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Fourth Edition

Michael G. Solomon

PMP® Exam Cram: Project Management Professional, Fourth Edition

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About the Author

Michael G. Solomon, CISSP, PMP, CISM, GSEC, is a full-time security and project management speaker, consultant, and trainer with more than 20 years of industry experience. He holds an MS in mathematics and computer science from Emory University (1998) and a BS in computer science from Kennesaw State University (1987). A former college instructor, Michael has written several IT and project management books, including *PMP Exam Prep Course* (LearnKey, 2009), *PMP ExamCram2* (Que, 2005), *Information Security Illuminated* (Jones & Bartlett, 2005), *Security+ Lab Guide* (Sybex, 2005), and *Computer Forensics JumpStart* (Sybex, 2005).

Dedication

The content of this book would not be possible without the unyielding support of my family. I'd like to dedicate this work to three people. First, my best friend and wife, Stacey, who constantly brings out more in me than I thought possible. Second, two guys who challenge me each day to be the best I can be—my sons, Noah and Isaac. Thanks for letting me take over the dining room table. :>)

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As the reader of this book, *you* are our most important critic and commentator. We value your opinion and want to know what we're doing right, what we could do better, what areas you'd like to see us publish in, and any other words of wisdom you're willing to pass our way.

As an associate publisher for Que Publishing, I welcome your comments. You can email or write me directly to let me know what you did or didn't like about this book—as well as what we can do to make our books better.

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Introduction

The Project Management Professional (PMP) certification is a valued asset in the ever-evolving professional project management field. PMP certification in the professional arena ensures employers are hiring a project manager with thorough, tested knowledge in project management principles, years of hands-on, specific experience performing project management tasks, and a commitment to continuing education in the field of project management. Among fellow PMP-certified practitioners, PMP certification gives colleagues a commonality of experience and provides opportunities for networking. PMPs share the same frame of reference in project management, regardless of the field of endeavor.

PMP-certified individuals work in a wide array of industries, from aerospace to telecommunications. Many hiring supervisors specify PMP certification as a preferred skill set when soliciting project managers.

Both private and public sector employers recognize the value a PMP-certified employee brings to a project. Corporations embrace the consistent application of project management methodologies for initiating, planning, executing, controlling, and closing projects. The Project Management Institute (PMI) project framework is highly praised by companies and government entities whether they are engaged in large-scale development projects or simply undertaking small, reengineering initiatives. In both scenarios, the PMI approach offers a consistent project management methodology that can be tailored to the size and complexity of the project. This framework coupled with the PMP certification program ensures that PMP-certified practitioners are in high demand in the workforce.

PMI has brought the art and science of project management full circle through its PMP certification program and methodology, the Project Management Body of Knowledge (PMBOK). PMI seeks to evaluate project management professionals through the application of the certification process to ensure a dependable workforce with solid credentials. The PMP certification examination tests for comprehensive project management knowledge as well as a thorough understanding of the PMBOK. This approach ensures that PMP-certified practitioners have comparable qualifications and strategic competencies in all aspects of project management. PMI advocates the practice of project management as a discipline, not unlike engineering or any other precise, science-based course of study. As such, PMI developed the PMBOK as a comprehensive framework of best practices for the implementation of project management regardless of the specific industry.

The Project Management Institute

PMI is the premier project management organization in the world. It is a nonprofit, educational group intent on advancing the practice of project management through the promotion and promulgation of widely accepted standards. It has more than 420,000 members in more than 170 countries with more than 250 charter-based local chapters. This is quite a feat for an organization that started in 1969 with five volunteers!

PMI establishes professional standards, provides continuing education opportunities for members, engages in industry-specific research, and offers certifications aimed at unifying and strengthening the discipline of project management.

If you consider yourself a project management professional and want to earn your PMP, consider joining PMI. You will receive a reduced rate when sitting for your PMP examination as well as all the other benefits of PMI membership, including seminars, workshops, and other continuing education opportunities. These benefits include a community of peers that provides valuable information exchange about industry trends and access to the latest knowledge through a monthly magazine and quarterly research journals. To learn more about PMI and membership, visit PMI's website at www.pmi.org.

What's New in the *PMBOK Guide*, Fourth Edition

PMI as a member-driven organization is continually evolving to meet the needs of its membership and the project management profession. To this end, the PMBOK has been revised to incorporate feedback from members and to reflect current industry practice and developments since the last edition. For those readers familiar with the last edition—the *PMBOK Guide*, Third Edition—you will want to acquaint yourself with the changes in the Fourth Edition. This is particularly important if you used an earlier edition of the PMBOK to prepare for the PMP certification examination.

The new edition of the PMBOK pursues greater consistency and clarity over the Third Edition. The Fourth Edition completes the transition to a noun-verb format for all process names. Additionally, introductions and many descriptions have been rewritten to be more consistent throughout the PMBOK. Enterprise Environmental Factors are more clearly defined. This particular change helps emphasize the difference from Organizational Process Assets.

New material has been added to reflect changes, adaptations, and additions to tools and techniques used in the current practice of project management. The number of processes decreased from 44 to 42. Two processes were deleted, two processes were added, and six processes were combined into four processes. The added processes are

- ▶ Collect Requirements—Section 5.1
- ▶ Identify Stakeholders—Section 10.1

The deleted processes are

- ▶ Develop Preliminary Scope Statement—Section 4.2
- ▶ Plan Scope—Section 5.1

The changed processes are

- ▶ Close Project—Section 4.7 changed to Close Project or Phase—Section 4.6
- ▶ Manage Project Team—Section 9.4 changed from controlling to executing
- ▶ Manage Stakeholders—Section 10.4 changed to Manage Stakeholder Expectations—also changed from controlling to executing
- ▶ Plan Purchases and Acquisitions—Section 12.1 and Plan Contracting—Section 12.2 changed to Plan Procurements—Section 12.1
- ▶ Request Seller Responses—Section 12.3 and Select Sellers—Section 12.4 changed to Conduct Procurements—Section 12.2

All the process inputs, tools, techniques, and outputs have been revised and updated to support improved integration and process mapping. In addition, project management processes have been mapped to show process integration. Also, process flow diagrams have been added to each process.

All these changes are the result of input from PMPs that was used to streamline and clarify the PMBOK. A complete listing of all changes to the *PMBOK Guide*, Fourth Edition is available in Appendix A of the PMBOK, and we also discuss these changes in more detail in Chapter 1, “Project Management Framework Fundamentals.” Each change is identified in its respective chapter in the PMBOK.

The new PMP certification examination went into effect on June 30, 2009 and is based on the *PMBOK Guide*, Fourth Edition.

The PMP Certification Process

PMP certification involves a number of steps, beginning with an application to the PMI that details the prospective PMP candidate's qualifications, experience, and training. After a candidate has received approval from PMI to sit for the examination, he or she registers for the examination and must comply with various procedures set forth for the actual examination. The PMP certification process concludes with passage of the examination and issuance of PMP credentials by PMI.

Registering for the PMP Certification Exam

Prior to actually taking a PMP certification examination, you must submit an application to PMI for approval, including detailed documentation supporting your professional project management experience and training in specific areas of expertise.

Application Submission

An application is included in the *PMP Credential Handbook*, available on PMI's website. This handbook provides detailed information on every step of the application process. If you believe you meet the requirements necessary for PMP candidates, you are ready to apply to PMI.

Note

Read the *PMP Credential Handbook* prior to applying for PMP certification. Much of the information in this section can be found in the PMP Credential Handbook. You can get it at www.pmi.org/pdf/pdc_pmphandbook.pdf.

Candidates for PMP certification must meet both the educational and experience requirements for one of two categories. Verification forms showing compliance with these criteria must be submitted with your application for either category. Both categories are detailed in Tables I.1 and I.2.

Category One, shown in Table I.1, is for applicants possessing a bachelor's degree or equivalent. In this category, less personal project management experience is necessary, although you must possess a minimum of 4,500 hours of hands-on project management activity. Category Two, shown in Table I.2, is ideal for candidates with longer work histories who do not hold a university

degree. In this category, you can use 7,500 hours of project management performance to substitute for a college degree.

TABLE I.1 **Category One Applicants**

Criteria	Minimum	Explanation
Bachelor's degree		Or equivalent from a university.
Personal project management experience within five process groups	4,500 hours	Within the last three years from the date of application.
Nonoverlapping months of personal project management experience	36 months	Individual months count toward the 36 months requirement once, even if you worked on multiple projects during the same month.
Specific instruction that addresses learning objectives in project management	35 contact hours	Must include instruction on project quality, scope, time, cost, human resources, communications, risk, procurement, and integration management.

TABLE I.2 **Category Two Applicants**

Criteria	Minimum	Explanation
Personal project management experience within five process groups	7,500 hours	Within the last five years from the date of application.
Nonoverlapping months of personal project management experience	60 months	Individual months count toward the 60 months requirement once, even if you worked on multiple projects during the same month.
Specific instruction that addresses learning objectives in project management	35 contact hours	Must include instruction on project quality, scope, time, cost, human resources, communications, risk, procurement, and integration management.

Additional information related to the educational and experience mandates for PMP certification eligibility are provided in the *PMP Credential Handbook*.

Application Fee and PMI Membership

The application also requires an application fee tiered for PMI members and non-PMI member with the later paying a higher rate. For computer-based testing (CBT), members of PMI pay \$405 for the examination while non-members are charged \$555. The prices for paper-based testing (PBT) are \$250 for PMI members and \$400 for non-members. The annual cost for PMI

membership is \$119, which means that membership is actually cheaper than the difference between the examination cost for non-members and members. The total cost for joining PMI and sitting for PMI examination is \$524. (This does not include chapter, special interest groups, and college memberships, which require additional fees.)

Audit

A random sample of applicants are chosen for audit prior to issuing eligibility letters. If you are selected for an audit, you are asked to provide additional information supporting your work experience, including supporting documentation from your supervisors that details your work on specific projects.

Examination Administration

The PMP certification examination is offered globally. Computer-based administration is available within North America and other countries through Prometric. In addition, a paper-pencil examination is offered at specific locations (see the *PMP Credential Handbook* for more information). A complete list of testing sites and vendors is available on the PMI website.

Prometric requires a PMI Identification Code to register. This code is provided to PMP candidates by PMI when approval is granted to sit for an examination. After you've been approved to sit for the exam, you can register online or use Prometric's interactive voice response telephone registration system.

Specific instructions for registering are also included in your approval letter from PMI.

To learn more about Prometric and its administration of the PMP certification examination, visit Prometric's website at www.prometric.com.

After your application has been approved by PMI, passing the actual PMP certification examination is your final step in becoming a PMP.

Re-Examination

Candidates who do not pass the PMP certification examination may apply to the PMI for re-examination using a form on PMI's website. This form must be submitted within one year of your original examination date.

Cancellation

Candidates within North America can cancel and reschedule an examination two business days prior to the scheduled testing. Candidates outside North America must cancel at least seven calendar days in advance.

Candidates unable to appear for a scheduled examination due to a medical emergency must submit written notification to the PMI Certification Program Department within 72 hours of the scheduled exam. A rescheduling fee is charged. All circumstances are reviewed on a case-by-case basis.

Refund

A refund can be obtained by written request to the PMI one month before your exam eligibility expires. (You have one year from the date of your eligibility letter in which to take the PMP certification examination.) A \$100 processing fee will be retained from your original application fee.

Arriving at the Exam Site

To be admitted into the test site you are required to present a form of identification that includes a picture and a signature (preferably your state driver's license). Your approval letter from PMI and your registration confirmation from Prometric detail what forms of identification are acceptable. You are not allowed to bring anything to the exam. An examiner provides you with a calculator and scrap paper.

Wear comfortable clothing and layer your clothing. You spend up to four hours in the examination room, and your ability to concentrate and focus on the task at hand can be dramatically affected by the room temperature and your sense of comfort.

Get to your exam site early so you can review the PMP Cram Sheet provided in this book and any additional notes you create to quickly focus your mind on specific topics prior to the test. An early arrival ensures you have ample time to relax and mentally prepare for the examination.

In the Exam Room

Do not start the examination immediately. Sit down at your computer terminal and acclimate to the examination room and your immediate environment. Organize your peripherals for your comfort. Are the mouse and keyboard set correctly? Does your chair need to be adjusted? Is the monitor at the correct eye level for you? A few minor corrections can make all the difference during the next few hours.

Prior to the start of the examination, the test administrator will review any specific instructions and inform you what is and is not allowed during the examination period. You are allowed to take breaks and use the restrooms as necessary.

Pretest Tutorial

Prior to beginning the examination you are provided with a briefing and 15-minute online tutorial designed to familiarize you with the computer and operational procedures for the test. If you have taken a computer-based test previously, or have participated in computer-based training, you will feel comfortable in this environment. The pretest tutorial will show you how to navigate through the test using your computer mouse. You'll be shown how to select an answer to a question, move forward to a new question, return to a previous question, and similar functions. The clock begins after you've completed the tutorial, so if you feel comfortable with the information presented, move forward to the actual examination.

Time Allotted for the Test

You have up to four hours to complete the examination. Pace yourself. There are 200 multiple-choice questions, which breaks down to 50 questions per hour and a little more than one minute per question. Not all questions require equal time. Don't agonize over every question; read the question and each possible answer in its entirety prior to selecting an answer.

Answer the PMI Way

More than one answer can seem plausible and correct. You are not asked to select the correct answer but rather the *best* answer from those provided. Attempt to rule out any obviously wrong choices immediately to narrow your field of best answers. You should strive to select the best answer based on how you believe PMI and the PMBOK would respond given the question and not necessarily from your own project management experience.

ExamAlert

It cannot be emphasized enough that the PMI answer is the correct answer. You might do a task a certain way in real practice, and that method might even be one of the answer choices, but for purposes of the PMP certification examination, the PMBOK answer is the only correct answer. Don't get caught off guard here!

The best answer as determined by PMI is provided as one of the four possible responses. Be suspicious of answers offering definitive responses like *never* and *always*. Some answers might tout non-PMI methods and reflect common project management misconceptions. Some answers might offer correct information, but the information is not pertinent to the question at hand. Similarly, some questions might contain factually correct information that has no bearing on the possible answers.

Pace Yourself During the Exam

After the first hour you will be able to determine your speed and make adjustments as necessary. It is important to be aware of your time so you won't have to rush at the end to complete the examination. You should leave adequate time to review any responses you were unsure of and to return to unanswered questions. If you are spending more than one minute on a question, it is better to skip over the question and mark it for review later than to agonize over the question and lose the opportunity to answer other questions you know the answers to.

The examination allows you to mark questions for later review and make multiple passes through the exam. Mark every question you are unsure of even if you have selected an answer. This approach saves you time when you review your responses because you will not need to review any unmarked questions. If, on a second review, you determine an answer, unmark the question. Continue this process of going through all the marked questions until you have answered all the questions or are nearing the end of the allotted time period.

Save the last 20 minutes or so of the test to finalize any unmarked answers and ensure you have provided an answer to each question. Try to make a best guess by ruling out definitely wrong answers, as discussed earlier, but do not give up. Select an answer for each question—even if you have to guess. There is no penalty for guessing.

ExamAlert

Remember, there is no penalty for guessing. So, be sure all questions have been answered—even if you have to guess. You at least give yourself an opportunity to get it right if you have an answer marked!

Throughout the testing period, keep an eye on the clock or use your watch timer to remind you at discreet intervals to take a break. It is amazing what simply standing up and stretching for a few minutes can do for your concentration.

At the conclusion of the test, candidates can opt to complete a satisfaction survey.

Exam Room Surveillance

You might be under surveillance during the examination. Some testing centers use both videotape and human monitors to ensure the validity of the test.

After you get underway with your examination and start to concentrate on the task at hand, you will be unaware of any other activity. Any monitoring by the testing center will be unobtrusive.

Grading Your Exam

At the end of the examination period, the administrator immediately scores your exam and provide you with a printed copy of your results indicating pass or fail status. The scores are submitted to PMI by the end of the business day. If you have passed the examination, PMI will mail a PMP credential packet to you within six to eight weeks.

If you are taking a paper-pencil examination, answer sheets are scored when they are returned to the test administrator. You can request that your exam be hand scored for an additional \$45 fee.

Any questions regarding your score from either the computer-based testing or paper-pencil examination should be addressed to PMI's exam supervisor.

About This Book

This book offers you tools, techniques, tips, and other information to assist you in passing the PMP certification examination and becoming PMP certified. The emphasis is on reconciling your approach to the exam with PMI's viewpoint and perspective on the examination. This book is not a guide to general project management but rather a specific study tool aimed at distilling PMI's approach to project management as set forth in the *PMBOK Guide*, Fourth Edition. Project initiation, planning, execution, control, and closing are the core topics in this book and are parallel to those same key areas in the PMBOK.

Using This Book and CD

This book and CD prepare you to pass the PMP certification examination by highlighting important project management principles, providing insight into proven test-taking strategies, emphasizing key information you can expect to see on the examination, and providing exam practice questions. You get guidance and clarification on PMBOK concepts and understand their relationship to other project management methodologies. You have many opportunities to apply your knowledge through practice examinations and test questions.

There is a practice examination offered in this book as well as practice questions at the beginning and end of each section. The Cram Saver questions before each section help you decide how well you already know the material. If you

answer all of the Cram Saver questions correctly you can choose to skim a section before going to its Cram Quiz at the end. After you complete a section, answer the Cram Quiz questions to determine how well you comprehended the information in the section. If you missed more than one or two questions, work your way through the section again, focusing on the concepts that you missed.

Similarly, you can test your knowledge and evaluate your level of preparation for the PMP certification examination by taking the practice exam under real conditions. After you've worked your way through this book, take the practice exam. Evaluate your results and then reread the chapters of this book related to those areas of the practice examination where you were less certain or did not select the correct answer.

Finally, the Cram Sheet condenses all the concepts, knowledge areas, processes groups, terminology, and formulates presented throughout this book into a tear-out sheet you can take with you to the exam site for quick review prior to entering the testing facility. The Cram Sheet is also a valuable tool for use in quick daily reviews after you have completed this book. Review the Cram Sheet every day; if there are any terms that seem vague then go to that particular topic in the book for a refresher.

Chapter Formats

Each chapter follows a regular structure, along with graphical cues about especially important or useful material. The structure of a typical chapter is as follows:

- ▶ **Topical coverage**—Each chapter begins by listing the exam topics covered in that chapter.
- ▶ **Cram Saver questions**—These are a short list of questions related to the specific section topic. Each question has a following explanation of both correct and incorrect answers. The Cram Saver questions help you decide how well you already know the material covered in the section.
- ▶ **Exam Alerts**—Throughout the topical coverage section, Exam Alerts highlight material most likely to appear on the exam by using a special exam alert layout that looks like this:

ExamAlert

This is what an Exam Alert looks like. An Exam Alert stresses concepts, terms, or activities that are likely to appear in one or more exam questions. For that reason, any information offset in Exam Alert format is worthy of extra attentiveness on your part.

Even if material isn't flagged as an Exam Alert, all the content in this book is associated in some way with test-related material. What appears in the chapter content is critical knowledge.

- ▶ **Cram Quiz questions**—Each section ends with a short list of test questions related to the specific topics of that section. Each question has a following explanation of both correct and incorrect answers. These practice questions highlight the most important areas on the exam.

The bulk of the book follows this chapter structure, but there are a few other important elements:

- ▶ **PMP Practice Exam**—There is a full practice test found at the end of this book. The questions are designed to challenge your knowledge and readiness for the PMP exam.
- ▶ **Answers to the PMP Practice Exam**—This provides the answers to the practice exam, complete with explanations of both the correct responses and the incorrect ones.
- ▶ **Cram Sheet**—This appears as a tear-out sheet, inside the front cover. It is a valuable tool that represents a collection of the most critical items you should memorize before taking the test. Remember, you can dump this information out of your head onto the margins of your test booklet or scratch paper as soon as you enter the testing room.

You might want to look at the Cram Sheet in your car or in the lobby of the testing center just before you walk into the testing center. The Cram Sheet is divided under headings, so you can review the appropriate parts just before the test.

Using the CD-ROM

The CD contains two elements that help you prepare for the PMP exam:

- ▶ **Exam Practice Engine**—This exam engine software includes all of the questions from the book's practice exam in electronic format. You can take a full, timed exam or choose to focus on particular topics in study mode. Use your feedback and the topics listed in the book to zero in on the areas where you need more study.
- ▶ **Cram Quizzes**—All of the book's Cram Quizzes and their answers have been compiled into one convenient document on the CD for you to have another portable practice option.

About the PMP Exam

The PMP certification examination consists of 200 four-option, multiple-choice questions developed by PMPs. According to the *PMI Credential Handbook*, “The passing score for all PMI credential examinations is determined by sound psychometric analysis” and is not based on a fixed number of correct answers.

There are no prescribed guidelines for a course of study because the examination is objective in scope and intended to test your knowledge of the project management field; however, emphasis is strongly placed on the PMBOK.

Do note that the PMP exam includes a performance requirement specific to professional responsibility in the practice of project management. The PMI Code of Ethics and Professional Conduct is not a component of the PMBOK; rather it is a standalone document available on the PMI website that you will be tested on as part of the examination. The PMI Code of Ethics and Professional Conduct can also be found in the *PMP Credential Handbook*.

The PMP certification examination tests for professional responsibility and five process groups:

- ▶ Initiating
- ▶ Planning
- ▶ Executing
- ▶ Monitoring and Controlling
- ▶ Closing

The most significant knowledge areas are planning, executing, and monitoring and controlling:

- ▶ **Planning**—This knowledge area accounts for 23% of the test material.
- ▶ **Executing**—This knowledge area accounts for 27% of the test material.
- ▶ **Monitoring and Controlling**—This knowledge area accounts for 21% of the test material.

Overall, 71% of the examination deals exclusively with planning, executing, and monitoring and controlling projects.

Of the six exam domains, professional and social responsibility accounts for 9% of the PMP certification examination.

Initiating and closing represent the 11% and 9% of the exam, respectively.

A new PMP certification examination went into effect on June 30, 2009, based on the *PMBOK Guide*, Fourth Edition.

PMP Exam Topics

Table I.3 lists all of the PMP exam topics covered in this book. Use this table to find where a topic is covered in the book. For example, if your CD exam feedback indicates you scored poorly in a particular topic, find that topic in this table so you can find where it is covered in the book.

In general, the chapters are organized by process group. Within each process group the sections are organized by knowledge area. As much as possible, the flow is consistent with the project flow defined in the PMBOK. The numbers in the section references in the following table and throughout the book refer to the specific sections in the *PMBOK Guide*, Fourth edition. At any time you can go directly to the PMBOK to see the section that corresponds to the topic in this book that you are reading.

TABLE I.3 **PMP Exam Topics**

Topic	Chapter
Understand the Project Management Framework	1
Explain Organizational and Environmental Factors	1
Describe the Project Life Cycle	1
Initiating Process Group—3.3	2
Develop Project Charter—4.1	2
Identify Stakeholders—10.1	2
Planning Process Group—3.4	3
Develop the Project Management Plan—4.2	3
Collect Requirements—5.1	3
Define Scope—5.2	3
Create Work Breakdown Structure—5.3	3
Define Activities —6.1	3
Sequence Activities—6.2	3
Estimate Activity Resources—6.3	3
Estimate Activity Durations—6.4	3
Develop Schedule —6.5	3
Estimate Costs—7.1	3
Determine Budget—7.2	3
Plan Quality—8.1	4
Develop Human Resource Plan—9.1	4

TABLE I.3 **Continued**

Topic	Chapter
Plan Communications—10.2	4
Plan Risk Management—11.1	4
Identify Risks—11.2	4
Perform Qualitative Risk Assessment—11.3	4
Perform Quantitative Risk Assessment—11.4	4
Plan Risk Responses—11.5	4
Plan Procurements—12.1	4
Direct and Manage Project Execution—4.3	5
Perform Quality Assurance—8.2	5
Acquire Project Team—9.2	5
Develop Project Team—9.3	5
Manage Project Team—9.4	5
Distribute Information—10.3	5
Manage Stakeholder Expectations—10.4	5
Conduct Procurements—12.2	5
Monitor and Control Project—4.4	6
Perform Integrated Change Control—4.5	6
Verify Scope—5.4	6
Control Scope—5.5	6
Control Schedule—6.6	6
Control Costs—7.3	6
Perform Quality Control—8.3	6
Report Performance—10.5	6
Monitor and Control Risks—11.6	6
Administer Procurements—12.3	6
Close Project or Phase—4.6	7
Close Procurements—12.4	7
PMI Code of Ethics and Professional Conduct	8
Responsibility	8
Respect	8
Fairness	8
Honesty	8

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CHAPTER 4

Explore More Elements of Project Planning

This chapter covers the following PMP exam topics:

- ▶ Plan Quality—8.1
- ▶ Develop Human Resource Plan—9.1
- ▶ Plan Communications—10.2
- ▶ Plan Risk Management—11.1
- ▶ Identify Risks—11.2
- ▶ Perform Qualitative Risk Analysis—11.3
- ▶ Perform Quantitative Risk Analysis—11.4
- ▶ Plan Risk Responses—11.5
- ▶ Plan Procurements—12.1

(For more information on the PMP exam topics, see “About the PMP Exam” in the introduction.)

The main components of the project management plan are the primary drivers that establish key project baselines (scope, schedule, and cost). Additional planning processes are equally important and establish the mechanisms to apply quality, stakeholder assignment, project information management (communication), reality (risk), and procurement assignment to those baselines. These plans include items such as the following:

- ▶ **Quality management plan**—This plan describes how the team will implement the quality policy. It addresses quality control, quality assurance, and continuous improvement.
- ▶ **Human Resources management plan**—Describes when and how Human Resource requirements will be met, including acquisition approach, timing, training, and recognition.
- ▶ **Communication management plan**—Describes how communication requirements will be met, including stakeholder communication, communication responsibility, communication timing, and techniques.
- ▶ **Risk management plan**—This plan describes how risk management activities will be performed, including methodology, responsibility, cost, timing, and definitions for risk categories, probabilities, and impacts.
- ▶ **Procurement management plan**—This plan describes how procurement activities will be performed, including contract types and responsibilities.

Quality Management

► Plan Quality—8.1

CramSaver

If you can correctly answer these questions before going through this section, save time by skimming the Exam Alerts in this section and then completing the Cram Quiz at the end of the section.

1. Who has overall responsibility for quality planning?
 - A. Project manager
 - B. Quality manager
 - C. Senior management
 - D. Project planner
2. Which of the following best describes the plan quality process?
 - A. Auditing quality requirements and the results from quality control measurements
 - B. Monitoring and recording results of executing quality activities
 - C. Identify quality requirements and/or standards for the project
 - D. Identify poor quality process or product quality

Answers

1. Answer A is correct. The project manager has overall responsibility. All other members of the project team assist in the process.
2. Answer C is correct. The Plan Quality process is the process of identifying quality requirements and/or standards to the project and product. Answer A is incorrect because it describes the Perform Quality Assurance process. Answer B is incorrect because it describes the Perform Quality Control process. Answer D is incorrect because it describes quality control activities.

Although the project manager has overall responsibility for quality, the entire project team plays a role in quality management. Every member of the project team must understand the importance of contributions, accept ownership for problems, be committed to monitoring and improving performance, and be willing to openly discuss issues among team members.

Although specific techniques and measures apply to the product being produced, the overall project quality management approach applies to any project and is relevant to the project as well as the product being produced.

ExamAlert

Understand the difference between *quality* and *grade*. Quality is a measure of how well the characteristics match requirements. Grade is assigned based on the characteristics that a product or service might have. So a product might be of low grade, meaning it has limited features, but might still be acceptable. Low quality is never acceptable.

Also understand the difference between *precision* and *accuracy*. According to the PMBOK, “Precision means the values of repeated measurements are clustered and have little scatter. Accuracy means that the measured value is very close to the true value. Precise measurements are not necessarily accurate. A very accurate measurement is not necessarily precise.”

The terms *quality* and *grade* are often confused. They are separate concepts and the PMBOK clearly notes their differences. Table 4.1 compares low and high values of quality and grade.

TABLE 4.1 **Quality and Grade**

	Quality	Grade
Low	Errors or defects that affect the usability of the product	Few options or features
High	No obvious defects, usable product	Many options and features

The plan quality process has a number of key inputs, many of which originate from other initiating and planning processes. Table 4.2 shows the inputs, tools and techniques, and outputs for the plan quality process.

TABLE 4.2 **Plan Quality Inputs, Tools and Techniques, and Outputs**

Inputs	Tools and Techniques	Outputs
Scope baseline	Cost-benefit analysis	Quality management plan
Stakeholder register	Cost of quality	Quality metrics
Cost performance baseline	Control charts	Quality checklists
Schedule baseline	Benchmarking	Process improvement plan
Risk register	Design of experiments	Project document updates
Enterprise environmental factors	Statistical sampling	
Organizational process assets	Flowcharting	
	Proprietary quality management methodologies	
	Additional quality planning tools	

The plan quality process incorporates various quality concepts with which you should be familiar. The following list highlights important key concepts in PMI's quality management:

- ▶ The cost of preventing mistakes is generally less than the cost of repairing them.
- ▶ In order to be successful, management support for the quality program must exist.
- ▶ Quality is tied closely to the scope-cost-time constraints; without quality these objectives cannot be met successfully.
- ▶ The cost of quality refers to the cost to implement a quality program.
- ▶ Understanding and managing customer expectations is important to a successful quality program.
- ▶ The quality program should emphasize continuous improvement.
- ▶ There is a close alignment between the quality approach and the overall project management approach on a project.

ExamAlert

Memorize PMI's definition of quality: "The degree to which a set of inherent characteristics fulfill requirements."

Quality Theories and PMI Quality Management Approach

The quality management approach presented in the PMBOK is intended to be compatible with other standards, including the International Organization for Standardization (ISO), Total Quality Management (TQM), Six Sigma, and others.

Exam questions on this topic are frequently taken from sources other than the PMBOK. Table 4.3 identifies some of the more popular quality theories.

TABLE 4.3 **Common Quality Theories**

Theory Name	Pioneers	Description
Continuous Improvement or Kaizen	Masaaki Imai, F.W. Taylor, and others	Processes are improved, mastered, and then further improvement is identified. Includes quality circles as a group-oriented means of developing ideas.

TABLE 4.3 Continued

Theory Name	Pioneers	Description
The Deming Cycle or Plan-Do-Check-Act	Dr. W. Edward Deming	Similar to Kaizen, an improvement is planned, completed, measured, and then further improvement acted upon.
Six Sigma	Based on statistical work by Joseph Juran	A statistical measure of quality equating to 3.4 defects per million items. If defects can be measured, a process can be put into place to eliminate them.
Total Quality Management (TQM)	Dr. W. Edward Deming	Fourteen points of management that call for awareness of quality in all processes.
Malcolm Baldrige Award	Howard Malcolm Baldrige	An award established by the U.S. Congress to promote quality awareness.
OPM3 (Organizational Project Management Maturity Model)	Project Management Institute (PMI)	Assess an organization's project management maturity level against general best practices.
CMM (capability maturity model)	Software Engineering Institute (SEI)	Five levels of capability exist: initial, repeatable, defined, managed, and optimized.

The Plan-Do-Check-Act (PDCA) Cycle

PMI identifies the Plan-Do-Check-Act (PDCA) cycle, also referred to as the Deming Cycle, as both a quality tool and the underlying concept for interaction among project management processes. First, an improvement is planned. Next, the improvement is carried out and measured. The results are checked and finally acted upon. Acting upon the improvement might mean making the improvement a standard, further modification to the improvement, or abandoning the improvement. Figure 4.1 demonstrates the PDCA cycle.

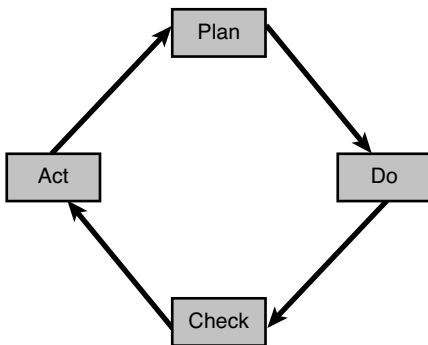


FIGURE 4.1 The Plan-Do-Check-Act cycle.

Quality Approaches and Project Management

Quality approaches align with project management approaches in a number of areas, including achieving customer satisfaction, preventing defects instead of inspecting for them, management support for quality, and continuous improvement. Table 4.4 provides additional detail.

TABLE 4.4 **Principles Common to Quality Management and Project Management**

Alignment Area	Description
Customer satisfaction	Customer requirements are met through a thorough understanding and management of expectations.
Prevention over inspection	It is cheaper to prevent defects than repair ones that are identified in inspections.
Management responsibility	Management must provide the support and resources for a quality program to be successful.
Continuous improvement	Processes are improved, mastered, and then further improvement is identified. Includes quality circles as a group-oriented means of developing ideas.

The Cost of Quality

The *cost of quality (COQ)* is a term that refers to the cost to produce a product or service that meets requirements. Part of the cost is rework when requirements aren't met. An effective quality program reduces cost from rework.

The three primary types of cost associated with the cost of quality are

- ▶ Prevention costs
- ▶ Inspection costs
- ▶ Failure costs (internal and external)

Addressing prevention and inspection can be viewed as addressing the cost of conformance. This includes training, prototyping, design reviews, and testing. Failure costs (the cost of nonconformance) includes bug fixes, rework, cost of late delivery, and customer complaints.

Differences Among Quality Planning, Quality Assurance, Quality Control

One area of confusion, especially among project managers without a background in quality, is the difference between the three processes in quality management. Table 4.5 helps clarify these concepts.

TABLE 4.5 Summary of Quality Management Processes

	Quality Planning	Quality Assurance	Quality Control
Process Group	Planning	Executing	Monitoring/controlling
Emphasis	Planning	Implementing	Measuring and adjusting
Key Activities	Determining relevant quality standards	Applying planned activities	Monitoring results
	Determining how to apply standards	Ensuring continuous improvement	Identifying ways to eliminate unwanted results
Key Outputs	Quality management plan	Requested changes	QC measurements
	Quality improvement plan	Recommended corrective action	Validated defect repair
	Quality metrics		Recommended corrective and preventive actions
	Quality checklist		Requested changes
			Recommended defect repair
			Validated deliverables

Control Charts and Other Tools

You'll see the term *control chart* mentioned in several areas of the PMBOK. A control chart is simply a graph that depicts upper and lower control limits, upper and lower specification limits, and actual performance data collected from project activities. Upper and lower specification limits correspond to the requirements from the project contract. The upper and lower control limits are placed at points at which action must be taken to avoid exceeding the specification limits. If performance data exceeds the upper control limit the project manager can implement appropriate changes to bring the quality back in line before the upper specification limit is exceeded and the project is in violation of the contract. The graph makes it easy to see when actual performance exceeds the predefined upper or lower limits. Figure 4.2 shows an example of a control chart.

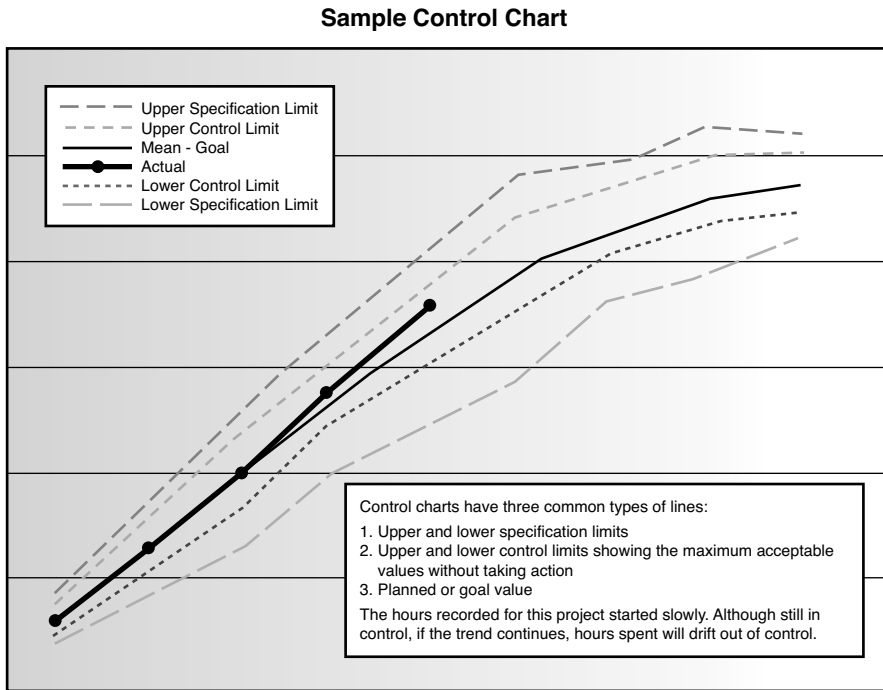


FIGURE 4.2 Sample Control Chart.

Control charts are not the only tools at your disposal. As a project manager you also have access to quality planning tools such as

- ▶ **Brainstorming**—Generally an open forum that includes knowledgeable people in appropriate disciplines and encourages free expression of ideas.
- ▶ **Affinity diagrams**—Diagram to help identify logical groupings based on similar attributes.
- ▶ **Force field analysis**—Visual depictions of forces that favor and oppose change.
- ▶ **Nominal group techniques**—Small brainstorming groups where output is reviewed by a larger group.
- ▶ **Matrix diagrams**—Multiple groups of information presented to show relationships between factors, causes, and objectives. Each intersection of a row and column describes a relationship between items placed in the row and in the column.
- ▶ **Prioritization matrices**—Provides a method of ranking sets of problems by importance.

Cram Quiz

Answer these questions. The answers follow the last question. If you cannot answer these questions correctly, consider reading this section again until you can.

1. Which of the following is not a responsibility of the project manager?
 - A. Acquiring HR resources for the project team
 - B. Managing overall responsibility for quality in the organization
 - C. Overall responsibility for risk on the project
 - D. Overall responsibility for customer satisfaction on the project
2. Which subsidiary plan/component documents how the organization will achieve the quality objectives for the project?
 - A. Quality management plan
 - B. Quality baseline
 - C. Process improvement plan
 - D. Quality control checklist
3. Which quality theory outlines 14 points and calls for quality awareness at all levels of the organization?
 - A. CMM
 - B. Kaizen
 - C. TQM
 - D. Malcolm Baldrige

Cram Quiz Answers

1. Answer B is correct. Senior management is responsible for quality in the organization. The project manager is responsible for product quality on the project.
 2. Answer A is correct. The quality management plan lists which quality policies apply to the project and documents how the quality objectives will be met. The quality baseline documents the quality objectives for the project. The process improvement plan documents how processes will be analyzed for improvement. A quality control checklist is used to ensure steps of a process are completed.
 3. Answer C is correct. Total Quality Management (TQM) uses 14 points and calls for quality awareness from everyone involved. CMM outlines five levels of process maturity. Kaizen, or continuous improvement, calls for a cycle of improvements to processes. Malcolm Baldrige is an award for quality awareness.
-

Human Resource Management

► Develop Human Resource Plan—9.1

CramSaver

If you can correctly answer these questions before going through this section, save time by skimming the Exam Alerts in this section and then completing the Cram Quiz at the end of the section.

1. Which of the following documents provide a graphical representation of project resources, organized by type?
 - A. Organizational Breakdown Structure
 - B. Risk Breakdown Structure
 - C. Responsibility Assignment Matrix
 - D. RACI matrix
2. Which of the following is NOT a tool and technique of the develop human resource plan?
 - A. Organization charts and position descriptions
 - B. Networking
 - C. Ground rules
 - D. Organizational theory

Answers

1. Answer B is correct. A Resource Breakdown Structure provides a graphical display of resources by type. An Organizational Breakdown Structure (OBS) graphically displays work packages. A Responsibility assignment matrix (RAM) is a chart displaying resources and for which assignments they are responsible, and a RACI matrix is a specific type of RAM that shows the resources that are responsible, accountable, consulted, and informed in project activities.
2. Answer C is correct. Ground rules is a tool and technique of the develop project team process. Answers A, B, and D are incorrect because they are all valid tools and techniques of the develop human resource plan.

The project manager must fulfill the role of manager and leader of the project team. Using the same skills and techniques a line manager uses, the project manager has the following responsibilities:

- Determine the HR needs of the project
- Negotiate with line managers for internal resources

- ▶ Acquire external resources through the procurement process
- ▶ Determine training needs
- ▶ Identify/plan team-building activities
- ▶ Determine the performance review approach for a project's human resources
- ▶ Determine the reward and recognition approach for motivational purposes
- ▶ Document the team structure and each team's responsibilities
- ▶ Create a project organization chart
- ▶ Develop a staffing management plan

ExamAlert

PMI puts a high value on the project manager's responsibilities to the team. Make sure you are comfortable with applying PMBOK content to hypothetical situations.

Key Human Resource Principles

Human resource management is the set of processes used to organize and manage the project team, also referred to as the project staff. A subset of the project team is the project management team, composed of the project manager, project sponsor, and others responsible for project management activities such as planning, controlling, and closing the project.

Project human resource management is composed of human resource planning, acquiring, developing, and managing the team. HR planning has a number of key deliverables, including project organization charts, the staffing management plan, and determining the roles and responsibilities of each human resource. Table 4.6 shows the inputs, tools and techniques, and outputs for the develop human resource plan process.

TABLE 4.6 Develop Human Resource Plan Inputs, Tools and Techniques, and Outputs

Inputs	Tools and Techniques	Outputs
Activity resource requirements	Organization charts and position descriptions	Human resource plan
Enterprise environmental factors	Networking	
Organizational process assets	Organizational theory	

It is important to understand the various methods organizations use to depict and describe human resources and their attributes. Table 4.7 summarizes the tools used in human resource planning.

TABLE 4.7 Human Resource Planning Tools

Name	Description	Use
Organizational breakdown structure (OBS)	Graphically displays work packages according to departments	Identifies the work assigned to each department
Resource breakdown structure	Graphically displays resources by type	Effective in tracking costs. Groups resources even if they are working on different deliverables
Responsibility assignment matrix (RAM)	A chart displaying resources and for which assignments they are responsible	Allows easy identification of all responsibilities for a given resource
RACI matrix	A specific type of RAM that shows the resources that are responsible, accountable, consulted, and informed in project activities	Provides more detail than RAM
Position description	Text-based description of responsibilities	Provides a high level of detail for a given position

Note

An organizational breakdown structure (OBS) is a graphical representation of the project team arranged according to an organization's existing structure. A resource breakdown structure is also a graphical representation but is organized according to resource type. A resource breakdown structure can contain resources other than human resources, such as equipment, and can be used to track costs.

In addition to graphical representations, resources might be documented in matrix-based documents such as a *responsibility assignment (RACI) matrix*.

These documents are effective communication tools to ensure team members understand for which assignments they are responsible. Table 4.8 shows an example of an RACI matrix.

Note

RACI stands for responsible, accountable, consult, inform.

TABLE 4.8 **RACI Matrix**

Activity	Person		
	Bill	Mary	John
Design	Responsible	Consult	Accountable
Build	Accountable	Responsible	Consult
Test	Inform	Accountable	Consult

The Staffing Management Plan

The *staffing management plan* is used to document the type of resources needed and the timing for those resources. The plan includes how the resources will be acquired, start and end dates, training requirements, policies and procedures for the team, and the team recognition approach and budget.

Note

Resource leveling is a schedule network analysis that results in schedule changes, start and finish dates, based on resource constraints. That is, resource leveling might cause start and finish dates to change if multiple activities rely on over-committed resources.

Cram Quiz

Answer these questions. The answers follow the last question. If you cannot answer these questions correctly, consider reading this section again until you can.

1. Which resource planning tool provides information on resource responsibility and accountability?
 - A. OBS
 - B. Resource breakdown structure
 - C. RAM
 - D. RACI matrix
2. What is the primary purpose of the human resource plan?
 - A. Identify and document roles, responsibilities, and skills necessary for project goal fulfillment
 - B. Describe how the project team will interact
 - C. Assemble the project team
 - D. Document strategies to motivate the project team

Cram Quiz Answers

1. Answer C is correct. The RACI (responsible, accountable, consulted, informed) matrix provides information both on resource responsibility and accountability. The RAM only provides responsibility information. Neither the OBS nor resource breakdown structure provide responsibility information.
 2. Answer A is correct. Answers B, C, and D describe other processes in the executing process group.
-

Communications Management

► Plan Communications—10.2

CramSaver

If you can correctly answer these questions before going through this section, save time by skimming the Exam Alerts in this section and then completing the Cram Quiz at the end of the section.

1. Why are communications among project team member important enough to create a distinct knowledge area to address its concerns?
2. Which of the following communication methods would be most appropriate for communicating with very large general audiences?
 - A. Interactive communication
 - B. One-way communication
 - C. Push communication
 - D. Pull communication

Answers

1. Answers will vary, but the smooth operation of a project is contingent on the project team members working together to get the work of the project accomplished. The only way work in a team environment can progress is through deliberate communication among the team members. Projects are no different from any team environment. When communication breaks down, so does the progress.
2. Answer D is the best answer. Pull communication is a good choice for very large volumes of information or for very large audiences. Answer A is incorrect because interactive communication works best between two parties or a small group. Answer B is incorrect because one-way communication can represent either push or pull communication. Answer C is not the best answer because push communication works well for a group of specific recipients. The recipient group might be large, but it is a specific group and not a general audience.

Projects require the coordinated efforts of multiple team members. The success of the project is at least partially dependent on the quality of communication between team members. The communication plan addresses the necessary elements of team communication and leaves little room for assumptions. This plan is important to set the expectations of how the project team should communicate in an effective and timely manner. It also sets the expectations of the stakeholders and makes their need for information a part of the overall

project plan. Most communication issues start with a lack of clear directives as to how and when to communicate. Further, most people are reluctant to initiate unsolicited communication. The communication plan is crucial to good project team interaction. The plan actually tells team members what is expected of them throughout the project. Table 4.9 shows the inputs, tools and techniques, and outputs for the plan communications process.

TABLE 4.9 Plan Communications Inputs, Tools and Techniques, and Outputs

Inputs	Tools and Techniques	Outputs
Stakeholder register	Communication requirements analysis	Communications management plan
Stakeholder management strategy	Communication technology	Project document updates
Enterprise environmental factors	Communication models	
Organizational process assets	Communication methods	

ExamAlert

The plan communications process addresses the information and communications needs of the stakeholders by determining the stakeholder information needs and defining an approach to meeting these needs.

Cram Quiz

Answer these questions. The answers follow the last question. If you cannot answer these questions correctly, consider reading this section again until you can.

1. What type of communication would be best for casual, non-urgent information exchange between team members in geographically distant locations?
 - A. Telephone
 - B. Conference call
 - C. Email
 - D. Shared memo
2. Which type of communication would be the best choice for discussing schedule changes to an entire team that is located in several different physical sites?
 - A. Conference call
 - B. Email
 - C. Website
 - D. One-on-one telephone calls

Cram Quiz Answers

1. Answer C is correct. Email provides a good medium for exchanging messages among team members who are in different time zones. Telephone conversations and conference calls require much more scheduling effort and shared memos require additional effort to exchange.
 2. Answer A is correct. In this case, a conference call provides the ability for the project manager to inform the team simultaneously and also take feedback from team members. The other options are more time consuming and make feedback more difficult.
-

Risk Management

- ▶ **Plan Risk Management—11.1**
- ▶ **Identify Risks—11.2**
- ▶ **Perform Qualitative Risk Analysis—11.3**
- ▶ **Perform Quantitative Risk Analysis—11.4**
- ▶ **Plan Risk Responses—11.5**

CramSaver

If you can correctly answer these questions before going through this section, save time by skimming the Exam Alerts in this section and then completing the Cram Quiz at the end of the section.

1. Which risk response is most likely to involve contingency reserves?
 - A. Transfer
 - B. Mitigate
 - C. Acceptance
 - D. Share
2. Which of the following activities is not part of risk management planning?
 - A. Developing a risk management plan
 - B. Identifying risk categories
 - C. Updating risk register
 - D. Determining risk roles and responsibilities
3. Which of the following tools and techniques are part of the perform qualitative risk analysis process?
 - A. Data gathering and representation techniques
 - B. Probability and impact matrix
 - C. Quantitative risk analysis and modeling techniques
 - D. Contingent response strategies
4. Which of the following best describes the perform quantitative risk analysis process?
 - A. The process of determining which risks might affect your project
 - B. The process of ranking the relative severity of risks to determine which risks deserve the most attention
 - C. The process of carrying out risk response plans and evaluating risk process effectiveness
 - D. The process of assigning numerical values to risks in order to analyze the effect of the risks to the project

Answers

1. Answer C is correct. Acceptance is when no change to the project is made to accommodate a risk. Passive acceptance requires no action beyond documenting the decision. Active acceptance includes further action, such as setting aside a contingency to offset the effect of the risk. Transferring moves the risk to a third party and there most likely would be an upfront cost associated with this response. Mitigate is taking steps to reduce the probability or effect. Sharing is similar to transferring but for a positive risk.
2. Answer C is correct. Updating the risk register first happens in risk identification. All other activities occur during risk management planning.
3. Answer B is correct. Probability and impact matrix is a tool and technique for the perform qualitative risk analysis process. Answers A and C are incorrect because these are both tools and techniques for the perform quantitative risk analysis process (not qualitative). Answer D is incorrect because contingent response strategies is a tool and technique for the plan risk response process.
4. Answer D is correct. Perform qualitative risk analysis is the process of assigning numerical values to risks in order to analyze the impact of the risks to the project. Answer A is incorrect because it describes the identify risks process. Answer B is incorrect because it describes the perform qualitative risk analysis process. Answer C is incorrect because it describes the monitor and control risks process.

PMI's risk management philosophy is based on a proactive approach to preventing negative risks and enhancing positive risks. Key points to remember about risk include

- ▶ Risk can be either positive or negative. Positive risks are opportunities; negative risks are threats.
- ▶ A risk breakdown structure (RBS) is used to organize risk in a hierarchical structure.
- ▶ Monte Carlo analysis is a technique using simulations and probability in determining quantitative risk analysis.
- ▶ Risk categories are important in classifying risk.
- ▶ Probability and impact are both needed to assess risks.
- ▶ Quantitative analysis is generally reserved for high-probability, high-impact risk.
- ▶ Risk management planning and risk response planning are not the same activities.

- ▶ Risk identification is an iterative process that is performed throughout the project, not just during planning.
- ▶ Decision tree analysis is a technique using probabilities and costs for structured decision making.
- ▶ Five of the six risk management processes are conducted during the planning process group.
- ▶ The risk register is an important tool for capturing and tracking risks.

ExamAlert

Risk register is a term introduced by PMI for the document detailing information on risks. The risk register includes all identified risks, the impacts of identified risks, proposed responses, responsible parties, and the current status.

Note

A risk can have either a negative or positive effect on the project.

The *risk methodology* is a definition of how risk will be managed. It includes the approach, tools, and techniques to be used for the project. The approach details how the steps of the risk process will be conducted. For example, the approach could specify that risk analysis will be conducted at the end of each planning meeting. The tools can include the risk register, the risk breakdown structure, the probability and impact matrix, and checklists.

Risk Management Planning and Risk Response Planning

The *risk management plan* includes the risk methodology, roles/responsibilities, budget, execution timing, and definitions for risk categories, probabilities, and impacts. It is a summation of how the project team will carry out the remainder of the risk management activities for the project. The risk management plan should not be confused with the risk response plan, which is where the project manager captures responses to specific risks that have been identified during the risk identification process.

ExamAlert

The risk management plan is not the same as the risk response plan.

The risk management plan is the single output of the plan risk management process. Table 4.10 shows the inputs, tools and techniques, and outputs for the plan risk management process.

TABLE 4.10 Plan Risk Management Inputs, Tools and Techniques, and Outputs

Inputs	Tools and Techniques	Outputs
Project scope statement	Planning meetings and analysis	Risk management plan
Cost management plan		
Schedule management plan		
Communications management plan		
Enterprise environmental factors		
Organizational process assets		

Risk Breakdown Structure (RBS)

A *risk breakdown structure (RBS)* is a tool that can be used to organize risks in a hierarchical fashion. The structure is defined using the risk categories. Even if an RBS is not used, risk categories are still defined in risk management planning. Risk categories can include

- ▶ **Technical**—Risk associated with using new technology.
- ▶ **External**—Risk associated with forces or entities outside the project organization. External risks can include external suppliers, customers, weather, and market conditions.
- ▶ **Organizational**—Risk associated with either the organization running the project or the organization where the project will be implemented.
- ▶ **Project Management**—Risk associated with project management processes.

Risk Probability and Impact

Probability can be defined as the likelihood that a risk will occur. It can be expressed mathematically (.2) or as a relative scale (low, medium, high). The definition for probability is developed during risk management planning.

Impact is the effect a risk has if it does occur. It can also be defined on a relative scale or mathematically. The definition for impact is developed during risk management planning.

The team documents in the project management plan detail how probabilities and impacts are measured. For example, a red/yellow/green scale might be used, where high-probability, high-impact risks are red; low-probability, low-impact risks are green; and so forth. A probability and impact matrix can also be used; for an example, refer to *PMBOK* Fourth Edition, Figure 11-10.

ExamAlert

Both probability and impact are necessary for evaluating risks.

Risk Identification, Analysis, Response Planning, and Monitoring/Controlling

In the risk management process, completing the risk management plan is the first step. After the plan is in place, according to PMI the next steps in the risk management process are

- ▶ Identification
- ▶ Analysis (qualitative and quantitative)
- ▶ Response planning
- ▶ Monitoring/controlling (discussed in Chapter 6, “Project Control”)

ExamAlert

Understand the difference between qualitative and quantitative risk analysis. Qualitative evaluation is a prioritization based on probability and impact. Quantitative evaluation uses techniques to further advance the specific probabilities and impacts of project risks. For instance, modeling techniques such as Monte Carlo determine the overall effect of risks on project objectives and are typically used for high-probability, high-impact risks.

Identify Risks

The *identify risks* process is determines the risks that might affect the project and characterizes those risks.

Obviously, the ability to identify risks is key in an effective risk management process. Keep in mind that identifying risks is not just the project manager’s responsibility; team members, subject matter experts, customers, stakeholders, and others are involved in this process. Table 4.11 shows the inputs, tools and techniques, and outputs for the identify risks process.

TABLE 4.11 Identify Risks Inputs, Tools and Techniques, and Outputs

Inputs	Tools and Techniques	Outputs
Risk management plan	Documentation reviews	Risk register
Activity cost estimates	Information gathering techniques	
Activity duration estimates	Checklist analysis	
Scope baseline	Assumptions analysis	
Stakeholder register	Diagramming techniques	
Cost management plan	SWOT analysis (Strength, Weakness, Opportunity, Threat)	
Schedule management plan	Expert judgment	
Quality management plan		
Project documents		
Enterprise environmental factors		
Organizational process assets		

The Risk Register

The *risk register* is the output of the identify risks process. The risk register contains the following information:

- ▶ Risk description
- ▶ Date identified
- ▶ Category
- ▶ Potential responses
- ▶ Current status

ExamAlert

Identify risks is not a one-time event occurring during the planning process. It should be conducted throughout the project, including during major milestones and when a risk occurs.

Qualitative and Quantitative Risk Analysis

Qualitative risk analysis provides further definition to the identified risks in order to determine responses to them. The key terms are *probability* and *impact*.

Probability is important because it measures how likely a risk will occur. A high-probability risk deserves more attention than a low-probability risk. Likewise, impact is a measure of how the risk will affect the project should it occur. A risk with low impact has a different response than one with a high impact.

ExamAlert

Qualitative risk analysis is most concerned with ranking risks. It is used to determine which risks pose more of a potential effect on the project.

Qualitative risk analysis quickly prioritizes risks in order to conduct response planning and quantitative risk analysis, if used. Using the probability of the impact and a probability impact matrix, the project manager develops a prioritized list of risks. The output to this step is captured in the risk register. Table 4.12 shows the inputs, tools and techniques, and outputs for the perform qualitative risk analysis process.

TABLE 4.12 Perform Qualitative Risk Analysis Inputs, Tools and Techniques, and Outputs

Inputs	Tools and Techniques	Outputs
Risk register	Risk probability and impact assessment	Risk register updates
Risk management plan	Probability and impact matrix	
Project scope statement	Risk data quality assessment	
Organizational process assets	Risk categorization	
	Risk urgency assessment	
	Expert judgment	

Quantitative risk analysis assigns numerical values to risks and looks at those risks that are high on the list of prioritized risks during qualitative risk analysis. The goal of this process is to quantify possible outcomes for the project, determine probabilities of outcomes, further identify high impacting risks, and develop realistic scope, schedule, and cost targets based on risks. Table 4.13 shows the inputs, tools and techniques, and outputs for the perform quantitative risk analysis process.

ExamAlert

Quantitative risk analysis is more concerned with assigning each risk a numerical value. This value can then be analyzed using various methods and presented graphically to paint a complete risk picture.

TABLE 4.13 Perform Quantitative Risk Analysis Inputs, Tools and Techniques, and Outputs

Inputs	Tools and Techniques	Outputs
Risk register	Data gathering and representation techniques	Risk register updates
Risk management plan	Quantitative risk analysis and modeling techniques	
Cost management plan	Expert judgment	
Schedule management plan		
Organizational process assets		

A key tool used in quantitative risk analysis is decision tree analysis. Using a decision tree diagram (see Figure 4.3), the impact of different scenarios is captured. Both probability and cost are used, resulting in an expected monetary value (EMV).

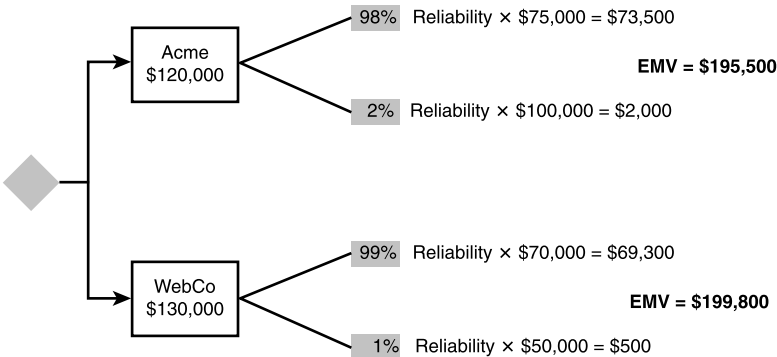


FIGURE 4.3 An example of a decision tree analysis.

For this example, there are two vendors for a software package; Acme and WebCo. The details of the two options are presented in Table 4.14.

TABLE 4.14 Decision Tree Analysis Example Data

	Acme	WebCo
Purchase cost	\$120,000	\$130,000
Maintenance	\$75,000/year (98% reliability)	\$70,000/year (99% reliability)
Failure cost	\$100,000 (2% probability)	\$50,000 (1% probability)

Responses to Positive and Negative Risk

After all risks are identified, options to deal with the risks must be identified. Each risk is assigned to one or more owners to carry out the planned response. The responses are documented in the risk register after it has been updated in the plan risk responses process. Table 4.15 shows the inputs, tools and techniques, and outputs for the plan risk responses process.

TABLE 4.15 Plan Risk Responses Inputs, Tools and Techniques, and Outputs

Inputs	Tools and Techniques	Outputs
Risk register	Strategies for negative risks or threats	Risk register updates
Risk management plan	Strategies for positive risks or opportunities	Risk-related contract decisions
	Contingent response strategiesplan	Project management updates
	Expert judgment	Project document updates

There are four responses to negative risks:

- ▶ Avoid
- ▶ Transfer
- ▶ Mitigate
- ▶ Accept

For positive risks the responses include

- ▶ Exploit
- ▶ Share
- ▶ Enhance
- ▶ Accept

They are summarized in Table 4.16.

TABLE 4.16 **Summary of Risk Responses**

Response	Description	Risk Type
Avoid	Eliminating the threat by changing the project management plan.	Negative
Transfer	Shifting the risk to a third party.	Negative
Mitigate	Reducing either the probability or impact of the risk.	Negative
Exploit	Taking steps to make the opportunity happen.	Positive
Share	Using a third party to help capture the opportunity.	Positive
Enhance	Increasing the probability or positive impact of the risk.	Positive
Accept	Taking no steps in the project because of the risk. Contingency reserves might be established.	Positive and Negative

Risk Monitoring and Controlling

The risk process is not just performed once during the planning process. Throughout the project, risks must be continually monitored, with additional analysis and risk response development as new risks are identified. *Risk monitoring and controlling* focuses both on identification and analysis of new risks, as well as tracking previously identified risks and risk triggers.

Note

Risk triggers, also sometimes referred to as risk symptoms or warning signs, are indications that risks have occurred or are about to occur. They are identified during risk identification and monitored throughout the project.

Risks should be re-evaluated when the following events occur:

- ▶ A risk trigger is identified
- ▶ A change request is approved
- ▶ Key project milestones are reached
- ▶ Project phases end
- ▶ Deviations are detected in variance and trend analysis
- ▶ Corrective or preventive actions are implemented

Cram Quiz

Answer these questions. The answers follow the last question. If you cannot answer these questions correctly, consider reading this section again until you can.

1. Which input is not used for risk identification?
 - A. Project charter
 - B. Scope baseline
 - C. Cost management plan
 - D. Academic studies
2. In evaluating project risk, a decision tree analysis is most helpful in which of the following scenarios?
 - A. Describing a potential risk and the implications for each available choice and outcome associated with the risk
 - B. Describing a potential risk and the most likely choice and outcome associated with the risk
 - C. Describing a potential risk and the least likely choice and outcome associated with the risk
 - D. None of the above
3. The identification of risks associated with a project happens when?
 - A. Occurs only at the beginning of a project when the risk management plan is developed
 - B. Is an ongoing process, regularly scheduled throughout the life cycle of a project
 - C. Occurs as needed throughout the life cycle of a project
 - D. Both C and D
4. Which of the following is the only valid tool and technique for the plan risk management process?
 - A. Reserve analysis
 - B. Planning meetings and analysis
 - C. Expert judgment
 - D. Contingent response strategies
5. Which input is not used for the qualitative risk analysis process?
 - A. Cost management plan
 - B. Risk register
 - C. Risk management plan
 - D. Project scope statement

6. Which tool and technique is not used for the Plan Risk Responses process?
- A. Strategies for positive risks or opportunities
 - B. Contingent response strategies
 - C. Risk audits
 - D. Expert judgment

Cram Quiz Answers

1. Answer A is correct. The project charter is not used. The scope baseline and cost management plan are used. Academic studies are part of enterprise environmental factors that also include commercial databases, benchmarking, or other industry studies.
 2. Answer A is the correct response. A decision tree diagram can be used to consider potential risks and all the implications associated with the risk. You can include every conceivable choice and outcome. Every option is considered. Answer B is incorrect because choice and outcome are limited to the most probable scenario. Answer C is incorrect because choice and outcome are limited to the least probable scenario. Answer D is incorrect.
 3. Answer D is the best response. Risk analysis is not limited to the beginning of a project's life cycle when the risk management plan is developed. The risk management plan should include a tool for risk assessment as a continuous process throughout the project. Risk reassessment should be a scheduled component of the project but should also have the flexibility to occur as needed at greater or lesser intervals based on the level of risk.
 4. Answer B is correct. Planning meetings and analysis is the only tool and technique defined for the plan risk management process. All of the other answers refer to tools and techniques from other processes.
 5. Answer A is correct. The cost management plan is an input for the perform quantitative risk analysis process. All of the other answers are valid inputs for the perform qualitative risk analysis process.
 6. Answer C is correct. Risk audits are a tool and technique for the monitor and control risks process. All other answers are valid tools and techniques for the plan risk response process.
-

Procurement Management

► Plan Procurements—12.1

CramSaver

If you can correctly answer these questions before going through this section, save time by skimming the Exam Alerts in this section and then completing the Cram Quiz at the end of the section.

1. Which contract type would be best for the seller if the scope of work is not well defined?
 - A. Fixed price
 - B. Purchase order
 - C. Time and material
 - D. Cost plus incentive fee
2. Which of the following is NOT a tool and technique for the Plan Procurements process?
 - A. Make-or-buy analysis
 - B. Expert judgment
 - C. Contract types
 - D. Bidder conferences

Answers

1. Answer D is correct. Cost plus incentive fee is always the lowest risk for the buyer. Fixed price and purchase order are the best choices when the item is well defined. Time and materials balances the risk between buyer and seller.
2. Answer D is correct. Bidder conferences is a tool and technique for the conduct procurements process. All other answers list valid tools and techniques for the plan procurements process.

Procurement management involves the relationship between the buyer and the seller when products, services, or other results are being purchased by the project team in order to complete the project. Key PMI principles for procurement management include

- The contract statement of work (SOW) is a key document that defines the work in order to allow buyers the ability to evaluate and bid on the work.

- ▶ There are three primary contract types:
 - ▶ Fixed price
 - ▶ Time and material
 - ▶ Cost reimbursement
- ▶ The risk to both the buyer and seller depends on the type of contract chosen.
- ▶ The contract is a formal, written document and any changes are submitted in writing.

Table 4.17 shows the inputs, tools and techniques, and outputs for the plan procurements process.

TABLE 4.17 Plan Procurements Inputs, Tools and Techniques, and Outputs

Inputs	Tools and Techniques	Outputs
Scope baseline	Make-or-buy analysis	Procurement management plan
Requirements documentation	Expert judgment	Procurement statements of work
Teaming agreements	Contract types	Make-or-buy decisions
Risk register		Procurement documents
Risk-related contract decisions		Source selection criteria
Activity resource requirements		Change requests
Project schedule		
Activity cost estimates		
Cost performance baseline		
Enterprise environmental factors		
Organizational process assets		

The Make/Buy Decision

The first step in procurement is resolving the make/buy decision. This decision is made during the plan purchases and acquisition process. An analysis is done to determine if the product or service can be produced by the project team or if it should be purchased. This analysis might also include buying versus renting/leasing a product.

The Contract Statement of Work

In addition to making the make/buy decision during the plan purchases and acquisition process, it is during this step that the contract statement of work (SOW) is developed and the type of contract to be used is determined. The SOW is a document that defines the work to be performed. A contract SOW is work performed under contract. The contract SOW is developed from the scope statement and WBS and should be sufficiently detailed to allow the potential sellers to determine their ability to perform the work. A project can have multiple SOWs.

Contract Types

A number of contract types are used in the procurement process. In order to be prepared for the exam, understand the benefit of each type, as summarized in Table 4.18

TABLE 4.18 **Contract Types**

Name	Description	Pro/Con
Firm fixed price (FFP) (or lump sum)	The work is completed for a predetermined price.	Benefits the buyer. Seller at risk if item isn't clearly defined. Seller must manage changes closely.
Fixed price incentive (FPIF)	Similar to fixed price but an incentive is offered for early completion.	More administrative effort for buyer and seller.
Fixed price with economic price adjustment (FP-EPA)	Similar to fixed price but with an agreed upon final adjustment due to changing economic conditions.	Used for very long term performance when costs can increase or decrease over time. To protect the buyer and seller the EPA clause must relate to a well-known financial index.
Purchase order	A form of fixed price, usually for off-the-shelf items.	Optimal for both parties when item is a commodity (such as computers).
Cost reimbursement, includes CPFF, CPIF, and CPAF (see following exam alert)	The seller is reimbursed for his costs, plus an additional fee.	Benefits the seller because his cost is covered. Risk to buyer if costs are higher than anticipated; the budget is affected.
Time and material (T&M)	Hybrid arrangement between fixed price and cost reimbursement where elements of both are used; a fixed unit rate can be set for certain elements of work while other components are completely reimbursable. For example, a programmer might be acquired at \$125 per hour without defining how long he will be used.	Seller benefits if amount of work can be extended, which affects the buyer's budget.

ExamAlert

PMI identifies three types of common cost-reimbursement contracts that only vary in how the fee is calculated, cost plus fixed fee (CPFF), cost plus incentive (CPIF), and cost plus award fee (CPAF). Be familiar with all three variations of cost-reimbursement contracts, found on pages 323 and 324 of the *PMBOK Guide*, Fourth Edition.

Figure 4.4 illustrates the risk to buyer and seller for the contract types.

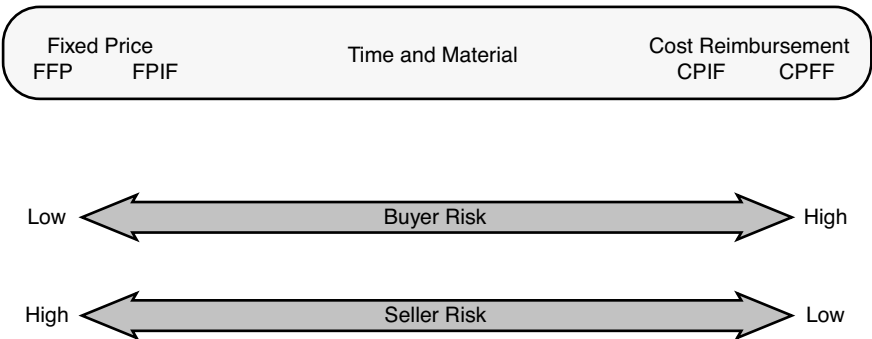


FIGURE 4.4 The buyer and seller risk for contract types.

The Procurement Management Plan

The procurement management plan is developed to describe how procurement activities will be carried out. The plan can include content that provides guidance for

- ▶ Type of contracts to be used
- ▶ Risks and risk management issues
- ▶ Criteria for independent estimates
- ▶ Standard procurement documents and procedures
- ▶ Coordinating procurement with other projects and multiple vendors
- ▶ Project assumptions or constraints that affect procurements
- ▶ Handling procurement schedules
- ▶ Addressing make-or-buy decisions
- ▶ Identifying and managing performance requirements
- ▶ Identifying prequalified sellers
- ▶ Procurement metrics used to evaluate sellers and manage contracts

Note

The steps of the procurement process are only necessary if the decision is made to buy outside resources.

Cram Quiz

Answer these questions. The answers follow the last question. If you cannot answer these questions correctly, consider reading this section again until you can.

1. The responsibility for tailoring a contract for goods and services to the needs of the project lies with whom?
 - A. The project manager
 - B. The project management team
 - C. The attorneys
 - D. The contract manager

2. The decision on whether a product or service can be produced by the project management team or can be purchased is called what?
 - A. Buyer assessment
 - B. Expert judgment
 - C. Make-or-buy analysis
 - D. Procurement evaluation

Cram Quiz Answers

1. Answer B is the best response. The responsibility for tailoring a contract for goods and services to the needs of the project lies with the project management team. The project management team can include the project manager, attorneys, and/or contract manager, but the responsibility does not rest solely with one individual.
 2. Answer C is the best response. The decision on whether a product or service can be produced by the project management team or can be purchased is called a *make-or-buy analysis*.
-

What Next?

If you want more practice on this chapter's exam topics before you move on, remember that you can access all of the Cram Quiz questions on the CD. You can also create a custom exam by topic with the practice exam software. Note any topic you struggle with and go to that topic's material in this chapter.

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