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FIFTH EDITION

KATHY SCHWALBE

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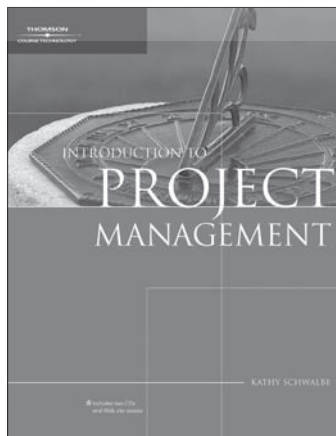
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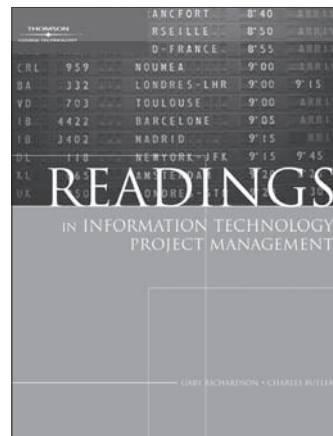
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Kathy Schwalbe, Ph.D., PMP

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Preface

The future of many organizations depends on their ability to harness the power of information technology, and good project managers continue to be in high demand. Colleges have responded to this need by establishing courses in project management and making them part of the information technology, management, engineering, and other curriculum. Corporations are investing in continuing education to help develop effective project managers and project teams. This text provides a much-needed framework for teaching courses in project management, especially those that emphasize managing information technology projects. The first four editions of this text were extremely well received by people in academia and the workplace. The fifth edition builds on the strengths of the previous editions and adds new, important information and features.

It's impossible to read a newspaper, magazine, or Web page without hearing about the impact of information technology on our society. Information is traveling faster and being shared by more individuals than ever before. You can buy your favorite digital music online, receive e-mail with a mobile phone, or use a wireless Internet connection at your local coffee shop. Companies have linked their many systems together to help them fill orders on time and better serve their customers. Software companies are continually developing new products to help streamline our work and get better results. When technology works well, it is almost invisible. But did it ever occur to you to ask, "Who makes these complex technologies and systems happen?"

Because you're reading this text, you must have an interest in the "behind-the-scenes" aspects of technology. If I've done my job correctly, as you read you'll begin to see the many innovations society is currently experiencing as the result of thousands of successful information technology projects. In this text, you'll read about projects around the world that went well, like Motorola's Six Sigma project in the U.S., Canada's Dynamic Mutual Funds customer relationship management project, England's Boots Company's systems infrastructure project, and Kuala Lumpur's state-of-the-art Integrated Transport Information System (ITIS) project. Of course, not all projects are successful; factors such as time, money, and unrealistic expectations, among many others, can sabotage a promising effort if it is not properly managed. In this text, you'll also learn from the mistakes people made on many projects that were not successful. I have written this book in an effort to educate you, tomorrow's project managers, about what will help make a project succeed—and what can make it fail. You'll also see how projects are used in everyday media, such as television and film. Many readers tell me how much they enjoy reading these real-world examples in the What Went Right?, What Went Wrong? and Media Snapshot features.

The Best Practice is a new feature to this edition that will help you understand how high-performing organizations successfully apply several project management concepts and tools. As practitioners know, there is no “one size fits all” solution to managing projects. By seeing how different organizations successfully implement project management, you can help your organization do the same.

Although project management has been an established field for many years, managing information technology projects requires ideas and information that go beyond standard project management. For example, many information technology projects fail because of a lack of user input, incomplete and changing requirements, and a lack of executive support. This book includes suggestions on dealing with these issues. New technologies can also aid in managing information technology projects, and examples of using software to assist in project management are included throughout the book.

Information Technology Project Management, Fifth Edition, is still the only textbook to apply all nine project management knowledge areas—project integration, scope, time, cost, quality, human resource, communications, risk, and procurement management—and all five process groups—initiating, planning, executing, monitoring and controlling, and closing—to information technology projects. This text builds on the *PMBOK® Guide Third Edition*, an American National Standard, to provide a solid framework and context for managing information technology projects. It also includes an appendix, *Guide to Using Microsoft Project 2007*, which many readers find to be invaluable. A second appendix provides advice on earning and maintaining Project Management Professional (PMP) certification from the Project Management Institute (PMI) as well as information on other certification programs, such as CompTIA's Project+ certification.

Information Technology Project Management, Fifth Edition, provides practical lessons in project management for students and practitioners alike. By weaving together theory and practice, this text presents an understandable, integrated view of the many concepts, skills, tools, and techniques involved in information technology project management. The comprehensive design of the text provides a strong foundation for students and practitioners in project management.

NEW TO THE FIFTH EDITION

Building on the success of the previous editions, *Information Technology Project Management, Fifth Edition*, introduces a uniquely effective combination of features. The main changes made to the fifth edition include the following:

- Appendix A has been updated for Microsoft Project 2007—the most widely used project management software tool today. This comprehensive appendix teaches students the fundamentals of Project 2007 in the context of project scope, time, cost, human resource, and communications management. Exercises at the end of the appendix will help you test your skills.
- The new Best Practice feature enhances each chapter by studying optimal approaches to implementing project management in various industries, which helps improve project management in organizations.
- A Quick Quiz has also been added to each chapter. These quizzes help you reinforce your understanding of key concepts. Additional interactive quizzes are available on the companion Web site.
- A new companion Web site for the fifth edition (www.course.com/mis/schwalbe5e) provides you with access to informative links from the footnotes, lecture notes, interactive quizzes, templates, additional running cases, suggested readings, new Podcasts, and many other items to enhance your learning.
- Podcasts are short audio files, about five minutes long, which are designed for use on an iPod, MP3 player, or on a PC using iTunes, Windows Media Player or other digital music player. You can listen to Podcasts on your way to class, while driving, or anytime when cracking open the book isn't practical. Each chapter includes Podcasts that provide a chapter summary, key terms, and quick quizzes.
- Updated examples are provided throughout the text. You'll notice several new examples in the fifth edition that explain recent events in managing real information technology projects. Several of the What Went Right?, What Went Wrong?, and Media Snapshot examples have been updated to keep you up-to-date. Additional examples and results of new studies are also included throughout the text, with appropriate citations.
- User feedback is incorporated. Based on feedback from reviewers, students, instructors, practitioners, and translators (this book has been translated into Chinese and Japanese), you'll see several additional changes to help clarify information.

APPROACH

Many people have been practicing some form of project management with little or no formal study in this area. New books and articles are being written each year as we discover more about the field of project management, and project management software continues to advance. Because the project management field and the technology industry change rapidly, you cannot assume that what worked even five years ago is still the best approach today. This text provides up-to-date information on how good project management and effective use of software can help you manage projects, especially information technology projects. Five distinct features of this text include its relationship to the Project Management Body of Knowledge, its detailed guide for using Microsoft Project 2007, its value in preparing for Project Management Professional and other certification exams, its inclusion of running case studies and online templates, and its companion Web site. You can also purchase a special bundling of this text that includes simulation software by Fissure.

Based on the *PMBOK® Guide Third Edition*

The Project Management Institute (PMI) created the Guide to the Project Management Body of Knowledge (the *PMBOK® Guide Third Edition*) as a framework and starting point for understanding project management. It includes an introduction to project management, brief descriptions of all nine project management knowledge areas, and a glossary of terms. The *PMBOK® Guide Third Edition* is, however, just that—a guide. This text uses the *PMBOK® Guide Third Edition* as a foundation, but goes beyond it by providing more details, highlighting additional topics, and providing a real-world context for project management. *Information Technology Project Management, Fifth Edition*, explains project management specifically as it applies to managing information technology projects in the 21st century. It includes several unique features to bring you the excitement of this dynamic field (for more information on features, see the section entitled “Pedagogical Features”).

Contains a Detailed Guide on How to Use Microsoft Project 2007

Software has advanced tremendously in recent years, and it is important for project managers and their teams to use software to help manage information technology projects. Each copy of *Information Technology Project Management, Fifth Edition*, includes a detailed guide on using the leading project management software on the market—Microsoft Project 2007. Examples using Project 2007 and other software tools are integrated throughout the text, not as an

afterthought. Appendix A, *Guide to Using Microsoft Project 2007*, teaches you in a systematic way to use this powerful software to help in project scope, time, cost, human resource, and communications management.

Resource for PMP and Other Certification Exams

Professional certification is an important factor in recognizing and ensuring quality in a profession. PMI provides certification as a Project Management Professional (PMP), and this text is an excellent resource for studying for the certification exam. This text will also help you pass other certification exams, such as CompTIA's Project+ exam. Having experience working on projects does not mean you can easily pass the PMP or other certification exams.

I like to tell my students a story about taking a driver's license test after moving to Minnesota. I had been driving very safely and without accidents for over sixteen years, so I thought I could just walk in and take the test. I was impressed by the sophisticated computer system used to administer the test. The questions were displayed on a large touch-screen monitor, often along with an image or video to illustrate different traffic signs or driving situations. I became concerned when I found I had no idea how to answer several questions, and I was perplexed when the test seemed to stop and a message displayed saying, "Please see the person at the service counter." This was a polite way of saying I had failed the test! After controlling my embarrassment, I picked up one of the Minnesota driving test brochures, studied it for an hour or two that night, and successfully passed the test the next day.

The point of this story is that it is important to study information from the organization that creates the test and not be over-confident that your experience is enough. Because this text is based on PMI's *PMBOK® Guide Third Edition*, it provides a valuable reference for studying for PMP certification. It is also an excellent reference for CompTIA's Project+ exam. I have earned both of those certifications and kept them in mind when writing this text.

Provides Exercises, Running Cases, Templates, Sample Documents, and Optional Simulation Software

Based on feedback from readers, the fifth edition continues to provide challenging exercises and running cases to help students apply concepts in each chapter. There are dozens of templates, examples of real project documents, and optional simulation software developed by Fissure, a PMI Registered Education Provider, that you can use to actively practice your skills in managing a project. All of these features help the subject matter come alive and have more meaning.

Includes a Companion Web Site

A companion Web site provides you with a one-stop location to access informative links and tools to enhance your learning. Similar to other companion Web sites provided by Course Technology, this site will be a valuable resource as you view lecture notes, templates, interactive quizzes, Podcasts, student files, important articles, and references. You can also link to the author's site to see real class syllabi, samples of student projects, and other helpful links.

ORGANIZATION AND CONTENT

Information Technology Project Management, Fifth Edition, is organized into three main sections to provide a framework for project management, a detailed description of each project management knowledge area, and three appendices to provide practical information for applying project management. The first three chapters form the first section, which introduces the project management framework and sets the stage for the remaining chapters.

Chapters 4 through 12 form the second section of the text, which describes each of the project management knowledge areas—project integration, scope, time, cost, quality, human resource, communications, risk, and procurement management—in the context of information technology projects. An entire chapter is dedicated to each knowledge area. Each knowledge area chapter includes sections that map to their major processes as described in the *PMBOK® Guide Third Edition*. For example, the chapter on project quality management includes sections on quality management, quality assurance, and quality control. Additional sections highlight other important concepts related to each knowledge area, such as Six Sigma, testing, maturity models, and using software to assist in project quality management. Each chapter also includes detailed examples of key project management tools and techniques as applied to information technology projects. For example, the chapter on project integration management includes samples of various project-selection documents, such as net present value analyses, ROI calculations, payback analyses, and weighted scoring models. The project scope management chapter includes a sample project charter, part of a preliminary and detailed project scope statement, and several work breakdown structures for information technology projects.

Appendices A through C form the third section of the text, which provides practical information to help you apply project management skills on real or practice projects. You will learn how to use Project 2007 by following the

detailed, step-by-step guide in Appendix A, which includes more than 60 screen shots to help you check your work. Appendix B summarizes what you need to know to earn PMP or other certifications related to project management. Appendix C provides additional running cases to help you practice your new skills.

PEDAGOGICAL FEATURES

Several pedagogical features are included in this text to enhance presentation of the materials so that you can more easily understand the concepts and apply them. Throughout the text, emphasis is placed on applying concepts to current, real-world information technology project management.

Learning Objectives, Chapter Summaries, Discussion Questions, Exercises, Quick Quizzes, Running Cases, and Study Aids

Learning Objectives, Chapter Summaries, Discussion Questions, Exercises, Quick Quizzes, Running Cases, and Study Aids are designed to function as integrated study tools. Learning Objectives reflect what you should be able to accomplish after completing each chapter. Chapter Summaries highlight key concepts you should master. The Discussion Questions help guide critical thinking about those key concepts. Exercises provide opportunities to practice important techniques, as do the Running Cases. The companion Web site provides several study aids, such as Podcasts and interactive quizzes for each chapter, which are different from the Quick Quizzes in the text.

Opening Case and Case Wrap-Up

To set the stage, each chapter begins with an opening case related to the material presented in that chapter. These “real-life” case scenarios (most based on the author’s experiences) spark student interest and introduce important concepts in a real-world context. As project management concepts and techniques are discussed, they are applied to the opening case and other similar scenarios. Each chapter then closes with a case wrap-up—with some ending successfully and some, realistically, failing—to further illustrate the real world of project management.

What Went Right? and What Went Wrong?

Failures, as much as successes, can be valuable learning experiences. Each chapter of the text includes one or more examples of real information technology projects that went right as well as examples of projects that went wrong. These examples further illustrate the importance of mastering key concepts in each chapter.

Media Snapshot

The world is full of projects. Several television shows, movies, newspapers, Web sites, and other media highlight project results, good and bad. Relating project management concepts to all types of projects highlighted in the media will help you understand and see the importance of this growing field. Why not get people excited about studying project management by showing them how to recognize project management concepts in popular television shows, movies, or other media?

Best Practice

Every chapter includes an example of a best practice related to topics in that chapter. For example, Chapter 1 describes best practices written by Robert Butrick, author of *The Project Workout*, from the Ultimate Business Library's Best Practice book. He suggests that organizations ensure their projects are driven by their strategy and engage project stakeholders.

Key Terms

The fields of information technology and project management both include many unique terms that are vital to creating a workable language when the two fields are combined. Key terms are displayed in bold face and are defined the first time they appear. Definitions of key terms are provided in alphabetical order at the end of each chapter and in a glossary at the end of the text.

Application Software

Learning becomes much more dynamic with hands-on practice using the top project management software tool in the industry, Microsoft Project 2007, as well as other tools, such as spreadsheet software and the Internet. Each chapter offers you many opportunities to get hands-on experience and build new software skills. This text is written from the point of view that reading about something

only gets you so far; to really understand project management, you have to do it for yourself. In addition to the exercises and running cases found at the end of each chapter, several challenging projects are provided at the end of Appendix A, *Guide to Using Microsoft Project 2007*.

SUPPLEMENTS

The following supplemental materials are available when this text is used in a classroom setting. All of the teaching tools available with this text are provided to the instructor on a single CD-ROM.

- **Electronic Instructor's Manual** The Instructor's Manual that accompanies this textbook includes additional instructional material to assist in class preparation, including suggestions for lecture topics and additional discussion questions.
- **ExamView®** This textbook is accompanied by ExamView, a powerful testing software package that allows instructors to create and administer printed, computer (LAN-based), and Internet exams. ExamView includes hundreds of questions that correspond to the topics covered in this text, enabling students to generate detailed study guides that include page references for further review. The computer-based and Internet testing components allow students to take exams at their computers, and also save the instructor time by grading each exam automatically.
- **PowerPoint Presentations** This text comes with Microsoft PowerPoint slides for each chapter. These are included as a teaching aid for classroom presentation, to make available to students on the network for chapter review, or to be printed for classroom distribution. Instructors can add their own slides for additional topics they introduce to the class.
- **Solution Files** Solutions to end-of-chapter questions can be found on the Instructor Resource CD-ROM and may also be found on the Course Technology Web site at www.course.com. The solutions are password protected.
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I never would have taken on this project—writing this book, the first, second, third, fourth, or fifth edition—without the help of many people. I thank the staff at Course Technology for their dedication and hard work in helping me produce this book and in doing such an excellent job of marketing it. Maureen Martin, Kate Hennessy, Karen Lyons, Marisa Taylor, and many more people did a great job in planning and executing all of the work involved in producing this book.

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I also thank my students and colleagues at Augsburg College and the University of Minnesota for providing feedback on the earlier editions of this book. I received many valuable comments from them on ways to improve the text and structure of my courses. I learn something new about project management and teaching all the time by interacting with students, faculty, and staff.

Three faculty reviewers provided excellent feedback for me in writing this fifth edition. Aileen Cater-Steel, University of Southern Queensland, Australia; Raffael Guidone, New York City College of Technology; and Tom Norriss, SUNY Cobleskill and Delhi, provided outstanding suggestions for improving the text in this fifth edition. I also wish to thank the many reviewers of the earlier editions of this text. I also thank the many other instructors and readers who have contacted me with praise as well as suggestions for improving this text. I really appreciate the feedback and do my best to incorporate as much as I can.

Most of all, I am grateful to my family. Without their support, I never could have written this book. My wonderful husband, Dan, has always supported me in my career, and he helps me keep up-to-date with software development since he is a lead architect for Com Squared Systems, Inc. Our three children, Anne, Bobby, and Scott, actually think it's cool that their mom writes books and speaks at conferences. They also see me managing projects all the time. Anne, now 23, teases me for being the only quilter she knows who treats each quilt as a project. (Maybe that's why I get so many done!) Our children all understand the main reason why I write—I have a passion for educating future leaders of the world, including them.

As always, I am eager to receive your feedback on this book. Please send comments to mis@course.com and copy_schwalbe@augsborg.edu.

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Appendix B

Advice for the Project Management Professional (PMP) Exam and Related Certifications

INTRODUCTION TO PROJECT MANAGEMENT CERTIFICATION PROGRAMS

This appendix provides information on project management certification programs and offers some advice for earning certifications. It briefly describes various certification programs and provides detailed information on PMI's PMP and CompTIA's Project+ certifications, the structure and content of these exams, suggestions on preparing for the exams, tips for taking the exams, sample questions, information on related certifications, and advice on certification and project management in general.

WHAT IS PMP CERTIFICATION?

The Project Management Institute (PMI) offers certification as a Project Management Professional (PMP). As mentioned in Chapter 1, the number of people earning PMP certification grew rapidly in the past 10 years. There are PMPs in more than 120 countries throughout the world. Detailed information about PMP certification, the PMP Certification Handbook, and an online application is available from PMI's Web site (www.pmi.org) under Professional Development & Careers. The following information is quoted from PMI's Web site:

The Project Management Institute (PMI®) is the world's leading association for the project management profession. It administers a globally recognized, rigorous, education, and/or professional experience and examination-based professional credentialing program that maintains an ISO 9001 certification in Quality Management Systems. To get the latest information, please visit the breaking news section.

Earning a professional credential through PMI means that one has:

- Demonstrated the appropriate education and/or professional experience;
- Passed a rigorous examination;
- Agreed to abide by a professional code of conduct;
- Committed to maintaining their active credential through meeting continuing certification requirements.

PMI professional credentials—available to members of the Institute and nonmembers alike—are widely recognized and accepted throughout the world as evidence of a proven level of education, knowledge and experience in project management.¹

Many companies and organizations are recommending or even requiring PMP certification for their project managers. A February 2003 newsletter reported that Microsoft chose PMI's PMP Certification Program as the certification of choice for its Microsoft Services Operation. Microsoft chose the PMP certification because of its global recognition and proven record in professional development for project managers.² Certcities.com ranked the PMP as No. 4 in their 10 hottest certifications for 2006. It "made a strong showing this year, rising from its debut stop at No. 10 last year, thanks in part to even stronger buzz for this industry-neutral title within the IT community."³

Certification Magazine published its annual review of how certification affects salaries of information technology professionals. This industry-wide study uses real-world numbers to show how education and experience affect a person's bottom-line salary. During a down market, people might ask why they should seek additional technical certifications. According to Gary Gabelhouse of *Certification Magazine*, "Perhaps it is best expressed in two words: job security. In boom times, one constantly reviews the rate of growth in salary as a key personal-success measurement. However, in down times, job security is paramount."⁴

The October 2004 issue of *PM Network* included an article entitled "The Rise of PMP," which provided several examples of companies and countries that have made concerted efforts to increase their number of PMPs. Hewlett-Packard had only six registered PMPs in 1997, but by August 2004, it had more than 1,500 and was adding 500 per year. Although most PMPs are in the United States (51,498) and Canada (7,444), the PMP credential is growing in popularity in

¹ Project Management Institute, "PMI® Certification Programs," (www.pmi.org/info/PDC_CertificationsOverview.asp?nav=0401) (January 2007).

² Project Management Institute Information Systems Specific Interest Group (ISSIG), *ISSIG Bits* (www.pmi-issig.org) (February 2003).

³ Nagel, Becky, "CertCities.com's 10 Hottest Certifications for 2006," CertCities.com, December 14, 2005.

⁴ Global Knowledge, "2003 Certification Salary by Certmag," *Global Knowledge E-Newsletter*, Issue #56 (March 2003).

several countries, such as Japan (6,001), China (4,472), and India (2,281). Thomas Walenta, PMP, a senior project manager for IBM Germany, said, "The PMP credential lends portability to a career plan. It has significantly shaped careers in the IT industry, with global companies creating career models for project managers based on PMI certification requirements."⁵

PMI also offers certifications as a Certified Associate in Project Management (CAPM), a Program Management Professional (PgMPSM), and OPM3[®] ProductSuite. PMI developed the CAPM certification as a stepping-stone to PMP certification. Candidates for the CAPM certification must also meet specific education and experience requirements and pass an exam. As you can imagine, the requirements are not as rigorous as they are for the PMP exam. You might want to consider getting the CAPM, or just wait until you have enough experience to earn the more popular PMP certification. PMI reported only 1,828 active CAPMs by the end of December 2006 and 221,144 active PMPs.⁶ As described below, you need 4,500 hours of project experience or a minimum of three years if you have a bachelor's degree to qualify for PMP certification.

What Are the Requirements for Earning and Maintaining PMP Certification?

You can now apply to take the PMP exam online. You can also fill out the application forms and mail them in with a check, if desired. *Before* you apply to take the exam, you must meet the following four requirements:

1. Have experience working in the field of project management. When you apply to take the exam, you enter the role you played in leading and directing project tasks on one or several projects and how many hours you worked in each of the five project management process groups for each project. Roles include:

- Project contributor
- Supervisor
- Manager
- Project leader
- Project manager
- Educator
- Consultant
- Administrator
- Other

Note that you do not have to have experience as a project manager to take the PMP exam; any of these roles will suffice. PMP certification requires all

⁵ Rewi, Adrienne, "The Rise of PMP," *PM Network* (October 2004) p. 18.

⁶ The Project Management Institute, "PMI Today," (February 2007).

applicants with a bachelor's degree to have a minimum of three years of unique, non-overlapping project management experience where at least 4,500 hours are spent leading and directing project tasks. Applicants without a bachelor's degree are required to have a minimum of five years of unique, non-overlapping project management experience where at least 7,500 hours were spent leading and directing project tasks. In both cases, the experience must be accrued within eight years of the date of application. You must fill out a simple form online (or by paper, if you choose not to apply online) listing the title of a project or projects you worked on; the start and end date for when you worked on the project(s); your role on the project; the number of hours you spent in leading and directing tasks related to the initiating, planning, executing, controlling, and closing processes; and a summary of the project tasks that you led and directed on the project. You must list some hours in each of the five process groups, but not for each project, if you worked on multiple projects. PMI staff will review your qualifications and let you know if you are qualified to take the PMP exam. *You cannot take the exam without this experience qualification.*

2. Document at least 35 contact hours of project management education. A contact hour is defined as one hour of participation in an educational activity. There is no time frame for this requirement. A university or college, a training company or independent consultant, a PMI chapter, a PMI Registered Education Provider (REP), a company-sponsored program, or a distance-learning company can provide the education. The hours must include content on project quality, scope, time, cost, human resources, communications, risk, procurement, and integration management. You must list the course title, institution, date, and number of hours for each course. For example, if you took a "principles of management" course at a university 20 years ago, you could list that on the education form along with a one- or two-day PMP exam preparation class.
3. Agree to the PMP certificant and candidate agreement and release statement. This form certifies that application information is accurate and complete and that candidates will conduct themselves in accordance with the Code of Ethics and Professional Conduct, professional development requirements, and other PMI certification program policies and procedures. You can simply check a box saying you agree to this information when applying online. Note that PMI randomly audits 10–15 percent of applications, so be prepared to provide more detailed information as requested if audited, such as college transcripts, signatures of supervisors or managers to verify experience, etc.

4. Pay the appropriate exam fee. As of January 2007, the PMP certification fee was \$405 for PMI members and \$555 for non-members. The re-examination fee (if you don't pass the exam) is \$275 for PMI members and \$375 for non-members. The annual individual PMI membership fee is \$129 (including the \$10 application fee). Note that students, or anyone enrolled in a degree-granting program at an accredited, or globally equivalent, college or university, can join PMI at the student member rate of only \$40 (including the \$10 application fee). If you want to earn your PMP certification, it makes sense to join PMI, not only for the financial savings, but also for other benefits. Consult PMI's Web site for membership information.

The last step in earning PMP certification is passing the exam! After PMI sends you an eligibility letter to take the PMP exam, you can sign up to take it at several different testing sites. You must take the exam within one year of receiving your eligibility letter. The eligibility letter will include complete details for scheduling your exam. As of January 2007, the PMP exam consisted of 200 four-option multiple-choice questions, and 25 of those questions are considered pretest questions that do not affect your score. The pretest questions are randomly placed throughout the exam and are used to test the validity of future examination questions. Although you cannot use any study aids during the exam, you can bring a nonprogrammable calculator to assist in performing calculations required to answer some of the questions. You are also given two blank pieces of paper, so you can write down formulas or other information when you enter the exam room, but you cannot bring in any notes or other materials. The questions on each test are randomly selected from a large test bank, so each person taking the exam receives different questions. The exam is preceded by a 15-minute computer tutorial to familiarize you with the mechanics of taking the exam. Test takers have 4 hours to take this computerized exam, and a passing score is 60.5 percent, or at least 106 correct answers out of the 175 scored questions, as of January 2007. PMI reviews and revises the exam annually. *Be sure you consult PMI's Web site for any notices about changes to the PMP exam.* For example, the passing percentage was changed several times to achieve PMI's goal of having around 75 percent of people pass the exam. PMI uses the Modified Angoff Technique, a certification industry practice standard, to determine the passing score.

PMI offers a professional development program for maintaining the PMP certification. To maintain your PMP status, you must earn at least 60 Professional Development Units within three years, pay a recertification fee every three years when you renew your certification (\$60 as of January 2007), and agree to continue to adhere to PMI's Code of Ethics and Professional Conduct. The Continuing Certification Requirements Handbook, available from PMI's Web site, provides more details on maintaining your PMP status. (Click the Professional Development & Careers link, and then select Certifications Program.)

What Is the Structure and Content of the PMP Exam?

The PMP exam is based on information from the entire project management body of knowledge as well as the area of professional responsibility. Essentially, the exam reviews concepts and terminology in PMI's *PMBOK® Guide Third Edition*, and texts such as this one will help to reinforce your understanding of key topics in project management. Table B-1 shows the approximate breakdown of questions on the PMP exam by process group as of January 2007. Candidates should review updated exam information on PMI's Web site to make sure they are using the latest information. PMI also provides sample exam questions from their site as well. See a link to this site and other sites with free sample questions on the companion Web site.

Table B-1: Breakdown of Questions on the PMP Exam by Process Groups

PROCESS GROUP	PERCENT OF QUESTIONS ON PMP EXAM	NUMBER OF QUESTIONS ON PMP EXAM (OUT OF 200)
Initiating	11	22
Planning	23	46
Executing	27	54
Monitoring and Controlling	21	42
Closing	9	18
Professional Responsibility	9	18

Study Table 3-1 from Chapter 3 of this text to understand the relationships among project management process groups, activities, and knowledge areas. Table 3-1 briefly outlines which activities are performed during each of the project management process groups and what is involved in each of the knowledge areas. It is also important to understand what each of the project management activities includes. Several questions on the certification exam require an understanding of this framework for project management, and many questions require an understanding of the various tools and techniques described in the *PMBOK® Guide Third Edition* and this text.

The PMP exam includes three basic types of questions:

1. *Conceptual questions* test your understanding of key terms and concepts in project management. For example, you should know basic definitions such as what a project is, what project management is, and what key activities are included in project scope management.
2. *Application questions* test your ability to apply techniques to specific problems. For example, a question might provide information for constructing a network diagram and ask you to find the critical path or determine how

much slack is available on another path. You might be given cost and schedule information and be asked to find the schedule or cost performance index by applying earned value formulas.

3. *Evaluative questions* provide situations or scenarios for you to analyze, and your response will indicate how you would handle them. For example, a project might have many problems. A question might ask what you would do in that situation, given the information provided. Remember that all questions are multiple-choice, so you must select the best answer from the options provided.

How Should You Prepare for the PMP Exam?

To prepare for the PMP exam, it is important to understand *your* learning and testing style, and to use whatever resources and study techniques work best for *you*. Below are some important questions to consider:

- *Are you a good test taker?* Some people are very good at studying and do well on multiple-choice exams, but others are not. If you have not taken a long multiple-choice test in a while, it may take you longer to prepare for the exam than others.
- *How confident do you need to be before taking the exam?* To pass the exam, you need to answer only 60.5 percent of the questions correctly. Your PMP certificate will not display your final score, so it does not matter if you get 61, 70, 80, 90, or even 100 percent correct.
- *How much information do you need to review before taking the exam?* The *PMBOK® Guide Third Edition* and this text should be enough content information, but many people want to review even more information before taking the PMP exam. Several companies sell books, sample tests, CD-ROMs, and audiotapes, or provide courses designed to help people pass the PMP exam. There's even a *PMP Certification for Dummies* book available with a CD-ROM of sample questions. In January 2007, performing a search using the keyword "PMP" at www.amazon.com resulted in 3,961 different books! Performing a search using the keywords "PMP exam" at www.google.com resulted in 547,000 hits. See the Suggested Readings section of the companion Web site for a list of suggested resources, many at no cost at all, such as www.pmstudy.com and www.bestsamplequestions.com.
- *How much time and money do you want to spend studying for the PMP exam?* Some people with little free time or money to spend on extra courses or materials would rather just take the PMP exam with little preparation; this will tell them what they need to study further if they don't pass on their first attempt. Even though there is a reexamination fee of \$275 (for PMI members), this cost is generally less than what you would have to pay for most exam preparation courses. Spend the time and money you

need to feel confident enough to pass the exam, but don't over-extend yourself.

- *Do you know PMI's language?* Even if you think you know about project management, studying the material in the *PMBOK® Guide Third Edition* before taking the exam will help you. Volunteer PMPs created the exam, and they often refer to information from the *PMBOK® Guide Third Edition* when writing questions. Many outstanding project managers might fail the exam if they don't use PMI's terminology or processes in their jobs.
- *Do you really understand the triple constraint of project management?* Many questions on the PMP exam are based on the scope, time, and cost knowledge areas. You should be familiar with project charters, WBSs, network diagrams, critical path analysis, cost estimates, earned value, and so on before you take the exam.
- *Do you want to meet other people in the field of project management as you study for your PMP exam?* Several chapters of PMI offer PMP exam review courses. These courses are often a good way to network with other local project managers or soon to be project managers. Many other organizations provide online and instructor-led courses in PMP preparation where you can also meet people in the field. Several organizations also provide their own in-house study groups as a means to network as well as pass the PMP exam.
- *Do you need extra support, peer pressure, or incentives to pass the PMP exam?* Having some support and positive peer pressure might help to ensure that you actually take and pass the exam in a timely manner. If you don't want to be part of a study group, even just telling a friend, colleague, or loved one that you have set a goal to pass the PMP exam by a certain date might provide motivation to actually do it. You could also reward yourself after you pass the exam.
- *How much are you willing to invest in getting PMP certification?* If you have the time and money, you could take one of the immersion courses several companies offer, like Cheetah Learning, Velociteach, Project Management Training Institute, or mScholar. These courses generally last four to five days and cost between two and three thousand dollars. The company offering the course will have you come to class with your qualification to take the PMP exam already completed, and you actually take the PMP exam on the fourth or fifth day of the class. If you don't pass, many training companies will let you take the class again at no additional cost. If you don't have any extra money to spend, you can find several free resources (see the companion Web site) and join or form your own study group, or just go take the exam and see how you do. However, try not to over study for the exam; if you know the material well and are passing practice exams, trust yourself and your skills. If you need to take it a second time to pass, just do so.

Ten Tips for Taking the PMP Exam

1. The PMP exam is computer based and begins with a short tutorial on how to use the testing software. The software makes it easy to mark questions you want to review later, so learning how to mark questions is helpful. Using this feature can give you a feel for how well you are doing on the test. It is a good idea to go through every question somewhat quickly and mark those questions on which you want to spend more time. If you mark 79 questions or less (the total number you can miss to get 60.5 percent on all 200 questions), you should pass the exam. Remember that 25 of the questions are not scored, and you need 60.5 percent correct on the 175 scored questions.
2. The time allotted for the exam is 4 hours, and each multiple-choice question has four answer choices. You should have plenty of time to complete the exam. Use the first two to three hours to go through all of the questions. Do not spend too much time on any one question. As you work, mark each question that you would like to return to for further consideration. Then use the remaining time to check the questions you are not sure of. If you're a morning person, schedule your exam in the morning. If you work better after lunch, schedule an afternoon exam. Make sure you are alert and well rested when you go in to take the exam.
3. Some people believe it is better to change answers you were originally unsure of. If you think that a different answer is better, after reading the question again, then change your answer. Don't get hung up on any questions. Move on and focus on answering the questions you can answer correctly.
4. Do not try to read more into the questions than what is stated. There are no trick questions, but some may be poorly worded or just bad questions. Remember that they were written by volunteers and are part of a huge test bank. Most of the questions are relatively short, and there are only four options from which to choose the answer.
5. To increase your chances of getting the right answer, first eliminate obviously wrong options, and then choose among the remaining options. Take the time to read all of the options before selecting an answer. Remember you have to pick the *best* answer available.
6. Some questions require doing calculations such as earned value management. It is worthwhile to memorize the earned value formulas to make answering these questions easier. You may use a nonprogrammable calculator while taking the exam, so be sure to bring one to make performing calculations easier.

7. You should be given two pieces of blank paper to use during the exam. You might want to bring the paper yourself to make sure it is available. Before starting the test, you should write down important equations so that you do not have to rely on your memory. When you come to a question involving calculations, write the calculations down so you can check your work for errors. See Table B-2 for a summary of formulas you should know for the PMP exam.
8. Read all questions carefully. A few sections of the test require that you answer three to four questions about a scenario. These questions can be difficult; it can seem as if two of the choices could be correct, although you can choose only one. Read the directions for these types of questions several times to be sure you know exactly what you are supposed to do. Also, remember important concepts such as the importance of using a WBS, emphasizing teamwork, and practicing professional integrity. You might want to skip the longer or more difficult questions and answer the shorter or easier ones first.
9. If you do not know an answer and need to guess, be wary of choices that include words such as always, never, only, must, and completely. These extreme words usually indicate incorrect answers because there are many exceptions to rules.
10. After an hour or two, take a short break to clear your mind. You might want to bring a snack to have during your break. You might also consider bringing earplugs if you're easily distracted by noises in the room.

Table B-2: Formulas to Know for the PMP Exam

TIME RELATED FORMULAS

Assume $o = 6$, $m = 21$, and $p = 36$ for the following examples, where o = optimistic, m = most likely, and p = pessimistic estimate

PERT weighted average = $(o + 4m + p)/6$

Example: PERT weighted average = $(36 + 4(21) + 6)/6 = 21$

PERT standard deviation = $(p - o)/6$

Example: PERT standard deviation = $(36 - 6)/6 = 5$

Range of outcomes using 1 std. dev. = $21 - 5 = 16$ days and $21 + 5 = 26$ days.

Range of outcomes using 2 std. dev. = $21 - 10 = 11$ days and $21 + 10 = 31$ days.

Range of outcomes using 3 std. dev. = $21 - 15 = 6$ days and $21 + 15 = 36$ days.

1 std dev. = **68.3%** of the population

2 std dev. = **95.5%** of the population

3 std dev. = **99.7%** of the population

Table B-2: Formulas to Know for the PMP Exam (continued)**COST/EARNED VALUE FORMULAS**

Earned Value = EV

Actual Cost = AC

Planned Value = PV

Cost Variance = CV = EV - AC

Schedule Variance = SV = EV - PV

Cost Performance Index = CPI = EV/AC

Schedule Performance Index = SPI = EV/PV

BAC = Budget At Completion or the planned total budget for the project

EAC = Estimate At Completion = BAC/CPI

Estimated time at completion = estimated time/SPI

Estimate To Complete (ETC) = EAC - AC

Variance At Completion (VAC) = BAC - EAC

Remember, a negative value for a variance or equivalently an index less than 100% means over budget/behind schedule.

COMMUNICATIONS FORMULAS

Number of communications channels = $(n(n-1))/2$

Example: Assume $n = 5$, where $n =$ number of people

Number of communications channels = $(5(5-1))/2 = (5*4)/2 = 10$

PROCUREMENT FORMULAS

Point of Total Assumption (PTA) = $(\text{Ceiling Price} - \text{Target Price})/\text{Government Share} + \text{Target Cost}$

Make or Buy Analysis: Create a formula so the “make” option equals the “buy” or “lease” option, and then solve for the number of days.

Example: Assume you can purchase equipment for \$3,000 and it costs \$100/day to operate OR you can lease the equipment for \$400/day. In how many days is the lease price equal to the purchase price? Set up an equation where the cost to lease or buy the item is equal to the cost to purchase or make the item.

1. Let $d =$ the number of days you'll use the equipment: $400d = \$3,000 + \$100d$
2. Then solve for d . Subtract $\$100d$ from both sides to get $300d = \$3,000$
3. Then divide each side by $\$300$ to get $d = 10$

Therefore, if you need the equipment for more than 10 days, it would be cheaper to buy it.

Sample PMP Exam Questions

A few sample questions similar to those you will find on the PMP exam are provided on the following pages. You can check your answers at the end of this appendix. If you miss 7 or less out of these 20 questions, you are probably ready to take the PMP exam. You can find additional sample questions and their answers on the companion Web site, as well as links to other free sample tests from various Web sites.

1. A document that formally recognizes the existence of a project is a _____.
 - a. Gantt chart
 - b. WBS
 - c. project charter
 - d. scope statement
2. Decomposition is used in developing _____.
 - a. the management plan
 - b. the communications plan
 - c. the earned value
 - d. the WBS
3. The critical path on a project represents _____.
 - a. the shortest path through a network diagram
 - b. the longest path through a network diagram
 - c. the most important tasks on a project
 - d. the highest-risk tasks on a project
4. If the earned value (EV) for a project is \$30,000, the actual cost (AC) is \$33,000, and the planned value (PV) is \$25,000, what is the cost variance?
 - a. \$3,000
 - b. -\$3,000
 - c. \$5,000
 - d. -\$5,000
5. If the earned value (EV) for a project is \$30,000, the actual cost (AC) is \$33,000, and the planned value (PV) is \$25,000, how is the project performing?
 - a. The project is over budget and ahead of schedule.
 - b. The project is over budget and behind schedule.
 - c. The project is under budget and ahead of schedule.
 - d. The project is under budget and behind schedule.
6. What is the target goal for defects per million opportunities using Six Sigma?
 - a. 1
 - b. 3.4
 - c. 34
 - d. 100
7. Project human resource management does not include which of the following processes?
 - a. acquiring the project team
 - b. developing the project team
 - c. managing the project team
 - d. estimating activity resources

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8. If a project team goes from three to five people, how many more communications channels are there?
 - a. 7
 - b. 6
 - c. 5
 - d. 4
9. Your project team has identified several risks related to your project. You decide to take actions to reduce the impact of a particular risk event by reducing the probability of its occurrence. What risk response strategy are you using?
 - a. risk avoidance
 - b. risk acceptance
 - c. risk mitigation
 - d. contingency planning
10. Which type of contract provides the least amount of risk for the buyer?
 - a. firm fixed price
 - b. fixed price incentive
 - c. cost plus incentive fee
 - d. cost plus fixed fee
11. Suppose you have a project with four tasks as follows:
 - Task 1 can start immediately and has an estimated duration of 1.
 - Task 2 can start after Task 1 is completed and has an estimated duration of 4.
 - Task 3 can start after Task 2 is completed and has an estimated duration of 5.
 - Task 4 can start after Task 1 is completed and must be completed when Task 3 is completed. Its estimated duration is 8.What is the length of the critical path for this project?
 - a. 9
 - b. 10
 - c. 11
 - d. 12
12. In which of the following project management process groups are the most time and money typically spent?
 - a. initiating
 - b. planning
 - c. executing
 - d. controlling

13. Creating a probability/impact matrix is part of which risk management process?
 - a. risk management planning
 - b. risk identification
 - c. qualitative risk analysis
 - d. quantitative risk analysis
14. It is crucial that your project team finish your project on time. Your team is using a technique to account for limited resources. You have also added a project buffer before the end date and feeding buffers before each critical task. What technique are you using?
 - a. critical path analysis
 - b. PERT
 - c. critical chain scheduling
 - d. earned value management
15. One of your senior technical specialists informs you that a major design flaw exists in a systems development project you are managing. You are already testing the system and planned to roll it out to more than 5,000 users in a month. You know that changing the design now will cause several cost and schedule overruns. As project manager, what should you do first?
 - a. Issue a stop work order until you understand the extent of the flaw.
 - b. Notify your project sponsor immediately to see if there are additional funds available to work on this problem.
 - c. Notify your senior management and let them decide what to do.
 - d. Hold a meeting as soon as possible with key members of your project team to discuss possible solutions to the problem.
16. You are a member of a large government project. You know that the contract insists that all equipment be manufactured in the United States. You see a senior member of your team replacing a company etching on a piece of equipment that was made in a foreign country. You confront this person, and he says he is following the project manager's orders. What should you do?
 - a. Nothing; the project manager made the decision.
 - b. Immediately report the violation to the government.
 - c. Update your resume and look for another job.
 - d. Talk to the project manager about the situation, and then decide what to do.
17. Which of the following is not an output of the integrated change control process?
 - a. project management plan updates
 - b. approved corrective action
 - c. forecasts
 - d. deliverables

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18. The ceiling price for a contract is \$1.25 million, the target price is \$1.1 million, the target cost is \$1 million, and the government share is 75%. What is the point of total assumption?
 - a. \$1.2 million
 - b. \$1 million
 - c. \$1.1 million
 - d. there is not enough information
19. Obtaining quotes, bids, offers, or proposals is part of which project procurement management process?
 - a. plan purchases and acquisitions
 - b. request seller responses
 - c. select sellers
 - d. contract administration
20. Your boss believes that all of your project team members avoid work as much as possible. He or she often uses threats and various control schemes to make sure people are doing their jobs. Which approach to managing people does your boss follow?
 - a. Maslow's hierarchy of needs
 - b. Theory X
 - c. Theory Y
 - d. Herzberg's motivation and hygiene factors

WHAT IS PROJECT+ CERTIFICATION?

The Computing Technology Industry Association (CompTIA) is the world's largest developer of vendor-neutral IT certification exams. By January 2007, more than 900,000 people worldwide have earned CompTIA certifications in topics such as PC service, networking, security, and Radio Frequency Identification (RFID). In April 2001, CompTIA started offering its IT Project+ certification, which was purchased from Prometric-Thomson Learning, and recognized as the Gartner Institute Certification Program. The certification was renamed Project+ in August 2004. According to CompTIA's manager of public relations, there are more than 9,000 people with CompTIA's Project+ certification as of January 2007. Detailed information about Project+ certification is

available from CompTIA's Web site (www.comptia.org) under certification. The following information is quoted from a press release on their site

Individuals managing any type of project for their company—whether or not it has an IT component to it—can benefit enormously from using the certification as a means of validating project management competency," said Lisa-Ann Barnes, president, IreeTec, Inc. and chair of the CompTIA Project+ advisory committee.

Individuals passing the certification exam validate knowledge mastery equivalent to 2,000 hours of on-the-job practical experience. CompTIA Project+ can serve as a standalone certificate for individuals or as a stepping-stone toward the Project Management Institute PMP certification, which requires 4,500 hours of experience.⁷

What Are the Requirements for Earning and Maintaining Project+ Certification?

You can register to take the Project+ exam online from CompTIA's Web site. Testing sites include Thomson Prometric and Pearson VUE. Unlike the PMP exam, there are very few requirements you need to meet to take the Project+ exam. CompTIA does not require that you have any work experience or formal education in project management before you can take the Project+ exam, but they do recommend 2,000 hours of work experience. The main requirements include paying a fee and passing the exam. Important information is summarized below:

1. As of January 2007, the cost for taking the Project+ exam is \$225 for non-members in the United States.
2. To pass this 90-minute, 80-question exam, you must score at least 63 percent.
3. You do not need to renew your Project+ certification.
4. Project+ certification is one of the prerequisites or equivalents to Novell's Certified Novell Engineer (CNE), Certified Novell Administrator (CNA), and Certified Novell Instructor (CNI) certifications. CompTIA's Project+ certification is also a Continuing Certification Requirement (CCR) to maintaining a Master CNE certification.
5. You can earn college credit with the Project+ certification. For example, CompTIA's Web site says that Capella University will provide six credit hours to someone with the Project+ certification. Many colleges and universities will grant credit based on your experience or other certifications. There is usually some fee involved, but it's often much less than the cost of taking the courses.

⁷ CompTIA Web site (www.comptia.org/pressroom/get_pr.aspx?prid=489) (October 2004).

Additional Information on the Project+ Exam

Because there are no experience or education requirements for taking the Project+ exam, you might want to take it very early in your career. Once you have enough experience and education to take the PMP exam, you might want to earn and maintain PMP certification.

As stated above, the Project+ exam consists of 80 questions. Table B-3 shows the approximate breakdown of questions on the Project+ exam by four domain areas. Candidates should review updated exam information on CompTIA's Web site to make sure they are prepared for the exams. For example, CompTIA provides a detailed list of objectives you should understand before taking the Project+ exam. Studying information in this book will also help you prepare for the Project+ exam. You might also want to purchase an exam guide to get specific information and access to more sample questions.

Table B-3: Breakdown of Questions on the Project+ Exam by Domain Areas

DOMAIN AREA	PERCENT OF QUESTIONS ON PROJECT+ EXAM
Project Initiation and Scope Definition	20
Project Planning	30
Project Execution, Control, and Coordination	43
Project Closure, Acceptance, and Support	7

Much of the advice for taking the PMP exam also applies to taking the Project+ exam. Many people find the questions to be similar on both exams, although the PMP exam is longer and more comprehensive. Below are some of the main differences between the content and types of questions you will find on the Project+ exam:

- The Project+ exam includes some scenarios and content specific to the information technology industry. For example, you should understand the various systems development life cycles and issues that often occur on information technology projects.
- You should understand the various roles of people on information technology projects, such as business analysts, database analysts, programmers, and so on.
- Although many of the questions are multiple-choice like the PMP exam questions, several questions involve choosing two or more correct answers. Several questions also involve matching or putting items in order, called drag-and-drop questions.
- The Project+ exam is not based on the *PMBOK® Guide Third Edition*, so you do not need to know the processes involved in the various knowledge areas. However, much of the terminology, concepts, tools, and techniques are the same on both exams.

Sample Project+ Exam Questions

A few sample questions similar to those you will find on the Project+ exam are provided below. CompTIA also provides sample questions on their Web site at http://certification.comptia.org/resources/practice_test.aspx. You can check your answers at the end of this appendix.

- Two software developers on your project disagree on how to design an important part of a system. There are several technologies and methodologies they could use. What should be the primary driver in deciding how to proceed?
 - following corporate standards
 - following industry standards
 - meeting business needs
 - using the lowest-cost approach
- Match the following items to their descriptions:

Stakeholder	a. Acts as a liaison between the business area and developers
Project manager	b. Writes software code
Business analyst	c. Person involved in or affected by project activities
Programmer	d. Responsible for managing project activities
- For a project to be successful, the project manager should strive to understand and meet certain goals. What are the three main project goals to meet? Select three answers.
 - scope or performance goals
 - time goals
 - political goals
 - cost goals
 - stock price goals
- You have received an incomplete project scope definition. Put the following actions in order of how you should proceed to complete them.
 - Incorporate additional changes to the scope definition document.
 - Review the draft scope definition document with your project team.
 - Get signatures on the completed scope definition document.
 - Rewrite the draft scope definition document with your users and project team.
- What term is used to describe the process of reaching agreement on a collective decision?
 - collaboration
 - cooperation
 - coordination
 - consensus

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6. What is a variance?
 - a. a buffer in a duration estimate
 - b. a small amount of money set aside for contingencies
 - c. a form of risk management
 - d. a deviation from the project plan
7. Which of the following would be legitimate reasons for a vendor to request a delay in delivering a product? Select two answers.
 - a. The vendor may have underestimated the amount of time required to produce and deliver the product.
 - b. The project contact from the vendor's organization may be going on vacation.
 - c. The vendor might be able to provide a better product by delivering the product late.
 - d. The vendor might lose money by delivering the product late.
8. When should you involve stakeholders in the change control process on information technology projects?
 - a. before a change is submitted
 - b. after a change is submitted
 - c. when a change is submitted
 - d. throughout the life of a project
9. Which of the following techniques can be used to help manage requirements? Select three answers.
 - a. prototyping
 - b. use case modeling
 - c. JAD
 - d. worst case modeling
10. Match the following items to their descriptions:

Lessons learned		a. Leave a clear and complete history of a project
Project audits		b. Review project progress and results
Project archives		c. Document what went right or wrong on a project

WHAT OTHER EXAMS OR CERTIFICATIONS RELATED TO PROJECT MANAGEMENT ARE AVAILABLE?

In recent years, several organizations have been developing more certifications related to project management and information technology project management, in particular. Some involve taking exams while others require coursework or attendance at workshops. Below are brief descriptions of other existing exams or certifications related to project management:

- Microsoft provides certification as a Microsoft Office Specialist (MOS) to recognize proficiency in using its software products. As of January 2007, you can earn certification for Microsoft Project 2000 or 2002. In October 2006, Microsoft Learning launched a new Microsoft Office Project 2007 Certification program. Its purpose is “to help advance project management as a profession and maximize value for its customer base of nearly 20 million Microsoft Office Project user licenses.”⁸ Microsoft is using the PMI’s *PMBOK® Guide Third Edition* as a foundation for supporting specific Project 2007 competencies. See Microsoft’s Web site for more details.
- The International Project Management Association (IPMA) offers a four-level certification program. The main requirements for each level are derived from typical activities, responsibilities, and requirements from practice. The IPMA four-level certification system, in descending order, includes the Certified Project Director, Certified Senior Project Manager, Certified Project Manager, and Certified Project Management Associate. More than 50,000 people worldwide had earned IPMA certifications, according to IPMA’s Web site in January 2007. See www.ipma.ch for more details.
- Certified IT Project Manager (CITPM): In 1998, the Singapore Computer Society collaborated with the Infocomm Development Authority of Singapore to establish an Information Technology Project Management Certification Program. PMI signed a Memorandum of Understanding with the Singapore Computer Society to support and advance the global credentialing of project management and information technology expertise. In January 2007, the Singapore Computer Society’s Web site listed three levels of the CITPM Certification: CITPM (Senior), CITPM, and CITPM (Associate). For more details consult their Web site (www.scs.org.sg/about_certprog.php).

⁸ Microsoft, “Microsoft Advances Its Project Management Technology and the Project Management Profession,” Microsoft PressPass, October 20, 2006.

- PMI's additional certifications. As mentioned earlier, PMI also offers certification as a Certified Associate in Project Management (CAPM), a Program Management Professional (PgMPSM), and OPM3® ProductSuite. Consult PMI's Web site for updated information on their certification programs.
- Many colleges, universities, and corporate training companies now provide their own certificate programs or entire degrees in project management. Typing "project management certificate" into google.com in January 2007 resulted in 81,400 hits. Some of the certificate courses apply toward bachelor's or advanced degrees, while many do not. Like any other educational program, it is important to research the quality of the program and find one that will meet your specific needs. See the author's Web site for a summary of more than 120 U.S. graduate programs created as part of a class project in 2006 (www.kathyschwalbe.com, under Project Management Info). Also see sites like www.gradschools.com to find more information on graduate programs in project management throughout the world.

FINAL ADVICE ON CERTIFICATION AND PROJECT MANAGEMENT IN GENERAL

Now that you have read this text and discussed project management with others, I hope that you have grown to see project management as a valuable skill, especially in the information technology field. Project management certification can be your first step toward advancing your career in the fast-paced world of technology and business, for no matter how much things change, the need for projects and project managers is a constant.

The knowledge and experience I have gained working on and managing projects continues to help me in my career and my personal life. I was fortunate to step into a project management role very early in my career as an Air Force officer. My first real job at the age of 22 was as a project manager. I have held several job titles since then—systems analyst, senior engineer, technical specialist, information technology management consultant, independent consultant, college professor, and now author. All of these jobs included working on or managing projects. As a wife and mother of three, I can also attest to the fact that project management skills help in planning and executing social activities (weddings, birthday parties, fundraisers, and so on) and in dealing with the joys and challenges of everyday life.

DISCUSSION QUESTIONS

1. What is PMP certification, and why do you think the number of people earning it has grown so much in the past ten years?
2. What do you need to do before you can take the PMP exam? What is the exam itself like? What do you need to do to maintain PMP certification?

- What do you need to do to take the Project+ exam? How does the Project+ exam differ from the PMP exam? Do you need to renew Project+ certification?
3. What is the difference between conceptual, application, and evaluative questions? Which project management process groups have the most questions on the PMP exam? What are the four domain areas tested on the Project+ exam?
 4. Which tips for taking the PMP exam do you think would be most helpful for you?
 5. If you plan to take the Project+ or PMP exam soon, what should you do to prepare?
 6. Briefly describe project management certification programs other than the PMP or Project+ certifications.

EXERCISES

1. Go to PMI's Web site and review the information about taking the PMP exam. Write a two-page paper summarizing what you found.
2. Go to CompTIA's Web site and review the information about taking the Project+ exam. Write a two-page paper summarizing what you found.
3. Answer the 20 sample PMP questions in this text or take another sample test (see the additional PMP questions on the companion Web site or links to other sample questions, or do an Internet search to find some other sample PMP tests). Take the sample test, and then score your results. Summarize how you did and areas you would need to study before you could take the PMP exam.
4. Interview someone who has PMP or Project+ certification. Ask him or her why he or she earned the certification and how it has affected his or her career. Write your findings in a two-page paper.
5. Do an Internet search on earning PMP or Project+ certification. Be sure to search for Yahoo! groups or similar sites related to these topics. What are some of the options you found to help people prepare for either exam? If you were to take one of the exams, what do you think you would do to help study for it? Do you think you would need additional information beyond what is in this text to help you pass? Write a two-page paper describing your findings and opinions.
6. Read a recent issue of PMI's *PM Network* magazine. You can order a copy from PMI's Web site, or contact someone from a local PMI chapter to obtain a copy. Summarize all of the ads you find in the magazine related to earning PMP or other project management related certification in a two-page paper. Also, include your opinion on which ad, course, book, CD-ROM, or other media appeals to you the most.

ANSWERS TO SAMPLE PMP EXAM QUESTIONS

1. c
2. d
3. b
4. b
5. a
6. b
7. d
8. a
9. c
10. a
11. b
12. c
13. c
14. c
15. d
16. d
17. c
18. a
19. b
20. b

ANSWERS TO SAMPLE PROJECT+ EXAM QUESTIONS

1. c
2. c, d, a, b
3. a, b, d
4. b, d, a, c
5. d
6. d
7. a, c
8. d
9. a, b, c
10. c, b, a



Appendix C

Additional Running Cases

INTRODUCTION

This appendix provides an additional running case with tasks covering each of the nine knowledge areas discussed in Chapters 4–12. Additional running cases are available on the companion Web site (www.course.com/mis/schwalbe/5e). This particular case should be interesting to the video game enthusiast and to anyone interested in marketing and providing products and services primarily over the Internet. The main purpose of this and other running cases is to help you practice some of the project management skills you are developing as part of your course. Several of the tasks involve using templates provided on the companion Web site. Instructors can download the suggested solutions for this and additional running cases from the password-protected section on Course Technology's Web site (www.course.com).

ADDITIONAL CASE 1: VIDEO GAME DELIVERY PROJECT

Part 1: Project Integration Management

An international marketing and distribution company has decided to provide a monthly video game rental program as a result of its market research. Lori, the VP of marketing, will be the project sponsor. She did a lot of market research related to this project, and she has high expectations for meeting untapped customer needs. The Video Game Delivery Project involves developing a Web-based application and support structure to provide customers with video games on a monthly rental basis. For example, a customer would pay a monthly fee and then be able to order several video games over the Internet, receive the games via express mail, return those games via express mail, and keep receiving additional games. Several companies already provide this type of service for movie rentals. Market research and corporate values suggest that the company focus on educational and sports-related video games only, but games would be available for all types of platforms, including popular gaming systems, computers, and learning systems used in preschools and elementary schools. You also plan to serve an international market, providing information and products in several different languages. This system must be very user-friendly, providing customers the ability to search for

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specific games by platform, age and gender appropriateness, customer reviews, sport (for sports-related games), language, and so on. Customers must be able to order the video games, track delivery and return of video games, pay online or via other payment methods (including credit or debit card, check, school payment systems, other electronic payment systems, etc.), and write reviews of the games they rent. The system must also be able to track referrals to the site from corporate partners and customers, display advertisements, and track customer usage patterns.

TASKS

1. Research similar Web-based applications. Based on the scenario description of similar Web sites and your personal opinions, summarize the main functions that this system could provide. Rate the functions as mandatory, optional, and nice-to-have. Then provide an initial assessment of how difficult it would be to provide each function. Write your results in a two-page paper, citing important references.
2. Prepare a weighted decision matrix using the template from the companion Web site (`wtd_decision_matrix.xls`) to evaluate providing the functions you identified in Task 1 above. Develop at least four criteria, assign weights to each criterion, assign scores, and then calculate the weighted scores for each function. Print the spreadsheet and bar chart with the results. Write a one-page paper describing this weighted decision matrix and summarize the results.
3. Prepare the financial section of a business case for the Video Game Delivery Project. Assume this project will take 12 months to complete and cost about \$500,000, and monthly operating costs would be about \$50,000 per month for year one and \$60,000 per month for years two and three. Estimated benefits are about \$1 million the first year after implementation and \$2 million the following two years. Use the business case spreadsheet template from the companion Web site (`business_case.doc`) to help calculate the NPV, ROI, and year in which payback occurs. Assume a 7 percent discount rate.
4. Prepare a project charter for the Video Game Delivery Project. Assume the project will take 12 months to complete and cost about \$500,000. Use the project charter template (`charter.doc`) and examples of project charters in Chapters 3 and 4 as guidelines.
5. You know that people will be requesting changes to the project and want to make sure you have a good integrated change control process in place. You also know that you want to address change requests as quickly as possible. Review the template for a change request form provided on the companion Web site (`change_request.doc`). Write a two-page paper describing how you plan to manage changes on this project in a timely manner. Address who will be involved in making change control decisions, what paperwork/electronic systems will be used to collect and respond to changes, and other related issues.

Part 2: Project Scope Management

Congratulations! You have been selected as the project manager for the Video Game Delivery Project. The company's VP of marketing, Lori, is the project sponsor. Now you need to put together your project team and get to work on this high-visibility project. Top management has told you that you can hand-pick your team. In addition, you will be working with several other companies on this project. Instead of developing all of the software yourselves, you'll use a Web-based application developed by ABC Corp. Of course, you'll need to customize the application somewhat to meet requirements for this project. ABC Corp.'s senior consultant, Gaurav, is your main contact with that company. You'll also be working with Edsys, an educational systems consulting firm that will help you in determining user requirements and developing partnership programs. Your company has never sold directly to schools, and senior management thinks it makes sense to get professional help in selling to that market segment. One of Edsys's top consultants, Julie, and some of her colleagues will assist you. Initial estimates suggest that about half of the \$500,000 budgeted for this project will go to hardware costs and the outsourced software and consulting services. You will need two information technology professionals, two marketing specialists, and one purchasing specialist on your internal project team.

TASKS

1. Develop a scope statement for the project. Use the template provided on the companion Web site (`scope_statement.doc`) and the example in Chapter 3 as guides. Be as specific as possible in describing product characteristics, requirements, and deliverables.
2. Develop a work breakdown structure (WBS) for the project. Break down the work to level 2 or level 3, as appropriate. Use the template on the companion Web site (`wbs.doc`) and samples in Chapters 3 and 5 as guides. Print the WBS in list form as a Word file. Be sure to base your WBS on the project charter, scope statement, and other relevant information.
3. Use the WBS you developed in Task 2 above to create a Gantt chart in Microsoft Project 2007 for the project. Use the outline numbering feature to display the outline numbers (click Tools on the menu bar, click Options, and then click Show outline number). Do not enter any durations or dependencies. Print the resulting Gantt chart on one page, being sure to display the entire Task Name column.
4. Develop a strategy for scope verification and change control for this project. Write a two-page paper summarizing key points of the strategy.

Part 3: Project Time Management

As project manager, you are actively leading the Video Game Delivery Project team in developing a schedule. The two information technology professionals on your team are Matt and Najwa, the marketing specialists are Magda and John, and the purchasing specialist is Nora. Recall that the project is expected to be completed in one year for \$500,000. Assume that all of your internal team members are available to work up to 75 percent of their time on this project. Your project sponsor, Lori, has made it clear that it is important to meet or beat the one-year schedule goal. Your team has agreed to add a one-month buffer at the end of the project to ensure that you finish on time or early.

TASKS

1. Review the WBS and Gantt chart you created for Tasks 2 and 3 in Part 2. Propose three to five additional activities you think should be added to help you estimate resources and durations. Write a one-page paper describing these new activities.
2. Identify at least eight milestones for this project. Write a one-page paper describing each milestone using the SMART criteria.
3. Using the Gantt chart you created for Task 3 in Part 2, and the new activities and milestones you proposed in Tasks 1 and 2 above, estimate the task durations and enter dependencies, as appropriate. Remember that your schedule goal for the project is one year. Print the Gantt chart and network diagram.
4. Write a one-page paper summarizing how you would assign people to each activity. Include a table or matrix listing how many hours each person would work on each task. These resource assignments should make sense given the duration estimates made in Task 3 above.
5. Assume that your project team starts falling behind schedule. You know that it is crucial to meet or beat the one-year schedule goal. Describe strategies for making up lost time and avoiding schedule slips in the future.

Part 4: Project Cost Management

Your project sponsor has asked you and your team to refine the existing cost estimate for the project so that there is a solid cost baseline for evaluating project performance. Recall that your schedule and cost goals are to complete the project in one year or less for under \$500,000. Also recall that you plan to purchase a Web-based application developed by ABC Corp. and customize it to meet

requirements for this project. You'll also have consultants from Edsys, who will help you determine user requirements and develop partnership programs. Initial estimates suggested that about half of the \$500,000 budgeted for this project would go to hardware costs and the outsourced software and consulting services.

TASKS

1. Prepare and print a one-page cost estimate for the project, similar to the one provided in Figure 7-2 in Chapter 7. Use the WBS level 1 categories provided below, and be sure to document assumptions you make in preparing the cost estimate. Assume a labor rate of \$100/hour for the project manager and \$60/hour for other project team members. Assume twice those numbers for outsourced labor.
 - a. Project Management (internal)
 - b. Requirements Definition
 - c. Off-the-Shelf System Installation
 - d. System Customization (for transferring/entering product and customer information and developing new capabilities like managing referrals, displaying advertisements, and tracking customer usage patterns)
 - e. Testing
 - f. Training, Roll Out, and Support
2. Using the cost estimate you created above, prepare a cost baseline by allocating the costs by WBS for each month of the project.
3. Assume you have completed six months of the project. The BAC was \$500,000 for this 12-month project. Also assume the following:
 - PV= \$300,000
 - EV= \$280,000
 - AC= \$250,000

Using this information, write a two-page report that answers the following questions.

- a. What is the cost variance, schedule variance, cost performance index (CPI), and schedule performance index (SPI) for the project?
- b. Use the CPI to calculate the estimate at completion (EAC) for this project. Use the SPI to estimate how long it will take to finish this project. Sketch an earned value chart using the above information, including the EAC point. See Figure 7-6 as a guide. Write a paragraph explaining what this chart shows.
- c. How is the project doing? Is it ahead of schedule or behind schedule? Is it under budget or over budget? Should you alert your senior management and ask for assistance? Should you talk to your sponsor before the meeting to discuss this data?

4. You notice that several of the tasks that involve getting inputs and approvals from stakeholders inside your own company (specifically the sales and legal departments) have taken longer to complete than planned. You have talked to the people in those departments several times, but everyone says they are doing the best they can. Write a one-page paper describing corrective action you could take to address this problem.

Part 5: Project Quality Management

The Video Game Delivery Project team is working hard to ensure that the new system meets expectations. The team has a detailed project scope statement, schedule, and so on, but as the project manager, you want to make sure you'll satisfy key stakeholders, especially Lori, the project sponsor. Lori is also very sensitive to customer needs, so you have to make sure the new system is stable and easy to use. You know Lori wants the system to provide the most important capabilities within a year so the company can start making money from this new venture. You also know that you might need to make some tradeoffs in terms of cost and scope to meet the schedule goal.

TASKS

1. Develop a list of quality standards or requirements related to meeting the stakeholder expectations described above, especially for customers. Also provide a brief description of each requirement. For example, a requirement might be that the new system is available 24 hours a day, 7 days a week, and that any normal 12-year-old should be able to use it.
2. You have decided to expand the testing program to observe several potential customers using early versions of the system to get their feedback. Write a two-page paper describing how this testing will work. Try to find information on how real companies get customer feedback such as this.
3. After analyzing results of early customer testing of the new system, you decide to create a Pareto diagram to easily see what problems or suggestions users reported. First, create a spreadsheet in Excel, using the data in the table below. List the most frequently described problems or suggestions first. Add a column called "% of Total" and another one called "Cumulative %." Then enter formulas to calculate those items. Next, use the Excel Chart Wizard to create a Pareto diagram based on this data. Use the Line – Column on 2 Axis custom type chart so your resulting chart looks similar to the one in Figure 8-6.

PROBLEMS/SUGGESTIONS	# OF TIMES REQUESTED
Shopping cart is not like others	18
No easy way to sort products by age, rating, cost, etc.	22
No product pictures	15
Can't use PayPal or similar payment options	3
System is too slow	10
Interface is boring	4

Part 6: Project Human Resource Management

Now that you have expanded the testing for the Video Game Delivery Project, you need to clarify who needs to do what for the customer-testing portion of the project. Recall that the team members include you, the project manager; Lori, your project sponsor; Matt and Najwa from the information technology department; Magda and John from the marketing department; Nora from the purchasing department; Gaurav from ABC Corp., who's providing the Web-based application and helping you customize it; and Julie, your main contact from Edsys, the educational systems consulting firm.

1. Prepare a responsibility assignment matrix based on the following information: The main tasks that need to be done for early customer testing are to determine the demographics for the testers, plan how many people and how many testing sessions will be held, find the testers, develop the test, prepare the facilities, create the survey and other methods for getting customer feedback, and analyze the results. Prepare a RACI chart to help clarify roles and responsibilities for these customer-testing tasks. Document key assumptions you make in preparing the chart.
2. You've decided to temporarily add additional people to the project to help run the customer testing. Based on feedback from your marketing specialists and the outside consultants, you decide that the customer testing will occur over a 10-day period. Assume that you'll need two marketing specialists and three technical specialists each day, yourself and one administrative assistant half time each day, one facilities expert for the first two days, and two assessment experts the last two days. Create a resource histogram, similar to the one in Figure 9-7, based on this information.
3. Customer testing has just started, but you realize that there isn't enough physical space or access to computers and other items everyone assumed would be available. You cannot add more people to address these problems, but you can suggest overtime, find additional computers, or provide other amenities to improve the work environment. Write a one-page paper describing what you can do quickly to address this situation.

Part 7: Project Communications Management

Several issues have arisen on the Video Game Delivery Project. Four months have passed since the project started. Gaurav and his company are complaining about not being paid appropriately. You initially thought you would only need a small amount of customization of the outsourced software, but now the supplier says the customization will cost another \$100,000 over their initial budget. The purchasing specialist on your internal project team, Nora, does not like this supplier at all and gets very hostile at team meetings. Everyone else has been fairly happy with the supplier, and you weren't that surprised when they raised the customization estimate. Nora went to senior management (without telling you), and suggested terminating that supplier. Your two information technology specialists, Matt and Najwa, came and told you that they both feel that they are being underutilized on the project. As project manager, you have been getting short, weekly status reports from all of your team members, but many of them did not address challenges people are obviously facing.

1. Create an issue log for the project. List at least three issues and related information based on the scenario presented.
2. In addition to written weekly status reports, what else might you suggest to improve project communications? Summarize your ideas in a one-page paper.
3. Write a two-page paper describing how you might approach two of the conflicts described above.

Part 8: Project Risk Management

Since several problems have been occurring on the Video Game Delivery project (see the running case information in Part 7 above), you have decided to be more proactive in managing risks. You also want to address positive and negative risks.

1. Create a risk register for the project, using Table 11-5 as a guide. Identify six potential risks, including at least two positive risks.
2. Plot the six risks on a probability/impact matrix, using Figure 11-5 as a guide. Assign a numeric value for the probability of each risk, and its impact on meeting the main project objectives. Use a scale of 1 to 10 to assign the values, with 1 being lowest and 10 being highest. For a simple risk factor calculation, multiply these two values (the probability score and the impact score). Enter the new data in the risk register. Write your rationale for how you determined the scores for one of the negative risks and one of the positive risks.

3. Develop a response strategy for one of the negative risks and one of the positive risks. Enter the information in the risk register. Write a separate paragraph describing what specific tasks would need to be done to implement the strategy. In addition, include time and cost estimates for each strategy.

Part 9: Project Procurement Management

After a monthly progress review meeting six months into your project, top management approved adding \$100,000 to the budget for software customization. Lori, your project sponsor, was not happy with this increase in costs, and she suggested that a procurement audit be performed as soon as possible to avoid any future contractual problems. You have also decided to replace Nora, your internal purchasing specialist.

TASKS

1. Research information on procurement audits. Write a two-page paper with your findings, and describe how a procurement audit might help your company.
2. Draft part of an RFP to have an outside expert/firm perform the procurement audit for this project. Assume it would take one month or less to complete, and you would require a report and presentation on the main findings and suggestions. Write a paragraph or two describing the purpose of the RFP, the organization's background, the basic requirements, and a description of the RFP process. Limit your answer to two or three pages. Also, document at least three major questions you would need answered before sending out the RFP.
3. Write a one-page position description for a new purchasing specialist for this project. Be specific in terms of educational and work experience requirements, personal traits, and so on. Include a requirement that this person work closely with project teams to help them know when contractors are not living up to expectations, how they can provide evidence to support their claims, and what they can do to prevent this type of problem from occurring.
4. Prepare a lessons-learned report for what you may have learned so far as project manager for this project. Use the template provided on the companion Web site (`lessons_learned_report.doc`) and be creative in your response.

Glossary

5 whys — a technique where you repeatedly ask the question “Why” (five is a good rule of thumb) to help peel away the layers of symptoms that can lead to the root cause of a problem

A

acceptance decisions — decisions that determine if the products or services produced as part of the project will be accepted or rejected

activity — an element of work, normally found on the WBS, that has an expected duration and cost, and expected resource requirements; also called task

activity attributes — information about each activity, such as predecessors, successors, logical relationships, leads and lags, resource requirements, constraints, imposed dates, and assumptions related to the activity

activity definition — identifying the specific activities that the project team members and stakeholders must perform to produce the project deliverables

activity duration estimating — estimating the number of work periods that are needed to complete individual activities

activity list — a tabulation of activities to be included on a project schedule

activity sequencing — identifying and documenting the relationships between project activities

activity-on-arrow (AOA) or arrow diagramming method (ADM) — a network diagramming technique in which activities are represented by arrows and connected at points called nodes to illustrate the sequence of activities

actual cost (AC) — the total of direct and indirect costs incurred in accomplishing work on an activity during a given period

adaptive software development (ASD) — a software development approach used when requirements cannot be clearly expressed early in the life cycle

agile software development — a method for software development that uses new approaches, focusing on close collaboration between programming teams and business experts

analogous estimates — a cost estimating technique that uses the actual cost of a previous, similar project as the basis for estimating the cost of the current project, also called top-down estimates

analogy approach — creating a WBS by using a similar project’s WBS as a starting point

appraisal cost — the cost of evaluating processes and their outputs to ensure that a project is error-free or within an acceptable error range

B

backward pass — a project network diagramming technique that determines the late start and late finish dates for each activity in a similar fashion

balanced scorecard — a methodology that converts an organization’s value drivers to a series of defined metrics

baseline — the original project plan plus approved changes

baseline dates — the planned schedule dates for activities in a Tracking Gantt chart

benchmarking — a technique used to generate ideas for quality improvements by comparing specific project practices or product characteristics to those of other projects or products within or outside the performing organization

best practice — an optimal way recognized by industry to achieve a stated goal or objective

bid — also called a tender or quote (short for quotation), a document prepared by sellers providing pricing for standard items that have been clearly defined by the buyer

blogs — easy to use journals on the Web that allow users to write entries, create links, and upload pictures, while readers can post comments to journal entries

bottom-up approach — creating a WBS by having team members identify as many specific tasks related to the project as possible and then grouping them into higher level categories

bottom-up estimates — a cost estimating technique based on estimating individual work items and summing them to get a project total

brainstorming — a technique by which a group attempts to generate ideas or find a solution for a specific problem by amassing ideas spontaneously and without judgment

budget at completion (BAC) — the original total budget for a project

budgetary estimate — a cost estimate used to allocate money into an organization's budget

buffer — additional time to complete a task, added to an estimate to account for various factors

burst — when a single node is followed by two or more activities on a network diagram

C

Capability Maturity Model Integration (CMMI) — a process improvement approach that provides organizations with the essential elements of effective processes

cash flow — benefits minus costs or income minus expenses

cash flow analysis — a method for determining the estimated annual costs and benefits for a project

cause-and-effect diagrams — diagrams that trace complaints about quality problems back to the responsible production operations to help find the root cause. Also known as fishbone or Ishikawa diagrams

champion — a senior manager who acts as a key proponent for a project

change control board (CCB) — a formal group of people responsible for approving or rejecting changes on a project

change control system — a formal, documented process that describes when and how official project documents may be changed

closing processes — formalizing acceptance of the project or project phase and ending it efficiently

coercive power — using punishment, threats, or other negative approaches to get people to do things they do not want to do

communications management plan — a document that guides project

communications planning — determining the information and communications needs of the stakeholders: who needs what information, when will they need it, and how will the information be given to them

compromise mode — using a give-and-take approach to resolving conflicts; bargaining and searching for solutions that bring some degree of satisfaction to all the parties in a dispute

configuration management — a process that ensures that the descriptions of the project's products are correct and complete

conformance — delivering products that meet requirements and fitness for use

conformance to requirements — the project processes and products meet written specifications

confrontation mode — directly facing a conflict using a problem-solving approach that allows affected parties to work through their disagreements

constructive change orders — oral or written acts or omissions by someone with actual or apparent authority that can be construed to have the same effect as a written change order

GLOSSARY-3

- contingency plans** — predefined actions that the project team will take if an identified risk event occurs
- contingency reserves or contingency allowances** — provisions held by the project sponsor or organization to reduce the risk of cost or schedule overruns to an acceptable level
- contract** — a mutually binding agreement that obligates the seller to provide the specified products or services, and obligates the buyer to pay for them
- control chart** — a graphic display of data that illustrates the results of a process over time
- cost baseline** — a time-phased budget that project managers use to measure and monitor cost performance
- cost budgeting** — allocating the overall cost estimate to individual work items to establish a baseline for measuring performance
- cost control** — controlling changes to the project budget
- cost estimating** — developing an approximation or estimate of the costs of the resources needed to complete the project
- cost management plan** — a document that describes how cost variances will be managed on the project
- cost of capital** — the return available by investing the capital elsewhere
- cost of nonconformance** — taking responsibility for failures or not meeting quality expectations
- cost of quality** — the cost of conformance plus the cost of nonconformance
- cost performance index (CPI)** — the ratio of earned value to actual cost; can be used to estimate the projected cost to complete the project
- cost plus fixed fee (CPFF) contract** — a contract in which the buyer pays the supplier for allowable performance costs plus a fixed fee payment usually based on a percentage of estimated costs
- cost plus incentive fee (CPIF) contract** — a contract in which the buyer pays the supplier for allowable performance costs along with a predetermined fee and an incentive bonus
- cost plus percentage of costs (CPPC) contract** — a contract in which the buyer pays the supplier for allowable performance costs along with a predetermined percentage based on total costs
- cost variance (CV)** — the earned value minus the actual cost
- cost-reimbursable contracts** — contracts involving payment to the supplier for direct and indirect actual costs
- crashing** — a technique for making cost and schedule trade-offs to obtain the greatest amount of schedule compression for the least incremental cost
- critical chain scheduling** — a method of scheduling that takes limited resources into account when creating a project schedule and includes buffers to protect the project completion date
- critical path** — the longest path through a network diagram that determines the earliest completion of a project
- critical path method (CPM) or critical path analysis** — a project network analysis technique used to predict total project duration
-
- D**
- decision tree** — a diagramming analysis technique used to help select the best course of action in situations in which future outcomes are uncertain
- decomposition** — subdividing project deliverables into smaller pieces
- defect** — any instance where the product or service fails to meet customer requirements
- Define, Measure, Analyze, Improve, Control (DMAIC)** — a systematic, closed-loop process for continued improvement that is scientific and fact based
- definitive estimate** — a cost estimate that provides an accurate estimate of project costs

- deliverable** — a product or service, such as a technical report, a training session, a piece of hardware, or a segment of software code, produced or provided as part of a project
- Delphi technique** — an approach used to derive a consensus among a panel of experts, to make predictions about future developments
- dependency** — the sequencing of project activities or tasks; also called a
- deputy project managers** — people who fill in for project managers in their absence and assist them as needed, similar to the role of a vice president
- design of experiments** — a quality technique that helps identify which variables have the most influence on the overall outcome of a process
- direct costs** — costs that can be directly related to producing the products and services of the project
- directives** — new requirements imposed by management, government, or some external influence
- discount factor** — a multiplier for each year based on the discount rate and year
- discount rate** — the rate used in discounting future cash flow; also called the capitalization rate or opportunity cost of capital
- discretionary dependencies** — sequencing of project activities or tasks defined by the project team and used with care since they may limit later scheduling options
- dummy activities** — activities with no duration and no resources used to show a logical relationship between two activities in the arrow diagramming method of project network diagrams
- duration** — the actual amount of time worked on an activity plus elapsed time
- E**
- early finish date** — the earliest possible time an activity can finish based on the project network logic
- early start date** — the earliest possible time an activity can start based on the project network logic
- earned value (EV)** — an estimate of the value of the physical work actually completed
- earned value management (EVM)** — a project performance measurement technique that integrates scope, time, and cost data
- effort** — the number of workdays or work hours required to complete a task
- empathic listening** — listening with the intent to understand
- enterprise or portfolio project management software** — software that integrates information from multiple projects to show the status of active, approved, and future projects across an entire organization
- estimate at completion (EAC)** — an estimate of what it will cost to complete the project based on performance to date
- ethics** — a set of principles that guide our decision making based on personal values of what is “right” and “wrong”
- executing processes** — coordinating people and other resources to carry out the project plans and produce the products, services, or results of the project or project phase
- executive steering committee** — a group of senior executives from various parts of the organization who regularly review important corporate projects and issues
- expectations management matrix** — a tool to help understand unique measures of success for a particular project
- expected monetary value (EMV)** — the product of the risk event probability and the risk event’s monetary value
- expert power** — using one’s personal knowledge and expertise to get people to change their behavior
- external dependencies** — sequencing of project activities or tasks that involve relationships between project and non-project activities

GLOSSARY-5

external failure cost — a cost related to all errors not detected and corrected before delivery to the customer

extrinsic motivation — causes people to do something for a reward or to avoid a penalty

F

fallback plans — plans developed for risks that have a high impact on meeting project objectives, to be implemented if attempts to reduce the risk are not effective

fast tracking — a schedule compression technique in which you do activities in parallel that you would normally do in sequence

features — the special characteristics that appeal to users

feeding buffers — additional time added before tasks on the critical path that are preceded by non-critical-path tasks

finish-to-finish dependency — a relationship on a project network diagram where the “from” activity must be finished before the “to” activity can be finished

finish-to-start dependency — a relationship on a project network diagram where the “from” activity must be finished before the “to” activity can be started

fitness for use — a product can be used as it was intended

fixed-price or lump-sum contracts — contracts with a fixed total price for a well-defined product or service

flowcharts — diagrams that show how various elements of a system relate to each other

forcing mode — using a win-lose approach to conflict resolution to get one’s way

forecasts — used to predict future project status and progress based on past information and trends

forward pass — a network diagramming technique that determines the early start and early finish dates for each activity

free slack (free float) — the amount of time an activity can be delayed without delaying the early start of any immediately following activities

functional organizational structure — an organizational structure that groups people by functional areas such as information technology, manufacturing, engineering, and human resources

functionality — the degree to which a system performs its intended function

G

Gantt chart — a standard format for displaying project schedule information by listing project activities and their corresponding start and finish dates in a calendar format; sometimes referred to as bar charts

groupthink — conformance to the values or ethical standards of a group

H

hierarchy of needs — a pyramid structure illustrating Maslow’s theory that people’s behaviors are guided or motivated by a sequence of needs

histogram — a bar graph of a distribution of variables

human resources frame — focuses on producing harmony between the needs of the organization and the needs of people

I

indirect costs — costs that are not directly related to the products or services of the project, but are indirectly related to performing the project

influence diagrams — diagrams that represent decision problems by displaying essential elements, including decisions, uncertainties, and objectives, and how they influence each other

information distribution — making needed information available to project stakeholders in a timely manner

initiating processes — defining and authorizing a project or project phase

intangible costs or benefits — costs or benefits that are difficult to measure in monetary terms

integrated change control — identifying, evaluating, and managing changes throughout the project life cycle

integration testing — testing that occurs between unit and system testing to test functionally grouped components to ensure a subset(s) of the entire system works together

interface management — identifying and managing the points of interaction between various elements of a project

internal failure cost — a cost incurred to correct an identified defect before the customer receives the product

internal rate of return (IRR) — the discount rate that results in an NPV of zero for a project

interviewing — a fact-finding technique that is normally done face-to-face, but can also occur through phone calls, e-mail, or instant messaging

intrinsic motivation — causes people to participate in an activity for their own enjoyment

ISO 15504 — a framework for the assessment of software processes developed by the International Organization for Standardization (ISO)

ISO 9000 — a quality system standard developed by the International Organization for Standardization (ISO) that includes a three-part, continuous cycle of planning, controlling, and documenting quality in an organization

issue — a matter under question or dispute that could impede project success

issue log — a tool to document and monitor the resolution of project issues

IT governance — addresses the authority and control for key IT activities in organizations, including IT infrastructure, IT use, and project management

J

Joint Application Design (JAD) — using highly organized and intensive workshops to bring together project stakeholders—the sponsor, users, business analysts, programmers, and so on—to jointly define and design information systems

K

kickoff meeting — a meeting held at the beginning of a project or project phase where all major project stakeholders discuss project objectives, plans, and so on

L

late finish date — the latest possible time an activity can be completed without delaying the project finish date

late start date — the latest possible time an activity may begin without delaying the project finish date

leader — a person who focuses on long-term goals and big-picture objectives, while inspiring people to reach those goals

learning curve theory — a theory that states that when many items are produced repetitively, the unit cost of those items normally decreases in a regular pattern as more units are produced

legitimate power — getting people to do things based on a position of authority

lessons-learned report — reflective statements written by project managers and their team members to document important things they have learned from working on the project

life cycle costing — considers the total cost of ownership, or development plus support costs, for a project

M

maintainability — the ease of performing maintenance on a product

make-or-buy decision — when an organization decides if it is in its best interests to make certain products or perform certain services inside the organization, or if it is better to buy them from an outside organization

GLOSSARY-7**Malcolm Baldrige National Quality**

Award — an award started in 1987 to recognize companies that have achieved a level of world-class competition through quality management

management reserves — dollars included in a cost estimate to allow for future situations that are unpredictable (sometimes called unknown unknowns)

manager — a person who deals with the day-to-day details of meeting specific goals

mandatory dependencies — sequencing of project activities or tasks that are inherent in the nature of the work being done on the project

matrix organizational structure — an organizational structure in which employees are assigned to both functional and project managers

maturity model — a framework for helping organizations improve their processes and systems

mean — the average value of a population

measurement and test equipment costs — the capital cost of equipment used to perform prevention and appraisal activities

merge — when two or more nodes precede a single node on a network diagram

methodology — describes how things should be done

metric — a standard of measurement

milestone — a significant event that normally has no duration on a project; serves as a marker to help in identifying necessary activities, setting schedule goals, and monitoring progress

mind mapping — a technique that can be used to develop WBSs by using branches radiating out from a central core idea to structure thoughts and ideas

mirroring — the matching of certain behaviors of the other person

monitoring and controlling processes — regularly measuring and monitoring progress to ensure that the project team meets the project objectives

Monte Carlo analysis — a risk quantification technique that simulates a model's outcome many times, to provide a statistical distribution of the calculated results

multitasking — when a resource works on more than one task at a time

Murphy's Law — if something can go wrong, it will

Myers-Briggs Type Indicator (MBTI) — a popular tool for determining personality preferences

N

net present value (NPV) analysis — a method of calculating the expected net monetary gain or loss from a project by discounting all expected future cash inflows and outflows to the present point in time

network diagram — a schematic display of the logical relationships or sequencing of project activities

node — the starting and ending point of an activity on an activity-on-arrow diagram

normal distribution — a bell-shaped curve that is symmetrical about the mean of the population

O

opportunities — chances to improve the organization

organizational breakdown structure (OBS) — a specific type of organizational chart that shows which organizational units are responsible for which work items

organizational culture — a set of shared assumptions, values, and behaviors that characterize the functioning of an organization

organizational process assets — formal and informal plans, policies, procedures, guidelines, information systems, financial systems, management systems, lessons learned, and historical information that help people understand, follow, and improve business processes in a specific organization

overalllocation — when more resources than are available are assigned to perform work at a given time

overrun — the additional percentage or dollar amount by which actual costs exceed estimates

P

parametric modeling — a cost-estimating technique that uses project characteristics (parameters) in a mathematical model to estimate project costs

Pareto analysis — identifying the vital few contributors that account for most quality problems in a system

Pareto charts — histograms that help identify and prioritize problem areas

Parkinson's Law — work expands to fill the time allowed

payback period — the amount of time it will take to recoup, in the form of net cash inflows, the total dollars invested in a project

performance — how well a product or service performs the customer's intended use

performance reporting — collecting and disseminating performance information, which includes status reports, progress measurement, and forecasting

PERT weighted average —

$$\frac{(\text{optimistic time} + (4 \times \text{most likely time}) + \text{pessimistic time})}{6}$$

6

phase exit or kill point — management review that should occur after each project phase to determine if projects should be continued, redirected, or terminated

planned value (PV) — that portion of the approved total cost estimate planned to be spent on an activity during a given period

planning processes — devising and maintaining a workable scheme to ensure that the project addresses the organization's needs

Point of Total Assumption (PTA) — the cost at which the contractor assumes total responsibility for each additional dollar of contract cost in a fixed price incentive fee contract

political frame — addresses organizational and personal politics

politics — competition between groups or individuals for power and leadership

power — the potential ability to influence behavior to get people to do things they would not otherwise do

Precedence Diagramming Method (PDM) — a network diagramming technique in which boxes represent activities

predictive life cycle — a software development approach used when the scope of the project can be clearly articulated and the schedule and cost can be accurately predicted

prevention cost — the cost of planning and executing a project so that it is error-free or within an acceptable error range

probabilistic time estimates — duration estimates based on using optimistic, most likely, and pessimistic estimates of activity durations instead of using one specific or discrete estimate

probability/impact matrix or chart — a matrix or chart that lists the relative probability of a risk occurring on one side of a matrix or axis on a chart and the relative impact of the risk occurring on the other

problems — undesirable situations that prevent the organization from achieving its goals

process — a series of actions directed toward a particular result

process adjustments — adjustments made to correct or prevent further quality problems based on quality control measurements

procurement — acquiring goods and/or services from an outside source

profit margin — the ratio between revenues and profits

profits — revenues minus expenses

program — a group of projects managed in a coordinated way to obtain benefits and control not available from managing them individually

GLOSSARY-9**Program Evaluation and Review**

Technique (PERT) — a project network analysis technique used to estimate project duration when there is a high degree of uncertainty with the individual activity duration estimates

program manager — a person who provides leadership and direction for the project managers heading the projects within the program

progress reports — reports that describe what the project team has accomplished during a certain period of time

project — a temporary endeavor undertaken to create a unique product, service, or result

project acquisition — the last two phases in a project (implementation and close-out) that focus on delivering the actual work

project archives — a complete set of organized project records that provide an accurate history of the project

project buffer — additional time added before the project's due date

project charter — a document that formally recognizes the existence of a project and provides direction on the project's objectives and management

project cost management — the processes required to ensure that the project is completed within the approved budget

project feasibility — the first two phases in a project (concept and development) that focus on planning

project integration management — coordinating all of the other project management knowledge areas throughout a project's life. These processes include developing the project charter, developing the preliminary project scope statement, developing the project management plan, directing and managing the project, monitoring and controlling the project, providing integrated change control, and closing the project

project life cycle — a collection of project phases, such as concept, development, implementation, and close-out

project management — the application of knowledge, skills, tools, and techniques to project activities to meet project requirements

Project Management Institute (PMI) — international professional society for project managers

project management knowledge areas — project integration management, scope, time, cost, quality, human resource, communications, risk, and procurement management

Project Management Office (PMO) — an organizational group responsible for coordinating the project management functions throughout an organization

project management plan — a document used to coordinate all project planning documents and guide project execution and control

project management process groups — the progression of project activities from initiation to planning, executing, monitoring and controlling, and closing

Project Management Professional (PMP) — certification provided by PMI that requires documenting project experience and education, agreeing to follow the PMI code of ethics, and passing a comprehensive exam

project management tools and techniques — methods available to assist project managers and their teams; some popular tools in the time management knowledge area include Gantt charts, network diagrams, and critical path analysis

project manager — the person responsible for working with the project sponsor, the project team, and the other people involved in a project to meet project goals

project organizational structure — an organizational structure that groups people by major projects, such as specific aircraft programs

project portfolio management — when organizations group and manage projects as a portfolio of investments that contribute to the entire enterprise's success

project procurement management — the processes required to acquire goods and services for a project from outside the performing organization

project quality management — ensuring that a project will satisfy the needs for which it was undertaken

project scope management — the processes involved in defining and controlling what is or is not included in a project

project scope statement — a document that includes, at a minimum, a description of the project, including its overall objectives and justification, detailed descriptions of all project deliverables, and the characteristics and requirements of products and services produced as part of the project

project sponsor — the person who provides the direction and funding for a project

project time management — the processes required to ensure timely completion of a project

proposal — a document prepared by sellers when there are different approaches for meeting buyer needs

prototyping — developing a working replica of the system or some aspect of the system to help define user requirements

Q

qualitative risk analysis — qualitatively analyzing risks and prioritizing their effects on project objectives

quality — the totality of characteristics of an entity that bear on its ability to satisfy stated or implied needs or the degree to which a set of inherent characteristics fulfill requirements

quality assurance — periodically evaluating overall project performance to ensure that the project will satisfy the relevant quality standards

quality audit — structured review of specific quality management activities that helps identify lessons learned and can improve performance on current or future projects

quality circles — groups of nonsupervisors and work leaders in a single company department who volunteer to conduct group studies on how to improve the effectiveness of work in their department

quality control — monitoring specific project results to ensure that they comply with the relevant quality standards and identifying ways to improve overall quality

quality planning — identifying which quality standards are relevant to the project and how to satisfy them

quantitative risk analysis — measuring the probability and consequences of risks and estimating their effects on project objectives

R

RACI charts — charts that show Responsibility, Accountability, Consultation, and Informed roles for project stakeholders

rapport — a relation of harmony, conformity, accord, or affinity

rate of performance (RP) — the ratio of actual work completed to the percentage of work planned to have been completed at any given time during the life of the project or activity

Rational Unified Process (RUP) — an iterative software development process that focuses on team productivity and delivers software best practices to all team members

referent power — getting people to do things based on an individual's personal charisma

relationship

reliability — the ability of a product or service to perform as expected under normal conditions

Request for Proposal (RFP) — a document used to solicit proposals from prospective suppliers

GLOSSARY-11

- Request for Quote (RFQ)** — a document used to solicit quotes or bids from prospective suppliers
- required rate of return** — the minimum acceptable rate of return on an investment
- reserves** — dollars included in a cost estimate to mitigate cost risk by allowing for future situations that are difficult to predict
- residual risks** — risks that remain after all of the response strategies have been implemented
- resource breakdown structure** — a hierarchical structure that identifies the project's resources by category and type
- resource histogram** — a column chart that shows the number of resources assigned to a project over time
- resource leveling** — a technique for resolving resource conflicts by delaying tasks
- resource loading** — the amount of individual resources an existing schedule requires during specific time periods
- resources** — people, equipment, and materials
- responsibility assignment matrix (RAM)** — a matrix that maps the work of the project as described in the WBS to the people responsible for performing the work as described in the organizational breakdown structure (OBS)
- return on investment (ROI)** — (benefits minus costs) divided by costs
- reward power** — using incentives to induce people to do things
- rework** — action taken to bring rejected items into compliance with product requirements or specifications or other stakeholder expectations
- risk** — an uncertainty that can have a negative or positive effect on meeting project objectives
- risk acceptance** — accepting the consequences should a risk occur
- risk avoidance** — eliminating a specific threat or risk, usually by eliminating its causes
- risk breakdown structure** — a hierarchy of potential risk categories for a project
- risk enhancement** — changing the size of an opportunity by identifying and maximizing key drivers of the positive risk
- risk events** — specific circumstances that may occur to the detriment of the project
- risk exploitation** — doing whatever you can to make sure the positive risk happens
- risk factors** — numbers that represent overall risk of specific events, given their probability of occurring and the consequence to the project if they do occur
- risk identification** — determining which risks are likely to affect a project and documenting the characteristics of each
- risk management plan** — a plan that documents the procedures for managing risk throughout a project
- risk management planning** — deciding how to approach and plan the risk management activities for a project, by reviewing the project charter, WBS, roles and responsibilities, stakeholder risk tolerances, and the organization's risk management policies and plan templates
- risk mitigation** — reducing the impact of a risk event by reducing the probability of its occurrence
- risk monitoring and control** — monitoring known risks, identifying new risks, reducing risks, and evaluating the effectiveness of risk reduction throughout the life of the project
- risk owner** — the person who will take responsibility for a risk and its associated response strategies and tasks
- risk register** — a document that contains results of various risk management processes, often displayed in a table or spreadsheet format
- risk response planning** — taking steps to enhance opportunities and reduce threats to meeting project objectives
- risk sharing** — allocating ownership of the risk to another party

risk transference — shifting the consequence of a risk and responsibility for its management to a third party

risk utility or risk tolerance — the amount of satisfaction or pleasure received from a potential payoff

risk-averse — having a low tolerance for risk

risk-neutral — a balance between risk and payoff

risk-seeking — having a high tolerance for risk

Robust Design methods — methods that focus on eliminating defects by substituting scientific inquiry for trial-and-error methods

rough order of magnitude (ROM) estimate — a cost estimate prepared very early in the life of a project to provide a rough idea of what a project will cost

run charts — charts that display the history and pattern of variation of a process over time

runaway projects — projects that have significant cost or schedule overruns

S

scatter diagrams — diagrams that help to show if there is a relationship between two variables; also called XY charts

schedule baseline — the approved planned schedule for the project

schedule control — controlling and managing changes to the project schedule

schedule development — analyzing activity sequences, activity duration estimates, and resource requirements to create the project schedule

schedule performance index (SPI) — the ratio of earned value to planned value; can be used to estimate the projected time to complete a project

schedule variance (SV) — the earned value minus the planned value

scope — all the work involved in creating the products of the project and the processes used to create them

scope baseline — the approved project scope statement and its associated WBS and WBS dictionary

scope control — controlling changes to the project scope

scope creep — the tendency for project scope to keep getting bigger

scope creep — the tendency for project scope to keep getting bigger

scope definition — reviewing the project charter and preliminary scope statement and adding more information as requirements are developed and change requests are approved

scope management plan — document that includes descriptions of how the project team will prepare the project scope statement, create the WBS, verify completion of the project deliverables, and control requests for changes to the project scope

scope statement — a document used to develop and confirm a common understanding of the project scope; the first version is often called a preliminary scope statement

scope verification — formalizing acceptance of the project scope, sometimes by customer sign-off

secondary risks — risks that are a direct result of implementing a risk response

sellers — contractors, suppliers, or providers who provide goods and services to other organizations

sensitivity analysis — a technique used to show the effects of changing one or more variables on an outcome

seven run rule — if seven data points in a row on a quality control chart are all below the mean, above the mean, or are all increasing or decreasing, then the process needs to be examined for nonrandom problems

six 9s of quality — a measure of quality control equal to 1 fault in 1 million opportunities

GLOSSARY-13

- Six Sigma** — a comprehensive and flexible system for achieving, sustaining, and maximizing business success that is uniquely driven by close understanding of customer needs, disciplined use of facts, data, statistical analysis, and diligent attention to managing, improving, and reinventing business processes
- slack** — the amount of time a project activity may be delayed without delaying a succeeding activity or the project finish date; also called float
- slipped milestone** — a milestone activity that is completed later than planned
- SMART criteria** — guidelines to help define milestones that are specific, measurable, assignable, realistic, and time-framed
- smoothing mode** — deemphasizing or avoiding areas of differences and emphasizing areas of agreements
- software defect** — anything that must be changed before delivery of the program
- Software Quality Function Deployment (SQFD) model** — a maturity model that focuses on defining user requirements and planning software projects
- staffing management plan** — a document that describes when and how people will be added to and taken off a project team
- stakeholder analysis** — an analysis of information such as key stakeholders' names and organizations, their roles on the project, unique facts about each stakeholder, their level of interest in the project, their influence on the project, and suggestions for managing relationships with each stakeholder
- stakeholders** — people involved in or affected by project activities
- standard deviation** — a measure of how much variation exists in a distribution of data
- start-to-finish dependency** — a relationship on a project network diagram where the "from" activity cannot start before the "to" activity is finished
- start-to-start dependency** — a relationship on a project network diagram in which the "from" activity cannot start until the "to" activity starts
- statement of work (SOW)** — a description of the work required for the procurement
- statistical sampling** — choosing part of a population of interest for inspection
- status reports** — reports that describe where the project stands at a specific point in time
- strategic planning** — determining long-term objectives by analyzing the strengths and weaknesses of an organization, studying opportunities and threats in the business environment, predicting future trends, and projecting the need for new products and services
- structural frame** — deals with how the organization is structured (usually depicted in an organizational chart) and focuses on different groups' roles and responsibilities to meet the goals and policies set by top management
- subproject managers** — people responsible for managing the subprojects that a large project might be broken into
- sunk cost** — money that has been spent in the past
- symbolic frame** — focuses on the symbols, meanings, and culture of an organization
- synergy** — an approach where the whole is greater than the sum of the parts
- system outputs** — the screens and reports the system generates
- system testing** — testing the entire system as one entity to ensure that it is working properly
- systems** — sets of interacting components working within an environment to fulfill some purpose
- systems analysis** — a problem-solving approach that requires defining the scope of the system to be studied, and then dividing it into its component parts for identifying and evaluating its problems, opportunities, constraints, and needs

systems approach — a holistic and analytical approach to solving complex problems that includes using a systems philosophy, systems analysis, and systems management

systems development life cycle (SDLC) — a framework for describing the phases involved in developing and maintaining information systems

systems management — addressing the business, technological, and organizational issues associated with creating, maintaining, and making a change to a system

systems philosophy — an overall model for thinking about things as systems

systems thinking — taking a holistic view of an organization to effectively handle complex situations

T

tangible costs or benefits — costs or benefits that can be easily measured in dollars

team development — building individual and group skills to enhance project performance

termination clause — a contract clause that allows the buyer or supplier to end the contract

Theory of Constraints (TOC) — a management philosophy that states that any complex system at any point in time often has only one aspect or constraint that is limiting its ability to achieve more of its goal

three-point estimate — an estimate that includes an optimistic, most likely, and pessimistic estimate

time and material contracts — a hybrid of both fixed-price and cost-reimbursable contracts

Top Ten Risk Item Tracking — a qualitative risk analysis tool for identifying risks and maintaining an awareness of risks throughout the life of a project

top-down approach — creating a WBS by starting with the largest items of the project and breaking them into their subordinate items

total slack (total float) — the amount of time an activity may be delayed from its early start without delaying the planned project finish date

Tracking Gantt chart — a Gantt chart that compares planned and actual project schedule information

triggers — indications for actual risk events

triple constraint — balancing scope, time, and cost goals

Tuckman model — describes five stages of team development: forming, storming, norming, performing, and adjourning

U

unit pricing — an approach in which the buyer pays the supplier a predetermined amount per unit of service, and the total value of the contract is a function of the quantities needed to complete the work

unit test — a test of each individual component (often a program) to ensure that it is as defect-free as possible

use case modeling — a process for identifying and modeling business events, who initiated them, and how the system should respond to them

user acceptance testing — an independent test performed by end users prior to accepting the delivered system

V

variance — the difference between planned and actual performance

W

watch list — a list of risks that are low priority, but are still identified as potential risks

WBS dictionary — a document that describes detailed information about each WBS item

weighted scoring model — a technique that provides a systematic process for basing project selection on numerous criteria

withdrawal mode — retreating or withdrawing from an actual or potential disagreement

GLOSSARY-15

work breakdown structure (WBS) — a deliverable-oriented grouping of the work involved in a project that defines the total scope of the project

work package — a task at the lowest level of the WBS

workarounds — unplanned responses to risk events when there are no contingency plans in place

Y

yield — the number of units handled correctly through the development process

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