it when one activity (imaging the machine) starts as soon as another one is finished (the operating system is installed).

12. B.

This question is asking you to apply a three-point estimate. The optimistic estimate is 5 weeks, the most likely is 9 weeks, and the pessimistic is 13, so the three-point estimate is  $(5 + 4 \times 9 + 13) \div 6 = 9$  weeks.

~~Cost Questions~~

13. B.

Funding limit reconciliation means checking the project's expenditures—how much you've already spent—against any limits that your company has on the commitments of funds. Companies typically don't allow project managers to throw unlimited amounts of money at the project, so this makes sure that the project can be done within the company's guidelines...so you can catch cost overruns before you've spent more than you're allowed to spend! This is how you know you haven't blown your budget—by comparing it against the hard limits set by your company.

14. A.

When you're asked to figure out the lower limit of your CPI to keep your project within its budget, you're being asked to calculate the to-complete performance index (TCPI). If you've got a BAC, an AC, and a % complete, then you know enough to compute the EAC, so you should use the formula  $TCPI = (BAC - EV) \div (EAC - AC)$ .

↖ The numbers in this question were a red herring. You didn't need them to come up with the answer.

15. D.

The first step in figuring this out is to determine the actual % complete, which you can do by figuring that you've installed 3,570 of the total 7,500 light switches, or  $3,575 \div 7,500 = 47.6\%$ . Then you can use the formulas, which show you that CPI is .7597, telling you that you've exceeded your budget:

Actual % complete = 47.6%

AC = \$153,500 (but since this doesn't tell you anything about your schedule, answer A is incorrect)

EV = BAC × actual % complete =  $\$245,000 \times 47.6\% = \$116,620$

CV = EV - AC =  $\$116,620 - \$153,500 = -\$36,880$  (since the CV is negative, you're below your budget, so answer C is incorrect; the CV in this case is negative)

CPI = EV ÷ AC =  $\$116,620 \div \$153,500 = .7597$

EAC = BAC ÷ CPI =  $\$245,000 \div .7597 = \$322,495$

ETC = EAC - AC =  $\$322,495 - \$153,500 = \$168,995$  (which doesn't actually tell you whether or not you're within your budget, so answer B is incorrect)

16. A.

A really common way of doing parametric estimation involves entering numbers into a spreadsheet that performs calculations based on historical data gathered from previous projects.

## Quality Questions

17. D.

Gaining formal acceptance of project deliverables is part of Scope Verification, which is NOT a quality activity, so it's not part of the cost of quality. All of the other answers involve costs incurred in either finding defects or dealing with them once they've been found, and that's all part of cost of quality.

18. B.

When you're performing quality assurance, that means that you're looking at the way that people are doing their jobs. Often, it means that you're taking a step back to look at the big picture—if many defects have the same root cause, if all of the processes are documented, and if they're being followed properly. However, if you're looking at individual deliverables, then you're doing inspection, which is part of quality control, not quality assurance.

*A lot of the time, when you're performing quality assurance, you're looking at ongoing processes and not just projects.*

19. A.

Statistical sampling helps you make decisions about a large number of items without having to look at every single one of them.

20. B.

The Process Improvement plan is a plan that you build as part of the Plan Quality Management process that helps you improve the way your company does its work. This is what you use to help your team think “outside” of your project, and look at the company's overall process or methodology for doing projects.

## Human Resource Questions

21. A.

Colocation means having most or all of your team members working in the same location. This is an important tool for running a team, but the question is asking about acquiring a team. Virtual teams, preassignment, and negotiation are all tools and techniques of Acquire Project Team.

22. C.

Many teams go through five stages of development: forming, storming, norming, performing, and adjourning. The storming stage occurs early on in team development, before the team members are really comfortable with one another or the work. During this stage, they often have trouble collaborating, and are not necessarily open to one another's ideas.

23. C.

One of the most important interpersonal and team skills that a project manager has is influencing, and leading by example is a very effective way to do this. But when a project manager sets a bad example, it is almost certain to be reflected in the behavior or attitude of the team.



Even if the team is in the storming phase of team development, they should still be expected to act in a professional manner—and this includes showing up to meetings on time.

24. D.

Referent power means that you have the power or ability to attract others and build loyalty. One effective way that people often wield referent power is to take advantage of the loyalty that the team already has to someone high up in the company—in this case, the CTO.

## Answers

**Communications Questions**

25. C.

Since Sue is in the high-power, low-interest quadrant, she needs to be kept satisfied. This means that she has to feel that her needs are actually being met, but since she's not following the project on a day-to-day basis, the only way you can do that is by delivering a final product that meets those needs. Bob is low-power, high-interest, so he needs to be kept informed. This means that he needs to feel like he's constantly in the loop on important decisions, even if he won't actively be taking part in them.

26. D.

This is a basic "lines of communication" problem—you need to figure out how many people are communicating. In this case it's six team members, four stakeholders, two subcontractors...and don't forget the project manager! That's  $6 + 4 + 2 + 1 = 13$  people. The formula is  $n(n - 1) \div 2 = 13(12) \div 2 = 78$ .

27. B.

The definition of a stakeholder includes "anyone who is directly impacted by your project." That means this person is a stakeholder! Since you never spoke to this person, you failed to identify him as a stakeholder, and as a result you did not meet his needs.

Tools and techniques like a Stakeholder Management strategy or stakeholder register are great, but they don't work well if you haven't identified all of the project's stakeholders.



28. B.

When you're making relevant information available to your project's stakeholders, you're performing the Manage Communications process. The power/interest grid is a useful tool, but it's not part of Manage Communications.

## Answers

~~Risk Questions~~

29. C.

The question asked for “quantitative techniques,” which means that it’s asking about tools and techniques in the Perform Quantitative Risk Analysis process. Even though the Probability and Impact matrix assigns numbers to risks, it’s not one of those tools and techniques—in fact, it’s not a quantitative technique at all! It’s a qualitative technique, because it’s used for prioritization and categorization.

30. C.

This is an example of risk mitigation, because you are taking steps to deal with the problem just in case it happens.

↑ Did the word “accept” throw you? Make sure that you always read the whole question, and don’t just take a single word out of context!

31. C.

The management reserve is the part of the budget reserved for unplanned risks. If a risk was on the risk register, it was planned for, and the contingency reserve is used to pay for it. In this case, since the management reserve was used, that means the risk wasn’t planned for at all.

32. A.

When the other team built that tool, that presented an opportunity. Asking the team to share the tool with you is your way of taking advantage of it. That’s called exploiting the opportunity.

↑ Even though the word “share” appeared in the question, since only one party—your team!—is benefiting from the action, you’re exploiting the opportunity, not sharing it. Since your use of the tool doesn’t benefit the other team at all, this isn’t an opportunity for them.

## Answers

**Procurement Questions**

33. B.

The firm fixed price contract is the riskiest type of contract that a seller can take on. When the project's costs exceed the price of the contract, the seller has to pay for the overrun.

 This is usually bad for the buyer, too!  
Contracting works best when it's a win-win situation for both the buyer and the seller.

34 A.

Claims administration is what you do when there are contested changes to the contract, and the seller and buyer can't reach an agreement on the change. Any time you see a dispute or appeal between the buyer and seller and there's no clear resolution, that's where claims administration comes into play.

35. D.

When a buyer and seller have a teaming agreement, the seller acts as a partner with the buyer. It's not just a typical "here's the terms, you go off and do the work" relationship that a lot of sellers and buyers have. Instead, the buyer asks for the seller's input, and makes the seller an active part of the management of the project.

 When a seller works on a project with a teaming agreement, the team members from both the buyer's and seller's teams usually have a lot of mutual respect. That's why this is a really effective way to do procurement.

36. C.

A document that defines the portion of work the contractor will do is the procurement statement of work (SOW). It's a clear, concise, unambiguous, and complete document that describes the work that must be done, and can include specifications of deliverables. But it doesn't include contract terms—those terms are part of the contract itself.

Answers

## ~~Stakeholder Questions~~

**37. C.**

Tom is a low-power, high-interest stakeholder. The project manager on the project should work to keep him informed.

**38. D.**

The project manager is performing the Control Stakeholder Engagement process. The outputs of Monitor Stakeholder Engagement are work performance information, change requests, Project Management plan updates, project document updates, and organizational process asset updates. The question mentioned most of these outputs.

**39. B.**

A resistant stakeholder is a stakeholder who doesn't want the project or decision you're making to happen. Even though Joanne is the sponsor for the project, she's actively working to cancel it, which shows that she doesn't really want it to happen.

## 16 Practice makes perfect

# Practice PMP exam

I KNOW WE'RE SUPPOSED TO BE STUDYING, BUT I CAN'T STOP THINKING ABOUT FUDGE.



**Bet you never thought you'd make it this far!** It's been a long journey, but here you are, ready to review your knowledge and get ready for exam day. You've put a lot of new information about project management into your brain, and now it's time to see just how much of it stuck. That's why we put together this 200-question PMP practice exam for you, completely updated for the 2018 exam. It looks just like the one you're going to see when you take the real PMP exam. Now's your time to flex your mental muscle. So take a deep breath, get ready, and let's get started.

## Exam Questions

1. The terms of union contracts are considered \_\_\_\_\_ in your project plan.

- A. Assumptions
- B. Constraints
- C. Requirements
- D. Collective bargaining agreements

2. A project manager is reporting the final status of the closed contract to the stakeholders. Which form of communication is appropriate?

- A. Informal written
- B. Informal verbal
- C. Formal written
- D. Formal verbal

3. Which of the following is not a tool or technique of the Control Quality process?

- A. Inspection
- B. Quality audits
- C. Pareto charts
- D. Statistical sampling

4. You have just delivered a product to your client for acceptance when you get a call that some features they were expecting are missing. What's the first thing you should do?

- A. Get your team together and reprimand them for building a product that doesn't meet user expectations.
- B. Tell the client that the product passed all of your internal quality inspections and scope verification processes, so it must be fine.
- C. Tell the team to start building the missing features into the product right away.
- D. Call a meeting with the client to understand exactly what is unacceptable in the product and try to figure out what went wrong along the way.

5. Which of the following is not a tool or technique of Estimate Costs?

- A. Bottom-up
- B. Parametric
- C. Cost aggregation
- D. Analogous

## Exam Questions

**6. Which of the following is not a source of information about specific project constraints and assumptions?**

- A. The Scope Management plan
- B. Requirements documentation
- C. The project scope statement
- D. The scope baseline

**7. A project manager uses a facilitator to gather opinions from experts anonymously. What risk identification tool or technique is being performed?**

- A. Brainstorming
- B. Delphi technique
- C. Interviews
- D. SWOT analysis

**8. Joe is an excellent programmer. He was promoted to the role of project manager because he understands technology better than anyone else in the company. Unfortunately, he is having trouble doing the project management job and his projects are failing. What is this an example of?**

- A. Gold plating
- B. Halo effect
- C. Preassignment
- D. Ground rules

**9. When are the most expensive defects most likely to be introduced into a product?**

- A. When the product is being assembled
- B. When the product is being designed
- C. When the Quality Management plan is being written
- D. When the product is being reviewed by the customers

## Exam Questions

10. You are the project manager for a railroad construction project. Your sponsor has asked you for a forecast for the cost of project completion. The project has a total budget of \$80,000 and CPI of .95. The project has spent \$25,000 of its budget so far. How much more money do you plan to spend on the project?

- A. \$59,210
- B. \$80,000
- C. \$84,210
- D. \$109,210

11. Which of the following best describes decomposition?

- A. Waiting for a task to expire so that it can break down into smaller tasks
- B. Taking a deliverable and breaking it down into the smaller work packages so that it can be organized and planned
- C. Categorizing work packages
- D. Dividing work packages into deliverables that can be planned for

12. Which is the best definition of quality?

- A. A product made of very expensive materials
- B. A product made with a lot of care by the team who built it
- C. A product that satisfies the requirements of the people who pay for it
- D. A product that passes all of its tests

13. Which of the following is not a project constraint?

- A. Cost
- B. Resources
- C. Procurements
- D. Scope

14. What is a risk owner?

- A. The person who monitors the watchlist that contains the risk
- B. The person who meets with stakeholders to explain the risk
- C. The person who makes a risk happen
- D. The person who is responsible for the response plan for the risk

15. You are currently performing the Conduct Procurements process. You are considering two bids from companies on your qualified sellers list. Your project is on a tight budget, and you have been instructed by senior management to consider the cost over any other criteria. You used the company that submitted the lower bid on a previous project, and you were not happy with its work. The company that submitted the higher bid has a

## Exam Questions

reputation for treating its clients well, flying project managers first-class, and giving them accommodations in five-star hotels. What is the best way to handle this situation?

- A. Select the company with the lowest bid.
- B. Give the manager at the company with the higher bid information that will allow him to tailor his bid so that it better meets your needs.
- C. Rewrite the RFP so that the company with the lowest bid is excluded.
- D. Select the company with the higher bid.

16. Which of the following shows roles and responsibilities on your project?

- A. Bar chart
- B. Resource histogram
- C. RACI matrix
- D. Resource Management plan

17. A project manager is working in a country where it is customary to pay the police for private protection services, and those costs have increased the AC. This has affected his earned value calculations. When he reviews the budget with his company's management, his supervisor tells him that in another country, those costs would be considered a bribe, and questions whether they should be added to the budget. What is the best way for the project manager to proceed?

- A. Do not pay the police for private protection services, because that would be a bribe.
- B. Pay the police for private protection services, because it is customary in the country they are operating in.
- C. Consult the Cost Management plan about payment.
- D. Initiate cost control to update the cost baseline.

18. Which of the following is a "hygiene factor" under Herzberg's Motivation-Hygiene Theory?

- A. Recognition for excellent work
- B. Self-actualization
- C. Good relations with coworkers and managers
- D. Clean clothing

19. A bar chart showing the number and type of resources you need throughout your project is called a(n)

- A. Organizational chart
- B. Resource schedule
- C. Resource histogram
- D. Staffing timetable

## Exam Questions

20. Brandi is a project manager on a software project. About halfway through development, her team found that they had not estimated enough time for some of the technical work they needed to do. She requested that the new work be added to the scope statement and that the time to do the work be added to the schedule. The change control board approved her change. What's her next step?

- A. Update the scope and schedule baselines to reflect the approved change.
- B. Start doing the work.
- C. Gather performance metrics on the team's work so far.
- D. Manage Quality

21. You are managing a software project. You are partway through the project, and your team has just delivered a preliminary version of part of the software. You are holding a weekly status meeting when one of the team members points out that an important stakeholder is running into a problem with one of the features of the current software. The team member feels that there is a risk that the stakeholder will ask for a change in that feature, even though that change would be out of scope of the current release—and if the stakeholder requests that change, there is a high probability that the change control board would approve the change. What is the best action to take next?

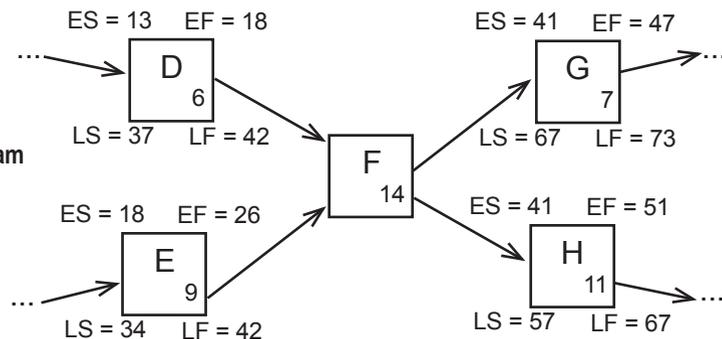
- A. Mitigate the risk by asking a team member to get familiar with the feature of the software that might be changed.
- B. Schedule a meeting with the stakeholder to discuss the risk.
- C. Add the risk to the risk register and gather information about its probability and impact.
- D. Add the risk to the issue log and revisit it when there is more information.

22. Tom is the project manager of an accounting project. He has just finished defining the scope for the project and is creating the WBS. He goes to his organizational process asset library and finds a WBS from a past project to use as a jumping-off point. Which of the following describes the asset that Tom is using?

- A. Decomposition
- B. Delphi technique
- C. Brainstorming
- D. Templates

23. Given this portion of the network diagram to the right, what's the LS of activity F?

- A. 27
- B. 40
- C. 43
- D. 56



## Exam Questions

**24. You are the project manager for a software development project. When you need to get staff from the manager of the QA department, he suggests a few test engineers with performance problems for your team. Which is the best response to this situation?**

- A. Stop talking to the QA manager.
- B. Call a meeting with the QA manager to try to figure out why he suggested those candidates and how the two of you can work together to find team members with suitable skills and interests for your team.
- C. Tell the QA manager that the staffing problems are really no big deal, and you're sure that the two of you can eventually figure out the right answer together.
- D. Tell the manager that you know which team members you want for your team and he needs to give them to you.

**25. You are managing a construction project using a firm fixed price (FFP) contract. The contract is structured so that your company will be paid a fee of \$85,000 to complete the work. There was a \$15,000 overhead cost that your company had to cover. It's now three months into the project, and your costs have just exceeded \$70,000. The project has now consumed the entire fee, and your company will now be forced to pay for all costs on the project from this point forward. What's the best way to describe this situation?**

- A. The project manager has overspent the budget.
- B. The project is overdrawn.
- C. The project has reached the point of total assumption.
- D. The project has ceased to be a profit center for the company.

**26. Which of the following is not an input of the Close Project or Phase process?**

- A. Project Management plan
- B. Project management methodology
- C. Accepted deliverables
- D. Organizational process assets

**27. You are managing a software engineering project. While investigating the cause of a low SPI, you discover that your team is having trouble completing their object design tasks, which are on the critical path. One of your team members tells you that her friend at another company sent her a copy of a software package it owns that will help your team meet its deadline. Without that software package, your project will probably be late. But you don't have enough money in the budget to purchase it. What's the best way to handle this situation?**

- A. Tell the team member not to use the software, and accept that the project will be late.
- B. Use the software so that your project comes in on time.
- C. Purchase the software so that you have a licensed copy.
- D. Find a way to add resources to the object design activity or move it off of the critical path.

## Exam Questions

**28. You are managing a project with a total budget of \$450,000. According to the schedule, your team should have completed 45% of the work by now. But at the latest status meeting, the team reported that only 40% of the work has actually been completed. The team has spent \$165,000 so far on the project. How would you best describe this project?**

- A. The project is ahead of schedule and within its budget.
- B. The project is behind schedule and within its budget.
- C. The project is ahead of schedule and over its budget.
- D. The project is behind schedule and over its budget.

**29. Which of the following is the correct order of the Monitoring and Controlling processes for Scope Management?**

- A. First Validate Scope, then Control Scope.
- B. First Control Scope, then Validate Scope.
- C. Both happen simultaneously.
- D. There is not enough information to decide.

**30. Which of the following is not part of a typical change control system?**

- A. Approval
- B. Change control board
- C. Project management information system
- D. Stakeholder analysis

**31. One way the Close Project or Phase process differs from Control Procurements is:**

- A. Procurement closure involves verification that all work and deliverables are acceptable, whereas Close Project or Phase does not.
- B. Close Project or Phase is only a subset of Control Procurements.
- C. The Control Procurements process means verifying that the project is complete or terminated; Close Project or Phase is the process of tying up all of the activities for every management process group.
- D. The Control Procurements process is performed by the seller; Close Project or Phase is performed by the buyer.

**32. Which of the following contracts has the most risk for the buyer?**

- A. Cost plus fixed fee (CPFF)
- B. Time and materials (T&M)
- C. Cost plus award fee (CPAF)
- D. Fixed price (FP)

## Exam Questions

33. You are managing a software project. During a walkthrough of newly implemented functionality, your team shows you a new feature that they have added to help make the workflow in the product easier for your client. The client didn't ask for the feature, but it does look like it will make the product easier to use. The team developed it on their own time because they wanted to make the client happy. You know this change would never have made it through change control. What is this an example of?

- A. Gold plating
- B. Scope creep
- C. Alternatives analysis
- D. Schedule variance

34. The project manager for a construction project discovers that the local city council will vote on a zoning change that would open up a new neighborhood to commercial building. She contacts other construction companies in the area that would benefit from the change to ask them to attend the council meeting in order to convince the city council to vote for the change. A "Yes" vote will benefit all of the companies. This is an example of which risk response strategy?

- A. Mitigate
- B. Share
- C. Exploit
- D. Enhance

35. You are managing a construction project. During your risk identification interviews, you learn that there has been a string of construction site thefts over the past few months in the area where you will be building your project. The team agrees that it's unlikely that people will be able to steal from your site. Even if thieves could get around your security, it's even more unlikely that your project will lose a significant amount of material if a theft does occur. You decide to monitor the risk from time to time to be sure that it continues to have a low probability and impact. Where do you record the risk so that you don't lose track of it?

- A. In a trigger
- B. On a watchlist
- C. In the Probability and Impact matrix
- D. In the Monte Carlo analysis report

## Exam Questions

**36. Which of the following is not a characteristic of the Project Management plan?**

- A. Collection of subsidiary plans
- B. Formal, written communication
- C. A bar chart that shows the order of tasks and their resource assignments
- D. Must be approved by project sponsor

**37. A team member approaches you with a change that could cut your schedule down by a month. What is the first thing you should do?**

- A. Write up a change request and see if you can get it approved.
- B. Make the change; it's going to save time and nobody will want the project to take longer than it should.
- C. Figure out the impact on the scope of the work and the cost before you write up the change request.
- D. Tell the team member that you've already communicated the deadline for the project, so you can't make any changes now.

**38. A project manager is faced with two team members who have conflicting opinions. One team member explains her side of the conflict. The other team member responds by saying, "I know you'll never really listen to my side, so let's just go with her opinion and get back to work." This is an example of:**

- A. Withdrawal
- B. Compromise
- C. Smoothing
- D. Forcing

**39. You're managing a construction project to install several hundred air conditioner panels in a new office building. Every floor has identical panels. The customer, a construction contracting company, has provided specifications for the installation. The team is using a process to install and verify each panel. As the team completes each panel, your team's quality control inspector measures it and adds the data point to a control chart. You examine the control chart, and discover that the process is out of control and you need to take a close look at it immediately. Which of the following best describes what you found on the control chart?**

- A. At least seven consecutive measurements are either above or below the mean but within the control limits.
- B. At least one point is inside of the control limits.
- C. At least seven consecutive measurements are inside of the control limits.
- D. At least one point is above or below the mean.

**40. A senior manager is presenting to your client's board of directors about your project. As part of managing communications, you must deliver status updates and other project materials to him via overnight mail. If the materials do not arrive tomorrow, your company will miss a major contract deadline and you will lose future business from this important client. The deadline cannot be negotiated. The team worked right up to the last minute in order to give you the files. Due to a traffic jam, you are running late and the overnight delivery company will close in five minutes. You can only make it if you drive over the speed limit. Which of the following is correct?**

## Exam Questions

- A. You must drive over the speed limit so that you can save the client relationship.
- B. You must stay within the speed limit, even if you lose the client.
- C. Update the organizational process assets to reflect the change.
- D. You can use the earned value metrics to show that the SPI is over 1, meaning the project is not late.

**41. You are planning a project that uses the same team as a project that is currently being performed by your company. What should you consult to find information about when those people will be available for your project?**

- A. The project schedule for your project
- B. The project manager for the project that the team is working on
- C. The Staffing Management plan for the project that the team is working on
- D. The Communications Management plan for your project

**42. When is the best time to have project kickoff meetings?**

- A. At the beginning of the project
- B. When each deliverable is created
- C. At the start of each phase
- D. When the Communications Management plan is approved

**43. Which of the following is not a tool in Identify Risks?**

- A. Brainstorming
- B. Risk urgency assessment
- C. Delphi technique
- D. SWOT analysis

**44. You are a project manager for a software project. Your team buys a component for a web page, but they run into defects when they use it. Those defects slow your progress down considerably. Fixing the bugs in the component will double your development schedule, and building your own component will take even longer. You work with your team to evaluate the cost and impact of all of your options and recommend hiring developers at the company that built the component to help you address problems in it. That will cost more, but it will reduce your delay by a month. What is your next step?**

- A. Fix the component.
- B. Write up the change request and take it to the change control board.
- C. Start Plan Procurements so you can get the contract ready for the vendor.
- D. Change the scope baseline to include your recommendation.

## Exam Questions

**45. You are developing the project scope statement for a new project. Which of the following is not part of creating a project scope statement?**

- A. Validate Scope
- B. Using the project charter
- C. Alternatives identification
- D. Obtaining plan approval

**46. A change has occurred on your project. You've documented the change, filled out a change request, and submitted that request to the change control board (CCB). What's the next thing that must happen on the project?**

- A. A senior manager decides whether or not to make the change and informs the project management team of the decision.
- B. The project manager informs the CCB whether or not to approve the change.
- C. Stakeholders on the CCB use expert judgment to evaluate the requested change for approval.
- D. The project manager meets with the team to analyze the impact of the change on the project's time, scope, and cost.

**47. You are managing a design project. You find that bringing all of your team members into a single room to work increases their communication, and helps build a sense of community. This is referred to as a:**

- A. War room
- B. Virtual team
- C. Socially active team
- D. Common area

**48. You are a project manager on a construction project. You have just prepared an RFP to send around to electrical contractors. You get a call from your uncle who owns an electrical contracting company. He wants to bid on your project. You know he's done good work before, and it may be a good fit for your company. How do you proceed?**

- A. You disclose the conflict of interest to your company, and disqualify your uncle's company.
- B. You disclose the conflict of interest to your company, and make the selection based on objective criteria.
- C. You disclose the conflict of interest to your company, and provide your uncle with information that the other bidders don't have so that he has a better chance of winning the contract.
- D. You do not disclose the conflict of interest, and give your uncle the bid.

**49. You are managing a software project. You are partway through the project, and your team has just delivered a preliminary version of part of the software. Your team gives a demonstration to the project sponsor and key stakeholders. Later, the sponsor informs you that there is an important client who will be using the software your team is building, and whose needs are not being met. As a result, you must now make a large and expensive change to accommodate that client. What is the best explanation for this?**

## Exam Questions

- A. The sponsor is being unreasonable.
- B. Stakeholder analysis was not performed adequately.
- C. The team made a serious mistake and you need to use punishment power to correct it.
- D. You do not have enough budget to perform the project.

**50. A team member is showing up late to work and leaving early, and it is affecting the project. The project manager decides that the team member must be reprimanded. Which of the following is the best way to handle this situation?**

- A. In a one-on-one meeting with the team member
- B. At the next team meeting
- C. In a private meeting with the team member and his functional manager
- D. Over email

**51. The scope baseline consists of:**

- A. The Scope Management plan, the project scope statement, and the WBS
- B. The Scope Management plan, requirements documents, and the WBS
- C. The Scope Management plan, the WBS, and the WBS dictionary
- D. The project scope statement, the WBS, and the WBS dictionary

**52. You are managing a construction project that is currently being initiated. You met with the sponsors, and have started to work on identifying stakeholders. You've documented several key stakeholders and identified their needs. Before you can finish initiating the project, your company guidelines require that you make a rough order of magnitude estimate of both time and cost, so that the sponsor can allocate the final budget.**

**What's the range of a rough order of magnitude (ROM) estimate?**

- A. -10% to +10%
- B. -25% to +75%
- C. -50% to +100%
- D. -100% to +200%

**53. Which of the following processes is in the Initiating process group?**

- A. Develop Project Charter
- B. Develop Project Management Plan
- C. Define Scope
- D. Define Activities

## Exam Questions

**54. Mary is a project manager at a consulting company. The company regularly builds teams to create products for clients. When the product is delivered, the team is dissolved and assigned to other projects. What kind of organization is she working for?**

- A. Weak matrix
- B. Projectized
- C. Functional
- D. Strong matrix

**55. An important part of performing stakeholder analysis is documenting quantifiable expectations. Which of the following expectations is quantifiable?**

- A. The project must improve customer satisfaction.
- B. The project should be higher quality.
- C. The project must yield a 15% reduction in part cost.
- D. All stakeholders' needs must be satisfied.

**56. At the close of your project, you measure the customer satisfaction and find that some customer needs were not fully met. Your supervisor asks you what steps you took on your project to improve customer satisfaction. Which subsidiary plan would you consult to determine this information?**

- A. Quality Management plan
- B. Communications Management plan
- C. Staffing Management plan
- D. Risk Management plan

**57. Which of the following describes the contents of a Staffing Management plan?**

- A. Organizational chart, training needs, estimated labor cost, and release criteria
- B. Sponsor, organizational chart, validate scope plan, and schedule
- C. RACI matrix, organizational chart, performance improvement plan, and budget
- D. Resource histogram, training needs, recognition and rewards, and resource calendar

## Exam Questions

58. Dave is the project manager for a construction team that is building a gazebo. When the project first started, he met with the stakeholders to define the scope. The sponsors mentioned that the gazebo is a really important part of their daughter's wedding ceremony that was planned for seven months from then. In fact, they said that if the gazebo couldn't be completed in seven months, it wouldn't be worth it for them to even start the project. Dave wrote down the seven-month deadline to put in his project scope statement. In which section of the document did the deadline appear?

- A. Project deliverables
- B. Project objectives
- C. Project constraints
- D. Project assumptions

59. Which conflict resolution technique is most effective?

- A. Withdrawal
- B. Compromise
- C. Smoothing
- D. Collaborating

60. Which of the following is not an input to Control Quality?

- A. Deliverables
- B. Work performance data
- C. Organizational process assets
- D. Test and evaluation documents

61. You have identified an opportunity to potentially increase the project's value. Which of the following is an example of enhancing that opportunity?

- A. By forming a partnership with another company, you will increase the project's value for both companies.
- B. By taking additional actions, you increase the potential reward without reducing its probability.
- C. By taking out insurance, you can reduce potential costs to the project.
- D. By documenting the opportunity in the register, you can keep track of it and ensure it gets exploited.

62. Which of the following best describes the Plan-Do-Check-Act cycle?

- A. Invented by Joseph Juran, it's a way of tracking how soon defects are found in your process.
- B. Invented by Walter Shewhart and popularized by W. E. Deming, it's a method of making small changes and measuring the impact before you make wholesale changes to a process.
- C. Made popular by Phillip Crosby in the 1980s, it's a way of measuring your product versus its requirements.
- D. It means that you plan your project, then do it, then test it, and then release it.

## Exam Questions

**63. You are developing the project charter for a new project. Which of the following is not part of the enterprise environmental factors?**

- A. Lessons learned from previous projects
- B. Knowledge of which departments in your company typically work on projects
- C. The work authorization system
- D. Government and industry standards that affect your project

**64. You are managing a construction project to install new door frames in an office building. You planned on spending \$12,500 on the project, but your costs are higher than expected, and now you're afraid that your project is spending too much money. What number tells you the difference between the amount of money you planned on spending and what you've actually spent so far on the project?**

- A. AC
- B. SV
- C. CV
- D. VAC

**65. Tom is the project manager on a construction project. Midway through his project, he realizes that there's a problem with the lumber they've been using in a few rooms and they're going to have to tear down some of the work they've done and rebuild. One of his team members suggests that the defect isn't bad enough to cause all of that rework. Tom says that he's worked on a project that made this same mistake before and they ended up having to redo the work when inspectors looked at the house. He convinces the team member that it's probably better to fix it now than later. What kind of power is he using to make the decision?**

- A. Legitimate
- B. Expert
- C. Referent
- D. Reward

**66. Which of the following is not one of the most common sources of project conflict?**

- A. Schedules
- B. Priorities
- C. Resources
- D. Costs

## Exam Questions

**67. Your company's quality assurance department has performed a quality audit on your project. They have found that your team has implemented something inefficiently, and that could lead to defects. What's the next thing that should happen on your project?**

- A. You work with the quality department to implement a change to the way your team does their work.
- B. You document recommended corrective actions and submit them to the change control board.
- C. You add the results of the audit to the lessons learned.
- D. You meet with the manager of the quality assurance department to figure out the root cause of the problem.

**68. A junior project manager at your company does not know how to perform earned value analysis. You spend a weekend with him to teach him how to do this. This is an example of:**

- A. Coaching
- B. Fraternizing, and should be discouraged
- C. Unpaid overtime
- D. Giving access to proprietary information, and should be reported to PMI

**69. Your client has terminated your project before it is complete. Which of the following is true?**

- A. You must stop all work and release the team immediately.
- B. You must work with the team to document the lessons learned.
- C. You must keep the team working on the project to give your senior management time to talk to the client.
- D. You must update the Project Management plan to reflect this change.

**70. When you look at a control chart that measures defects in the product produced by your project, you find that seven values are showing up below the mean on the chart. What should you do?**

- A. Look into the process that is being measured; there's probably a problem there.
- B. Ignore the anomaly; this is the rule of seven, so statistically the data doesn't matter.
- C. This indicates that the mean is too high.
- D. You should adjust your lower control limit—the values indicate a problem with where the limits have been set.

**71. When do you perform stakeholder analysis?**

- A. During the Initiating process group
- B. When developing the project charter
- C. When creating the Project Management plan
- D. When putting changes through change control

## Exam Questions

**72. You have just been authorized to manage a new project for your company. Which of the following best describes your first action?**

- A. Create the work breakdown structure.
- B. Develop the Project Management plan.
- C. Start working on the project charter.
- D. Figure out who has a stake in the project.

**73. You're the project manager on a software project that is planning out various approaches to technical work. There's a 20% chance that a component you are going to license will be difficult to integrate and cost \$3,000 in rework and delays. There's also a 40% chance that the component will save \$10,000 in time and effort that would have been used to build the component from scratch. What's the EMV for these two possibilities?**

- A. \$13,000
- B. \$7,000
- C. \$3,400
- D. -\$600

**74. You are managing a software engineering project when two team members come to you with a conflict. The lead developer has identified an important project risk: you have a subcontractor that may not deliver on time. Another developer doesn't believe that the risk is likely to happen; however, you consult the lessons learned from previous projects and discover that subcontractors failed to deliver their work on two previous projects. You decide that the risk is too big; you terminate the contract with the subcontractor, and instead hire additional developers to build the component. Both team members agree that this has eliminated the risk. Which of the following best describes this scenario?**

- A. Transference
- B. Mitigation
- C. Avoidance
- D. Acceptance

**75. Which of the following best describes the contents of a WBS dictionary entry?**

- A. The definition of the work package including its net present value
- B. Work package ID and name, statement of work, required resources, and Monte Carlo analysis
- C. Work package ID and name, statement of work, risk register, earned value calculation, scheduled complete date, and cost
- D. Work package ID and name, statement of work, responsible organization, schedule milestones, quality requirements, code of account identifier, required resources, cost estimate

## Exam Questions

**76. Two of your project team members approach you with a conflict that they are having with each other over the technical approach to their work. One of the two people is very aggressive, and tries to get you to make a decision quickly. The other team member is quiet, and seems less willing to talk about the issue. The conflict is starting to cause delays, and you need to reach a decision quickly. What's the best approach to solving this conflict?**

- A. Tell the team members that they need to work this out quickly, because otherwise the project could face delays.
- B. Since it's a technical problem, tell the team members that they should take it to the functional manager.
- C. Collaborate with the team to solve the issue, even though one team member is hesitant.
- D. Escalate the issue to your manager.

**77. Tom is a project manager on an industrial design project. He is always watching when his team members come into the office, when they take their breaks, and when they leave. He periodically walks around the office to be sure that everyone is doing work when they are at their desks and he insists that he make every project decision, even minor ones. What kind of manager is he?**

- A. Theory X
- B. Theory Y
- C. Cost cutter
- D. Effective

**78. You are the project manager on a construction project. As you're planning out the work your team will do, you divide up all of the work into work packages and create a WBS that shows how they fit into categories. For each one of the work packages, you write down details such as initial estimates and information about what account it should be billed against. Where do you store all of that information?**

- A. Scope Management plan
- B. WBS
- C. WBS dictionary
- D. Project scope statement

**79. You are managing a project with an EV of \$15,000, PV of \$12,000, and AC of \$11,000. How would you best describe this project?**

- A. The project is ahead of schedule and within its budget.
- B. The project is behind schedule and within its budget.
- C. The project is ahead of schedule and over its budget.
- D. The project is behind schedule and over its budget.

## Exam Questions

**80. You are using a Pareto chart to examine the defects that have been found during an inspection of your product. Which process are you performing?**

- A. Manage Quality
- B. Plan Quality Management
- C. Control Quality
- D. Validate Scope

**81. You are initiating a project that has a virtual team. Half of your team members will be located in another country, where they are working for a subcontractor. The subcontractor's team members speak a different language than your team does. When you need to get information to them, it must first be translated. This is an example of:**

- A. Encoding
- B. Transmission
- C. Decoding
- D. Acknowledgment

**82. Complete the following sentence: "The later a defect is found, \_\_\_\_\_."**

- A. the easier it is to find
- B. the more expensive it is to repair
- C. the less important it is to the product
- D. the faster it is to repair

**83. Your top team member has performed extremely well, and you want to reward her. She knows that you don't have enough money in the budget to give her a bonus, so she approaches you and requests an extra day off, even though she is out of vacation days. She asks if she can take one of her sick days, even though the company doesn't allow that. Which of the following is correct?**

- A. You should give her the time off, because McClelland's Achievement Theory states that people need achievement, power, and affiliation to be motivated.
- B. You should give her the time off, because Expectancy Theory says that you need to give people an expectation of a reward in order to motivate them.
- C. You should give her the time off because a Theory Y manager trusts the team.
- D. You should not give her the time off.

**84. Which of the following is not a tool or technique of Perform Qualitative Risk Analysis?**

- A. Risk urgency assessment
- B. Expected monetary value analysis
- C. Probability and Impact matrix
- D. Risk categorization

## Exam Questions

**85. While creating a project charter, you discover a new project management software tool has come onto the market. You spend the weekend taking an online tutorial to learn about it. This is an example of:**

- A. An assigned project manager using authority and responsibility
- B. Not paying for copyrighted software
- C. Contributing to the Project Management Body of Knowledge
- D. Enhancing personal professional competence

**86. Joe is a project manager on an industrial design project. He has found a pattern of defects occurring in all of his projects over the past few years, and he thinks there might be a problem in the process his company is using that is causing it. He uses Ishikawa diagrams to come up with the root cause for this trend over projects so that he can make recommendations for process changes to avoid this problem in the future. What process is he performing?**

- A. Plan Quality Management
- B. Manage Quality
- C. Control Quality
- D. Perform Qualitative Risk Analysis

**87. You are managing a software engineering project when two team members come to you with a conflict. The lead developer has identified an important project risk: you have a subcontractor that may not deliver on time. The team estimates that there is a 40% chance that the subcontractor will fail to deliver. If that happens, it will cost an additional \$15,250 to pay your engineers to rewrite the work, and the delay will cost the company \$20,000 in lost business. Another team member points out an opportunity to save money in another area to offset the risk: if an existing component can be adapted, it will save the project \$4,500 in engineering costs. There is a 65% probability that the team can take advantage of that opportunity. What is the expected monetary value (EMV) of these two things?**

- A. -\$14,100
- B. \$6,100
- C. -\$11,175
- D. \$39,750

**88. Your project team has completed the project work. All of the following must be done before the project can be closed except:**

- A. Ensure that the schedule baseline has been updated.
- B. Get formal acceptance of the deliverables from the customer.
- C. Make sure the scope of the project was completed.
- D. Verify that the product acceptance criteria have been met.

**89. During procurement closure, a procurement audit includes all of the following except:**

- A. Reviewing the contract terms to ensure that they have all been met
- B. Identifying successes and failures that should be recognized
- C. Documenting lessons learned
- D. Using the payment system to process consideration as per the terms of the contract

## Exam Questions

**90. You are reviewing performance goals to figure out how much bonus to pay your team members. What document would you consult to find your team's bonus plan?**

- A. The reward and recognition plan
- B. The Staffing Management plan
- C. The Resource Management plan
- D. The project's budget

**91. You're managing a construction project to install several hundred air conditioner panels in a new office building. You have completed 350 panels out of a total of 900 planned panels, but according to your schedule you should have completed 400 of them. Your company's contract states that you'll be paid a fixed price of \$75 per panel. You've spent \$45,000 so far on the project. Which of the following best describes your situation?**

- A. The CPI is .813, which means your project is currently over your budget.
- B. The CV is -\$4,350, which means your project is currently over your budget.
- C. The TCPI is 1.833, which is the minimum CPI you need to stay within budget.
- D. The SPI is .84, which means your project is behind schedule.

**92. Your team has identified a risk with some of the chemicals you are using on your highway construction project. It is really difficult to mix them just right and, based on past projects, you've figured out that there's a high probability that about 14% of the chemical supply will be lost in mixing problems. You decide to buy an extra 15% of the chemicals up front so that you will be prepared for those losses and your project won't be delayed. Which response strategy are you using?**

- A. Avoid
- B. Accept
- C. Mitigate
- D. Transfer

**93. A project manager is planning the staffing levels that will be needed through the course of her project. She figures out the number of people that will be needed in each role over time and displays that information in a chart as part of her Staffing Management plan. What is that chart called?**

- A. Gantt chart
- B. RACI matrix
- C. Organization chart
- D. Resource histogram

## Exam Questions

**94. You are working on a construction project. You, your team, and your senior manager all feel that the work is complete. However, one of your important clients disagrees, and feels that one deliverable is not acceptable. What is the best way to handle this conflict?**

- A. Consult the contract and follow its claims administration procedure.
- B. Renegotiate the contract.
- C. File a lawsuit to force the stakeholder to accept the deliverable.
- D. Terminate the contract and follow any termination procedure in the contract.

**95. A notice sent to a subcontractor about the contract is an example of which kind of communication?**

- A. Informal verbal
- B. Formal written
- C. Formal verbal
- D. Informal written

**96. You need to determine when to release resources from your project. Which part of the Staffing Management plan will be most useful for this?**

- A. Resource histogram
- B. Safety procedures
- C. Recognition and rewards
- D. Training needs

**97. Which of the following is not a type of communication?**

- A. Formal written
- B. Paralingual
- C. Nonverbal
- D. Noise

**98. A company is about to begin work on a large construction project to build four new buildings for a bank that wants to open new branches. The sponsor is writing a project charter. She recalls that a previous project the company performed for another bank ran over budget because the team had underestimated the effort required to install the reinforced walls in the vault. The previous project manager had documented the details of the lessons learned from this project. Where should the sponsor look for these lessons learned?**

- A. The project records management system
- B. The company's organizational process assets
- C. The project's work performance information
- D. The project's performance reports

## Exam Questions

**99. The customer has reviewed the deliverables of a project and finds that they are acceptable, and must now communicate that acceptance to the project manager. Which form of communication is appropriate?**

- A. Informal written
- B. Informal verbal
- C. Formal written
- D. Formal verbal

**100. Which of the following is not found in a project charter?**

- A. The summary budget
- B. High-level requirements
- C. Procedures for managing changes to contracts
- D. Responsibility and name of the person authorized to manage the project

**101. In which plan do you define the processes that will be used to keep people informed throughout the project?**

- A. Staffing Management plan
- B. Project Management plan
- C. Schedule Management plan
- D. Communications Management plan

**102. Which enterprise environmental factor defines how work is assigned to people?**

- A. RACI matrix
- B. Project management information system (PMIS)
- C. Resource histogram
- D. Work authorization system

**103. You are managing a software engineering project when two team members come to you with a conflict. The lead developer has identified an important project risk: you have a subcontractor that may not deliver on time. Another developer doesn't believe that the risk is likely to happen; however, you consult the lessons learned from previous projects and discover that subcontractors failed to deliver their work on two previous projects. The lead developer suggests that you have two team members take three weeks to research the component being built by the subcontractor, and come up with some initial work that you can fall back on in case that subcontractor does not deliver. You decide to follow the lead developer's advice over the objections of the other team member. Which of the following best describes this scenario?**

- A. Transference
- B. Mitigation
- C. Avoidance
- D. Acceptance

## Exam Questions

**104. You are managing a project with AC = \$25,100, ETC = \$45,600, VAC = -\$2,100, BAC = \$90,000, and EAC = \$92,100. Your sponsor asks you to forecast how much money you expect to spend on the remainder of the project. Which is the best estimate to use for this forecast?**

- A. \$45,600
- B. \$87,400
- C. \$90,000
- D. \$92,100

**105. Which is the best description of project scope?**

- A. All of the features and deliverables your project will deliver
- B. All of the products your project will make
- C. All of the people involved in your project
- D. All of the work you will do to build the product

**106. Which of the following best describes the main purpose of the project charter?**

- A. It authorizes the project manager to work on the project.
- B. It identifies the sponsor and describes his or her role on the project.
- C. It contains a list of all activities to be performed.
- D. It describes the initial scope of the work.

**107. You have been hired by a contractor who wants you to manage a construction project for one of his clients. The project team has been working for six weeks. You need to determine whether the team is ahead of or behind schedule. Which of the following tools, techniques, activities, or other project artifacts is the best one for you to consult?**

- A. Work performance data
- B. Project management software
- C. Schedule change control system
- D. Bottom-up estimating

**108. You are managing an accounting project when a new CFO is hired at your company. He'll be affected by all accounting projects in your company. What's the best thing for you to do?**

- A. Show him the project charter so that he knows that you are in charge of the project
- B. Work with him to understand the current requirements and determine if he has new ones to add to the project
- C. Keep working on the project and get his feedback when he can review the finished product
- D. Add him to the communications plan

## Exam Questions

**109. You're managing an industrial design project. Your project is currently in the Initiating phase. The project charter has been created, and you are working on identifying the stakeholders. Which of the following is not something that you should do?**

- A. Review lessons learned from prior projects
- B. Perform a stakeholder analysis
- C. Review procurement documents
- D. Create the change control system

**110. Alberto is the project manager of a software implementation project. His company has made an organization-wide decision to move to a new accounting and human resources software package. He has read that some projects to implement the same package have resulted in the loss of personnel data when they tried to import it into the new system. He backs up the data so that it could be restored in the event of such a problem but also buys insurance to cover the cost of keying in the data manually if the implementation doesn't work. Which response strategies are Alberto using?**

- A. Mitigating and accepting
- B. Mitigating and avoiding
- C. Mitigating and transferring
- D. Mitigating and sharing

**111. Rekha is a project manager on a large construction project. Late in the project, her client demands a big change. She assesses the impact of the change and tells the client how much time and money it will cost. But the client says that he doesn't have the time or budget to allow the change. What's the best way for Rekha to handle this situation?**

- A. Have her senior managers meet with the client to explain the situation.
- B. Hold a meeting with the client to figure out why he's asking for the change.
- C. Do nothing; she's the project manager, so she sets the rules.
- D. Have the client find more money for the budget.

**112. You are conducting a status meeting and monitoring your risk register when you discover a risk that remains even after you implement all of your response strategies. What kind of risk is this and what should you do about it?**

- A. It's a secondary risk; you don't need to worry about it.
- B. It's a residual risk; you need to plan a response strategy for it.
- C. It's a residual risk; you don't need to plan a response strategy for it because you've already implemented all of the risk responses you can plan for.
- D. It's a contingency reserve. You should only use it if the first risk occurs.

## Exam Questions

113. Rekha is a project manager on a large construction project. Late in the project, her client demands a big change. She assesses the impact of the change and tells the client how much time and money it will cost. But the client won't allow any change to the schedule and won't pay anything more for change. Rekha explains that the proposed change is well outside the documented scope of the original work. The client tells Rekha that he doesn't care what was in the original scope and that she needs to implement the change with no impact to schedule or budget. What conflict resolution technique is the client using?

- A. Collaborating
- B. Withdrawal
- C. Smoothing
- D. Forcing

114. Which of the following is not a tool of the Define Scope process?

- A. Expert judgment
- B. Decomposition
- C. Multicriteria decision analysis
- D. Facilitation

115. Which of the following best describes the records management system?

- A. A system to store contracts and project records for future project managers to reference
- B. A library that stores the lessons learned from past projects
- C. A filing system to store paid invoices
- D. A system to store human resource records, salary information, and work performance history

116. A project manager is negotiating with a contractor. Neither has a good idea of how long the project will take, or how much the materials will cost. Which contract type is most appropriate for this project?

- A. Cost plus fixed fee (CPFF)
- B. Time and materials (T&M)
- C. Cost plus award fee (CPAF)
- D. Firm fixed price (FFP)

117. Which is not an example of cost of quality?

- A. The cost of inspecting your product to be sure that it meets requirements
- B. The cost of reviewing documents used to produce your product to be sure that they do not have defects
- C. The cost of training your team on techniques that will help them avoid defects
- D. The cost of contracting another company to build part of the product

## Exam Questions

**118. Which of the following is not a stakeholder?**

- A. A project team member
- B. An attorney from your company's competitor
- C. A representative from your project team's union
- D. The project sponsors

**119. What is the main output of the Define Scope process?**

- A. Requirements documentation
- B. Scope definition
- C. Scope dictionary
- D. Project scope statement

**120. Paul is a project manager for an industrial design project. The project has a 60% chance of making the company \$230,000 over the next year. It has a 40% chance of costing the company \$150,000. What's the project's EMV?**

- A. \$138,000
- B. \$60,000
- C. \$78,000
- D. \$230,000

**121. While identifying risks for a new construction project, you discover that a chemical you are using on your building cannot be applied in rainy conditions. You also learn that your project will be ready for the chemical application around the time when most of the rainfall happens in this part of the country. Since the project can't be delayed until after the rainy season and you need to make sure the building gets the chemical coating, you decide that your team will just have to allow enough time in the schedule for nonworked rain days.**

**This is an example of which strategy?**

- A. Mitigate
- B. Exploit
- C. Accept
- D. Transfer

**122. You are acquiring a project team, and as part of that process you must interview new project managers for your company. One of the candidates claims to be a PMP-certified project manager, but you discover that she has never taken the PMP exam. What is the best way to handle this situation?**

- A. Consult the Resource Management plan to see if PMP certification is a resource requirement.
- B. Report the person to your manager.
- C. Report the person to PMI.
- D. Call the police.

## Exam Questions

123. Which of the following types of power is the most effective in leading teams?

- A. Expert
- B. Referent
- C. Reward
- D. Punishment

124. You are being hired to manage a highway construction project for a contractor working for Smith County. The sponsor is a project officer who works for the Smith County municipal government. You have three separate teams working all three shifts, with a separate foreman for each team. Each team has members from two different unions, and each union has its own representative. Who is the best person to approve the project charter?

- A. The project manager
- B. The Smith County project officer
- C. The team foreman
- D. The two union representatives

125. Which of the following is not an input of the Control Procurements process?

- A. Work performance data
- B. Procurement Management plan
- C. Agreements
- D. Procurement documents

126. While working on the WBS for a large project that spans multiple teams, you meet with a fellow project manager to discuss his portion of the work. He tells you in confidence that he lied about having a PMP certification, and never actually passed the exam. What is the best way to handle this situation?

- A. Report the person to PMI.
- B. Report the person to his manager.
- C. Ask him to tell the truth to his manager.
- D. Do nothing because you were told this in confidence.

127. Your team has recommended a change to the Validate Scope process. What's the first thing you should do?

- A. Implement the change.
- B. Analyze the change versus the Project Management plan to see what its impact will be.
- C. Write up a change request.
- D. Tell your team that the process has already been decided and they should follow it.

## Exam Questions

**128. Your project just completed, and one of your subcontractors has sent you floor seats to the next big hockey game to thank you for your business. What is the best way to respond?**

- A. Thank the subcontractor, but do not give him preference in the next RFP.
- B. Thank the subcontractor, but politely refuse the gift.
- C. Ask for tickets for the entire team, so that it is fair to everyone.
- D. Report the subcontractor to PMI.

**129. A project manager discovers that a project problem has occurred. The problem was never discussed during risk planning activities or added to the risk register, and it will now cost the project money. What is the best response?**

- A. Don't take any action, just accept that there's a problem that the team did not plan for.
- B. Stop all project activity and approach senior management for advice.
- C. Add the risk to the risk register and gather information about its probability and impact.
- D. Use the management reserve to cover the costs of the problem.

**130. You are managing a large construction project that's been broken down into subprojects (or phases). Each of these subprojects is scheduled to take between three and six months to complete. At the end of each subproject, you plan to go through the closing processes and document lessons learned. Which of the following best describes what you must do at the beginning of each subproject or phase?**

- A. Make sure you don't involve the team, to avoid introducing too much project management overhead.
- B. Identify the stakeholders.
- C. Use the earned value technique to decide whether or not to finish the project.
- D. Release all resources from the project and contact sellers to renegotiate all contracts.

**131. Which of the following is not an output of the Monitor Stakeholder Engagement process?**

- A. Change requests
- B. Deliverables
- C. Updates to the Project Management plan
- D. Project documents updates

**132. There are 17 people on a project. How many lines of communication are there?**

- A. 136
- B. 105
- C. 112
- D. 68

**133. Which of the following project selection methods is not a comparative approach (or benefit measurement model)?**

## Exam Questions

- A. Linear programming
- B. Murder boards
- C. Benefit-cost ratios
- D. Peer review

**134. You're managing a team of project managers, and as part of developing the team you hold a PMP study group so that you and your coworkers can work together to study for the exam. One person recently took and passed the exam, and has offered to give you all of the questions he can remember. How should you respond?**

- A. Accept the questions, but to be fair to everyone in the study group you should make sure everyone gets a copy.
- B. Refuse the offer, but encourage other study group members to make up their own minds.
- C. Refuse the offer, and report the person to your manager.
- D. Refuse the offer, and report the person to PMI.

**135. The project charter is typically approved by the project sponsor, although some charters can be approved by key stakeholders instead. Which of the following best describes the role of the project sponsor on the project?**

- A. The sponsor manages the project.
- B. The sponsor provides funding for the project.
- C. The sponsor verifies that all of the work was completed.
- D. The sponsor negotiates all contracts.

**136. Two of your project team members approach you with a conflict that they are having with each other over the technical approach to their work. One of the two people is very aggressive, and tries to get you to make a decision quickly. The other team member is quiet, and seems less willing to talk about the issue. The conflict is starting to cause delays, and you need to reach a decision quickly. You spend the weekend studying conflict resolution techniques, which is an example of:**

- A. Contributing to the Project Management Body of Knowledge
- B. Maslow's Hierarchy of Needs
- C. Enhancing personal professional competence
- D. Collaborating

**137. You are managing a software project. The stakeholders have found a few requirements that were missed in the initial project scope statement. You put the change requests through change control and they are approved, so you need to update the scope statement to include the new work. Where can you find the most updated version of the scope statement?**

- A. In the configuration management system
- B. In the document repository
- C. In the Project Management plan
- D. In the Communications Management plan

## Exam Questions

**138. After a status meeting, one of your team members, John, pulls you aside and tells you that he was insulted by a comment from another team member. He felt that the comment was racist. You meet with the team member who made the comment, Suzanne, but she says that the other team member's performance has been very poor. She has never made a comment like this before at the company. You review the records, and see that she is correct—he has consistently delivered lower-quality work than any other team member. What is the best way to handle this situation?**

- A. At the next team meeting, reprimand John for his poor performance and Suzanne for the racist comment.
- B. Get John additional help for his poor performance.
- C. Reprimand Suzanne in private for her racist comment, and follow any company policies for reporting racism among employees.
- D. Suzanne has never had this problem before, so she should be given another chance.

**139. You're managing a project that is currently executing. You're evaluating the work being performed by constantly measuring the project performance, and recommending changes, repairs, and corrections where necessary. What process are you performing?**

- A. Integrated Change Control
- B. Monitor and Control Project Work
- C. Control Scope
- D. Communications Management

**140. Which of the following helps you determine whether a process is stable or has predictable performance?**

- A. Scatter chart
- B. Control chart
- C. Cause-and-effect diagram
- D. Pareto chart

**141. As you complete each deliverable for your project, you check that it is correct along with your stakeholders and sponsors. Which process are you performing?**

- A. Define Scope
- B. Define Activities
- C. Validate Scope
- D. Control Scope

**142. You are a project manager on a large military contract that involves 7 subcontractor companies and a total of 1,253 team members, 752 stakeholders and sponsors, and 14 project managers (including you). You need to get a handle on the communications channels, because otherwise your project will devolve into chaos. How many potential channels of communication are there on this project?**

## Exam Questions

- A. 2,019
- B. 91
- C. 2,037,171
- D. No way to determine

**143. Which of the following is not true of obtaining project plan approval?**

- A. Until you obtain plan approval, you don't need to put changes to it through change control.
- B. Change control makes sure that only approved changes can make it into the approved plan.
- C. Only one person needs to approve the Project Management plan and that's the project manager.
- D. It's important for the entire team to buy into the Project Management plan for it to be successful.

**144. Customer satisfaction should be measured at the end of the project to maintain long-term relationships. Which of the following is not always an aspect of customer satisfaction?**

- A. The product meets its stated and unstated requirements.
- B. The project is profitable.
- C. The product is high quality.
- D. The customer's needs are met.

**145. A member of your seven-person project team comes up with a controversial idea. Two others agree that it should be pursued. Two members of the team are opposed to it, while the remaining two have a different approach. You end up going with the controversial idea. This is an example of:**

- A. Unanimity
- B. Majority
- C. Plurality
- D. Dictatorship

**146. You have been hired by a contractor who wants you to manage a construction project for one of his clients. The project team has been working for two months, and is 35% done with the job. Two of your team members come to you with a conflict about how to handle the ongoing maintenance for a piece of equipment. You know that they can safely ignore the problem for a while, and you're concerned that if your project falls behind schedule before next week's stakeholder meeting, it will cause problems in the future. You tell the two team members that the problem really isn't as bad as they think it is, and if they take a few days to cool off about it you'll help them with a solution. This approach to conflict resolution is known as:**

- A. Withdrawal
- B. Compromise
- C. Smoothing
- D. Forcing

## Exam Questions

**147. Which of the following tools is used to document the lessons that were learned when the contract was administered?**

- A. Quality audit
- B. Buyer-conducted performance review
- C. Contract review
- D. Procurement audit

**148. You are managing a project to build a new wing onto a local school building over a summer break. One night, the school and your construction site are destroyed by a tornado. Your client demands that you continue work despite the disaster, but you consult the contract, and find a clause that states that you are not responsible for any more work. This is referred to as:**

- A. A force majeure clause
- B. An “act of God” clause
- C. Mitigation
- D. An ex parte communication

**149. A project manager is running into problems with the team. People are repeatedly running into trouble over seemingly small problems, such as who takes notes at meetings, what dress is appropriate for the office, and who people need to notify when they take a day off. The problems started out small, but as more people run into more problems the situation is rapidly escalating. This situation is most likely caused by a lack of:**

- A. Sensitivity training
- B. Common courtesy
- C. A reward system
- D. Ground rules

**150. You are a project manager for a software project. As you are defining the scope of the work you need to do, you sit down with all of the project’s stakeholders and record all of the requirements you can get from them. Which of the following is not a valid requirement from stakeholder analysis?**

- A. The work the team does must be better than they did on their last project.
- B. There can be no more than 5% schedule variance on the project.
- C. The quality of the product must fit within organizational metrics for software quality.
- D. The budget must be within 10% of our projected cost.

**151. There have been several rounds of layoffs at your company. Now your project team is worried about their job security, and you’ve noticed that their performance has decreased significantly because of it. This is predicted by which motivational theory?**

- A. McGregor’s Theory of X and Y
- B. Maslow’s Hierarchy of Needs

## Exam Questions

- C. McClelland's Achievement Theory
- D. Herzberg's Motivation-Hygiene Theory

**152. Which of the following is not included in a cost of quality calculation?**

- A. Team members' time spent finding and repairing defects
- B. Quality managers' time spent writing quality standards
- C. Project managers' time spent creating the Project Management plan
- D. Team members' time spent reviewing specifications, plans, and other documents

**153. Which of the following contracts has the most risk for the seller?**

- A. Cost plus fixed fee (CPFF)
- B. Time and materials (T&M)
- C. Cost plus percentage of costs (CPPC)
- D. Firm fixed price (FFP)

**154. You are managing an industrial design project for an important client. Two of your team members have a disagreement on project priorities. One person wants to do certain activities first, while the other feels they should be left until the end of the project. You work with both people to forge a compromise where those activities are neither first nor last, but instead done in the middle of the project. Nobody is particularly unhappy with this solution. Another name for a compromise is a:**

- A. Win-win solution
- B. Win-lose solution
- C. Lose-lose solution
- D. Standoff solution

**155. A project manager on a construction project includes a line item in the budget for insurance for the equipment and job site. This is an example of:**

- A. Transference
- B. Mitigation
- C. Avoidance
- D. Acceptance

**156. You are talking to experts and gathering independent estimates for your contract. Which of the following best describes what you are doing?**

- A. Plan Procurement Management
- B. Conduct Procurements
- C. Control Procurements
- D. Close Procurements

## Exam Questions

**157. A project manager is creating a report of the final status of a closed project to the stakeholders. Which of the following is not used in a final project report to communicate the status of a project?**

- A. Variance information
- B. Lessons learned
- C. Scope baseline
- D. Status of deliverables

**158. You are the project manager for a railroad construction project. Your sponsor has asked you for a forecast for the cost of project completion. Which of the following is the best metric to use for forecasting?**

- A. EV and AC
- B. SV and CV
- C. ETC and VAC
- D. SPI and CPI

**159. Information about the project must be distributed to all stakeholders. Which of the following process outputs is used to report the status and cost of project activities?**

- A. Work performance data
- B. Issue logs
- C. Status reports
- D. Project records

**160. A company uses a management technique that employs quality assurance techniques to continuously improve all processes. This is called:**

- A. Just-in-time management
- B. Kaizen
- C. Ishikawa diagrams
- D. Inspection

**161. You are initiating a project that has a virtual team. Half of your team members will be located in another country, where they are working for a subcontractor. The subcontractor's team members speak a different dialect of English than your team does. After a conference call to review the project charter, two of your team members make jokes about the way your subcontractor's team members speak. What is the best way to handle this situation?**

- A. Correct the team members individually, and hold a training session for your team to help remove communication barriers.
- B. Immediately correct the two people in front of the rest of the team.
- C. Report the team members to senior management and recommend that they be punished.
- D. Remove noise from the communication by contacting the subcontractor and requesting that the team adjust the way they speak.

## Exam Questions

**162. Mike is a project manager for an IT technology implementation project. He is using an Ishikawa diagram to figure out what could cause potential risks on his project. Which process is he doing?**

- A. Identify Risks
- B. Perform Qualitative Risk Analysis
- C. Control Quality
- D. Plan Risk Responses

**163. Amit is the manager of a software project. His client has agreed on a project scope statement at the beginning of the project, but whenever the client verifies deliverables, she comes up with features that she would like to add into the product. Amit is working with the client to find what requirements were missed in the planning stages of the project and how to plan better in the future. What is the best description of his project's current situation?**

- A. Gold plating
- B. Scope creep
- C. Alternatives analysis
- D. Schedule variance

**164. You are executing a project, and as part of developing the project team you create materials for a PMP training seminar. Afterward, you decide to offer it to all other project managers in your company to help them obtain enough hours to qualify to take the PMP exam. This is an example of:**

- A. Organizational process assets
- B. Contributing to the Project Management Body of Knowledge
- C. Cheating, which should be reported to PMI
- D. Lessons learned

**165. You are managing a construction project to install wiring in an office building. While verifying that the scope of the work has been completed, you discover that one of your team members has taken a box of cable from the job site so he can wire his attic. What is the best way to respond?**

- A. Do nothing.
- B. Report the team member to your manager.
- C. Report the team member to PMI.
- D. Call the police.

**166. You are working with potential sponsors to determine which project your company will pursue. Based on the benefit-cost (BCR) ratios, which of the following four projects should you recommend?**

- A. Project A has a BCR of 5:2
- B. Project B has a BCR of 5:4
- C. Project C has a BCR of 3:1
- D. Project D has a BCR of 2:1

## Exam Questions

**167. Which of the following are examples of the kinds of power?**

- A. Legitimate, expert, reward, political, and bargaining
- B. Legitimate, expert, reward, political, and punishment
- C. Legitimate, expert, reward, economic, and bargaining
- D. Legitimate, expert, reward, referent, and punishment

**168. You're managing a software project. Your team has discovered a problem, and as a result you've requested a change. The change will cost the project an extra three weeks, but without it several stakeholders might have problems with the final product. What's the next thing that you should do?**

- A. Instruct the team to make the change.
- B. Call a meeting with each stakeholder to figure out whether or not to make the change.
- C. Document the change and its impact, and put it through the change control system.
- D. Don't make the change because it will delay the project.

**169. Which of the following is not part of the Close Project or Phase process?**

- A. Making sure that all exit criteria have been met.
- B. Obtaining formal acceptance of all deliverables from all stakeholders.
- C. Moving the project's deliverables to the next phase or into production.
- D. Writing down lessons learned.

**170. Which of the following is a valid way to break down the work in a WBS?**

- A. By risk or quality metric
- B. By product feature or unit of work
- C. By project phase or project deliverable
- D. By charge code or initial estimate

**171. Which of the following is an output of Direct and Manage Project Work?**

- A. Work performance data
- B. Statement of work
- C. Issue log
- D. Agreements

## Exam Questions

**172. You are working on a construction project. You, your team, and your senior manager all feel that the work is complete. Your stakeholders have communicated their final acceptance of the project. You are now meeting with your team to update the organizational process assets with a record of knowledge gained about the project to help future project managers with their projects. This is best described as:**

- A. Lessons learned
- B. Project records
- C. Project management information system (PMIS)
- D. Work performance information

**173. Which of the following is not true about the project charter?**

- A. It formally assigns the project manager.
- B. It is always created by the project manager.
- C. It contains external constraints and assumptions.
- D. It includes a high-level milestone schedule.

**174. You're managing a construction project to install several hundred air conditioner panels in a new office building. Every floor has identical panels. The customer, a construction contracting company, has provided specifications for the installation. The team is using a process to install and verify each panel. As the team completes each panel, your team's quality control inspector measures it and identifies defects. The root cause of each defect is identified. He keeps track of each step in this process and marks each one complete as it is finished. Which is the best tool to use for this?**

- A. Control chart
- B. Fishbone diagram
- C. Checksheets
- D. Pareto chart

**175. Which risk analysis tool is used to model your risks on a computer to show random probabilities?**

- A. Computerized risk audit
- B. Monte Carlo analysis
- C. EMV analysis
- D. Delphi technique

**176. Which of the following best describes when you perform the Monitor and Control Project Work process?**

- A. Continuously throughout the project
- B. As soon as every deliverable is completed
- C. At scheduled milestones or intervals during the project
- D. At the end of every project phase

## Exam Questions

**177. Which of the following is not an output of Monitor and Control Project Work?**

- A. Project Management plan updates
- B. Change request status updates
- C. Change requests
- D. Project document updates

**178. You are the project manager of a software project. Two developers, Bill and Alfredo, are having an argument about how to implement a feature. Bill thinks that it's more important that the project get done quickly, so he's suggesting that you reuse some work that's been done on a previous project to get started. Alfredo thinks that that work doesn't apply to this project and will just waste time. Bill is almost always right about these things and he's very influential on the team, so it's important that you keep him happy. What should you do?**

- A. Since you do want to get the project done quickly, you side with Bill.
- B. Side with Alfredo; it could end up taking longer in the end.
- C. Call a meeting to hear both sides of the situation and decide in favor of the solution that is best supported by objective evidence.
- D. Call a meeting in private with Bill to hear more about his position.

**179. Which of the following is not an example of a deliverable?**

- A. Project Management plan
- B. Project schedule
- C. Work breakdown structure
- D. Parametric estimation

**180. Which is not an input to the Create WBS process?**

- A. Project scope statement
- B. Organizational process assets
- C. Requirements documentation
- D. WBS dictionary

**181. Which of the following is not an artifact that can be generated in the process of finalizing all activities for a project?**

- A. Updates to the lessons learned register
- B. A final product, result, or service
- C. Updates to the business documents
- D. A final report

## Exam Questions

**182. At the beginning of the project, you hold a meeting with all of the stakeholders in your project in order to figure out how everyone will communicate as the work goes on. Which of the following terms best describes that meeting?**

- A. Qualitative analysis
- B. Status meeting
- C. Communication plan meeting
- D. Kickoff meeting

**183. You are managing a project with 23 team members and 6 key stakeholders. Two team members identify a problem with the current approach. Addressing that problem will require changes to the project plan and its subsidiary plans. One of the stakeholders previously indicated that any delays are unacceptable, and your team members tell you that it's possible the change could cause the team to miss at least one critical deadline. What is the best way to deal with this situation?**

- A. Analyze the impact that the change will have on the work to be done, the schedule, and the budget.
- B. Deny the change because any delays are unacceptable.
- C. Gather consensus among the team that you should make the change before approaching the stakeholders, so that they can see the team supports making the change.
- D. Make the change to the project plan and subsidiary plans, and ask the team to implement the change.

**184. You have been asked to select from three projects. Project A has a net present value of \$54,750 and will take six months to complete. Project B has a net present value of \$85,100 and will take two years to complete. Project C has a net present value of \$15,000 and a benefit-cost ratio of 5:2. Which project should you choose?**

- A. Project A
- B. Project B
- C. Project C
- D. There is not enough information to decide.

**185. Which of the following is a defect?**

- A. A mistake made by a team member on the job
- B. A change that the team needs to make in how they do the work
- C. A Project Management plan that does not meet its requirements
- D. A change request that's been rejected by the change control board

## Exam Questions

**186.** A project manager is faced with two team members who have conflicting opinions. One team member explains her side of the conflict, and presents a possible solution. But before the other team member starts to explain his side of things, the project manager says, "I've heard enough, and I've decided to go with the solution I've heard." This is an example of:

- A. Withdrawal
- B. Compromise
- C. Smoothing
- D. Forcing

**187.** As you determine the acceptance criteria, constraints, and assumptions for the project you record them in which document?

- A. Project Management plan
- B. Project scope statement
- C. Project charter
- D. Communications Management plan

**188.** You've been hired by a large consulting firm to evaluate a software project for them. You have access to the CPI and EV for the project, but not the AC. The CPI is .92, and the EV is \$172,500. How much money has actually been spent on the project?

- A. \$158,700
- B. \$172,500
- C. \$187,500
- D. There is not enough information to calculate the actual cost.

**189.** Approved changes are implemented in which process?

- A. Direct and Manage Project Work
- B. Monitor and Control Project Work
- C. Perform Integrated Change Control
- D. Develop Project Management Plan

**190.** You've been hired by a large consulting firm to lead an accounting project. You determine the needs of the project and divide the work up into work packages so that you can show how all of it fits into categories. What are you creating?

- A. A WBS
- B. A schedule
- C. A project scope statement
- D. A contract

## Exam Questions

**191. Over half of conflicts on projects are caused by:**

- A. Bad habits, defects, technology
- B. Resources, priorities, schedules
- C. Budget, carelessness, personalities
- D. Technology, money, personalities

**192. Which of the following is not a tool or technique of Monitor Risks?**

- A. Bringing in an outside party to review your risk response strategies
- B. Revisiting your risk register to review and reassess risks
- C. Using earned value analysis to find variances that point to potential project problems
- D. Gathering information about how the work is being performed

**193. You work for a consulting company and your team has implemented an approved scope change on your project. You need to inform your client that the change has been made. What's the best form of communication to use for this?**

- A. Formal verbal
- B. Formal written
- C. Informal written
- D. Informal verbal

**194. Which of the following is not typically found in a project charter?**

- A. Project requirements
- B. Authorization for a project manager to work on a project
- C. Work packages decomposed into activities
- D. An initial set of schedule milestones

**195. What are the strategies for dealing with positive risks?**

- A. Avoid, mitigate, transfer, accept, exploit
- B. Transfer, mitigate, avoid, exploit, avoid
- C. Exploit, share, enhance, accept, escalate
- D. Mitigate, enhance, exploit, accept, escalate

**196. In which process do you create the risk breakdown structure?**

- A. Identify Risks
- B. Plan Risk Responses
- C. Perform Qualitative Risk Analysis
- D. Plan Risk Management

## Exam Questions

**197. As you are executing your project, you are constantly checking your risk register to be sure that you have planned responses for all of your risks. At one team status meeting, you find that a lower-priority risk has suddenly become more likely. Where do you keep information about low-priority risks?**

- A. Triggers
- B. The watchlist
- C. Risk Management plan
- D. Qualitative analysis documents

**198. Which of the following are not all examples of project documents?**

- A. Scope baseline, project funding requirements, stakeholder requirements
- B. Activity list, stakeholder register, risk register
- C. Forecasts, risk register, quality metrics
- D. Basis of estimates, resource requirements, statement of work

**199. You're managing a project with a schedule performance index (SPI) of 1.07 and a cost performance index (CPI) of 0.94. How would you best describe this project?**

- A. The project is ahead of schedule and within its budget.
- B. The project is behind schedule and within its budget.
- C. The project is ahead of schedule and over its budget.
- D. The project is behind schedule and over its budget.

**200. Which of the following is the best example of a reward system?**

- A. The team member who works the hardest will receive \$1,000.
- B. Everyone will get a bonus of \$500 if the project meets its quality goals, \$500 if it meets its budget goals, and \$600 if it comes in on time.
- C. The five team members who put in the most hours will get a trip to Disneyland.
- D. The team will only get a bonus if the project comes in 50% under budget, schedule, and quality metric goals; even though the team leads know this goal is unrealistic, they agree that it will motivate the team to work harder.

## Before you look at the answers...

Before you find out how you did on the exam, here are a few ideas to help make the material stick to your brain. Remember, once you look through the answers, you can use these tips to help you review anything you missed.

This is especially useful for conflict resolution questions—the ones where you're presented with a disagreement between two people and asked how you'd handle it.

### 1 Don't get caught up in the question.

If you find yourself a little confused about a question, the first thing you should do is try to figure out exactly what the question is asking. It's easy to get bogged down in the details, especially if the question is really wordy. Sometimes you need to read a question more than once. The first time you read it, ask yourself, "What's this question *really* about?"

### 2 Try this stuff out on your job.

Everything you're learning about for the PMP exam is really practical. If you're actively working on projects, then there's a really good chance that some of the ideas you're learning about can be applied to your job. Take a few minutes and think about how you'd use these things to make your projects go more smoothly.

### 3 Write your own questions.

Is there a concept that you're just not getting? One of the best ways that you can make it stick to your brain is to write your own question about it! We included Question Clinic exercises in *Head First PMP* to help you learn how to write questions like the ones you'll find on the exam.

When you write your own question, you do a few things:

- You reinforce the idea and make it stick to your brain.

- You think about how questions are structured.

- By thinking of a real-world scenario where the concept is used, you put the idea in context and learn how to apply it.

And all that helps you recall it better!

### 4 Get some help!

Have you joined your **local PMI chapter**? It's one of your most valuable resources to help you prepare for the exam—maybe even more valuable than this book! Most PMI chapters have a PMP study group that you can join. That's a great way to find other people who are also studying for the exam.

**Also the authors of this book have been known to post occasional exam tips, tricks, and career advice. Follow them on Twitter:**  
**@AndrewStellman @JennyGreene**

## Exam Questions

### 1. Answer: B

When you work with a union, then the union contract can have an impact on your project. That means you need to consider the union itself a stakeholder, and when you do your planning you need to make sure any union rules and agreements are considered as constraints.

### 2. Answer: C

All project reports must be communicated as formal written documents. Not only that, but anything that has to do with a contract definitely needs to be formal written.

### 3. Answer: B

Quality audits are when your company reviews your project to make sure that you are following all of the processes in your company correctly. They are a tool of the Manage Quality process.

### 4. Answer: D

You can't do anything about the problem until you understand it. You should meet with the client to get a better understanding of what went wrong and why the product is not meeting their needs.

### 5. Answer: C

Cost aggregation is used to build your budget, but it is not a tool for cost estimation. Bottom-up, parametric, and analogous estimation techniques are used for both cost and time estimates.

### 6. Answer: A

The project Scope Management plan is a really important tool in your project. It tells you exactly how you'll create the project scope, define the WBS, verify that the work has been done, and make changes to the scope. But it doesn't tell you about specific assumptions that you and the team have made, or constraints on your project. To find those, you should look in the requirements documentation and the project scope statement.

*The scope baseline contains the WBS and project scope statement, so you'll find constraints and assumptions there, too!*

Answers

~~Exam Questions~~**7. Answer: B**

The Delphi technique is a way to get opinions and ideas from experts. This a technique involves a facilitator who uses questionnaires to ask experts about important project risks. The facilitator takes those answers and circulates them—keeping each expert anonymous so he or she can give honest feedback.

**8. Answer: B**

The halo effect is when you put someone in a position he can't handle, just because he's good at another job. Just because Joe is a great programmer, that doesn't mean he'll be a good project manager.

**9. Answer: B**

The most expensive defects are the ones introduced when the product is being designed. This is a little counterintuitive at first, but it really makes sense once you think about how projects are run. If your team introduces a defect into a product while it's being assembled, then they have to go back and fix it. But if there's a flaw in the design, then you have to halt production and go back and figure out all the things that flaw affected. You may have to order new parts, reassemble components, and maybe even go back and redesign the product from the ground up.

That's why your Quality Management processes are so focused on reviewing EVERY deliverable—not just the final product, but all of the components, designs, and specifications, too.

**10. Answer: A**

This question is asking you to create a forecast using estimate to complete (ETC), which uses CPI to project how much money is likely to be spent for the rest of the project. The first step is to plug the numbers into the formula  $EAC = BAC / CPI$ , which yields  $EAC = \$80,000 / .95 = \$84,210$ . That's how much money you're likely to spend on the project. Now you can figure out  $ETC = EAC - AC = \$84,210 - \$25,000 = \$59,210$ .

## Exam Questions

**11. Answer: B**

Decomposition is the main tool for creating the WBS. It just means breaking the work down into smaller and smaller pieces based on how your company does the work until it is small enough to categorize and organize hierarchically.

**12. Answer: C**

Quality Management is all about making sure that the product you are building conforms to your customer's requirements. If you have done a good job of gathering and understanding those requirements, all of the measurements you take on your project should help you see if what you are building will satisfy your clients in the end.

**13. Answer: C**

The most important project constraints that you'll see on the exam are scope, quality, schedule, budget, resources, and risk. Any change to one of those constraints affects the others. It's important to balance all of these constraints throughout your project.

**14. Answer: D**

Every risk should have a risk owner listed in the register. That person is responsible for keeping the response plan up to date and making sure the right actions are taken if the risk does occur.

**15. Answer: A**

There are a few really important ethical issues in this question. Your senior management was clear about the rules: go with the lowest bidder. And that's what you should do. But on top of that, you shouldn't choose your sellers based on perks that you'll get—that's called a bribe. And you should always refuse bribes.

**16. Answer: C**

The RACI matrix shows roles and responsibilities on your project. RACI stands for Responsible, Accountable, Consulted, Informed. Some people on your project will be responsible for activities; others might be accountable for them. The RACI matrix is a table that shows people and how they relate to the work that is being done.

## Answers

~~Exam Questions~~**17. Answer: B**

Some questions on the exam might ask you about how to operate in another country. In this case, the question is about whether or not something is a bribe. Clearly, if it's a bribe, you can't pay it. But is it? If a payment to a government official (or anyone else) is customary, then it's not a bribe. You should go ahead and pay the police—as long as it's acceptable and legal in that country.

*(Sometimes a bribe isn't money. Sometimes it's not 100% clear if something even is a bribe. But if you see an exam question where you're getting any reward for doing your normal job, make sure you treat that reward as a bribe—and refuse it!)*

**18. Answer: C**

Herzberg's Motivation-Hygiene Theory states that people need things like good working conditions, a satisfying personal life, and good relations with the boss and coworkers—these are called “hygiene factors.” Until people have them, they generally don't care about “motivation factors” like achievement, recognition, personal growth, or career advancement.

**19. Answer: C**

The resource histogram is a bar chart that shows your staffing needs over time. If you need more testers in the end of the project than you do while you're building a product, for example, you can forecast how many you will need and what their skill level needs to be from the beginning. That way, you'll be sure that they're available when you need them.

**20. Answer: A**

When a change has been approved, you always need to update the baseline and then implement the change. That way, you will be sure to track your performance versus the new scope and schedule expectations, not the old ones.

**21. Answer: C**

Your risk register is one of the most important project management tools that you have—that's why you review it and go over your risks at every meeting. Any time you come across a new risk, the first thing you should do is document it in the risk register. It's really easy to lose track of risks, especially when you're running a big project. By adding every risk to the register, you make sure that you don't forget about any of them. So once you've identified the risk, what's the next step? You analyze the impact and probability of the risk! That's what the Perform Qualitative Risk Analysis process is for. You shouldn't take any other action until you've analyzed the risk. The reason is that it might turn out that the risk is very unlikely, and there might be another risk with a higher probability and larger impact that deserves your attention.

Answers

~~Exam Questions~~

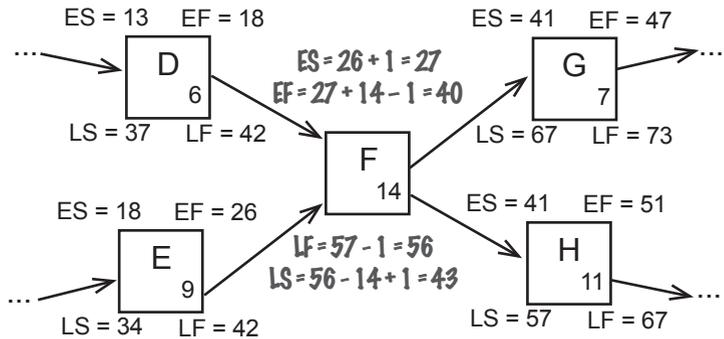
22. Answer: D

Tom is using a template. As your company completes projects, the documents created along the way are stored in an organizational process asset library. The WBSes from those past projects can be a great way to be sure that you are thinking of all of the work that you will need to do from the very beginning. Your project will never match the old WBS exactly, but there could be work packages listed there that you might not have thought of on your own but really are necessary in your project.

While a template is definitely one of your organization's process assets, it's NOT a tool or technique of the Create WBS process. It's an input!

23. Answer: C

To calculate the LS for activity F, we first need to find its LF by taking the lower LS of G or H, 57, and subtracting 1: the LF for F is  $57 - 1 = 56$ . Now we can calculate LS by subtracting duration and adding 1:  $LS = 56 - 14 + 1 = 43$ .



24. Answer: B

You need to figure out the root cause of the problem if you are going to find a lasting solution to it. The best choice is to meet with the manager and understand why he offered the team members to you and what you can do to work together to find the right people for your team. It's possible that he has some information about those staff members that make them a good fit after all.

25. Answer: C

The point of total assumption is the point at which the seller assumes the costs. In a firm fixed-price contract, this is the point where the costs have gotten so large that the seller basically runs out of money from the contract and has to start paying the costs.

26. Answer: B

The project management methodology describes the process (or lifecycle) that you use to manage your project. It really doesn't have anything to do with closing a project or phase. The other three answers, however, do! You need the Project Management plan to give you the procedure for closing the project phase. You need the accepted deliverables to verify that they're complete. And you need your organizational process assets for lessons learned and closure guidelines.

# Answers

## Exam Questions

### 27. Answer: A

As a certified project management professional, it's your duty to respect copyrights. Purchased software is copyrighted, and you cannot use it without a license. Ever. If you don't have the budget to buy it, you can't use it.

When a question says that you don't have enough money in the budget to do something that will keep your project from being late, then your project will be late. That's why time and cost are two of the constraints you have to deal with.

### 28. Answer: B

If you want to evaluate how the project is doing with respect to the schedule and budget, you need to calculate CPI and SPI. The first step is to write down the information you have so far: BAC = \$450,000, planned % complete = 45%, actual % complete = 40%, and AC = \$165,000. Now you can calculate PV = BAC × planned % complete = \$450,000 × 45% = \$202,500. And you can calculate EV = BAC × actual % complete = \$450,000 × 40% = \$180,000. Now you have the information you need to calculate CPI and SPI. CPI = EV / AC = \$180,000 / \$165,000 = 1.09, which is above 1.0—so your project is within its budget. And you can calculate SPI = EV / PV = \$180,000 / \$202,500 = .89, which is below 1.0—so your project is behind schedule.

### 29. Answer: D

Sometimes Validate Scope happens before Control Scope, and sometimes it happens afterward—and sometimes it happens both before AND afterward. That actually makes a lot of sense when you look at what those two processes do, and how they interact with each other. You always perform some Validate Scope activities at the end of your project, because you need to verify that the last deliverable produced includes all of the work laid out for it in the scope statement. Most projects will almost certainly have gone through Control Scope before then. So it might seem like Control Scope always happens before Validate Scope. But you don't just perform Validate Scope at the end—you actually do it after every deliverable is created, to make sure that all the work for that deliverable was done. Not only that, but sometimes Validate Scope fails because your team didn't do all of the work that was needed—that's why change requests are an output of Validate Scope. And if those changes include scope changes, then your project will end up going through Control Scope again—possibly for the first time in the project, if this is the first scope change you've had to make. So Control Scope can happen before Validate Scope, but it can happen afterward as well. That's why there's no prescribed order for those two processes: they can happen in any order.

### 30. Answer: D

Stakeholder analysis is important, but it's not part of change control.

Change control is how you deal with changes to your Project Management plan. And a change control system is the set of procedures that lets you make those changes in an organized way. A typical change control system includes a change control board, utilizes a project management information system, and ends with either approval or rejection.

## Exam Questions

### 31. Answer: C

When you're performing the **Control Procurements** process, you're closing out work done by a seller for a contract. Doing that involves a few steps: you verify that all of the work and deliverables are acceptable, you finalize any open claims, and in case of early termination, you follow the termination clause in the contract. On the other hand, when you're performing the Close Project or Phase process, you're finalizing all of the various activities that you do across all of the process groups, and you're also verifying that the work and deliverables are complete.

### 32. Answer: B

Of all of the contract types listed in the question, the time and materials (T&M) contract is the riskiest kind of contract for the buyer, because if the cost of the materials gets really high then it's passed along to the buyer—and the seller doesn't have any incentive to keep it down! (It's true that cost plus award fee (CPAF) could involve paying an additional fee to the seller, but that fee is based entirely on the buyer's subjective evaluation of the seller's performance, which lowers the risk.)

### 33. Answer: A

Gold plating is when you or your team add more work to the project that was not requested by the sponsor or client. It is always a bad idea to gold-plate a project because the impact is sometimes not immediately known. Sometimes, a feature that might seem really useful to your team is actually a detriment to the client. Gold-plated features can also introduce bugs that slow down later development.

Unplanned work done by the team is always gold plating, even if it makes the client happy. But if the client never asked for it, it's not scope creep because the project's planned scope never changed.

### 34. Answer: B

The project manager is asking the other companies to help her make this opportunity happen and they can all share in its benefits.

### 35. Answer: B

A watchlist is where you keep risks that don't have a high enough probability or impact to make it into the risk register but still need to be monitored. By recording the risk in a watchlist, you will have a reminder to check to be sure that circumstances haven't changed as your project goes on. That should give you enough time to come up with a risk response strategy if circumstances do change over time.

## Exam Questions

**36. Answer: C**

The Project Management plan is not a bar chart (or a Gantt chart). It's the collection of all of the planning documents you create through all of the knowledge areas within the five process groups. It describes how your project will handle all of the activities associated with your project work.

**37. Answer: C**

Just because the change will help the project's timeline doesn't mean that it will be an overall benefit to the project. It's important to check how the project will impact the other two constraints as part of your change request. Once you know all the facts about the change, the change control board can make an informed decision about how to proceed.

**38. Answer: A**

Withdrawal happens when someone gives up and walks away from the problem, usually because he's frustrated or disgusted. If you see a team member doing this, it's a warning sign that something's wrong.

**39. Answer: A**

A control chart is a really valuable tool for visualizing how a process is doing over time. By taking one measurement after another and plotting them on a line chart, you can get a lot of great information about the process. Every control chart has three important lines on it: the mean (or the average of all data points), an upper control limit, and a lower control limit. There's an important rule called the rule of seven that helps you interpret control charts. That rule tells you that if you find seven consecutive measurements that are on the same side of the mean, there's something wrong. That's because it's extremely unlikely for seven measurements like that to occur—it's much more likely that there's a problem with your process. If you can figure out an improvement to fix that, you'll have a lot fewer defects to repair later!

**40. Answer: B**

The PMP Code of Professional Conduct states that you must follow every law, no matter how trivial. Any time you see a question that asks about breaking a law, your answer should always be the choice that doesn't break it—no matter how minor the infraction, and how serious the consequences.

## Answers

~~Exam Questions~~**41. Answer: C**

The Staffing Management plan tells you everything that you need to know about when resources will be released from a project. Since the team you need for your project is currently on another project, that project's Staffing Management plan will tell you when they will be released from that project and available for yours.

**42. Answer: C**

If your project is broken up into phases, you should have a kickoff meeting at the start of each phase. You use that meeting to talk about lessons learned from past projects and establish the way people will communicate as the project work goes on.

*Brainstorming and the Delphi technique are both part of information-gathering techniques, which is one of the tools and techniques of Identify Risks.*

**43. Answer: B**

A risk urgency assessment is a tool of Perform Qualitative Risk Analysis. Identify Risks is all about finding risks. Perform Qualitative Risk Analysis is about ranking them based on what your team thinks their impact and probability will be for your project.

**44. Answer: B**

Once you've figured out the impact of the change to your schedule, budget, and scope, the next step is to take the change request to the change control board. If they approve your recommendation, then the request to repair the defects will be approved and you can update your baseline and implement the change.

*(If you're wondering why the defect repairs are recommended rather than approved, it's because they still need to go through change control! After all, there are some defects that are just not worth repairing, but only the stakeholders on the change control board can determine which ones are worth it and which ones aren't.)*

**45. Answer: A**

Validate Scope is the Monitoring and Controlling process for the Scope Management knowledge area. It doesn't have anything to do with planning out the scope of the project—you do it as you complete each project phase to make sure that your team has completed all of the project work.

**46. Answer: C**

A change control board (or CCB) is a group of people that approves or rejects changes. It usually includes the sponsor, which makes sense because the sponsor is the one funding the project. It's

## Answers

~~Exam Questions~~

not the project manager's job to tell the CCB whether or not to approve a change—they use their expert judgment to figure out whether or not the change is valuable. It is the project manager's job to make sure the impact of the change on the triple constraint (time, scope, and cost) is evaluated, but that impact analysis should happen *before* the change request is sent to the CCB.

**47. Answer: A**

Colocation means that you have all of your team located in the same room. When you do this, you can increase communication and help them build a sense of community. Sometimes the room the colocated team meets in is called a war room.

**48. Answer: B**

Any time there's a conflict of interest, it's your duty to disclose it to your company. After that, you should always proceed based on your company's policies. If there are no specific policies about that, then make sure that the conflict does not affect your decisions.

When bidders are competing for a contract, you must make sure they all have the same information so that no one bidder is given an unfair advantage. That's why a bidder conference is a great tool—it gives all bidders access to the same information.

**49. Answer: B**

Stakeholder analysis means talking to the stakeholders and figuring out their needs, and it's something that you do when you're defining the project scope. If there's an important client who has needs that your project is supposed to fulfill, that client is always a stakeholder. And if your project is not meeting that client's needs, then you didn't do a good enough job when you were performing stakeholder analysis!

**50. Answer: A**

Punishment power is exactly what it sounds like—you correct a team member for poor behavior. Always remember to do this one-on-one, in person, and in private! Punishing someone in front of peers or superiors is extremely embarrassing, and will be really counterproductive.

Punishment isn't usually the best way to handle a situation, but if it's the only option, make sure you do it right.

**51. Answer: D**

The scope baseline is made up of the project scope statement, the WBS, and the WBS dictionary. The WBS dictionary is considered a supporting document to the WBS, so if the WBS were to change, then the dictionary would, too.

## Exam Questions

**52. Answer: B**

A rough order of magnitude (ROM) estimate is an estimate that is very rough. According to the *PMBOK Guide*, you should expect a ROM estimate to be anywhere from –25% to +75% of the actual result. That means that if your ROM estimate for a project is six months, then you should expect the actual project to be anywhere from three months to nine months.

**53. Answer: A**

It's pretty easy to remember which processes are in the Initiating group, because there are only two of them! But more importantly, it's useful to know what you need to do when you initiate a project. First you need to create the project charter (by performing the Develop Project Charter process), which authorizes the project manager to do the work. And then you need to identify your stakeholders (by performing the Identify Stakeholders process), which helps you understand who needs your project done and what interest they have in it.

**54. Answer: B**

Mary is working for a projectized organization. In those companies, the project manager has authority over the team as well as the project.

**55. Answer: C**

It's very hard to figure out whether or not your project is successful unless you can measure that success. That's why you need to come up with goals that have numbers attached to them—which is what *quantifiable* means. Of all four answers, only answer C has a goal that you can actually measure.

**56. Answer: A**

Customer satisfaction is an important part of modern quality management. Remember, customer satisfaction is about making sure that the people who are paying for the end product are happy with what they get. But the way that you make sure that your customers are happy is by meeting their needs—and you do that by ensuring the product the team builds meets the customer's requirements. That's what Quality Management is all about, and it's an important reason why you do it.

## Exam Questions

**57. Answer: D**

The Staffing Management plan always includes a resource histogram, so that should be your first clue about which one of these answers is right. The resource histogram shows what kind of resource is needed through each week of your project and how many staff members you need. When planning out your staffing needs, you need to take into account the training it will take to get them up to speed as well as the kinds of incentives you are going to offer for a job well done. Resource calendars are important too; they'll tell you when your staff members will be available. You need to think about what staff members need to get done before they are released to work on other projects.

**58. Answer: C**

Since the project absolutely must be completed in seven months for it to be worth doing, the deadline is a constraint. It must be met for the project to be considered successful.

**59. Answer: D**

Collaborating means working with the team to figure out the cause of the problem and fix it. That's the best way to be sure that the right decision is made.

**60. Answer: D**

The most important part of the Control Quality process is that your team has to inspect each deliverable in order to verify that it meets its requirements. So what do you need to do that? Well, obviously you need the deliverables! And quality checklists are really useful, too, because they help you inspect each deliverable. You need work performance data, because that tells you how well the team is doing the job. But test and evaluation documents aren't an input—they're the output!

**61. Answer: B**

There are four things you can do with any opportunity. You can exploit it by making sure you do everything you can to take advantage of it. You can share it by working with another company in a way that gives you a win-win situation. You can enhance it by figuring out a way to increase its value. Or, if there's no way to take advantage of it, you can just accept it and move on. In this case, taking additional actions that will increase the potential reward is enhancing the opportunity.

## Exam Questions

**62. Answer: B**

The Plan-Do-Check-Act cycle is a way of making small improvements and testing their impact before you make a change to the process as a whole. It comes from W. Edwards Deming's work in process improvement, which popularized the cycle that was originally invented by Walter Shewhart in the 1930s.

**63. Answer: A**

Lessons learned are part of the organizational process assets, not enterprise environmental factors. Your company's enterprise environmental factors tell you about how your company typically does business—like how your company's departments are structured, and the regulatory and industry environment your company operates in. An important enterprise environmental factor that you'll run across when you're planning a project is the work authorization system. That's your company's system to determine who is supposed to be working on what, and when the work should get done.

*Just remember, lessons learned are your most important organizational process assets.*

**64. Answer: C**

The cost variance (CV) is the difference between the amount of money you planned on spending and the total that you've spent so far. This should make sense—if your CV is negative, it means that you've blown your budget.

**65. Answer: B**

Tom is using expert power. Since he's been through this problem before, his team is more likely to accept his authority. Expert power is the best form of power to use when making project decisions. The team will respect decisions that are based on experience and expertise.

**66. Answer: D**

It's important to know that resources, schedules, and priorities cause 50% of project problems and conflicts. Sure, it's important for the PMP exam. But even more importantly, if you're trying to solve a problem by looking for the root cause of a conflict, the odds are that you'll find that cause in one of those three areas!

Answers

~~Exam Questions~~**67. Answer: B**

Quality audits are when your company reviews your project to see if you are following its processes. The point is to figure out if there are ways to help you be more effective by finding what you are doing on your project that is inefficient or that causes defects. When you find those problem areas, you recommend corrective actions to fix them.

Any time you create recommended corrective actions, they go through change control.

**68. Answer: A**

Coaching is an important interpersonal skill for any project manager to have. Any time you do coaching, mentoring, training, or anything else to help others learn about project management, you're not only helping your team member, you're also contributing to the Project Management Body of Knowledge.

**69. Answer: B**

Even if a project is shut down before the work is completed, you still need to document the lessons learned and add them to the organizational process assets. In fact, if a project is terminated early, that's probably the best time to do that! When a project goes seriously wrong, then there are always important lessons that you can learn—even if it wasn't your fault!

**70. Answer: A**

Seven values on one side of the mean in a control chart indicate a problem with the process that is being measured.

**71. Answer: A**

Stakeholder analysis is one of the tools and techniques of the Identify Stakeholders process. And that shouldn't really be a surprise. After all, the goal of stakeholder analysis is to write down the needs of your stakeholders. Identify Stakeholders is the only process in the Stakeholder Management knowledge area that is part of the Initiating process group.

**72. Answer: D**

Take a look at the answers to this question. What do you see? A list of processes—"Create WBS," "Develop Project Management Plan," "Develop Project Charter," and "Identify Stakeholders." Your job is to figure out which of these processes comes next. So what clues do you have to tell you where you are in the project lifecycle? Well, you've just been authorized to manage a new project. Since the project charter is what authorizes a project manager to work on a project, it means that the Develop Project Charter process has just been performed. So which of the processes in the list comes next? The other Initiating process: Identify Stakeholders.

~~Exam Questions~~**73. Answer: C**

The expected monetary value (or EMV) of the problems integrating the component is the probability (20%) times the cost (\$3,000), but don't forget that since it's a risk, that number should be negative. So its EMV is  $20\% \times \$3,000 = -\$600$ . The savings from not having to build the component from scratch is an opportunity. It has an EMV of  $40\% \times \$10,000 = \$4,000$ . Add them up, and you get  $-\$600 + \$4,000 = \$3,400$ .

**74. Answer: C**

The best thing that you can do with a risk is avoid it—if you can prevent it from happening, it definitely won't hurt your project. The easiest way to avoid a risk is to cut it out of your project entirely; in this case, getting rid of the subcontractor avoids the risk.

Sometimes avoiding one risk can lead to another. It's possible that there was a reason that you went with the subcontractor in the first place, and now you've exposed the project to a different risk! That's why Risk Management is so important.

**75. Answer: D**

The WBS dictionary always corresponds to an entry in the WBS by name and work package ID. So that's the easiest way to cross-reference the two. The statement of work describes the work that will be done. The responsible organization is the team or department who will do it. Schedule milestones are any set dates that will affect the work. The quality requirements describe how you will know if the work has been done properly. The resource and cost estimates are just a list of how many people will be needed to do the work and how much it will cost. Answer A couldn't be right because net present value doesn't have anything to do with individual work packages. The other options mention earned value and Monte Carlo analysis, which have nothing to do with Scope Management either.

**76. Answer: C**

The best way to resolve any problem is to collaborate with the team to figure out the source of the problem and then resolve the root cause of the conflict. Any time you have an opportunity to use different perspectives to solve the problem, you should do it. Remember, one of the most important things that a project manager does is make sure that team conflicts get resolved.

**77. Answer: A**

Tom is a Theory X manager. He believes that employees need to be watched all of the time and that all of his team members are selfish and unmotivated.

Answers

## Exam Questions

**78. Answer: C**

The WBS dictionary is the companion document to the WBS. It gives all the details that you know about each work package in the WBS, including estimates and billing information.

**79. Answer: A**

This is a calculation question that's asking you to use SPI and CPI to evaluate your project. Luckily, it's easy to do that! First calculate  $SPI = EV / PV = \$15,000 / \$12,000 = 1.25$ —so your project is ahead of schedule. Then calculate  $CPI = EV / AC = \$15,000 / \$11,000 = 1.36$ —so your project is within its budget.

**80. Answer: C**

Whenever you use a Pareto chart to examine the results of an inspection of your product, you are in Control Quality. If you were examining the process your company uses to build multiple projects, you would be in Perform Quality Assurance.

**81. Answer: A**

Translating your communications into a different language so that they can be transmitted to someone else is an example of encoding.

**82. Answer: B**

The reason we work to do quality planning up front is that it is most expensive to deal with problems if you find them late in the project. The best case is when you never inject the defects in the first place; then it doesn't cost anything to deal with them. Prevention is always better than inspection.

**83. Answer: D**

You must always follow your company's policy—it's your ethical duty as a project manager. You should find some other way to reward her that is not against your company's rules.

## Answers

~~Exam Questions~~**84. Answer: B**

Perform Qualitative Risk Analysis is all about prioritizing each risk, and figuring out its probability and impact. It's an important part of risk planning. But it's not about coming up with specific numbers! That's what Perform Quantitative Risk Analysis is for—and EMV analysis is part of quantitative (not qualitative) analysis, because it's where you assign numeric values to risks.

Remember, quantitative means numbers and qualitative means judgments!

**85. Answer: D**

The PMP Code of Professional Conduct tells us that an important part of any project manager's career is enhancing personal professional competence. This means increasing your knowledge and applying it so that you can improve your ability to manage projects.

**86. Answer: B**

Joe is doing root-cause analysis on process problems: that's Manage Quality. Remember, Control Quality is when you are trying to find problems in your work products through inspection. Manage Quality is when you are looking at the way your process affects the quality of the work you are doing.

**87. Answer: C**

To calculate the expected monetary value (EMV) of a set of risks and opportunities, multiply each probability by its total cost and add them together. In this question, the cost of the risk is  $-\$15,250 + -\$20,000 = -\$35,250$ , so its EMV is  $40\% \times -\$35,250 = -\$14,100$ . The value of the opportunity is  $\$4,500$  and its probability is 65%, so its EMV is  $65\% \times \$4,500 = \$2,925$ . So the total EMV for the two is  $-\$14,100 + \$2,925 = -\$11,175$ .

Don't forget that the cost of a risk is negative, and the cost of an opportunity is positive.

**88. Answer: A**

Before you can close your project, there are a few things you need to do. Remember the acceptance criteria in the scope statement? Well, those criteria need to be met. And you need to get formal written acceptance from the customer. And every work item in the WBS needs to be completed.

Until the customer accepts the final product, your project isn't done!

**89. Answer: D**

Once you've closed out a procurement, it's important to conduct a procurement audit. This is where you go over everything that happened on the project to figure out the lessons learned, and

## Answers

~~Exam Questions~~

look for anything that went right or wrong. However, consideration—or payment—is not part of an audit (unless there was a problem processing or paying it).

That's why the payment system is one of the Control Procurements tools and techniques, and not part of Close Procurements—you can't close out the contract until it's been paid.

90. Answer: B

The Staffing Management plan includes a “Reward and Recognition” section that describes how you’ll reward your team for good performance. It also contains training requirements and release criteria.

There's no such thing as a “Reward and Recognition plan” in the PMBOK Guide.

91. Answer: C

It's pretty obvious just from a quick glance at the numbers that this project is in trouble. The total budget for completion is  $900 \text{ panels} \times \$75 \text{ per panel} = \$67,500$ , and your actual costs are already  $\$45,000$ . But if you look at all the answers, every one of them could potentially be correct: you know that you're pretty far below budget, so the CPI will be below 1 and the CV will be negative. And since you should have completed 400 panels, you're behind schedule, so you know your SPI will also be below 1. So which of the answers is right? There's only one way to find out: do the calculations. Actual % complete is  $350 \div 900 = 38.9\%$  so  $PV = \$67,500 \times .389 = \$26,258$ . Planned % complete is  $400 \div 900 = 44.4\%$ , so  $PV = \$67,500 \times .444 = \$29,970$ .  $CPI = \$26,258 \div \$45,000 = .584$ , and  $CV = \$26,258 - \$45,000 = -\$18,742$ , so neither of those numbers matches the answers for A and B. And for answer D,  $SPI = \$26,258 \div \$29,970 = .876$ , which doesn't match, either. But for answer C,  $TCPI = (\$67,500 - \$26,258) \div (\$67,500 - \$45,000) = 1.833$ , which does match the answer. Answer C is correct.

92. Answer: C

By buying the extra chemical stock, you are mitigating the risk.

93. Answer: D

A resource histogram is just a way to visualize the number of people in each role that you will need on your project as time goes on. Once you have figured out your schedule and the order of activities, you figure out how many people it's going to take to do the work and plot that out over time. Then you have a good idea of what the staffing needs of your project will be.

Answer D is wrong because you can't just terminate a contract, since it's legally binding. But if a contract does eventually get terminated early during claims administration, you do have to follow any termination procedures in the contract.

94. Answer: A

When there's a dispute between a buyer and a seller, that's called a claim. Most contracts have some language that explains exactly how claims should be resolved—and since it's in the contract, it's legally binding, and both the buyer and seller need to follow it. Usually it's not an option to renegotiate a contract, especially at the end of the project after the work is complete, and lawsuits should only be filed if there are absolutely, positively no other options.

## Exam Questions

**95. Answer: B**

Any time you have any communication having to do with the contract, it's always formal written communication.

**96. Answer: A**

One of the most important elements of the Staffing Management plan is the timetable, which tells you who will work on what, and when they will be released from the project. One of the most common ways of showing the timetable is the resource histogram (or staffing histogram). That timetable will let you know exactly when you plan to release your project resources.

**97. Answer: D**

While noise can interfere with communication, it's not a communication type.

**98. Answer: B**

Lessons learned from past projects are always part of a company's organizational process assets, and are usually stored in a process asset library. The other three answers are important project tools, but they're not where you find lessons learned.

↙ All the answers to that question sounded good, right? Just remember, lessons learned are your most important organizational process assets!

**99. Answer: C**

Once your project team is done with the work, it's time to check the deliverables against the scope statement, WBS, and Scope Management plan. If your deliverables have everything in those documents, then they should be acceptable to stakeholders. When all of the deliverables in the scope are done to their satisfaction, then you're done with the project! What comes next? Formal acceptance, which means you have written confirmation from the stakeholders that the deliverables match the requirements and the Project Management plan. Since this communication is a project document, it's formal written communication.

**100. Answer: C**

The procedure for managing changes to a contract is found in the Contract Management plan. The other three answers are all things you typically find in a project charter.

Answers

## Exam Questions

**101. Answer: D**

The Communications Management plan defines all of the processes that will be used for communication on the project.

**102. Answer: D**

The work authorization system is a part of your company's enterprise environmental factors, and it's generally part of any change control system. It defines how work is assigned to people. If work needs to be approved by specific managers, the work authorization system will make sure that the right people are notified when a staff member's work assignments change.

**103. Answer: B**

Risk mitigation means taking some sort of action that will cause a risk, if it materializes, to do as little damage to your project as possible. Having team members spend time doing work to prepare for the risk is a good example of risk mitigation.

**104. Answer: A**

Sometimes you don't need to do any calculations when you run across a question like this. The question asked you which number to use for a forecast of how much money you expect to spend on the rest of the project. Well, isn't that the definition of ETC? Since you were given the value of ETC, you could just use that number!

**105. Answer: D**

Product scope means the features and functions of the product or service being built. Project scope means the work that's needed to build the product.

**106. Answer: A**

The project charter does several important things: it lays out the project requirements, describes an initial summary milestone schedule, documents the business case, and identifies initial risks, assumptions, and constraints. But most importantly, a project charter identifies the project manager, and assigns him or her the authority necessary to get the job done.

## Exam Questions

**107. Answer: A**

Work performance data is what you're doing when you look at the work that the team is performing in order to determine whether the project is ahead or behind schedule. A really good way to do that is to use schedule variance (SV) and schedule performance index (SPI) calculations.

**108. Answer: B**

Since the CFO is affected by your project, that means he's a stakeholder. The best thing you can do in this situation is get the new stakeholder's opinion incorporated in the project up front. It's important that all of the project stakeholders understand the needs and objectives that the project is meant to address. The worst case is to have the stakeholder's opinion incorporated at the end of the project—that could mean a lot of rework or even an entirely unacceptable product.

**109. Answer: D**

An important part of identifying stakeholders is reviewing lessons learned from prior projects (because they may help you identify stakeholder issues early), performing stakeholder analysis (which often involves a power/interest grid), and reviewing procurement documents (because a contract often brings extra stakeholders with it). However, you don't create the change control system in the Initiating phase—that's something that you do as part of your project planning activities.

**110. Answer: C**

The project manager is mitigating the risk by backing up the data so that it doesn't get lost. He is transferring it to the insurance company by insuring the company for the cost of rekeying the information.

**111. Answer: B**

This project is not in good shape. The client has needs that aren't being met, but there may not be enough time or money to meet them. What's the project manager going to do? Well, the first thing that you should do any time you have a problem is try to figure out what's causing it. All of the other answers involved taking some sort of action, and you should never take action until you've figured out the root cause of the problem.

## Exam Questions

**112. Answer: C**

Residual risks are risks that remain even after you have planned for and implemented all of your risk response strategies. They don't need any further analysis because you have already planned the most complete response strategy you can in dealing with the risk that came before them.

**113. Answer: D**

The client is trying to command Rekha to do what he says even though she has good reasons for not doing it. He isn't working to solve the problem, he's just forcing the resolution to go his way.

**114. Answer: B**

Decomposition doesn't have anything to do with Define Scope—it's how you decompose tasks in the Create WBS process. The other answers are all tools of the Define Scope process. Note that facilitation is part of interpersonal and team skills, and multicriteria decision analysis is part of decision making.

**115. Answer: A**

The records management system is one of the tools that you use in the Close Procurements process. It's what you use to store your contracts and any related documents, so that future project managers can refer to them in future projects.

**116. Answer: B**

Time and materials (T&M) contracts are used in labor contracts. In a T&M contract, the seller pays a rate for each of the people working on the team plus their material costs. The "time" part means that the buyer pays a fixed rate for labor—usually a certain number of dollars per hour. And the "materials" part means that the buyer also pays for materials, equipment, office space, administrative overhead costs, and anything else that has to be paid for.

**117. Answer: D**

Any activity that helps you find, prevent, or fix defects in your product is included in the cost of quality. The activities you do to build the product don't count toward that number.

~~Exam Questions~~**118. Answer: B**

A stakeholder is anyone who is affected by the cost, time, or scope of your project. And that includes unions—if you have team members who are in a union, then you always need to consider that union as a stakeholder and make sure its needs are met. However, you don't need to consider the needs of your company's competitors.

**119. Answer: D**

The project scope statement defines the scope of work for the project. It's where everyone comes to a common understanding about the work that needs to be accomplished on the project.

**120. Answer: C**

$\$230,000 \times 0.70 = \$138,000$  savings, and  $\$150,000 \times 0.40 = -\$60,000$  expenses. Add them together and you get \$78,000.

When you calculate EMV, anything that saves your project money is counted as positive, and anything that costs it money is negative. Multiply each by the probability and add them together.

**121. Answer: C**

This is an example of accepting a risk. The team can't do anything about the weather, so the project manager has accepted the fact that they could end up being delayed by it.

**122. Answer: C**

If you discover that someone claims to have the PMP credential but is not actually certified, you must contact PMI immediately so that it can take action.

**123. Answer: A**

The most effective type of power for a project manager is expert power. That's when your team respects you because they know that you know what you are talking about.

**124. Answer: B**

Since the Smith County project officer is the sponsor, he's the person who is best suited to sign the charter. A project charter is typically approved and signed by the sponsor. Some projects

## Exam Questions

are approved by key stakeholders, but they are never approved by project managers (since the project manager is only granted authority once the project is signed) or team members.

### 125. Answer: B

Control Procurements is the Monitoring and Controlling process for Procurement Management. It's when you run into a change that has to be made to a specific contract. You use work performance information to determine how the contract is going, and the contract and procurement documents to see exactly what everyone's on the hook for. But you don't actually see the Procurement Management plan as an input to Control Procurements.

### 126. Answer: A

If you discover that someone claims to have the PMP credential but is not actually certified, you must contact PMI immediately so that it can take action.

### 127. Answer: B

You may get a question on the exam that asks what to do when you encounter a change. You always begin dealing with change by consulting the Project Management plan.

### 128. Answer: B

The PMP Code of Professional Conduct says that you're not allowed to accept any kind of gift, not even if it's after the project has finished. That would be the same thing as taking a bribe.

### 129. Answer: D

This is a tough situation for any project manager. You've got a problem that's happened, and you didn't plan for it. Now it's going to cost you money. What do you do? Well, you can't just accept it and move on—that's only something you do with risks that have no other option. You have options with a problem that happens during your project. And you can't just go to the boss, because you're the project manager and it's your job to figure out what to do. There's no use in doing risk planning, because you already know the probability (100%) and impact (the cost of fixing the problem). So what do you do?

That's where your reserve comes in. There are two kinds of reserves: a contingency reserve and a management reserve. The contingency reserve is what you use for "known unknowns"—you use it to pay for risks that you've planned for. But this situation isn't like that. That's why you tap into the management reserve. That's the money in the budget you set aside for "unknown unknowns"—problems that you didn't plan for but which came up anyway.

## Exam Questions

**130. Answer: B**

When you have a project that's broken up into subprojects or phases, it's important that you perform the Initiating processes at the beginning of the project. Answer B is the one that best describes something that happens during the processes in the Initiating group—performing the Identify Stakeholders process.

**131. Answer: B**

This question looks hard, but it's actually pretty easy if you remember that Control Stakeholder Engagement is just an ordinary Monitoring and Controlling process—it's the one for the Stakeholder Management knowledge area. Once you know that, it's easy to pick out the output that doesn't fit! When you're handling a change in a Monitoring and Controlling process, you update your project plan and project documents, and you request changes. But you don't create deliverables.

**132. Answer: A**

The formula for lines of communication is  $n \times (n-1) / 2$ . So the answer to this one is  $(17 \times 16) / 2 = 136$ .

**133. Answer: A**

There are two kinds of project selection methods. Benefit measurement models, or comparative methods, are used to compare the benefits and features of projects. Mathematical models use complex formulas to determine which project has the most value to the company. You should get familiar with some of the more common comparative approaches to project selection, like murder boards, benefit-cost ratios, and peer reviews.

**134. Answer: D**

If you find out that someone is cheating on the PMP exam by distributing questions that are on it, you must report that person to PMI immediately. If that person is a PMP-certified project manager, he will be stripped of his certification.

**135. Answer: B**

The project sponsor is the person (or people) that pays for the project. Sometimes this means the sponsor directly provides funding; other times, it means the sponsor is the person who signs the organizational approval to assign resources. Either way, you can usually tell who the sponsor is by finding the person who can approve or deny the budget.

## Answers

~~Exam Questions~~

136. Answer: C

An important part of any project manager's career is enhancing personal professional competence. This means increasing your knowledge and applying it so that you can improve your ability to manage projects.

The "document repository" sounded good, but you won't find that term anywhere in the PMBOK Guide. Watch out for made-up terms on the exam!

137. Answer: A

The configuration management system is there to be sure that everybody on the team has the most updated version of all of the project documents. Whenever a project document is changed, it is checked into the configuration management system so that everyone knows where to go to get the right one.

138. Answer: C

Project managers must have a "zero tolerance" policy on racist remarks, or any other cultural insensitivity. If there is an incident involving racism, sexism, or any other kind of discrimination, your top priority is to correct that. Every company has a policy that guides how you handle this kind of situation, so a question involving racism will usually involve the company's policy or HR department.

139. Answer: B

An important part of making sure that your project goes well is keeping an eye on the work, and that's what the Monitor and Control Project work process is for. It's where you constantly evaluate the work being done, and any time you see a problem you recommend changes, defect repairs, and preventive and corrective actions.

The rule of seven tells you that seven consecutive data points outside of the control limits indicate that the process may have a problem. But not all question about control charts will ask you about the rules of seven.

140. Answer: B

A control chart is a tool that helps you analyze a process and determine if it's stable, or if the results of that process are predictable. It typically consists of a plot of process measurements or outputs on a scale that includes statistically calculated upper and lower control limits, so that you can identify measurements that indicate process instabilities.

## Exam Questions

**141. Answer: C**

You need to make sure that what you're delivering matches what you wrote down in the scope statement. That way, the team never delivers the wrong product to the customer. As you complete each deliverable, you work with the stakeholders and the sponsor to make sure that you did the right work.

**142. Answer: C**

Even though the numbers are large, this is a simple application of the channels of communication formula:  $\# \text{ lines} = n \times (n - 1) \div 2$ . There is a total of  $1,253 + 752 + 14 = 2,019$  people. So the number of channels is  $2019 \times 2018 \div 2 = 2,037,171$ . That's a pretty staggering number, but it's realistic for a large project—and it's why Communications Management is such an important part of a project manager's toolbox.

**143. Answer: C**

It's not enough that the project manager approves of the Project Management plan; it needs to be approved by all of the stakeholders in the project. Everyone on the team should feel comfortable with the processes that are going to be used to do the work.

**144. Answer: B**

Customers can be satisfied even when a project is not profitable—customer satisfaction isn't always about money. Rather, customer satisfaction is about making sure that the people who are paying for the end product are happy with what they get. When the team gathers requirements for the specification, they try to write down all of the things that the customers want in the product so that you know how to make them happy. Some requirements can be left unstated, too. Those are the ones that are implied by the customer's explicit needs. In the end, if you fulfill all of your requirements, your customers should be satisfied.

**145. Answer: C**

Plurality is an example of a group decision-making technique in which a decision can be made by the largest block of people in the group, even if they don't have a 50% majority.

Answers

## Exam Questions

**146. Answer: C**

Smoothing is minimizing the problem, and it can help cool people off while you figure out how to solve it. But it's only a temporary fix, and does not really address the root cause of the conflict.

**147. Answer: D**

Once you've closed out a contract, it's important to conduct a procurement audit. This is where you go over everything that happened on the project to figure out the lessons learned, and look for anything that went right or wrong.

**148. Answer: A**

"Force majeure" is a kind of clause that you'll see in a contract. It says that if something like a war, riot, or natural disaster happens, you're excused from the terms of the contract.

**149. Answer: D**

Ground rules help you prevent problems between team members, and let you establish working conditions that everyone on the team can live with. You set up the ground rules for a project to help guide people in their interactions with each other. Make sure you discuss the ground rules with the team during the kickoff meeting!

**150. Answer: A**

Saying that the work must be "better" is subjective. Requirements gathered in stakeholder analysis need to be quantifiable. That way, the team has a goal they can shoot for and you can always tell how close to or far from it you are.

Answers

~~Exam Questions~~

151. Answer: B

Maslow's Hierarchy of Needs says that people have needs, and until the lower ones (like acceptance on the team, job safety, or job security) are satisfied, they won't even begin to think about the higher ones (fulfilling their potential and making a contribution).

Cost of quality doesn't include the time the project manager spends putting together the Project Management plan—except for the time spent on the quality portions!

152. Answer: C

Cost of quality is what you get when you add up the cost of all of the prevention and inspection activities you are going to do on your project. It doesn't just include the testing. It includes any time spent writing standards, reviewing documents, meeting to analyze the root causes of defects, reworking to fix the defects once they're found by the team—absolutely everything you do to ensure quality on the project.

153. Answer: D

A firm fixed price (FFP) contract means that the buyer pays one amount regardless of how much it costs the seller to do the work. A fixed-price contract only makes sense in cases where the scope is very well known. If there are any changes to the amount of work to be done, the seller doesn't get paid any more to do it.

So if the costs get really high, then the buyer has to swallow them.

154. Answer: C

A lot of people think compromise is a great way to handle conflicts. But any time there's a compromise, it means that everyone needs to give up something. That's why compromise is often called a lose-lose solution. It's always better to solve the problem and fix the root cause of the conflict. You should only force people to compromise if that's the only option.

Insurance is just a contract that you use to pay a company to take on some of your risk.

155. Answer: A

One effective way to deal with a risk is to pay someone else to accept it for you. This is called transference. The most common way to do this is to buy insurance.

156. Answer: B

When you're working with procurements, independent estimates is one of the tools and techniques of the Conduct Procurements process. It certainly sounds a lot like something you'd

## Answers

~~Exam Questions~~

do while planning out your procurements. Don't forget that the Conduct Procurements process involves finding sellers as well as carrying out the work to complete the contract. That's why you use things like bidder conferences and qualified seller lists in Conduct Procurements.

**157. Answer: C**

The scope baseline is not a particularly useful thing once a project's done. A baseline is what you use to measure any changes to the project—whenever there's a change, you always want to compare it against the baseline. But once the project is done, the baseline isn't necessary anymore.

**158. Answer: C**

Forecasting is a cost monitoring tool that helps you predict how much more money you'll need to spend on the project. So which of the cost metrics would you use to do that? There are two useful numbers that you can use for forecasting. One of them is called estimate to complete (ETC), which tells you how much more money you'll probably spend on your project. And the other one, variance at completion (VAC), predicts what your variance will be when the project is done.

**159. Answer: A**

Did you think the answer was "Status reports"? You generally won't see that as a valid answer on the exam. The PMBOK Guide is clear on this: a PM's job is to plan the work and control the project, not just gather and report status.

You create one of the most important outputs of your entire project when the team is doing the project work. Work performance data tells you the status of each deliverable in the project, what the team's accomplished, and all of the information you need to know in order to figure out how your project's going. But you're not the only one who needs this—your team members and stakeholders need to know what's going on, so they can adjust their work and correct problems early on. One thing to keep in mind: work performance data means data generated from raw observations. Performance data can be collected and analyzed to create work performance information, and it's that information that's used to create status reports. Understanding the relationship between work performance data, work performance information, and work performance reports will definitely help you on the exam.

Ishikawa diagrams—or fishbone diagrams—are an important tool that's used in Kaizen.

**160. Answer: B**

Kaizen is a Japanese word that means "improvement"—and it's also a management technique that helps your company use problem solving to constantly find new ways to improve. Kaizen focuses on making small improvements and measuring their impact. It's a philosophy that guides management, rather than a particular way of doing quality assurance.

## Answers

~~Exam Questions~~**161. Answer: A**

The PMP Code of Professional Conduct requires cultural sensitivity to others. It's unacceptable to belittle people based on how they speak, the way they dress, or any other aspect of their cultural background. If you see a member of your team doing this, it's your responsibility to do what's necessary to correct the behavior and prevent it from happening in the future.

*Don't assume that every time you see a fishbone diagram the question is talking about Control Quality.*

**162. Answer: A**

Diagramming techniques (including Ishikawa diagrams and flowcharts) are a tool of the Identify Risks process. You use them to find the root cause of defects in Quality Management processes, but they can also be useful in finding the risks that can lead to trouble in Risk Management.

**163. Answer: B**

The project's scope is changing every time the client is asked to verify the product—that's scope creep. The best way to avoid that is to be sure that the project scope statement that is written in the planning stages of the project is understood and agreed to by everyone on the project. Scope changes should never come late in the project; that's when they cost the most and will jeopardize the team's ability to deliver.

**164. Answer: B**

Any time you hold a seminar, give a talk, write an article, or help others learn about project management, you're contributing to the Project Management Body of Knowledge.



*This is an important part of every PMP-certified project manager's career!*

**165. Answer: D**

If you discover that someone has broken the law, it is your duty to call the authorities and report that person. You need to do this, even if it seems like the offense is minor.

**166. Answer: C**

When you're asked to use benefit-cost (BCR) ratios to select a project, always choose the project with the highest BCR because that's the project that gives you the most benefit for the least cost. An easy way to do it is to divide: Project A has a BCR of 5:2, and  $5 / 2$  is 2.5. Do that with all four projects, and you find that project C has the highest BCR.

## Answers

**Exam Questions****167. Answer: D**

Legitimate power is the kind of power you have when you tell someone who reports to you to do something. Expert power is when your opinion carries weight because people know that you know what you're talking about. Reward power is when you promise a reward for doing as you ask. Referent power is when people do what you say because of your association with somebody else. Punishment power is when people do what you say because they are afraid of the consequences.

**168. Answer: C**

Every change request needs to be evaluated to determine whether or not the change should be made. That's what we do in the Perform Integrated Change Control process—every change is analyzed to determine its impact. It's then documented as a change request and put into the change control system. That's where the stakeholders on the CCB determine if the change should be made.

**169. Answer: B**

By the time the Close Project or Phase process happens, you should have already gotten formal written acceptance for the deliverables. That's what the Validate Scope process is for, and you verify that formal acceptance in the Close Project or Phase process.

**170. Answer: C**

The WBS work packages can be displayed by project phase or by project deliverable. It depends on how your company needs to see the work organized. If you use the same phased lifecycle for all projects, it can be easier to show all of the work as it breaks down within each phase. If you have various teams depending on the deliverables your team will produce, it can make sense to break the work down by project deliverable.

**171. Answer: A**

The two main outputs of Direct and Manage Project Work are deliverables and work performance data. Work performance data is a name for all of the actual data that comes from the work your team is doing.

## Answers

~~Exam Questions~~**172. Answer: A**

Lessons learned are some of your most important organizational process assets. At the end of every project, you sit down with the project team and write down everything you learned about the project. This includes both positive and negative things. That way, when you or another project manager in your company plans the next project, you can take advantage of the lessons you learned on this one.

↑ It's really important that you work with the team to write down the lessons you've learned, because they have a lot of insight into what went right and wrong on the project.

**173. Answer: B**

The project charter is often created without the project manager's involvement. Sometimes it is handed to the project manager by the sponsor or high-level manager.

**174. Answer: C**

Checksheets are a great way to keep a tally of any quality-related activities you need to repeat while controlling quality or performing quality assurance on your project.

**175. Answer: B**

Monte Carlo analysis is a way of seeing what could happen to your project if probability and impact values changed randomly.

**176. Answer: A**

One of the most important things that you do as a project manager is to constantly monitor the project for changes, and take the appropriate action whenever you make a change. But changes don't happen on any sort of schedule—if they did, it would make project management a whole lot easier! That means you need to continuously monitor your project to figure out whether or not its plans and scope need to change.

You can think of change requests as what you get when someone finds a problem and needs to make a change. Once you've figured out whether or not to do that change (in Perform Integrated Change Control), you give the person an update on its status.

**177. Answer: B**

This question is basically asking you the difference between change requests and change request status updates. Change request status updates are outputs from Perform Integrated Change Control, not Monitor and Control Project Work. ↙

Answers

## Exam Questions

**178. Answer: C**

You can't know the answer to technical questions as well as your team. So, while it's important to understand both sides of the issue, your job is to make sure that problems are solved and fairly evaluated.

**179. Answer: D**

Parametric estimation is a tool for creating estimates. It's not a deliverable.

**180. Answer: D**

The WBS dictionary is an output of the Create WBS process. It is created along with the WBS and gives all of the details about each work package in the WBS.

*Keep an eye out for questions that describe processes instead of using their names. You'll see that a lot on the exam.*

**181. Answer: C**

This question asked about artifacts generated by the process of finalizing all activities for the project. That's another way of asking about the outputs of the Close Project process. Business documents are an input to Close Project, not an output.

**182. Answer: D**

The kickoff meeting gets all of the stakeholders together to explain how communication will go. That way, everyone knows who to talk to if things go wrong or they run into any questions.

**183. Answer: A**

Not every change needs to be made. Before you make any change, you always need to evaluate its impact on the triple constraint—time, cost, and scope—and how those changes will affect the quality of the deliverables. Until you analyze that impact, there's no way to know whether or not it makes sense to make the change.

~~Exam Questions~~**184. Answer: B**

The idea behind net present value (or NPV) is that you can compare potential projects by figuring out how much each one is worth to your company right now. You figure out a project's NPV by coming up with how much the project is worth, and then subtracting how much it will cost. If you're asked to choose between projects and given the NPV of each of them, choose the one with the biggest NPV. That means you're choosing the one with the most value!

**185. Answer: C**

It's easy to get change, defects, and corrective actions mixed up—they're all words that sound suspiciously similar! Just remember: a defect is any deliverable that does not meet its requirements. A defect is *not* always caused by a mistake—defects can come from lots of sources, and team members' errors only cause some defects. For example, plenty of defects are caused by equipment problems.

Don't forget that the Project Management plan itself is a deliverable! That means that it can have defects, too—a lot of companies have specific standards and requirements that every project plan must meet. And if a defect is found in the plan after the work has started, then you need to go through change control to repair it!

**186. Answer: D**

Forcing means putting your foot down and making a decision. One person wins, one person loses, and that's the end of that.

**187. Answer: B**

The project scope statement is where you figure out exactly what your stakeholders need, and turn those needs into exactly what work the team will do to give them a great product. Any constraints or assumptions that need to be made to determine the work need to be written down in the scope statement as well.

**188. Answer: C**

You can figure out the actual cost that was spent on a project, even if all you're given are some of the project metrics. In this case, if you only have CPI and EV, you can figure out the AC by writing down the formula that has all three of them:  $CPI = EV / AC$ . Now flip the formula around:  $AC = EV / CPI = \$172,500 / .92 = \$187,500$ .

## Answers

~~Exam Questions~~**189. Answer: A**

Changes are found in Monitor and Control Project Work; they are approved in Perform Integrated Change Control, and implemented in Direct and Manage Project Execution. When you are monitoring and controlling the project work, you are always looking for changes that might need to be made to your plan and assessing their impact. Then you present those changes to the change control board for approval. If they approve, you implement them in the Direct and Manage Project Execution process—that's where all the work gets done.

**190. Answer: A**

A work breakdown structure is the best way to visualize all of the work that will be done on your project. It divides all of the work up into work packages and shows how it fits into higher-level categories. By looking at the WBS, you can communicate to other people just how much work is involved in your project.

**191. Answer: B**

Over half of the conflicts on projects come from resources, priorities, and schedules. It can be tough to get resources assigned to projects, especially if they have skills that are in high demand. Sometimes multiple projects (and even roles within projects) are vying to get top priority. Finally, you probably don't need to think too hard to remember a conflict about schedules on a project you've worked on—many projects start with overly aggressive deadlines that cause conflicts from the very beginning.

**192. Answer: D**

When do you gather work performance information? You do it when you're reporting on the performance of the team—that's why it's a tool and technique of the Control Communications process. But that's not something you do during Control Risks—work performance information is an input to that process, which means it needs to be gathered *before* you start controlling your risks.



Some questions on the PMP exam will describe tools or techniques rather than using their names. A question might say "bringing in an outside party to review your risk response strategies" instead of "risk audit." You're actually asked about concepts you've learned, not just about a bunch of things you've memorized.

## ~~Exam Questions~~

**193. Answer: B**

You should always use formal written communication when you are communicating with clients about changes in your project.

**194. Answer: C**

The project charter is created long before you start identifying work packages and activities. Those things are done as part of the project planning, which happens only after the project charter is completed.

**195. Answer: C**

Positive risks are opportunities that could happen on your project. The strategies for dealing with them are all about making sure that your project is in a position to take advantage of them or at least share in them with other projects if possible.

**196. Answer: D**

The RBS is part of the Risk Management plan. It's structured very similarly to a WBS. The RBS helps you to see how risks fit into categories so you can organize your risk analysis and response planning.

**197. Answer: B**

Sometimes you'll find that some risks have obviously low probability and impact, so you won't put them in your register. Instead, you can add them to a watchlist, which is just a list of risks that you don't want to forget about, but you don't need to track as closely. You'll check your watchlist from time to time to keep an eye on things.

**198. Answer: A**

Everything listed in each of the answers is a project document...except for the scope baseline. The baselines and subplans are all part of the Project Management plan, so they don't fall under the heading of "project documents."

## Answers

~~Exam Questions~~

## 199. Answer: C

When you're looking at CPI and SPI numbers, remember: lower = loser. If your CPI is below 1.0, then your project is over its budget. If the SPI is below 1.0, then the project is behind schedule. In this case, the project is ahead of schedule, since its SPI is above 1.0. But it's over its budget, because it's got a CPI that's below 1.0.

## 200. Answer: B

The key to a good bonus system is that it must be achievable and motivate everyone in the team to work toward it. If you are only rewarding one team member or a few people in the group, the rest of the team will not be motivated. Also, making the goals too aggressive can actually demotivate people.

**So how'd you do?**

PMI uses a scoring system called the "Modified Agnoff Technique" (which it explains in the PMP Handbook, available for download from their website), which makes it a little hard to predict exactly how you'll do. But if you're scoring in the 80% to 90% range on this exam, then you're in really good shape.

**The End**



# Index

## Symbols

80/20 rule 454, 477, 843

## A

- AC (actual cost) 386–387, 393, 396, 399
- acceptance criteria
  - about 61–62
  - in project scope statement 204–205, 245
  - in Validate Scope process 238
- accepted deliverables
  - in Close Project or Phase process 152
  - in Validate Scope process 187, 237
- accepted risk 581, 585, 611–612
- Achievement Theory 503
- acknowledge, in communication 538–539
- Acquire Resources process
  - about 483
  - inputs to 492
  - outputs of 493
  - tools and techniques in 492
- active listening 548, 562, 576
- activity attributes
  - change control and updating 321
  - in Control Schedule process 324
  - in Define Activities process 273
  - in Develop Schedule process 292–293
  - in Estimate Activity Durations process 284–286
  - in Estimate Activity Resources process 490–491
  - in Sequence Activities process 275, 283
- activity cost estimates
  - in Determine Budget process 364–365
  - in Estimate Activity Resources process 490
  - in Estimate Costs process 362, 368
- activity duration estimates
  - in Develop Schedule process 292
  - in Estimate Activity Durations process 264, 290
- activity list
  - in Control Schedule process 324
  - in Define Activities process 264, 273
  - in Develop Schedule process 292–293
  - in Estimate Activity Durations process 284–286
  - in Estimate Activity Resources process 490
  - in Sequence Activities process 275
- activity list updates, in Sequence Activities process 283
- activity on node (AON) diagram 276–277
- activity resource requirements
  - in Develop Schedule process 292
  - in Estimate Activity Durations process 284–286
- actual cost (AC) 386–387, 393, 396, 399
- adaptive lifecycles 12–13
- adjourning, as stage of team development 504
- advertising, in Conduct Procurements process 664–665
- affinity diagrams 195, 200
- Agile development 270, 317
- agreements (contracts)
  - about 127
  - closing 678, 834
  - consideration in 659
  - force majeure clause in 659
  - in Close Project or Phase process 152
  - in Collect Requirements process 191, 194
  - in Conduct Procurements process 648, 665
  - in Control Procurements process 671
  - in Control Resources process 514
  - in Determine Budget process 365
  - in Develop Project Charter process 118
  - in Develop Schedule process 292
  - information on laws 644
  - in Identify Risks process 588
  - in Identify Stakeholders process 694
  - in Monitor and Control Project Work process 144
  - in Plan Stakeholder Engagement process 699, 701
  - insurance policies as 659
  - legal advisors for 647
  - point of total assumption in 659
  - types of 656–658

- union contracts 670, 675
- writing 647
- alternative analysis
  - in Define Scope process 203
  - in Estimate Activity Resources process 491
  - in Plan Risk Responses process 611
- analogous (top-down) estimating
  - in Estimate Activity Durations process 287
  - in Estimate Activity Resources process 491
  - in Estimate Costs process 357–358
- AON (activity on node) diagram 276–277
- approved change requests. *See also* change requests
  - in Control Procurements process 671
  - in Control Quality process 440
  - in Control Scope process 231–232
  - in Direct and Manage Project Work process 136
  - in Perform Integrated Change Control process 145
- assumption log
  - in Collect Requirements process 191
  - in Control Resources process 515
  - in Control Schedule process 324
  - in Define Scope process 201
  - in Develop Project Charter process 122
  - in Develop Schedule process 292
  - in Estimate Activity Resources process 491–492
  - in Perform Quantitative Risk Analysis process 601
  - in Plan Quality Management process 433
  - in Sequence Activities process 283
- assumptions
  - in Control Schedule process 324
  - in Estimate Activity Durations process 284
  - in Identify Risks process 590, 592
  - in PERT estimates 288
  - in Plan Stakeholder Engagement process 699, 701
  - in project scope statement 205, 245
  - introducing risk with 56
- audits
  - quality 456–457, 672–675
  - risk 620–622, 639
- authorization 118, 134
- autocratic decision making 193
- avoided risk 581, 585, 612
- avoiding power 93

## B

- BAC (budget at completion)
  - calculating 376–378, 382–383, 387
  - calculating EV with 380
  - calculating PV with 377
  - calculating TCPI with 386, 399
  - forecasting with 392–395
- backward pass 308
- balanced matrix organizations 45
- bar charts 444, 488
- baselines
  - about 129
  - cost. *See* cost baseline
  - in Project Management plan 133
  - performance measurement 131, 150–151, 367
  - schedule. *See* schedule baseline
  - scope. *See* scope baseline
- basis of estimates
  - in Control Schedule process 324
  - in Determine Budget process 364–365
  - in Develop Schedule process 292
  - in Estimate Activity Durations process 290
  - in Estimate Activity Resources process 491
  - in Estimate Costs process 362, 368
  - in Perform Quantitative Risk Analysis process 601
- BCR (benefit cost ratio) 360–361, 368–369
- benchmarking
  - about 192
  - in Collect Requirements process 192
  - in Plan Quality Management process 434, 438
  - in Plan Stakeholder Engagement process 699, 701
- benefit cost ratio (BCR) 360–361, 368–369
- Benefits Management plan, in Determine Budget process 365
- beta distribution 288, 602
- bidder conferences
  - avoiding unfair advantage in bids 827
  - in Conduct Procurements process 664–667, 669
  - sellers at 686
- bid documents, in Plan Procurement Management process 651, 660–661, 663
- bottom line

- about 349
  - looking after 56
  - bottom-up estimating
    - in Estimate Activity Durations process 287
    - in Estimate Activity Resources process 491
    - in Estimate Costs process 357–358
  - brainstorming
    - about 127, 192
    - in Collect Requirements process 192, 194
    - in Identify Risks process 589, 826
    - in Identify Stakeholders process 694
    - in Plan Quality Management process 434
    - nominal group technique in 194
  - bribery 728, 821, 841
  - budget. *See also* Cost Management knowledge area
    - cost baseline and 131
    - impacting scope 56
    - managing 62, 88
    - project overruns and 823
  - budget at completion (BAC). *See* BAC (budget at completion)
  - buffer (contingency reserve) 287, 290, 622, 637
  - business case documents
    - about 124, 134
    - in Close Project or Phase process 152
    - in Collect Requirements process 191–192
    - in Determine Budget process 365
    - in Develop Project Charter process 118–119
    - in Identify Stakeholders process 694
    - in Plan Procurement Management process 650
    - project charter vs 126
  - buyer-conducted performance review 672
- C**
- cause-and-effect diagrams 444, 454
  - CCB (change control board) 143, 145–147, 149, 151, 232
  - certification
    - about 1
    - meaning of passing test for 32
    - reasons to get 1–5, 9, 33
  - change control
    - in Control Scope process 230–232
    - in Monitor and Control Project Work process 144
    - in Perform Integrated Change Control process 145
    - in Project Management plan 139, 148–149, 164
    - in Validate Scope process 239
    - recommended corrective actions and 831
    - scope baseline and 222–223, 231
    - updating activity attributes and resource requirements and 321
  - change control board (CCB) 143, 145–147, 149, 151, 232
  - change control system 148–149, 232, 234
  - change log
    - in Identify Stakeholders process 694
    - in Manage Stakeholder Engagement process 706
    - in Perform Integrated Change Control process 145
  - change requests. *See also* approved change requests
    - about 146–149, 151
    - in Acquire Resources process 493
    - in Conduct Procurements process 665
    - in Control Costs process 375
    - in Control Procurements process 671–672
    - in Control Quality process 440, 453
    - in Control Resources process 515
    - in Control Schedule process 323
    - in Control Scope process 229–232
    - in Control Scope request 187
    - in Define Activities process 273
    - in Develop Schedule process 318
    - in Direct and Manage Project Work process 136
    - in Identify Stakeholders process 695
    - in Implement Risk Responses process 615
    - in Manage Quality process 456
    - in Manage Stakeholder Engagement process 707, 709
    - in Manage Team process 508, 523
    - in Monitor and Control Project Work process 144
    - in Monitor Communications process 557
    - in Monitor Risks process 624
    - in Monitor Stakeholder Engagement process 712
    - in Perform Integrated Change Control process 145
    - in Plan Procurement Management process 651
    - in Validate Scope process 237, 239
  - channels of communication 560–562
  - charismatic leaders 92
  - charismatic (personal) power 93
  - charters
    - portfolio 15–16
    - program 15–16
    - project. *See* project charter

- team 484–486
- checklist analysis, in Identify Risks process 589
- checklists, in Control Quality process 441
- checksheets, in Control Quality process 441
- claims administration, in Control Procurements process 672–674
- closed procurements, in Control Procurements process 671–672, 678
- Close Project or Phase process
  - about 113–114, 152–153
  - Close Procurements process vs. 824
  - inputs to 152
  - outputs of 153
  - tools and techniques in 152
- Closing process group
  - about 75, 79–80, 111
  - Close Project or Phase process in 113–114, 152–153
- coaching
  - as PM characteristic 26
  - in Develop Team process 499
  - team building vs. 28
- Code of Ethics and Professional Conduct, PMI 725–727, 733. *See also* professional responsibility
- coercive (punitive) power 93
- collaboration techniques 194, 510, 512
- collective bargaining agreements 670, 675
- Collect Requirements process
  - about 187, 191
  - inputs to 191
  - outputs of 198–199, 210
  - tools and techniques in 192–197, 200
- colocation, in Develop Team process 497
- communication methods
  - about 543
  - in Manage Communications process 546–550, 552
  - in Manage Stakeholder Engagement process 706, 708
  - in Plan Communications Management process 543, 545
- communication models
  - about 538–539, 542, 552
  - in Manage Communications process 542, 544, 550
- Communication Requirements Analysis, in Plan Communications Management process 542, 544
- communication skills
  - in Manage Communications process 550
  - in Monitor Stakeholder Engagement process 711
- Communications Management knowledge area
  - about 85–89, 535
  - anatomy of communication 538–539
  - key concepts 564–565
  - Manage Communications process in 540, 546–552
  - Monitor Communications process in 541, 553–562
  - Plan Communications Management process in 540, 542–545
  - test practice question answers on 769
  - test practice questions on 754
- Communications Management plan
  - about 129, 131
  - in Manage Communications process 546
  - in Plan Communications Management process 540, 543, 545
- communication technology
  - anatomy of 538
  - in Develop Team process 497–498
  - in Manage Communications process 543–544, 550
- composite organizations 57
- compromise, resolving conflicts by 510, 516
- Conduct Procurements process
  - about 645–646, 648, 663–664
  - inputs to 664
  - outputs of 665
  - tools and techniques in 664–669
- configuration management system 149
- conflict management and resolution
  - answering questions in 817
  - as PM characteristic 26
  - collaborating in 510, 512
  - common reasons for conflicts 509
  - compromise in 510
  - forcing in 511
  - in Develop Team process 499
  - in Manage Team process 508–512
  - smoothing in 511
  - withdrawal in 511
- consideration, in contracts 659
- consultants (contractors) 45, 50, 270
- context diagrams, group creativity technique 195
- contingency reserve (buffer) 287, 290, 622, 637

- contingent response strategies, in Plan Risk Responses process 611
- contractors (consultants) 45, 50, 270
- contracts. *See* agreements (contracts)
- control accounts 224, 368
- control charts
  - about 445, 454, 458
  - in Control Quality process 445
  - in Manage Quality process 456
- Control Costs process
  - about 353, 372
  - inputs to 373–374
  - outputs of 375
  - tools and techniques in 375–400
- controlling PMOs 24, 27–28, 30, 47
- Control Procurements process
  - about 645–646, 649, 671
  - inputs to 671
  - outputs of 671–672, 678
  - tools and techniques in 672–675
- Control Quality process
  - about 430, 439–440, 458–462
  - inputs to 440
  - outputs of 452–453
  - tools and techniques in 441–445, 477
- Control Resources process
  - about 483, 514
  - inputs to 514
  - outputs of 515
  - tools and techniques in 514
- Control Schedule process
  - about 265, 327
  - inputs to 323–325
  - outputs of 323–325
  - tools and techniques in 326
- Control Scope process
  - about 187, 229–231, 233–234
  - inputs to 229
  - outputs of 229
  - tools and techniques in 229, 232–233
- coordinators, project 44, 48
- copyrighted materials 730
- corrections, project 147–148
- corrective action 150, 162
- cost aggregation, in Determine Budget process 366, 368
- cost baseline
  - in Control Resources process 515
  - in Determine Budget process 366–368
  - in Perform Quantitative Risk Analysis process 601
  - in Plan Risk Responses process 610
  - in Project Management plan 131
- cost-benefit analysis
  - in Plan Quality Management process 434
  - in Plan Risk Responses process 611
- cost constraints 22, 54, 56
- cost disagreements, causing conflicts 509
- cost estimates
  - in Conduct Procurements process 664
  - in Determine Budget process 364–365
  - in Estimate Activity Resources process 490
  - in Estimate Costs process 362, 368
  - in Perform Quantitative Risk Analysis process 601
  - in Plan Procurement Management process 664
- cost forecasts
  - in Control Costs process 375
  - in Perform Quantitative Risk Analysis process 601
- Cost Management knowledge area
  - about 85–89, 349
  - Control Costs process in 353, 372–400
  - Determine Budget process in 353, 364–369
  - Estimate Costs process in 353, 356–362, 368–369
  - key concepts 402–403
  - Plan Cost Management process in 353–355
  - test practice question answers on 766
  - test practice questions on 751
- Cost Management plan
  - about 129, 131
  - in Control Costs process 373–374
  - in Determine Budget process 365
  - in Estimate Costs process 356
  - in Plan Cost Management process 354–355
- cost of quality
  - about 435, 438, 846
  - in Estimate Costs process 359
  - in Plan Quality Management process 434, 438
- cost performance index (CPI) 386–392, 395, 398

costs plus award fee (CPAF) contracts 656–658, 662, 666  
costs plus fixed fee (CPFF) contracts 656–658, 662, 666  
costs plus incentive fee (CPIF) contracts 656–658, 662, 666  
cost variance (CV) 386–387  
CPAF (costs plus award fee) contracts 656–658, 662, 666  
CPFF (costs plus fixed fee) contracts 656–658, 662, 666  
CPI (cost performance index) 386–392, 395, 398  
CPIF (costs plus incentive fee) contracts 656–658, 662, 666  
crashing project schedules 314, 321, 335  
Create WBS process  
    about 187, 210–213, 220–223  
    inputs to 210–211  
    outputs of 210, 222–225  
    tools and techniques in 214–215  
critical path method  
    about using 297–299, 313  
    backward pass in 308  
    early start and early finish in 305, 307, 309–311, 313  
    float for activities in 300–304, 313  
    forward pass in 307  
    in Control Schedule process 326  
    late start and late finish in 306–311, 313  
    risk management and 592  
Crosby, Philip 427  
cultural awareness 26, 499, 732  
culture, as enterprise environmental factor 60  
customers  
    on exam 127  
    satisfaction of 427  
    sponsors vs. 126  
CV (cost variance) 386–387

## **D**

data analysis  
    about 287  
    in Close Project or Phase process 152  
    in Conduct Procurements process 665, 669  
    in Control Procurements process 672  
    in Control Quality process 442  
    in Control Resources process 514

    in Control Schedule process 326  
    in Define Scope process 203  
    in Determine Budget process 366  
    in Develop Schedule process 317  
    in Estimate Activity Durations process 287  
    in Identify Stakeholders process 694  
    in Monitor and Control Project Work process 144  
    in Monitor Communications process 556  
    in Monitor Stakeholder Engagement process 711  
    in Perform Integrated Change Control process 145  
    in Perform Qualitative Risk Analysis process 595  
    in Perform Quantitative Risk Analysis process 601  
    in Plan Cost Management process 354  
    in Plan Procurement Management process 650  
    in Plan Quality Management process 434  
    in Plan Risk Management process 583  
    in Plan Risk Responses process 611  
    in Plan Schedule Management process 266  
    in Plan Scope Management process 188  
    in Plan Stakeholder Engagement process 699, 701  
databases, as enterprise environmental factor 60  
data gathering techniques  
    about 120, 124, 127  
    in Collect Requirements process 192  
    in Control Quality process 441  
    in Develop Project Charter process 120–121  
    in Develop Project Management Plan process 128  
    in Identify Risks process 588–589  
    in Identify Stakeholders process 694  
    in Perform Qualitative Risk Analysis process 595  
    in Perform Quantitative Risk Analysis process 601  
    in Plan Procurement Management process 651  
    in Plan Risk Responses process 611  
    in Plan Stakeholder Engagement process 699, 701  
    Plan Quality Management process 434  
data points, out of control 445  
data representation  
    in Collect Requirements process 195  
    in Identify Stakeholders process 694  
    in Monitor Stakeholder Engagement process 711  
    in Perform Qualitative Risk Analysis process 595  
    in Plan Communications Management process 542, 545  
    in Plan Quality Management process 435  
    in Plan Resource Management process 484–486  
    in Plan Stakeholder Engagement process 699

- decision analysis
  - in Acquire Resources process 492
  - in Collect Requirements process 193
  - in Define Scope process 203
- decision making
  - group techniques 193
  - in Collect Requirements process 193
  - in Estimate Activity Durations process 287
  - in Estimate Costs process 359
  - in Manage Team process 508
  - in Monitor and Control Project Work process 144
  - in Monitor Stakeholder Engagement process 711
  - in Perform Integrated Change Control process 145
  - in Plan Quality Management process 435
  - in Plan Risk Responses process 611
  - in Plan Stakeholder Engagement process 699, 701
  - in Validate Scope process 237
- Decision Tree analysis 603, 606–607
- decoding, in communication model 538–539, 552
- decomposition
  - about 214, 269
  - in Create WBS process 214–215, 225
  - in Define Activities process 269, 271–272
- defects
  - finding and correcting 452–454
  - impacting quality 56, 88
  - prevention of 430–437
  - prevention vs. inspection 430–432
  - repairing 138, 147–148
  - root cause analysis for 442
  - validated repair of 453
- Define Activities process
  - about 264, 268
  - inputs to 268
  - outputs of 273, 293
  - tools and techniques in 269–270
- Define Scope process
  - about 187
  - inputs to 201
  - outputs of 204–207, 210
  - tools and techniques in 202–203
- deliverables
  - about 138, 187
- decomposing into work packages 214–215, 225
- focus in quality management processes of 819
- in Close Project or Phase process 152
- in Control Quality process 440, 453
- in Direct and Manage Project Work process 136–138
- in Identify Stakeholders process 695
- in Manage Project Knowledge process 140
- in project scope statement 204–205, 245
- inspecting 237–239, 239, 439, 453
- in Validate Scope process 187, 237–239
- Project Management Plan as 852
- work performance data and change to Project Management plan 164
- work performance data and change to Project Management plan vs. 139
- Deming Cycle 458
- Deming, W. Edwards 458
- dependencies
  - getting information about 281
  - in sequencing activities 280–281
- dependency determination and integration tool 280
- depreciation 360–361
- design for X technique 456–457
- Determine Budget process
  - about 353, 364, 368–369
  - inputs to 365
  - outputs of 366–367
  - tools and techniques in 366–367
- Develop Project Charter process
  - about 112, 115–120, 127
  - inputs to 118
  - outputs of 122–124
  - tools and techniques in 120–121
- Develop Project Management Plan process
  - about 112, 116–117, 128–133
  - inputs to 128
  - outputs of 129
  - tools and techniques in 128
- Develop Schedule process
  - about 265, 321
  - inputs to 292–293
  - outputs of 292–293, 318–319
  - tools and techniques in 316–317

Develop Team process  
  about 483, 496–497  
  inputs to 497  
  outputs of 506  
  tools and techniques in 497–505

Direct and Manage Project Work process  
  about 112, 117, 136–138, 146  
  inputs to 136  
  outputs of 136, 229  
  tools and techniques in 136

directive PMOs 24, 27–28, 30, 47

discretionary dependencies 280

discriminating against others 736

document analysis  
  about 194  
  in Collect Requirements process 194  
  in Identify Risks process 590  
  in Identify Stakeholders process 694

duration estimates  
  about 290  
  in Estimate Activity Durations process 290  
  in Perform Quantitative Risk Analysis process 601

## **E**

EAC (estimate at completion) 392–395, 398–399

early start (ES) and early finish (EF) 305, 307, 309–311, 313

earned value analysis 672

earned value (EV). *See* EV (earned value)

earned value management (EVM)  
  formulas 387–388, 392–395, 398  
  in Control Costs process 375

effective listening 548, 562

effort estimate 290

EMV (Expected Monetary Value)  
  calculating 604–605  
  Decision Tree analysis using 606–607  
  on negative risk 636  
  values for project savings and costs 840

encoding, in communication model 538–539, 552

enhanced risk 611–612

enterprise environmental factors  
  about 125, 133

  company culture as 60

  in Acquire Resources process 492–493

  in Collect Requirements process 191

  in Control Procurements process 671

  in Control Quality process 440

  in Create WBS process 211

  in Define Activities process 268

  in Define Scope process 201

  in Determine Budget process 365

  in Develop Project Charter process 118, 127

  in Develop Project Management Plan process 128

  in Develop Schedule process 292

  in Develop Team process 497

  in Direct and Manage Project Work process 136

  in Estimate Activity Durations process 284–286

  in Estimate Activity Resources process 490

  in Estimate Costs process 356

  in Identify Risks process 588

  in Identify Stakeholders process 694

  in Manage Communications process 546

  in Manage Project Knowledge process 140

  in Manage Stakeholder Engagement process 706, 708

  in Manage Team process 508, 523

  in Monitor and Control Project Work process 144

  in Monitor Communications process 554

  in Monitor Stakeholder Engagement process 710

  in Perform Integrated Change Control process 145

  in Perform Qualitative Risk Analysis process 594

  in Perform Quantitative Risk Analysis process 601

  in Plan Communications Management process 544

  in Plan Cost Management process 354

  in Plan Procurement Management process 650

  in Plan Quality Management process 433

  in Plan Resource Management process 484–486

  in Plan Risk Management process 582

  in Plan Risk Responses process 610

  in Plan Schedule Management process 266

  in Plan Scope Management process 188

  in Plan Stakeholder Engagement process 699, 701

  in Sequence Activities process 275

escalated risk 581, 611

Estimate Activity Durations process  
  about 264, 369  
  inputs to 284–286  
  outputs of 290, 293  
  tools and techniques in 287–289

Estimate Activity Resources process

- about 482
- inputs to 490
- outputs of 491
- tools and techniques in 491
- estimate at completion (EAC) 392–395, 398–399
- estimate costs
  - in Determine Budget process 364
  - in Estimate Costs process 356
- Estimate Costs process
  - about 353, 356, 368–369
  - inputs to 356
  - outputs of 362
  - tools and techniques in 357–361
- ETC (estimate to complete) 393–395, 847
- ethics, code of
  - about 725–727, 733
  - avoiding unfair advantage in bids 827
  - being responsible to community 732
  - following company policies 729
  - on allowing racist remarks 843
  - on bribery 728, 821, 841
  - on discriminating against others 736
  - preparing for questions on 733
  - run projects properly 731
- EV (earned value)
  - calculating 379–383, 387
  - calculating CPI with 386
  - calculating CV with 386
  - calculating SPI with 384–385
  - calculating TCPI with 386, 399
  - finding missing information on exam about 396–397
- EVM (earned value management)
  - formulas 387–388, 392–395, 398
  - in Control Costs process 375
- exam question help
  - answering conflict resolution questions 817
  - answering questions on formulas 566–567
  - eliminating wrong answers 417
  - fake artifacts and processes 174
  - getting brain to think about exam xxix–xxxii
  - “have-a-meeting” question 520–521
  - information presented in questions 370
  - “just the facts” questions 173
  - on formulas 419
  - red herrings 171, 173, 370–371, 637
  - remembering processes using organizational process assets 582
  - “slack” used in exam 346
  - study aid for exam 679
  - tips on answering test practice questions on 746–747
  - use of formal document 576
  - use of “technique” 575
  - “which-comes-next” question 294
  - “which-is-BEST” questions 208
  - “which-is-not” questions 172
  - “Which-is-not” questions 626–627
  - “which-one” questions 450–451
  - writing questions for exam preparation 817
- exam scoring 855
- exclusions, in project scope statement 204–205, 245
- Executing process group
  - about 75, 79–80, 111
  - Acquire Resources process in 483, 492–493
  - Conduct Procurements process in 645–646, 648, 663–669
  - Develop Team process in 483, 496–506
  - Direct and Manage Project Work process in 112, 117, 136–138, 146
  - Implement Risk Responses process in 614–615
  - Manage Communications process in 540, 546–552
  - Manage Project Knowledge process in 113–114, 140–141
  - Manage Quality process in 430, 455–458, 460–462, 477
  - Manage Stakeholder Engagement process in 693, 706–709
  - Manage Team process in 483, 508–512, 523
- Expectancy Theory 503
- Expected Monetary Value (EMV)
  - calculating 604–605
  - Decision Tree analysis using 606–607
  - on negative risk 636
  - values for project savings and costs 840
- expeditors, project 41, 44, 48
- expert judgment
  - about 124, 287
  - in Close Project or Phase Process 152
  - in Conduct Procurements process 664, 669
  - in Control Procurements process 672
  - in Define Activities process 269

- in Define Scope process 203
- in Determine Budget process 366
- in Develop Project Charter process 120–121, 134
- in Develop Project Management Plan process 128
- in Direct and Manage Project Work process 136
- in Estimate Activity Durations process 287
- in Estimate Activity Resources process 491
- in Identify Risks process 590
- in Identify Stakeholders process 694
- in Implement Risk Responses process 614
- in Manage Project Knowledge process 140
- in Manage Stakeholder Engagement process 707, 709
- in Monitor and Control Project Work process 144
- in Monitor Communications process 556
- in Perform Integrated Change Control process 145
- in Perform Qualitative Risk Analysis process 594
- in Perform Quantitative Risk Analysis process 602
- in Plan Communications Management process 542, 544
- in Plan Cost Management process 354
- in Plan Procurement Management process 651
- in Plan Quality Management process 435
- in Plan Resource Management process 484
- in Plan Risk Management process 583
- in Plan Risk Responses process 611
- in Plan Schedule Management process 266
- in Plan Scope Management process 188
- in Plan Stakeholder Engagement process 699, 701

expert power 93, 500

exploited risk 611–612

external dependencies 280

## F

facilitation and facilitators

- in Collect Requirements process 194
- in Define Scope process 202
- in Identify Risks process 589
- in Perform Qualitative Risk Analysis process 594
- in Perform Quantitative Risk Analysis process 602
- in Plan Risk Responses process 611

fake artifacts and processes, on exam 174

“Faster, cheaper, better—pick two” saying 57

fast-tracking project schedules 315, 321, 335

Federal Acquisition Regulation website, US 656

feedback, in Manage Communications process 548–549, 552

feedback/response, in communication model 538–539

FF (Finish to Finish) dependencies 280

FFP (firm fixed price) contracts 656–658, 662

final product, in Close Project or Phase process 153

final report, in Close Project or Phase process 153

financing projects 367

find it...evaluate it...fix it, in handling changes 176

Finish to Finish (FF) dependencies 280

Finish to Start (FS) predecessors/dependencies 280

firm fixed price (FFP) contracts 656–658, 662

fishbone (Ishikawa) diagrams 444, 475, 590, 847–848

fitness for use 427

“five whys” 442

fixed price plus incentive fee (FPIF) contracts 656–658, 662

fixed price with economic cost adjustments (FPEPA) contracts 656

float for activities 300–304, 313, 592

flowcharts

- in Manage Quality process 456
- in Plan Quality Management process 435

focus groups

- about 192
- in Collect Requirements process 192
- in Develop Team process 497

force majeure clause, in contracts 659

forcing, resolving conflicts by 511

forecasts and forecasting

- about 150–151, 375
- exam question answers 577, 847
- in Control Costs process 375
- in Control Schedule process 323
- using formulas 392–395

formal verbal communication method 546–547, 552

formal written communication method 546–547, 552

forming, as stage of team development 504

formulas

- answering questions on 566–567
- counting channels of communication 560–562

earned value management 387–388, 392–395, 398  
 exam question help on 419  
 flipping 396–397  
 learning and using 9  
 test practice question answers on 762  
 test practice questions on 745

forward pass method 307

FPEPA (fixed price with economic cost adjustments)  
 contracts 656

FPIF (fixed price plus incentive fee) contracts 656–658,  
 662

FS (Finish to Start) predecessors/dependencies 280

functional managers 44–45, 118

functional organizations  
 about 43–44  
 interview comments to determine type of job 49–50  
 PM effectiveness in 48  
 teams in 48

functional requirements 198

funding limit reconciliation, in Determine Budget process 367–368

## G

Gantt charts 444

gold plating 227–228, 824

grade vs. quality 428–429

ground rules  
 in Develop Team process 496  
 in Manage Stakeholder Engagement process 707,  
 709

Guide to the Project Management Body of Knowledge®.  
*See* PMBOK® Guide

guilt-based power 93

## H

halo effect 492

“have-a-meeting” question, in exam 520

Herzberg’s Motivation-Hygiene Theory 502

heuristic 290

hierarchical charts, in Perform Qualitative Risk Analysis process 595

Hierarchy of Needs 502

histograms  
 about 444  
 in Control Quality process 444  
 in Manage Quality process 456  
 in Resource Management plan 488–489

human resources management. *See* Resource Management knowledge area

hybrid lifecycles 13

hybrid organization 46, 57

hygiene factors 502

## I

idea/mind maps 195

Identify Risks process  
 about 586, 588  
 inputs to 588  
 outputs of 593  
 tools and techniques in 588–592

Identify Stakeholders process  
 about 115, 692, 694  
 inputs to 694  
 outputs of 695  
 tools and techniques in 694–697

impact analysis 230

Implement Risk Responses process  
 about 614  
 inputs to 614  
 outputs of 615  
 tools and techniques in 614

incremental lifecycles 13

independent cost estimates  
 in Conduct Procurements process 664  
 in Plan Procurement Management process 651

influence diagrams, in Perform Quantitative Risk Analysis process 602

influencing  
 as PM characteristic 26  
 factors that cause change 322  
 in Develop Team process 499

informal verbal communication method 546–547, 552

informal written communication method 546–547, 552

- informational power 93
  - information management systems. *See* PMIS (project management information system)
  - information management vs. knowledge management 140–141
  - ingratiating power 93
  - Initiating process group
    - about 74, 79–80, 111
    - Develop Project Charter process in 112, 115–124, 127
    - Identify Stakeholders process in 115, 692, 694–697
    - Planning process group vs. 98
  - inputs to processes 81–83
  - inspection
    - about 443
    - in Control Procurements process 672–675
    - in Control Quality process 439, 443, 452–453
    - in Validate Scope process 237–239
    - prevention vs. 430–432
  - insurance policies
    - in procurement management 659, 846
    - in risk management 610
  - integrated change control process. *See* Perform Integrated Change Control process
  - Integration Management knowledge area
    - about 85–89, 107, 111
    - Close Project or Phase process in 113–114, 152–153
    - Develop Project Charter process in 112, 115–124, 127
    - Develop Project Management Plan process in 112, 116–117, 128–133
    - Direct and Manage Project Work process in 112, 117, 136–138, 146
    - importance of 154, 157
    - key concepts 158–159
    - Manage Project Knowledge process in 113–114, 140–141
    - Monitor and Control Project Work process in 113–114, 117, 143–150
    - Perform Integrated Change Control process in 113–114, 117, 143–150, 161
    - test practice question answers on 763
    - test practice questions on 748
  - interactional leaders 92
  - internal dependencies 280
  - internal rate of return 360–361
  - interpersonal skills
    - in Conduct Procurements process 665, 669
    - in Control Resources process 514
    - in Define Scope process 202
    - in Develop Project Management Plan process 128
    - in Develop Team process 497–499
    - in Identify Risks process 590
    - in Implement Risk Responses process 614
    - in Manage Communications process 550
    - in Manage Project Knowledge process 140
    - in Manage Stakeholder Engagement process 706, 708
    - in Manage Team process 508
    - in Monitor Communications process 556
    - in Monitor Stakeholder Engagement process 711
    - in Perform Qualitative Risk Analysis process 594
    - in Perform Quantitative Risk Analysis process 602
    - in Plan Communications Management process 542, 545
    - in Plan Risk Responses process 611
    - used by PMs 25–26, 29, 31, 90, 92
  - interviews
    - determining type of jobs 49–50
    - in Collect Requirements process 192
    - in Identify Risks process 589
    - in Perform Qualitative Risk Analysis process 595
    - in Perform Quantitative Risk Analysis process 602
    - in Plan Quality Management process 434
    - in Plan Risk Responses process 611
  - Ishikawa (fishbone) diagrams 444, 475, 590, 847–848
  - issues log
    - in Control Resources process 515
    - in Direct and Manage Project Work process 136
    - in Identify Stakeholders process 694
  - iteration approach to phases 77
  - Iteration Burndown Chart 326
  - iterative lifecycles 13
- ## J
- JAD (Joint Application Design) sessions 194
  - job-hunting
    - checklist 42, 64
    - interview comments to determine type of organiza-

tions 49–50

Joint Application Design (JAD) sessions 194

Juran, Joseph 427

Just-In-Time methodology 458

“just the facts” questions, on exam 173

## K

Kaizen management technique 458, 847

kickoff meetings 550, 562

knowledge areas

communications management. *See* Communications Management knowledge area

cost management. *See* Cost Management knowledge area

elements of 85–89

integration management. *See* Integration Management knowledge area

process groups vs. 85, 98

procurement management. *See* Procurement Management knowledge area

quality management. *See* Quality Management knowledge area

resource management. *See* Resource Management knowledge area

risk management. *See* Risk Management knowledge area

schedule management. *See* Schedule Management knowledge area

scope management. *See* Scope Management knowledge area

stakeholder management. *See* Stakeholder Management knowledge area

subsidiary plans in 129–131

test practice question answers on 758–759

test practice questions on 740–741

time management. *See* Schedule Management knowledge area

knowledge as PM characteristic 6–8

knowledge management vs. information management 140–141

knowledge repositories 59

## L

lag time 281, 317, 326

*laissez-faire* leaders 92

late start (LS) and late finish (LF) 306–311, 313

laws, breaking 729

leadership and leadership skills

about 498

as PM role 90, 92

in Develop Team process 498, 500–501

in successful projects 25

management vs. 92

leading role, stakeholders in 702–704

lead time 281, 317, 326

Lean thinking 442

legitimate power 500

lessons learned

about 125, 141

as organizational process assets 830, 836

documenting 850–851

in Collect Requirements process 191

in Control Costs process 373–374

in Control Quality process 440, 452

in Control Resources process 515

in Control Schedule process 323–324

in Define Activities process 268

in Develop Schedule process 292

in Estimate Activity Durations process 284

in Estimate Activity Resources process 491

in Estimate Costs process 356

in Identify Risks process 588

in Implement Risk Responses process 614

in Manage Communications process 551–552

in Manage Project Knowledge process 140

in Plan Risk Responses process 610

writing down 153

lifecycle costing 360, 368–369

lifecycle, project 12–13, 46

logical data models, in Plan Quality Management process 435

## M

maintenance process, software development 51–54, 62

majority, group decision making technique 193

make or buy analysis, in Plan Procurement Management process 650–655

- make or buy decisions
  - in Conduct Procurements process 663–664
  - in Plan Procurement Management process 651–655, 663
- Manage Communications process
  - about 540, 552
  - inputs to 546
  - outputs of 551
  - tools and techniques in 546–550
- management information systems. *See* PMIS (project management information system)
- management reserve 367–368
- management skills, in Develop Team process 496–503
- Manage Project Knowledge process
  - about 113–114, 140–141
  - inputs to 140
  - outputs of 140
  - tools and techniques in 140
- Manage Quality process
  - about 430, 455–456, 460–462
  - inputs to 456
  - outputs of 456
  - tools and techniques in 456–457, 477
- Manage Stakeholder Engagement process
  - about 693, 706
  - inputs to 706, 708
  - outputs of 707, 709
  - tools and techniques in 706–709
- Manage Team process
  - about 483
  - inputs to 508
  - outputs of 508, 523
  - tools and techniques in 508–512
- mandatory dependencies 280
- market, as enterprise environmental factor 60
- market research, in Plan Procurement Management process 651
- Maslow’s Hierarchy of Needs 502
- matrix diagrams 702
  - in Plan Quality Management process 435
  - in Resource Management plan 487, 489
- matrix organizations
  - about 44–45
  - interview comments to determine type of job 49–50
  - PMs authority in 44–45
  - project charter in 118
- McClelland’s Achievement Theory 503
- McGregor’s Theory X and Theory Y 502
- mean, statistical 445
- medium, in communication model 538
- meetings
  - in Close Project or Phase Process 152
  - in Control Quality process 441
  - in Develop Project Management Plan process 128
  - in Develop Team process 497
  - in Direct and Manage Project Work process 136
  - in Estimate Activity Resources process 491
  - in Identify Risks process 590
  - in Identify Stakeholders process 694
  - in Manage Communications process 550
  - in Manage Stakeholder Engagement process 707, 709
  - in Monitor and Control Project Work process 144
  - in Monitor Communications process 556
  - in Monitor Risks process 618, 620, 622
  - in Monitor Stakeholder Engagement process 711
  - in Perform Integrated Change Control process 145
  - in Perform Qualitative Risk Analysis process 594
  - in Plan Communications Management process 543, 545
  - in Plan Cost Management process 354
  - in Plan Procurement Management process 651
  - in Plan Quality Management process 435
  - in Plan Resource Management process 484
  - in Plan Risk Management process 583
  - in Plan Schedule Management process 266
  - in Plan Scope Management process 188
  - in Plan Stakeholder Engagement process 699, 701
  - kickoff 550, 562
- metrics, quality
  - in Control Quality process 440
  - in Plan Quality Management process 436–437
- Microsoft Project 130, 312, 326–327, 491
- milestone list
  - in Define Activities process 273
  - in Estimate Activity Durations process 284
  - in Perform Quantitative Risk Analysis process 601
  - in Plan Procurement Management process 650
  - in Sequence Activities process 275, 283
- milestone schedule 124
- mind mapping, in Plan Stakeholder Engagement pro-

cess 699, 701  
 mitigated risk 581, 585, 612  
 Monitor and Control Project Work process  
   about 113–114, 117, 143–150  
   inputs to 144  
   outputs of 144  
   tools and techniques in 144  
 Monitor Communications process  
   about 541  
   inputs to 553–554  
   outputs of 557  
   tools and techniques in 555–556  
 Monitoring and Controlling process group  
   about 75, 79–80, 111  
   Control Costs process in 353, 372–400  
   Control Procurements process in 645–646, 671–675, 678  
   Control Quality process in 430, 439–447, 452–453, 458–462, 477  
   Control Resources process in 483, 514–515  
   Control Schedule process in 265, 323–327  
   Control Scope process in 187, 229–234  
   Monitor and Control Project Work process in 113–114, 117, 143–150  
   Monitor Communications process in 541, 553–562  
   Monitor Risks process in 587, 617–624  
   Monitor Stakeholder Engagement process in 693, 710–712  
   Perform Integrated Change Control process in 113, 117, 143–150  
   Validate Scope process in 187, 237–241  
 Monitor Risks process  
   about 587, 617–618, 622  
   inputs to 618  
   outputs of 623–624  
   tools and techniques in 619–621  
 Monitor Stakeholder Engagement process  
   about 693, 710  
   inputs to 710  
   outputs of 712  
   tools and techniques in 711  
 Monte Carlo analysis 316, 321, 603, 607  
 Motivation-Hygiene Theory 502  
 motivation, project team 25, 496–498, 502–503  
 multi-criteria decision analysis

in Acquire Resources process 492  
 in Collect Requirements process 193  
 in Define Scope process 203  
 in Plan Quality Management process 435  
 multi-divisional organizations 44

## N

negative risks 611, 636  
 negative stakeholders 57, 696, 702  
 negotiation  
   in Acquire Resources process 492  
   in Conduct Procurements process 665, 669  
   in Develop Team process 499  
 net present value (NPV) 360–361, 368–369  
 network diagrams. *See also* project schedule network diagram  
   activity list in 264  
   backward pass in 308  
   creating 276–277, 281, 283  
   critical path method in 297–299, 313, 326  
   early start and early finish in 305, 307, 309–311, 313  
   float for activities in 300–304, 313  
   forward pass method in 307  
   late start and late finish in 306–311, 313  
   predecessor tasks in 276–277, 280  
   successor tasks in 276–277, 281  
 neutral role, stakeholders in 702–704  
 noise, in communication model 538–539  
 nominal group techniques 194, 200  
 nonfunctional requirements 198  
 nonverbal communication  
   in Manage Communications process 548–549  
   paralingual communication vs. 562  
 norming, as stage of team development 504, 516  
 NPV (net present value) 360–361, 368–369

## O

observation  
   about 196  
   in Collect Requirements process 196  
 Ohno, Taiichi 442  
 operations management, function of 28

operations (processes). *See* processes and process framework

opportunity cost 360–361

organic organizations 44

organizational environment

- finding new jobs within 41–42
- interview comments to determine type of 49–50
- type on PMP exam 48
- types of structure 44–46, 57

organizational process assets

- about 60, 83, 125
- in Acquire Resources process 492
- in Close Project or Phase process 152, 152–153
- in Collect Requirements process 191
- in Conduct Procurements process 664
- in Control Costs process 373–374
- in Control Procurements process 671
- in Control Quality process 440
- in Control Resources process 514
- in Control Schedule process 323
- in Control Scope process 229
- in Create WBS process 211
- in Define Activities process 268
- in Define Scope process 201
- in Determine Budget process 365
- in Develop Project Charter process 118, 127
- in Develop Project Management Plan process 128
- in Develop Schedule process 292
- in Develop Team process 497
- in Direct and Manage Project Work process 136
- in Estimate Activity Durations process 284–286
- in Estimate Activity Resources process 490
- in Estimate Costs process 356
- in Identify Risks process 588
- in Identify Stakeholders process 694
- in Implement Risk Responses process 614
- in Manage Communications process 546
- in Manage Project Knowledge process 140
- in Manage Stakeholder Engagement process 706, 708
- in Manage Team process 508
- in Monitor and Control Project Work process 144
- in Monitor Communications process 554, 562
- in Perform Integrated Change Control process 145
- in Perform Qualitative Risk Analysis process 594
- in Perform Quantitative Risk Analysis process 601

- in Plan Communications Management process 544
- in Plan Cost Management process 354
- in Plan Procurement Management process 650
- in Plan Quality Management process 433
- in Plan Resource Management process 484–486
- in Plan Risk Management process 582
- in Plan Risk Responses process 610
- in Plan Schedule Management process 266
- in Plan Scope Management process 188
- in Plan Stakeholder Engagement process 699, 701
- in Sequence Activities process 275
- lessons learned as 830, 836
- performance measurements 327
- progress reports in 327

organizational process asset updates

- in Acquire Resources process 493
- in Close Project or Phase process 153
- in Conduct Procurements process 665
- in Control Procurements process 672
- in Direct and Manage Project Work process 136
- in Manage Communications process 551
- in Manage Project Knowledge process 140
- in Manage Quality process 456
- in Monitor Risks process 624
- in Plan Procurement Management process 651

organizational theory, in Plan Resource Management process 484

out of control data points 445

outputs of processes 81–83

“overlapping activities” 315

overlapping project phases 77

## **P**

paralingual communication

- in Manage Communications process 548–549
- nonverbal communication vs. 562

parametric estimating

- about 290
- in Determine Budget process 368
- in Estimate Activity Durations process 287
- in Estimate Activity Resources process 491
- in Estimate Costs process 357–358, 368

Pareto charts 454, 457, 477, 843

- PDM (precedence diagramming method) 276–277
- people, as enterprise environmental factor 60
- performance as PM characteristic 6–8
- performance measurement
  - in Control Schedule process 325
  - in organizational process assets 327
- performance measurement baseline 131, 150–151, 367
- performance (project) reporting
  - in Manage Communications process 550
  - in Monitor Communications process 557, 562
- performance reviews
  - in Control Costs process 375
  - in Control Procurements process 672–674
  - in Control Quality process 442
  - in Control Schedule process 326
- performing, as stage of team development 504
- Perform Integrated Change Control process
  - about 113, 117, 143–150
  - inputs to 145
  - outputs of 145
  - tools and techniques in 145
- Perform Qualitative Risk Analysis process
  - about 586–587, 594, 599, 834
  - inputs to 594
  - outputs of 598
  - tools and techniques in 594–597
- Perform Quantitative Risk Analysis process
  - about 587, 601, 834
  - inputs to 601
  - outputs of 608
  - tools and techniques in 601–606
- personal (charismatic) power 93
- personalities clashing, causing conflicts 509
- personal skills as PM characteristic 6–8
- persuasive power 93
- PERT (Program Evaluation Review Technique) 288–289
- PfMP (Portfolio Management) 14
- PgMP (Program Management) 14
- phases
  - breaking down work by 213, 225
  - iterative relationship of 77
  - managing projects in 76–77
  - overlapping 77
  - sequential relationships between 76
- physical resource assignments
  - in Acquire Resources process 493
  - in Control Resources process 515
- Plan Communications Management process
  - about 540
  - inputs to 542, 544
  - outputs of 543, 545
  - tools and techniques in 542–545
- Plan Cost Management process
  - about 353–355
  - inputs to 354
  - outputs of 355
  - tools and techniques in 354
- Plan-Do-Check-Act cycle 458
- planned value (PV). *See* PV (planned value)
- Planning process group
  - about 74, 79–80
  - Collect Requirements process in 187, 191–200, 210
  - Control Costs process in 353, 372–389
  - Create WBS process in 187, 210–225
  - Define Activities process in 264, 268–273
  - Define Scope process in 187, 201–207, 210
  - Determine Budget process in 353, 364–369
  - Develop Project Management Plan process in 112, 116–117, 128–133
  - Develop Schedule process in 265, 292–293, 316–319
  - Estimate Activity Durations process 369
  - Estimate Activity Durations process in 264, 284–290, 293
  - Estimate Activity Resources process in 482, 490–491
  - Estimate Costs process in 353, 356–362, 368–369
  - Identify Risks process in 586, 588–593
  - Initiating process group vs. 98
  - Perform Qualitative Risk Analysis process in 586–587, 594–599, 834
  - Perform Quantitative Risk Analysis process in 587, 601–608, 834
  - Plan Communications Management process in 540, 542–545
  - Plan Cost Management process in 353–355
  - Plan Procurement Management process in 645–646, 648, 650–663
  - Plan Quality Management process in 430, 433–437, 443
  - Plan Resource Management process in 482, 484–489

- Plan Risk Management process in 582–584
- Plan Risk Responses process in 587, 610–613
- Plan Schedule Management process in 264, 266–267
- Plan Scope Management process in 187–189
- Plan Stakeholder Engagement process in 692, 699–705
- Sequence Activities process in 264, 275–283, 293
- Plan Procurement Management process
  - about 645–646, 648
  - inputs to 650
  - outputs of 651, 656–663
  - tools and techniques in 650–655
- Plan Quality Management process
  - about 430, 443
  - inputs to 433
  - outputs of 436–437
  - tools and techniques in 434–435
- Plan Resource Management process
  - about 482, 484
  - inputs to 484–486
  - outputs of 484–489
  - tools and techniques in 484–486
- Plan Risk Management process
  - about 582
  - inputs to 582
  - outputs of 583–584
  - tools and techniques in 583
- Plan Risk Responses process 610–614
  - about 587, 610
  - inputs to 610
  - outputs of 613
  - tools and techniques in 611–612
- Plan Schedule Management process
  - about 264, 266
  - inputs to 266
  - outputs of 267
  - tools and techniques in 266
- Plan Scope Management process
  - about 187–189
  - inputs to 188
  - outputs of 189
  - tools and techniques in 188
- Plan Stakeholder Engagement process
  - about 692, 699, 704–705
  - inputs to 699, 701
  - outputs of 699, 701
  - tools and techniques in 699–703
- plurality, group decision making technique 193
- PMBOK® Guide
  - 49 processes 78–80
  - about 4–5, 9
  - goals of 23
  - learning and xxvii–xxxi
  - on technical skills 91
- PMI (Project Management Institute)
  - certification offered by 14
  - on professional responsibility 725–737
  - Talent Triangle 90–91, 98
- PMIS (project management information system)
  - about 133–134
  - critical path calculations using 312
  - in change control system 149, 232, 234
  - in Control Costs process 375
  - in Control Resources system 514
  - in Control Schedule process 326–327
  - in Define Activities process 268
  - in Develop Schedule process 317
  - in Direct and Manage Project Work process 136
  - in Estimate Activity Resources process 491
  - in Estimate Costs process 359
  - in Manage Communications process 550
  - in Manage Project Knowledge process 140
  - in Manage Team process 508
  - in Monitor Communications process 556
- PMOs (Project Management Offices)
  - about 46
  - controlling 24, 27–28, 47
  - directive 24, 27–28, 47
  - supportive 24, 28, 30, 47
  - types of 24, 47
- PMP Code of Professional Conduct 726, 733. *See also* professional responsibility
- PMP practice exam. *See also* exam question help
  - answering conflict resolution questions 817
  - answers 825–856
  - questions 773–816
- PMs (Project Managers)
  - about 11
  - activities of 21, 111
  - analytical techniques used by 152
  - assign authority level of 124

- authority in organizations 44–45
- authorization for 118, 134
- categorizing types of stakeholder power 93
- certification for 33, 727
- core characteristics of 6–8, 12–14
- dealing with constraints 14
- effectiveness in functional and projectized organizations 48
- interpersonal skills used by 25–26, 29, 31, 90, 92
- kinds of power 500–501
- organization type on PMP exam 48
- role of 90–92
- point of total assumption, in contracts 659
- policies, company 59
- political and cultural awareness
  - as PM characteristic 26
  - in Develop Team process 499
- portfolio charter 15–16
- Portfolio Management (PMP) 14
- portfolio managers
  - about 11
  - adding business value 14
  - certification for 14
  - dealing with constraints 14
- portfolios 10
- positional power 93
- power
  - choosing form of 516
  - kinds of PM 500–501
  - types exerted in projects 93
- Power/Interest Grid 697
- PPMIS (project management information system)
  - in Implement Risk Responses process 614
- preassignment, in Acquire Resources process 492
- precedence diagramming method (PDM) 276–277
- predecessor tasks, in sequencing activities 275–276, 280
- predictive lifecycles 12–13, 46
- pressure-based power 93
- prevention of defects
  - inspection vs. 430–432
  - Plan Quality Management process and 433–438
- preventive action 150, 162
- priorities in conflict management 509
- probability and impact matrix 595
- probability distribution, in Perform Quantitative Risk Analysis process 602
- problem-solving
  - by testing for quality 454
  - change control and 150, 162
  - familiar project problems 2–3
  - in Control Resources process 514
  - in Manage Team process 508–512
- procedures, as organizational process assets 59
- processes and process framework
  - about 59, 71
  - anatomy of 81–83
  - combining 84
  - for escalating issues 61
  - in process groups 78–80, 83
  - knowledge areas organizing 85–88
  - order of processes 199
  - projects vs. 19–20
  - quality assurance and 456
  - test practice question answers on 760
  - test practice questions on 742–743
- process groups
  - about 74–75, 78–80, 83
  - closing. *See* Closing process group
  - executing. *See* Executing process group
  - initiating. *See* Initiating process group
  - knowledge areas vs. 85, 98
  - monitoring and controlling. *See* Monitoring and Controlling process group
  - phases of projects in 76–77
  - planning. *See* Planning process group
- procurement documents
  - in Close Project or Phase process 152
  - in Conduct Procurements process 663–664
  - in Control Procurements process 671–672
  - in Identify Risks process 588
  - in Plan Procurement Management process 648
- Procurement Management knowledge area
  - about 85–89, 641–644
  - Conduct Procurements process in 645–646, 648, 663–669
  - Control Procurements process in 645–646, 671–675,

- 678
- key concepts 676
- Plan Procurement Management process in 645–646, 648, 650–663
- test practice question answers on 771
- test practice questions 756
- Procurement Management plan
  - about 129, 131, 651
  - in Conduct Procurements process 664
  - in Plan Procurement Management process 650
- procurement statement of work
  - in Conduct Procurements process 663–664
  - in Plan Procurement Management process 651, 660, 663
- procurement strategy, in Plan Procurement Management process 651, 663
- product analysis
  - about 202
  - in Define Scope process 202
  - requirements gathering vs. 203
- product evaluations, in Control Quality process 443, 452
- product requirements
  - collecting 21, 187, 189, 197
  - conformance to 427
  - making decisions about 193
  - matching deliverables to 238
  - requirements gathering vs. product analysis 203
- product scope 183–184, 199, 244
- professional responsibility
  - avoiding unfair advantage in bids 827
  - being responsible to community 732
  - ethics and 725–727, 733
  - following company policies 729
  - on allowing racist remarks 843
  - on bribery 728, 736, 821, 841
  - on discriminating against others 736
  - preparing for questions on 733
  - run projects properly 731
- program charter 15–16
- Program Evaluation Review Technique (PERT) 288–289
- Program Management (PgMP) 14
- program managers 11, 14
- programs
  - about 10
  - difference from portfolios and projects 17–18
  - progress reports, in Organizational Process Assets 327
- project calendars
  - frequency of updating 327
  - in Control Schedule process 323
  - in Develop Schedule process 318
- project charter
  - about 15–16, 112, 133
  - answering questions on 134
  - business case document vs 126
  - contents of 122
  - in Close Project or Phase process 152
  - in Collect Requirements process 191
  - in Define Scope process 201
  - in Develop Project Charter process 112, 115–124, 127
  - in Develop Project Management Plan process 128
  - in Identify Stakeholders process 694
  - in matrix organizations 118
  - in Plan Communications Management process 544
  - in Plan Cost Management process 354
  - in Plan Procurement Management process 650
  - in Plan Quality Management process 433
  - in Plan Resource Management process 484
  - in Plan Risk Management process 582
  - in Plan Schedule Management process 266
  - in Plan Scope Management process 188
  - in Plan Stakeholder Engagement process 699, 701
  - necessity of 126
  - sections of 123–124
- project communications, in Manage Communications process 551
- project constraints
  - changes impacting 57
  - external constraints 675
  - identifying 55–56
  - in Develop Schedule process 292
  - in Identify Risks process 590
  - in Plan Stakeholder Engagement process 699, 701
  - in project scope statement 205, 245
  - managing 54
  - portfolio managers dealing with 14
  - project managers dealing with 21
  - types of 22, 54, 56–57
- project coordinators 44, 48
- project documents

- about 211
  - in Close Project or Phase process 152
  - in Collect Requirements process 191
  - in Conduct Procurements process 664
  - in Control Costs process 373–374
  - in Control Procurements process 671
  - in Control Quality process 440
  - in Control Resources process 514
  - in Control Schedule process 323
  - in Control Scope process 229
  - in Create WBS process 211
  - in Define Scope process 201
  - in Determine Budget process 365, 367
  - in Develop Schedule process 292
  - in Develop Team process 497
  - in Direct and Manage Project Work process 136
  - in Estimate Activity Durations process 284
  - in Estimate Costs process 356
  - in Identify Risks process 588
  - in Identify Stakeholders process 694
  - in Identify Stakeholders process 694
  - in Implement Risk Responses process 614
  - in Manage Communications process 546
  - in Manage Project Knowledge process 140
  - in Manage Quality process 456
  - in Manage Stakeholder Engagement process 706, 708
  - in Manage Team process 508
  - in Monitor and Control Project Work process 144
  - in Monitor Communications process 554
  - in Monitor Risks process 618
  - in Monitor Stakeholder Engagement process 710
  - in Perform Integrated Change Control process 145
  - in Perform Qualitative Risk Analysis process 594
  - in Perform Quantitative Risk Analysis process 601
  - in Plan Communications Management process 542, 544
  - in Plan Procurement Management process 650
  - in Plan Resource Management process 484
  - in Plan Risk Responses process 610
  - in Plan Stakeholder Engagement process 699, 701
  - in Sequence Activities process 275
  - in Validate Scope process 237
- project document updates
- about 204
  - in Acquire Resources process 493
  - in Close Project or Phase process 153
  - in Conduct Procurements process 665
  - in Control Costs process 375
  - in Control Procurements process 672
  - in Control Quality process 452
  - in Control Resources process 515
  - in Control Schedule process 323–324
  - in Control Scope process 229
  - in Create WBS process 224
  - in Define Scope process 204
  - in Determine Budget process 366
  - in Develop Schedule process 319
  - in Estimate Activity Resources process 491
  - in Estimate Costs process 362
  - in Identify Risks process 593
  - in Identify Stakeholders process 695
  - in Implement Risk Responses process 615
  - in Manage Communications process 551
  - in Manage Quality process 456
  - in Manage Stakeholder Engagement process 707, 709
  - in Manage Team process 508, 523
  - in Monitor and Control Project Work process 144
  - in Monitor Communications process 557
  - in Monitor Risks process 624
  - in Monitor Stakeholder Engagement process 712
  - in Perform Integrated Change Control process 145
  - in Perform Quantitative Risk Analysis process 601
  - in Plan Communications Management process 543, 545
  - in Plan Procurement Management process 651
  - in Plan Quality Management process 437
  - in Plan Resource Management process 484–486
  - in Plan Risk Responses process 613
  - in Sequence Activities process 283
  - in Validate Scope process 237, 239
- project execution 111, 117, 138, 143
- project expeditors 41, 44, 48
- project funding requirements
- in Control Costs process 373–374
  - in Determine Budget process 367–368
- projectized organizations. *See* project-oriented (projectized) organizations
- project lifecycle 12–13, 46
- project management information system. *See* PMIS (project management information system)
- Project Management Institute (PMI)
- certification offered by 14

- on professional responsibility 725–737
- Talent Triangle 90–91, 98
- Project Management Offices. *See* PMOs (Project Management Offices)
- Project Management plan
  - about 129
  - as deliverable 852
  - change control in 139, 148–149, 164
  - in Acquire Resources process 492
  - in Close Project or Phase process 152
  - in Control Costs process 373–374
  - in Control Procurements process 671
  - in Control Quality process 440
  - in Control Resources process 514
  - in Control Schedule process 323, 323–324
  - in Control Scope process 229, 231–232
  - in Create WBS process 211
  - in Define Activities process 268
  - in Define Scope process 201
  - in Determine Budget process 365, 367
  - in Develop Project Management Plan process 112, 128–133
  - in Develop Schedule process 292
  - in Develop Team process 497
  - in Direct and Manage Project Work process 136–137
  - in Estimate Activity Durations process 284
  - in Estimate Activity Resources process 490
  - in Identify Risks process 588
  - in Identify Stakeholders process 694
  - in Implement Risk Responses process 614
  - in Manage Project Knowledge process 140
  - in Manage Stakeholder Engagement process 706, 708
  - in Manage Team process 508
  - in Monitor and Control Project Work process 144
  - in Monitor Communications process 554
  - in Monitor Risks process 618
  - in Monitor Stakeholder Engagement process 710
  - in Perform Integrated Change Control process 113, 145
  - in Perform Qualitative Risk Analysis process 594
  - in Perform Quantitative Risk Analysis process 601
  - in Plan Communications Management process 544
  - in Plan Cost Management process 354
  - in Plan Procurement Management process 648, 650
  - in Plan Quality Management process 433, 436–437
  - in Plan Resource Management process 484
  - in Plan Risk Management process 582
  - in Plan Risk Responses process 610
  - in Plan Schedule Management process 266
  - in Plan Scope Management process 187–188
  - in Plan Stakeholder Engagement process 699, 701
  - in Sequence Activities process 275
  - in Validate Scope process 237–238
  - matching deliverables to 238
  - Open Issues section in 133
  - performance measurement baseline in 150–151
  - project schedule vs. 130
  - Scope Management plan vs. 225
  - subsidiary plans in 129–131
- Project Management plan updates
  - in Acquire Resources process 493
  - in Conduct Procurements process 665
  - in Control Costs process 375
  - in Control Procurements process 672
  - in Control Quality process 452
  - in Control Resources process 515
  - in Control Schedule process 323
  - in Control Scope process 229
  - in Develop Schedule process 319
  - in Identify Stakeholders process 695
  - in Manage Communications process 551
  - in Manage Project Knowledge process 140
  - in Manage Quality process 456
  - in Manage Stakeholder Engagement process 707, 709
  - in Manage Team process 508, 523
  - in Monitor and Control Project Work process 144
  - in Monitor Communications process 557
  - in Monitor Risks process 624
  - in Monitor Stakeholder Engagement process 712
  - in Perform Integrated Change Control process 145
  - in Plan Communications Management process 545
  - in Plan Quality Management process 437–438
  - in Plan Risk Responses process 613
- project management software. *See* PMIS (project management information system)
- project managers. *See* PMs (Project Managers)
- project organization chart, in Plan Resource Management process 487
- project-oriented (projectized) organizations
  - about 43–44
  - interview comments to determine type of job 49–50

- PMs authority in 44–45
  - teams in 48
  - project (performance) reporting
    - in Manage Communications process 550
    - in Monitor Communications process 557, 562
  - project resource management. *See* Resource Management knowledge area
  - project risk management. *See* Risk Management knowledge area
  - projects
    - about 10
    - breaking down work by 213
    - characteristics of 19–20
    - difference from portfolios and programs 17–18
    - familiar problems with 2–3
    - figuring out length of 284–290
    - financing 367
    - inputs in 81–83
    - managing in phases 76–77
    - operations vs. 19–20
    - outputs in 81–83
    - PMs running great 23
    - process groups in 74–75
    - steps to follow 72–75
    - tools and techniques in 81–83
    - value of 11
  - project schedule
    - causing conflicts 509
    - compression techniques 314–315, 317, 321, 326, 335
    - in Control Schedule process 265, 323, 324
    - in Determine Budget process 365
    - in Develop Schedule process 265, 292–293, 318
    - in Estimate Costs process 356
    - in Plan Risk Responses process 610
    - Project Management plan vs. 130
    - schedule baseline and 131
  - project schedule network diagram
    - creating 283
    - in Define Activities process 264
    - in Develop Schedule process 292
    - in Sequence Activities process 264, 283
  - project scope 183–184, 199, 244. *See also* entries beginning with scope
  - project scope statement
    - about 204
    - change control and 231
    - components of 205, 245
    - in Create WBS process 211, 222
    - in Define Scope process 187, 204–205
    - in Estimate Activity Durations process 285–286
    - in Scope Management knowledge area 206–207
    - requirements documentation vs. 206–207
  - project team assignments
    - in Acquire Resources process 493
    - in Develop Schedule process 292
    - in Estimate Activity Durations process 284
    - in Plan Procurement Management process 650
    - in Plan Risk Responses process 610
  - project teams. *See* Resource Management knowledge area
  - prompt lists, in Identify Risks process 590
  - proposal evaluation techniques, in Conduct Procurements process 665, 667, 669
  - prototypes, using 197
  - punishment power 516
  - punitive (coercive) power 93
  - purchase orders 660
  - PV (planned value)
    - calculating 377–379, 383, 387
    - calculating SPI with 384–385
- ## Q
- qualified seller list 687
  - qualitative risk analysis 586–587, 594–599, 834
  - qualitative vs. quantitative analysis 600
  - quality
    - about 423–425
    - conformance to requirements and 427
    - customer satisfaction and 427
    - definition of 426
    - fitness for use and 427
    - grade vs. 428–429
    - testing for 425–426, 435, 438, 443, 452, 454
  - quality assurance 458
  - quality attributes 198
  - quality audits
    - in Control Procurements process 672–675
    - in Manage Quality process 456–457

quality constraints 22, 54, 56  
quality control measurements, in Control Quality process 452  
quality function deployment 194  
Quality Management knowledge area  
  about 85–89, 430, 819  
  Control Quality process in 430, 439–447, 452–453, 458–462, 477  
  key concepts 464–465  
  Manage Quality process in 430, 455–458, 460–462, 477  
  Plan Quality Management process in 430, 433–437, 443  
  test practice question answers on 767  
  test practice questions on 752  
Quality Management plan  
  about 129, 131, 436  
  focus of 138  
  in Control Quality process 440, 452  
  in Manage Quality process 456  
  in Plan Quality Management process 436  
quality metrics  
  in Control Quality process 440  
  in Plan Quality Management process 436–437  
quantitative risk analysis 587, 601–609, 834  
quantitative vs. qualitative analysis 600  
questionnaires. *See also* surveys  
  about 192  
  in Collect Requirements process 192, 196, 200  
  in Control Quality process 441  
  in Identify Stakeholders process 694

## **R**

RACI matrix 487, 489  
racist remarks 843  
ranking risks 594–599  
RBS (risk breakdown structure) 583–584, 589  
recognition and rewards  
  in Develop Team process 497, 502–503  
  in Resource Management plan 488  
red herrings, on exam 171, 173, 370–371, 637  
referent power 93, 501

regression analysis 152  
relational power 93  
releases, dividing software development maintenance into 62  
repositories, knowledge 59  
requests for information (RFI) 660, 663  
requests for proposals (RFP) 660, 663  
requirements documentation  
  in Collect Requirements process 187, 192, 198–199  
  in Create WBS process 211  
  in Define Scope process 201  
  in Identify Stakeholders process 694  
  in Plan Procurement Management process 650  
  in Plan Quality Management process 433, 438  
  in Scope Management knowledge area 206–207  
  in Validate Scope process 238  
  project scope statement vs. 206–207  
Requirements Management plan  
  about 131, 189, 199  
  in Collect Requirements process 191, 199  
  in Plan Quality Management process 433  
  in Plan Scope Management process 189  
requirements traceability matrix  
  in Collect Requirements process 198–199  
  in Plan Procurement Management process 650  
  in Plan Quality Management process 433  
  in Validate Scope process 238  
reserve analysis  
  about 287, 290  
  in Control Costs process 375  
  in Determine Budget process 366, 368  
  in Estimate Costs process 359  
  in Monitor Risks process 619  
residual risks 615  
resistant role, stakeholders in 702–704  
resource breakdown structure  
  in Control Resources process 515  
  in Develop Schedule process 292  
  in Estimate Activity Durations process 284  
  in Estimate Activity Resources process 491  
resource calendars  
  in Acquire Resources process 493  
  in Conduct Procurements process 665  
  in Control Schedule process 323–324

- in Develop Schedule process 292
  - in Estimate Activity Durations process 284
  - in Estimate Activity Resources process 490
  - in Plan Risk Responses process 610
- resource constraints 22, 54, 56
- Resource Management knowledge area
  - about 85–89, 479
  - Acquire Resources process in 483, 492–493
  - Control Resources process in 483, 514–515
  - Develop Team process in 483, 496–506
  - Estimate Activity Resources process in 482, 490–491
  - key concepts 519–520
  - Manage Team process in 483, 508–512, 523
  - Plan Resource Management process in 482, 484–489
  - test practice question answers on 768
  - test practice questions on 753
- Resource Management plan
  - about 129, 131
  - in Control Resources process 515
  - in Determine Budget process 365
  - in Estimate Costs process 356
  - in Plan Resource Management process 484–489
  - in Plan Risk Responses process 610
- resource optimization techniques
  - about 317
  - in Control Schedule process 326–327
- resource requirements
  - change control and updating 321
  - conflict management and 509
  - in Develop Schedule process 292–293
  - in Estimate Activity Durations process 284
  - in Estimate Activity Resources process 491
  - in Estimate Costs process 356
  - in Perform Quantitative Risk Analysis process 601
  - in Plan Procurement Management process 650
- responsibility, professional. *See* professional responsibility
- reward-oriented power 93, 500
- RFI (requests for information) 660, 663
- RFP (requests for proposals) 660, 663
- risk
  - about 580
  - avoiding 832
  - figuring out impact of 607
  - looking for 592
  - ranking 594–599
  - ways of handling 581, 611–612
- risk analysis
  - qualitative 586–587, 594–599, 834
  - qualitative vs. quantitative 600
  - quantitative 587, 601–608, 834
- risk audits 620–622, 639
- risk breakdown structure (RBS) 583–584, 589
- risk categorization
  - about 594
  - in Perform Qualitative Risk Analysis process 594
  - risk breakdown structure and 584
- risk constraints 22, 54, 56
- risk data quality assessment 595
- Risk Management knowledge area
  - about 85–89
  - assumptions and 56
  - Identify Risks process in 586, 588–593
  - Implement Risk Responses process in 614–615
  - Monitor Risks process in 587, 617–624
  - Perform Qualitative Risk Analysis process in 586–587, 594–599, 834
  - Perform Quantitative Risk Analysis process in 587, 601–608, 834
  - Plan Risk Management process 582–584
  - Plan Risk Responses process in 587, 610–613
  - test practice question answers on 770
  - test practice questions on 755
- Risk Management plan
  - about 129, 131
  - in Implement Risk Responses process 614
  - in Perform Quantitative Risk Analysis process 601
  - in Plan Quality Management process 433, 437
  - in Plan Risk Management process 583
  - in Plan Risk Responses process 610
- risk probability and impact assessment 595
- risk register
  - about 588, 593
  - in Control Resources process 515
  - in Control Schedule process 324
  - in Define Scope process 201
  - in Determine Budget process 365
  - in Develop Schedule process 292
  - in Estimate Activity Durations process 284

- in Estimate Activity Resources process 490
- in Estimate Costs process 356
- in Identify Risks process 588, 593
- in Monitor Risks process 617–618
- in Perform Qualitative Risk Analysis process 594–598
- in Perform Quantitative Risk Analysis process 601, 609
- in Plan Procurement Management process 650
- in Plan Quality Management process 433
- in Plan Risk Responses process 610, 613
- risk register updates
  - in Perform Qualitative Risk Analysis process 596–598
  - in Perform Quantitative Risk Analysis process 601, 608
- risk report
  - in Identify Risks process 593
  - in Perform Quantitative Risk Analysis process 601
  - in Plan Risk Responses process 610
- risk tolerance, as enterprise environmental factor 60
- rolling wave planning 269–270
- ROM (rough order of magnitude) estimates 359, 368–369
- root cause analysis
  - in Control Quality process 442
  - in Identify Risks process 590, 593
  - in Plan Stakeholder Engagement process 699, 701
- root cause identification, in Identify Risks process 590, 593
- rough order of magnitude (ROM) estimates 359, 368–369
- rule of seven, in quality control 454, 476
- run charts 450

## S

- scatter diagrams, in Control Quality process 445
- schedule. *See* project schedule
- schedule baseline
  - about 131
  - in Control Resources process 515
  - in Control Schedule process 324
  - in Develop Schedule process 319
  - in Perform Quantitative Risk Analysis process 601
  - in Project Management plan 150
- schedule data
  - about 327
  - in Control Schedule process 323, 323–324
  - in Develop Schedule process 318
- schedule forecasts
  - in Control Schedule process 323
  - in Perform Quantitative Risk Analysis process 601
- Schedule Management knowledge area
  - about 85–89, 259
  - aggressive time lines and 262
  - Control Schedule process in 265, 323–327, 337
  - Define Activities process in 264, 268–273
  - Develop Schedule process in 265, 292–293, 316–319
  - Estimate Activity Durations process in 264, 284–290, 293, 369
  - key concepts 330–331
  - modeling techniques 316
  - Plan Schedule Management process in 264, 266–267
  - Sequence Activities process in 264, 275–283, 293
  - test practice question answers on 765
  - test practice questions on 750
- Schedule Management plan
  - about 129, 131
  - in Define Activities process 268
  - in Plan Schedule Management process 264, 267
  - in Sequence Activities process 275
- schedule models 267, 316
- schedule performance index (SPI) 326, 384–385, 387–391
- schedule variance (SV) 326, 384–385, 387, 398
- scheduling software/tools 281–282, 316, 326
- scope baseline
  - about 818
  - change control and 222–223, 231
  - in Create WBS process 212–213, 222–224
  - in Define Activities process 268
  - in Determine Budget process 365
  - in Estimate Costs process 356
  - in Plan Quality Management process 433, 437
  - in Project Management plan 131, 150
  - in Sequence Activities process 275
  - updating 173
- scope constraints 22, 54, 56

- scope creep 183, 227–228
- Scope Management knowledge area
  - about 177, 185–187, 199
  - Collect Requirements process in 187, 191–200, 210
  - Control Scope process in 187, 229–234
  - Create WBS process in 187, 210–225
  - Define Scope process in 187, 201–207, 210
  - key concepts 242–243
  - Plan Scope Management process in 187–189
  - product vs. project scope 183–184, 244
  - test practice question answers on 764
  - test practice questions on 749
  - Validate Scope process in 187, 237–241
- Scope Management plan
  - about 129, 131, 185–187, 199, 225
  - change control and 222–223, 232
  - in Collect Requirements process 191, 200
  - in Create WBS process 211
  - in Define Scope process 201
  - in Plan Scope Management process 189
  - in Validate Scope process 238
  - Project Management plan vs. 225
- secondary risks 615
- self-actualization 502
- seller proposals, in Conduct Procurements process 664, 666
- sellers
  - about 643, 652
  - at bidder conference 686
  - in Conduct Procurements process 648, 663–667
  - qualified seller list 687
  - selecting 660
- Sensitivity analysis, in Perform Quantitative Risk Analysis process 603
- Sequence Activities process
  - about 264, 275–277
  - inputs to 275
  - outputs of 283
  - tools and techniques in 276–282
- sequential phases 76
- servant leaders 92
- shared risk 611–612
- Shewhart, Walter 458
- shortcuts in projects, run projects properly by avoiding
  - 731
- simulation modeling technique 316, 603
- situational power 93
- “slack,” in exam 346
- smoothing, resolving conflicts by 511
- software development maintenance process 51–54, 62
- source selection criteria
  - in Conduct Procurements process 663–664
  - in Plan Procurement Management process 648, 651, 660–661, 663
- SOW (statement of work)
  - in Develop Project Charter process 127
  - in Conduct Procurements process 663–664
  - in Plan Procurement Management process 651, 660, 663
- SPI (schedule performance index) 326, 384–385, 387–391
- sponsors
  - about 112
  - charters and 16
  - customers vs. 126
  - strategic goals of 91
- SS (Start to Start) dependencies 280
- stages of team development 504–505, 516
- stakeholder analysis 202, 694, 696–697
- stakeholder engagement assessment matrix 699, 701–704
- Stakeholder Management knowledge area
  - about 85–89, 689
  - Identify Stakeholders process in 115, 692, 694–697
  - Manage Stakeholder Engagement process in 693, 706–709
  - Monitor Stakeholder Engagement process in 693, 710–712
  - Plan Stakeholder Engagement process in 692, 699–705
  - test practice question answers on 772
  - test practice questions on 757
- Stakeholder Management plan
  - about 129, 131
  - in Collect Requirements process 191, 197, 200
  - in Plan Stakeholder Engagement process 699, 701
  - talking to stakeholders 192
- stakeholder mapping representation 694

- stakeholder register
  - in Collect Requirements process 191
  - in Identify Stakeholders process 695–697
  - in Plan Procurement Management process 650
  - in Plan Quality Management process 433, 437
  - in Plan Risk Management process 582
  - in Plan Risk Responses process 610
  - requirements vs. expectations in 696
- stakeholders
  - accepting deliverables 152
  - assessing engagement of 702–704
  - changes impacting 57, 143
  - definition of 695
  - identifying. *See* Identify Stakeholders process
  - interviewing 192
  - managing expectations of 21
  - negative 57, 696, 702
  - operations teams as 28
  - types of power exerted by 93
  - validating project deliverables 237–238
- standards, as enterprise environmental factor 60
- Start to Start (SS) dependencies 280
- statement of work (SOW)
  - in Develop Project Charter process 127
  - in Conduct Procurements process 663–664
  - in Plan Procurement Management process 651, 660, 663
- statistical sampling, in Control Quality process 441
- storming, as stage of team development 504
- strategic and business management 90–91
- strong matrix organizations 45
- subprojects 111
- subsidiary plans 129–131
- successor tasks, in sequencing activities 275–276, 281
- summary milestone schedule 124
- supportive PMOs 24, 28, 30, 47
- supportive role, stakeholders in 702–704
- surveys. *See also* questionnaires
  - abouts 192
  - in Collect Requirements process 192
  - in Control Quality process 441
  - in Develop Team process 497

- in Identify Stakeholders process 694
- SV (schedule variance) 326, 384–385, 387, 398
- SWOT analysis, in Identify Risks process 590
- systems maintenance process
  - about 51–53
  - dividing into releases 62
  - project constraints in 54

## T

- Talent Triangle (PMI) 90–91, 98
- TCPI (to-complete performance index) 375, 386–387, 399–400
- team building
  - about 25
  - coaching vs. 28
  - in Develop Team process 483, 496–506
- team charter, in Plan Resource Management process 484–487
- team performance assessments
  - in Develop Team process 497, 506
  - in Manage Team process 508
- technical opinions, causing conflicts 509
- technical performance measurement, in Monitor Risks process 619–620
- technical project management 90–91
- “technique,” used on exam 575
- templates 201, 211, 255, 822
- testing for quality
  - about 425–426, 438
  - finding problems by 454
  - in Control Quality process 443, 452
  - in Plan Quality Management process 435
- Theory X and Theory Y 502
- three-point estimates
  - about 287
  - in Estimate Activity Durations process 287–289
- time and materials (T&M), in contracts 656–658, 662, 688
- time constraints 22, 54, 56
- time management. *See* Schedule Management knowl-

- edge area
- resources in
  - estimating 490–491
- T&M (time and materials), in contracts 656–658, 662, 688
- to-complete performance index (TCPI) 375, 386–387, 399–400
- tools and techniques in processes 81–83
- top-down (analogous) estimating
  - in Estimate Activity Durations process 287
  - in Estimate Activity Resources process 491
  - in Estimate Costs process 357–358
- training
  - in Control Quality process 440
  - in Develop Team process 497
  - in Resource Management plan 488
  - in staffing management plan 488
- transactional leaders 92
- transferred risk 581, 585, 612
- transformational leaders 92
- transmit message, in communication 538–539
- trend analysis 152, 229, 672–674
- triangular distribution 602
- triggers 599, 611, 622
- triple constraint 57
- trust-building in project teams 25, 499
- Tuckman, Bruce 504, 516

## U

- unanimity, group decision making technique 193
- unaware role, stakeholders in 702–704
- union contracts 670, 675
- upper control limit, in control charts 445
- user stories 194
- US Federal Acquisition Regulation website 656

## V

- VAC (variance at completion) 393–395

- validated defect repair, in Control Quality process 453
- Validate Scope process
  - about 187, 233, 237–241
  - inputs to 237
  - outputs of 187, 237
  - tools and techniques in 237
- value, in choosing projects 369
- variance analysis 229, 233–234
- variance at completion (VAC) 393–395
- vendor bid analysis, in Estimate Costs process 359
- verified deliverables 237, 453
- vertical bar charts 444, 488
- virtual teams
  - as organizational structure 46
  - in Acquire Resources process 492
  - in Develop Team process 497

## W

- war room 497
- watch lists 595, 599, 622, 636
- WBS dictionary
  - about 220, 224
  - change control and 232
  - in Create WBS process 220–222
  - in Define Activities process 268
  - in Determine Budget process 365
- WBS (work breakdown structure)
  - about 187, 210
  - breaking down work 212–221, 225
  - change control and 231–232
  - in activity decomposition 271–272
  - in Define Activities process 268
  - in Estimate Costs process 356
  - in requirements traceability matrix 199
  - scope baseline and 222
  - work packages in 212–215, 220–221, 224–225
- weak matrix organizations 44
- “which-comes-next” question, in exam 294–295
- “which-is-BEST” questions, in exam 208–209
- “which-is-not” question, on exam 172, 626–627
- “which one” questions, on exam 450–451

- withdrawal, resolving conflicts by 511
- work authorization system 125, 167, 173
- work breakdown structure. *See* WBS (work breakdown structure)
- work packages
  - in Create WBS process 212–215, 220–221, 224–225
  - in Define Activities process 269
  - in Estimate Costs process 356
- work performance data
  - in Control Costs process 373–374
  - in Control Procurements process 671
  - in Control Quality process 440
  - in Control Resources process 514
  - in Control Schedule process 323, 325
  - in Control Scope process 229
  - in Direct and Manage Project Work process 136, 139, 164
  - in Monitor Communications process 553–554
  - in Monitor Risks process 618
  - in Monitor Stakeholder Engagement process 710
  - in Validate Scope process 237
  - turning into work performance information 541
- work performance information
  - in Control Costs process 375
  - in Control Procurements process 649, 671–672
  - in Control Quality process 439, 453
  - in Control Resources process 515
  - in Control Schedule process 323, 325, 327
  - in Control Scope process 229
  - in Direct and Manage Project Work process 137
  - in Monitor and Control Project Work process 144
  - in Monitor Communications process 557
  - in Monitor Risks process 624
  - in Monitor Stakeholder Engagement process 712
  - in Validate Scope process 237
  - work performance data turning into 541
- work performance reports
  - in Manage Communications process 546
  - in Manage Team process 508
  - in Monitor and Control Project Work process 144
  - in Monitor Risks process 618
  - in Perform Integrated Change Control process 145