

Systems Analysis and Design

Ninth Edition



SHELLY | ROSENBLATT

Systems Analysis and Design Ninth Edition



**Gary B. Shelly
Harry J. Rosenblatt**

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Systems Analysis and Design, Ninth Edition

Gary B. Shelly

Harry J. Rosenblatt

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PREFACE

The Shelly Cashman Series® offers the finest textbooks in computer education. We are proud that our previous editions of *Systems Analysis and Design* have been so well received by instructors and students. *Systems Analysis and Design, Ninth Edition* continues with the innovation, quality, and reliability you have come to expect from the Shelly Cashman Series.

Overview

Systems Analysis and Design, Ninth Edition includes exciting Video Learning Sessions, developed to maximize the learning experience. The Video Learning Sessions combined with the text offer an interactive, multimedia approach to information systems development. Many two- and four-year colleges and schools use this book in information systems, computer science, and e-commerce curriculums. The textbook emphasizes the role of the systems analyst in a dynamic, business-related environment.

Facing a challenging global marketplace, companies need strong IT resources to survive and compete effectively. Many of today's students will become the systems analysts, managers, and IT professionals of tomorrow. This textbook will help prepare them for those roles.

Using this book, students learn how to translate business requirements into information systems that support a company's short- and long-term objectives. Case studies and assignments teach analytical and problem-solving skills. Students learn about traditional structured analysis, object-oriented concepts, and agile methods. Extensive end-of-chapter exercises emphasize critical-thinking skills.

The *Ninth Edition* introduces several major new features, including four new Video Learning Sessions and a new end-of-chapter assignment called *Ready for a Challenge*, which stresses critical thinking skills. This edition also includes significant updates on topics such as agile development, IT security, and Web 2.0 trends.

Objectives of This Textbook

Systems Analysis and Design, Ninth Edition is intended for a three credit-hour introductory systems analysis and design course. This textbook is designed to:

- Enhance critical thinking skills with the new Ready for a Challenge feature at the end of each chapter. The scenario-based tasks and sample answers help students develop perception, organization, analysis, problem-solving, and decision-making skills that they can take to the workplace.
- Explain systems analysis and design using an appealing full-color format, numerous screen shots and illustrations, and an easy-to-read style that invites students to learn.
- Introduce project management concepts early in the systems development process, with a new chapter that explains project management tools and techniques.
- Challenge students with a Question of Ethics mini-case in each chapter that asks them to respond to real-life ethical issues in an IT environment.
- Provide multi-method coverage, including a comparison of structured, object-oriented, and agile systems development methods.
- Emphasize the importance of planning, implementing, and managing an effective IT security program.
- Explain how IT supports business requirements in today's intensely competitive environment, and describe major IT developments and trends.

- Describe a systems analyst's job in a typical business organization, and show students how to use various tools and techniques to improve their skills and manage their careers.
- Provide students with a comprehensive Systems Analyst's Toolkit that highlights four major cross-functional tools, including: Communications Tools, CASE Tools, Financial Analysis Tools, and Internet Resource Tools.

Video Learning Sessions

Eighteen multimedia Video Learning Sessions describe key systems analysis skills and concepts and provide students with a self-paced, interactive learning tool that reinforces the text. The sessions provide step-by-step explanations that are easy to follow and understand.

Each session includes practice tasks, sample answers, and challenge tasks to keep students interested and engaged as they learn.

- Topics include DFDs, object-oriented analysis, functional decomposition diagrams, structure charts, data normalization, entity-relationship diagrams, decision tables, financial tools, and project management.
- A **Your Turn** feature in every Video Learning Session challenges students to apply their skills and check their work against sample answers. This hands-on practice can help students better handle actual assignments and tasks.
- The Video Learning Sessions offer a self-paced multimedia format that students can review at their convenience.
- Instructors may use the Video Learning Sessions as classroom presentations, distance-education support, student review tools, and exam preparation.



Other New and Updated Features in This Text

Systems Analysis and Design, Ninth Edition offers these exciting new and expanded features:

- New Ready for a Challenge end-of-chapter assignment allows students to practice critical thinking skills, first by trying *Practice Tasks* and viewing sample answers, and then by completing the *Challenge Tasks*. These tasks can help students develop perception, organization, analysis, problem-solving, and decision-making skills that they can take to the workplace.
- Increased emphasis on project management skills and techniques, with one or more Gantt charts in each chapter, work breakdown structures, and realistic project examples. A link to Open Workbench connects students to open-source project management software that they can download and install.
- Question of Ethics mini-case in each chapter challenges students with real-life ethical issues in an IT environment.
- Multi-method coverage provides comparison of structured, object-oriented, and agile development methods, starting in Chapter 1. New material on agile methods includes examples of extreme programming, scrum, spiral models, and related topics.
- New coverage of risk management, both in a project management context and as a key element of IT security planning.
- Extensive update of networking coverage, including new material on switches, routers, and multistation access units. New coverage of wireless networks, including wireless standards, topologies, and trends.
- Expansion of IT security material, including risk management, fault management, backup and recovery, wireless security issues, and a six-level security framework.



- Expanded coverage of IT trends, including cloud computing, Web 2.0, social networking, RFID, wireless networks, mobile computing, offshore outsourcing, e-business, ERP, Web hosting, client/server architecture, network concepts, Webinars, podcasts, RSS feeds, Web-based applications, and others.
- Updated Systems Analyst's Toolkit teaches students IT support skills in four cross-functional areas, including Communication Tools, CASE Tools, Financial Analysis Tools, and Internet Resource Tools.
- New Management Information Systems CourseMate Web site for *Systems Analysis and Design, Ninth Edition* available for a fully digital course solution. CourseMate provides one location for all interactive activities, Video Learning Sessions, and an interactive e-book. EngagementTracker provides the ability to assess student understanding of concepts through the interactive activities.

Organization of This Textbook

Systems Analysis and Design, Ninth Edition, contains 16 learning units in twelve chapters and a four-part Systems Analyst's Toolkit that teaches valuable cross-functional skills.

Chapter 1 – Introduction to Systems Analysis and Design Chapter 1 provides an up-to-date overview of IT issues, major trends, and various systems development approaches, including structured, object-oriented, and agile methods. The chapter emphasizes the important role of systems analysis and design in supporting business objectives.

Chapter 2 – Analyzing the Business Case Chapter 2 offers a business-related starting point for successful systems analysis. Topics include strategic planning, review of systems requests, how to conduct a feasibility study, and the steps in a preliminary investigation.

Chapter 3 – Managing Systems Projects Chapter 3 explains project management, cost estimating, and change control for information systems. This chapter includes hands-on skills that systems analysts can use to create Gantt charts and PERT charts.

Chapter 4 – Requirements Modeling Chapter 4 describes fact-finding techniques and team-based modeling methods, including JAD and RAD, that systems analysts use to model and document a new system.

Chapter 5 – Data and Process Modeling Chapter 5 explains how systems analysts create a logical model for the new system by using data flow diagrams and process description tools, including structured English, decision tables, and decision trees.

Chapter 6 – Object Modeling Chapter 6 explains object-oriented tools and techniques, including use case diagrams, class diagrams, sequence diagrams, state-transition diagrams, activity diagrams, and the Unified Modeling Language.

Chapter 7 – Development Strategies Chapter 7 focuses on software acquisition options, including outsourcing and offshore outsourcing options, application service providers, and other trends that view software as a service rather than a product.

Chapter 8 – User Interface Design Chapter 8 highlights output and report design, the interaction between humans and computers, including usability issues, graphical screen design, input issues, and data entry guidelines.

Chapter 9 – Data Design Chapter 9 describes data design terms, concepts, and skills including entity-relationship diagrams, cardinality, data normalization rules, data warehousing, data mining, a comparison of logical and physical records, and data control measures.

Chapter 10 – System Architecture Chapter 10 explains the elements of system architecture, with emphasis on RFID, ERP, supply chain management, client/server architecture, and network topology, including wireless networking standards and trends.

Chapter 11 – Managing Systems Implementation Chapter 11 includes coverage of application development and implementation topics, including structure charts, documentation techniques, system testing, user training, data conversion, changeover methods, and post-implementation evaluation.

Chapter 12 – Managing Systems Support and Security Chapter 12 describes user support, maintenance techniques, and factors that indicate the end of a system's useful life. This chapter explains IT security concepts, techniques, and tools, and specifically addresses six security levels: physical, network, application, file, user, and procedural security. Chapter 12 also describes risk management, data backup and disaster recovery, and explains future challenges and opportunities that IT professionals will face in a dynamic workplace.

Toolkit Part A – Communication Tools Part A of the Toolkit describes oral and written communication tools that can make a systems analyst more effective. Topics include guidelines for successful communications, tips for better readability, how to organize and plan a presentation, effective speaking techniques, and managing communication skills.

Toolkit Part B – CASE Tools Part B of the Toolkit focuses on computer-aided software engineering (CASE) tools that systems analysts use to document, model, and develop information systems. Examples of several popular CASE tools are provided, along with sample screens that show CASE tool features.

Toolkit Part C – Financial Analysis Tools Part C of the Toolkit explains various tools that systems analysts use to determine feasibility and evaluate the costs and benefits of an information system. Specific tools include payback analysis, return on investment (ROI), and net present value (NPV).

Toolkit Part D – Internet Resource Tools Part D of the Toolkit explains Internet-based information gathering strategies. Topics include search engines, subject directories, the invisible Web, advanced search techniques, Boolean logic and Venn diagrams. This Toolkit Part also discusses social networking, newsgroups, newsletters, blogs, podcasts, RSS feeds, Webinars, mailing lists, Web-based discussion groups, chat rooms, instant messaging, and online learning opportunities.

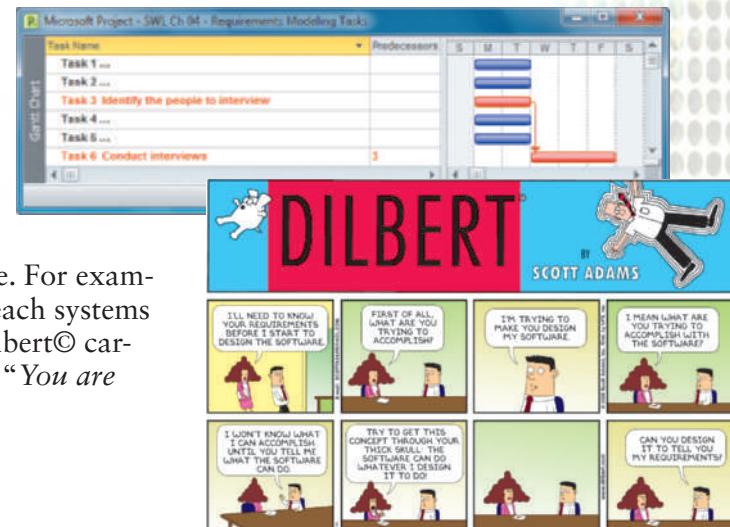
FOR THE STUDENT

The Shelly Cashman Series wants you to have a valuable learning experience that will provide the knowledge and skills you need to be successful. With that goal in mind, we have included many activities, games, and learning tools, that we hope you will find interesting, challenging, and enjoyable. For example, because a picture is worth a thousand words, each systems development phase begins with an eye-catching Dilbert® cartoon and a multi-color Gantt chart that provides a “*You are Here*” roadmap.

Chapter Opening Features

Each chapter contains the following features to help you get started:

- **Chapter Introduction** Read the Chapter Introduction for a brief overview of the chapter.
- **Chapter Objectives** The Chapter Objectives lists the main skills and knowledge you will have when you finish the chapter.
- **Chapter Introduction Case: Mountain View College Bookstore** The Mountain View College Bookstore case is a continuing case study that provides a real-world overview of the topics that will be covered in each chapter. As you work through the textbook, you will see how the Mountain View IT team discusses the issues, identifies the key points, and creates specific task lists.



Learning Tools within the Chapter

As you work through each chapter, you will find these helpful tools and features:



- **Video Learning Sessions** An online library of 18 self-paced multimedia sessions is available to you and the text includes reminders about them. Depending on your personal learning style, you might use the videos in various ways. For example, one approach might be to review the chapter, watch the VLS, try the Your Turn tasks, and then check your answers.
- **A Question of Ethics** A mini-case in each chapter will challenge you with real-life ethical issues in an IT environment.
- **Case in Point** This exciting feature provides four embedded mini-case opportunities for you to analyze and apply the skills and concepts you are learning in the chapter.
- **Toolkit Time** The Systems Analyst's Toolkit explains skills that you can apply at any point in the textbook. Toolkit Time marginal notes remind you about the Toolkit, where to find it, and how it might help you address the issues or material in the chapter.
- **On the Web** Learn more about a topic by visiting the suggested Web sites and exploring the links we have provided.



End-of-Chapter Exercises

The following exercises are in every text chapter:



- **Learn It Online** Each chapter features a Learn It Online page that includes six exercises. These exercises utilize the Web to offer chapter-related reinforcement activities that will help you gain confidence in systems analysis and design. These exercises include True/False, Multiple Choice, Short Answer, Flash Cards, Practice Test, and several learning games.
- **CASE SIM: SCR Associates** This is an interactive Web-based case study, with a work session at the end of each chapter. Visit SCR's Web site and log on to the company's intranet to read e-mail messages addressed to you, listen to voice mail messages, and perform assigned tasks in a realistic corporate setting. In this simulation you report to Jesse Baker, but you e-mail your completed assignments to your instructor. Detailed instructions on how to use this case are available in the Management Information Systems CourseMate Web site for *Systems Analysis and Design, Ninth Edition* at www.cengagebrain.com. To log on to the SCR intranet, you must use the password **sad9**. When you log on to the SCR intranet, you also will be asked to enter your first and last name so your e-mail can be addressed to you correctly.
- **Chapter Exercises** In this section, you will find 10 Review Questions, four Discussion Topics, and four Projects. These exercises allow you to apply your understanding of the material and will help to prepare you for tests and assessments.
- **Apply Your Knowledge** This section includes four mini-cases per chapter. Each mini-case requires you to use the knowledge and skills you learned in the chapter.
- **Case Studies** Case studies provide practical experience and allow you to practice specific skills learned in the chapter. Each chapter contains several case studies, two of which (New Century Health Clinic and Personal Trainer, Inc.) continue throughout the textbook. You can complete your assignments using Microsoft Word and Excel forms, available in the Management Information Systems CourseMate Web site for *Systems Analysis and Design, Ninth Edition* at www.cengagebrain.com.

- **Chapter Capstone Case: SoftWear, Limited** SoftWear, Limited (SWL) is a continuing case study where students act as members of the SWL systems development team and perform various assignments in each chapter, including a set of project management tasks and a sample Gantt chart.
- **Ready for a Challenge** This new end-of-chapter assignment stresses critical thinking skills, which many educators and employers believe are very important in the workplace. Perform the Practice Tasks first, view the sample answers, and apply your knowledge and skill to the Challenge Tasks. *Ready for a Challenge* can help you develop perception, organization, analysis, problem-solving, and decision-making skills that you can take to the workplace.



Additional Support Tools

These additional tools can enhance your learning experience:

GLOSSARY/INDEX This edition of the textbook includes a glossary/index feature to assist your understanding of key terms and phrases, or to use as a quick reference tool.

STUDENT STUDY TOOL This interactive study tool, accessible via the Management Information Systems CourseMate Web site for *Systems Analysis and Design, Ninth Edition* provides:

- Detailed outlines of every chapter that highlight key topics covered and can be used as a guide when reviewing for an exam
- Chapter glossaries that allow you to look up all key terms in one place, and provide page references where key terms can be found if you need more information
- Figures and Test Yourself questions that provide additional reinforcement of chapter concepts
- User guide for Open Workbench (a free, open-source project management program), and links to download and install a trial version of Microsoft Project and a full version of Open Workbench

MANAGEMENT INFORMATION SYSTEMS COURSEMATE Broaden your learning experience and enhance your understanding of the material in each chapter with the Management Information Systems CourseMate Web site. Visit www.cengagebrain.com for access to:

- Full, interactive digital e-book
- Video Learning Sessions and Your Turn exercises
- Ready for a Challenge Practice Tasks and Challenge Tasks
- On the Web links
- Learn It Online exercises, including True/False, Multiple Choice, Short Answer, Flash Cards, Practice Test, and several learning games
- SCR Associates Internet and intranet sites
- Forms Library
- Project Management Resources

FOR THE INSTRUCTOR

The Shelly Cashman Series is dedicated to providing you all of the tools you need to make your class a success. Information on all supplementary materials is available through your Course Technology representative or by calling one of the following

telephone numbers: Colleges, Universities, Continuing Education Departments, Post-Secondary Vocational Schools, Career Colleges, Business, Industry, Government, Trade, Retailer, Wholesaler, Library, and Resellers, call Cengage Learning at 800-354-9706; K-12 Schools, Secondary and Vocational Schools, Adult Education, and School Districts, call Cengage Learning at 800-354-9706. In Canada, call Nelson Cengage Learning at 800-268-2222.

Instructor Resources Disc

The Instructor Resources disc (0-538-48163-3) for this textbook includes both teaching and testing aids. The contents of the disc are listed below:

- **Instructor's Manual** Includes lecture notes summarizing the chapter sections, figures and boxed elements found in every chapter, teacher tips, classroom activities, lab activities, and quick quizzes in Microsoft Word files.
- **Syllabus** Easily customizable sample syllabus that covers policies, assignments, exams, and other course information. Also included is a Microsoft Project file used to create the five Phase Opener Gantt charts. An instructor can use this project file to create a visual syllabus that could include additional tasks, quizzes, and projects. The project file also can be used to track class progress through the course.
Instructors are welcome to distribute this file to students, and show them how to manage tasks, resources, and deadlines for team projects that might be assigned.
- **PowerPoint Presentations** A multimedia lecture presentation system provides slides for each chapter, based on chapter objectives.
- **Figure Files** Illustrations for every figure in the textbook in electronic form.
- **Solutions to Exercises** Includes solutions for end-of-chapter exercises, including Ready for a Challenge Practice and Challenge Task solutions, chapter reinforcement exercises, and extra case studies.
- **Test Bank & Test Engine** Test Banks include 112 questions for every chapter, and feature objective-based and critical thinking question types, page number references, and figure references when appropriate. The ExamView test engine is the ultimate tool for your testing needs.
- **Additional Activities for Students** The forms that students can use to complete the Case Studies are included. Two additional case studies are also provided for every chapter, to be assigned as homework, extra credit, or assessment tools. Chapter Reinforcement Exercises, which are true/false, multiple-choice, and short answer questions that help students gain confidence in the material learned are included, as are the Your Turn Practice Tasks and sample solutions.
- **Additional Faculty Files** A copy of the powerful CASE tool, Visible Analyst — Student Edition, is provided for your evaluation. Several sample solutions to case study tasks also are included. To install this program, you follow a simple registration process that entitles you to use the software and obtain support. Detailed instructions are provided on the Instructor Resources disc. Also included are Word document versions of the e-mail and voice mail messages posted for students on the SCR Web site and the Interview Summaries for the New Century Case Study.

Course Cartridge Content

Course Technology has partnered with the leading distance learning solution providers and class-management platforms today. To access this material, visit <http://www.cengage.com/coursecare/cartridge/> and search for your title. Instructor resources include the following: additional case projects, sample syllabus, PowerPoint presentations, and more. For students to access this material, they must have purchased a Course Cartridge PIN-code specific to this title and your campus platform. The resources for students might include (based on instructor preferences): topic reviews, review questions, practice tests, and more. For additional information, please contact your sales representative.

SOFTWARE BUNDLING OPPORTUNITIES *Systems Analysis and Design, Ninth Edition* can be bundled with several popular software programs:

- **Visible Analyst Student Edition** Whether you are designing e-business applications, developing a data warehouse, or integrating legacy systems with new enterprise applications, Visible Analyst is a valuable software based learning tool that helps students become more marketable with its advanced, affordable, and easy to use modeling capabilities. Visible Analyst was recently awarded the “Best Systems Analysis & Design Modeling Tool” by the Indian Education Ministry. Key users include: Business Analysts who analyze the organization and design of businesses or government departments and assess business models and their integration with technology; other professions that use systems analysis and design methods and techniques include Systems Analysts, Database Engineers, Computer Scientists, and Software Engineers. Visible Analyst is a separate software tool available individually as a Student Edition or as a University Edition with concurrent floating licenses for college or university computer labs. For more information about Visible Analyst, please visit: www.visible.com/Modeler/index.htm or contact sales@visible.com.
- **Microsoft Visio** The advanced diagramming tools of Visio 2010 help you simplify complexity with dynamic, data-driven visuals and new ways to share on the Web in real time. Start by building your diagram with professional-looking templates and modern, pre-drawn shapes. Then, easily link your diagram to popular data sources (such as Excel). You’ll see data automatically refresh right within your diagram, reflected in vibrant visuals such as icons, symbols, colors, and bar graphs. Finally, with just a few clicks, publish your data-linked diagram to SharePoint, and provide access to others on the Web, even if they don’t have Visio. Together, simplicity, data-driven shapes, and Web sharing make Visio 2010 one of the most powerful ways to see and understand important information.
- **Microsoft Project** Microsoft® Project 2010 delivers powerful, visually enhanced ways to effectively manage a wide range of projects and programs. From meeting crucial deadlines to selecting the right resources and empowering your teams, Project 2010 offers easier and more intuitive experiences to help you simply be more productive and realize amazing results.

ACKNOWLEDGMENTS

First, special thanks to Deb Kaufmann, our development editor, who made an enormous contribution to this edition. Her insight and suggestions were extremely valuable. Thanks to Larry Brock, Andrew Page, and Ron Savilla. As former students at Central Piedmont Community College, their ideas were especially valuable, and helped shape the new edition. Thanks also to David Rosenblatt, who contributed to an earlier edition of *Systems Analysis and Design*, and returned to help with the Ninth Edition.

Finally, thanks to our students for their feedback and comments. They suggested that we add additional *Video Learning Sessions* and interactive content such as *Ready for a Challenge* and *Your Turn*. We hope they continue to offer suggestions, and we will certainly continue to listen to them.

ABOUT OUR COVERS

The Shelly Cashman Series is continually updating our approach and content to reflect the way today's students learn and experience new technology. This focus on student success is reflected on our covers, which feature real students from Bryant University using the Shelly Cashman Series in their courses, and reflect the varied ages and backgrounds of the students learning with our books. When you use the Shelly Cashman Series, you can be assured that you are learning computer skills using the most effective courseware available.

INDEX

- (dash), 227–228, 229
- . (decimal point), 213, 219, 364
- # (pound sign), 356
- 1:1** A type of entity relationship. A one-to-one relationship, abbreviated 1:1, exists when exactly one of the second entity occurs for each instance of the first entity. 406
- 1:M** A type of entity relationship. A one-to-many relationship, abbreviated 1: M, exists when one occurrence of the first entity can be related to many occurrences of the second entity, but each occurrence of the second entity can be associated with only one occurrence of the first entity. 406, 419
- 4G (fourth generation)** The latest generation of high-speed wireless broadband technologies and devices. 173
- 6 by 6 rule** The 6 by 6 rule suggests that on a slide, no more than six items should be placed on each slide, and each item should have no more than six words. 641, 645
- 7 by 7 rule** The 7 by 7 rule suggests that on a slide, no more than seven items should be placed on each slide, and each item should have no more than seven words. 641, 645
- 802.11** A family of wireless network specifications developed by the IEEE. 482–485802.11g An IEEE wireless network specification introduced in 2003 based on a frequency of 2.4 GHz and maximum bandwidth of 54 Mbps; compatible with and replaces 802.11b, and will likely be replaced by the 802.11n standard. 483, 485
- 802.11i** A security standard for Wi-Fi wireless networks that uses the WPA2 protocol, currently the most secure encryption method for Wi-Fi networks. 598
- 802.11n** An IEEE wireless network specification adopted in 2009 that uses multiple-input/multiple output (MIMO) technology to achieve speeds of 200+ Mbps while increasing the wireless range, and is backward-compatible with 802.11 a, b, and g. 483
- 802.11y** An emerging IEEE wireless networking standard that uses multiple input/multiple output (MIMO) technology to increase bandwidth and range. 483
- 802.16** Specifications developed by the IEEE for broadband wireless communications over MANs
- (metropolitan area networks). 485
- abbreviation codes** Alphabetic abbreviations. For example, standard state codes include NY for New York, ME for Maine, and MN for Minnesota. 423
- absolute date** The total number of days from some specific base date. To calculate the number of days between two absolute dates, you subtract one date from the other. For example, using a base date of January 1, 1900, September 27, 2012 has an absolute date value of 41179 and July 13, 2011 has an absolute date of 40737. If you subtract the earlier date value from the later one, the result is 442 days. 435
- acceptance** One of four risk control strategies. In acceptance, the risk is accepted and nothing is done. Risk is usually accepted only if protection from risk is clearly not worth the expense. 592
- acceptance test** Also known as a system test. Acceptance testing involves the entire information system. An acceptance test includes all typical processing situations. During an acceptance test, users enter data, including samples of actual, or live data, perform queries, and produce reports to simulate actual operating conditions. All processing options and outputs are verified by users and the IT project development team to ensure that the system functions correctly. 527
- access point** A central wireless device that provides network services to wireless clients. 483
- Access (Microsoft)**, 171, 298
 - database design and, 405, 426, 428–430, 433
 - Help screen, 345
 - input masks and, 365–366
 - physical storage and, 433
 - referential integrity and, 405
 - report design tools, 350–351
 - system implementation and, 523–524
 - user interface design and, 356
- action codes** Action codes indicate what action is to be taken with an associated item. For example, a student records program might prompt a user to enter or click an action code such as D (to display the student's record), A (to add a record), and X (to exit the program). 424
- active voice** Active voice refers to using sentences where the actor is the subject of the sentence. For example, "Tom designed the system" is in active voice. 633
- activity** An activity, or task, is any work that has a beginning and an end, and requires the use of company resources including people, time, and/or money. Examples include conducting a series of interviews, designing a report, selecting software, waiting for the delivery of equipment, and training users. 106
- activity diagram** A diagram that resembles a horizontal flow chart that shows the actions and events as they occur. Activity diagrams show the order in which actions take place and identify the outcome. 266
- actor** An external entity with a specific role. In a use-case model, actors are used to model interaction with the system. 151
- adaptive maintenance** Adaptive maintenance adds new capability and enhancements. 575, 576–577
- adaptive method** An adaptive method typically uses a spiral development model, which builds on a series of iterations. 21. *See also agile methods*
- administrator** Account that allows essentially unrestricted access to the application. 601
- Adobe Acrobat**, 637
- Adobe ColdFusion**, 401
- advanced search** An advanced search can include the option to search within returned results and the ability to search within specific areas, such as newsgroups. 697
- aesthetics** An approach that focuses on how an interface can be made attractive and easy to use. 343
- aggregator** Client software or Web application that aggregates syndicated Web content such as blogs, podcasts, and RSS feeds in a single location for easy viewing. Also called feed reader or RSS reader. 704
- agile development**. *See also agile methods*
 - future of, 523
 - overview, 520–523
- agile methods** Systems development methods that attempt to develop a system incrementally, by building a series of prototypes and constantly adjusting them to user requirements. Also called adaptive methods. 149, 512. *See also agile development*
- alias** Term used in various data dictionaries to indicate an alternate name, or a name other than the standard data element name, that is used to describe the same data element. 219, 222
- all-in-one devices**, 173
- allocated baseline** The allocated baseline documents the system at the end of the design phase and identifies any changes since the functional baseline. The allocated baseline includes testing and verification of all system requirements and features. 583
- alphabetic codes** Alphabetic codes use alphabet letters to distinguish one item from another based on a category, an abbreviation, or an easy-to-remember value, called a mnemonic code. 423
- AltaVista**, 694
- Amazon**, 12, 459
- amendment** Version or variant of the IEEE 802.11 wireless networking standards. 482
- American Association for Artificial Intelligence (AAAI)**, 344
- analytical skills** Skills that help one recognize a problem, evaluate the key elements, and identify a useful solution. 143
- AND** The AND operator often is used to narrow a set of search results. 694, described, 696, 697, 698
- appendices**, in reports, 81
- application** Part of the information system, an application handles the input, manages the processing logic, and provides the required output. security, 601–603
- testing**, overview, 306
- application development** The process of constructing the programs and code modules that are the building blocks of an information system. Application development is handled by an application development group within a traditional IT department that is composed of systems analysts and programmers who handle information system design, development, and implementation. 28, 511–520
- application generator** An application generator, also called a code generator, allows you to develop computer programs rapidly by translating a logical model directly into code. 654
- Application layer**, 477
- application logic** The underlying business rules or logic for an application. 464
- application server** Application servers serve as "middlemen" between customers and an

organization's databases and applications. They are often used to facilitate complex business transactions. 464, 465

application software Software such as e-mail, word processors, spreadsheets, and graphics packages used by employees. 8

application service provider (ASP)

A firm that delivers a software application, or access to an application, by charging a usage or subscription fee. 291, 299, 302, 469–470
described, 291
user references supplied by, 306

applications programmer A person who works on new systems development and maintenance. 579

archived The storage of previous version of a system when a new version is installed. 583

ASCII Stands for American Standard Code for Information Interchange, a data storage coding method used on most personal computers and workstations. 433, 544

asset Hardware, software, data, networks, people, or procedures that provide tangible or intangible benefit to an organization. 590

Association for Computing

Machinery (ACM) A professional association for the IT industry that sponsors seminars and training and has a Web site where members can keep up with current issues, trends, and opportunities. 709

associative entity An entity that has its own set of attributes and characteristics. Associative entities are used to link between many-to-many (M:N) relationships. 407

attack A hostile act that targets an information system, or an organization itself.
described, 592
overview, 592–593
profiles, 592

attribute A single characteristic or fact about an entity. An attribute, or field, is the smallest piece of data that has meaning within an information system. For example, a Social Security number or company name could be examples of an attribute. In object-oriented analysis, an attribute is part of a class diagram that describes the characteristics of objects in the class. Also known as a data element. 254, 402, 519
database design and, 402
described, 222, 250
representing objects and, 252, 253

audiences, defining, 640

audit fields Special fields within data records to provide

additional control or security information. Typical audit fields include the date the record was created or modified, the name of the user who performed the action, and the number of times the record has been accessed. 436

audit log files Audit log files record details of all accesses and changes to a file or database and can be used to recover changes made since the last backup. 436

audit trail An audit trail records the source of each data item and when it entered a system. In addition to recording the original source, an audit trail must show how and when data is accessed or changed, and by whom. All these actions must be logged in an audit trail file and monitored carefully. 313

authorization zone Part of a form that contains any required signatures. 361

automated facsimile A system that allows a customer to request a fax using e-mail, the company Web site, or a telephone. The response is transmitted in a matter of seconds back to the user's fax machine. 358

automatic update service Enables an application to contact the vendor's server and check for a needed patch. 602

availability One of the three main elements of system security: confidentiality, integrity, and availability (CIA). Availability ensures that authorized users have timely and reliable access to necessary information. 590

avoidance One of four risk control strategies. In avoidance, the risk is eliminated by adding protective safeguards. 592

B2B (business-to-business) A commercial exchange (e.g. products or services) between businesses, typically enabled by the Internet or electronic means. 14, 400

B2C (business-to-consumer) A commercial exchange (e.g. products or services) between businesses and consumers conducted over the Internet. 13

back door attacks, 593

backup The process of saving a series of file or data copies to be retained for a specified period of time. Data can be backed up continuously, or at prescribed intervals. 436, 607, 608–609

backup media Data storage options, including tape, hard drives, optical storage, and online storage. 607

backup policy A backup policy contains detailed instructions and procedures for all backups. 607, 608

balancing A process used to maintain consistency among an entire series of diagrams, including

input and output data flows, data definition, and process descriptions.

described, 212
examples, 214–216

bandwidth The amount of data that the system can handle in a fixed time period. Bandwidth requirements are expressed in bits per second.

described, 586, 587
network standards and, 482, 483
system architecture and, 472, 482

baseline A formal reference point that measures system characteristics at a specific time. Systems analysts use baselines as yardsticks to document features and performance during the systems development process. 583

Basic Service Set (BSS) A wireless network configuration in which a central wireless device called an access point is used to serve all wireless clients; also called infrastructure mode. 483

batch A group of data, usually inputted into an information system at the same time. 369

batch control A total used to verify batch input. Batch controls might check data items such as record counts and numeric field totals. For example, before entering a batch of orders, a user might calculate the total number of orders and the sum of all the order quantities. When the batch of orders is entered, the order system also calculates the same two totals. If the system totals do not match the input totals, then a data entry error has occurred. 368

batch input A process where data entry is performed on a specified time schedule, such as daily, weekly, monthly, or longer. For example, batch input occurs when a payroll department collects time cards at the end of the week and enters the data as a batch. 368, 369

batch processing In a batch processing system, data is collected and processed in groups, or batches. Although online processing is used for interactive business systems that require immediate data input and output, batch processing can handle other situations more efficiently. 475–476

Bay Systems, 481

benchmark A benchmark measures the time a package takes to process a certain number of transactions.

described, 306
development strategies and, 296, 306–307

prototyping and, 315

benchmark testing Benchmark testing is used by companies to

measure system performance. 585

best-case estimate The most optimistic outcome is called the best-case estimate. 107

binary digit The smallest unit of data is one binary digit, called a bit. 433

binary storage format A format that offers efficient storage of numeric data. For example, when you specify numeric data types using Microsoft Access, you can choose from a variety of storage formats, including integer and long integer, among others. 434

Bing, 694

biometric devices Devices that identify a person by a retina scan or by mapping a facial pattern. 60

biometric scanning systems Mapping an individual's facial features, handprint, or eye characteristics for identification purposes. 60, 594

BIOS-level password A password that must be entered before the computer can be started. It prevents an unauthorized person from booting a computer by using a USB device or a CD-ROM. Also called a power-on password or a boot-level password. 595

bit The smallest unit of data is one binary digit, called a bit. 433

black box A metaphor for a process or action that produces results in a non-transparent or non-observable manner. In data flow diagrams, a process appears as a black box where the inputs, outputs, and general function of the process are known, but the underlying details are not shown.

balancing and, 216
described, 201, 256
overview, 201–202
viewing objects as, 256

black hole A process is said to be a "black hole" if it has no output. 203

BlackBerry (Research in Motion), 173–174

block A block, or physical record, is the smallest unit of data that is accessed by the operating system. 433

block sequence codes Block sequence codes use blocks of numbers for different classifications. 423

blocking factor The number of logical records in one physical record. 433

blog A Web-based log, or journal. 289, 703
described, 704
development strategies and, 305, 317

Bluetooth A form of wireless transmission very popular for short-distance wireless

- communication that does not require high power. 173, 371, 485
- body zone** The main part of the form. It usually takes up at least half of the space on the form and contains captions and areas for entering variable data. 361
- Boolean logic** A system named after British mathematician George Boole and refers to the relationships among search terms. 695, 697
- boot-level password** A password that must be entered before the computer can be started. It prevents an unauthorized person from booting a computer by using a USB device or a CD-ROM. Also called a BIOS-level password or a boot-level password. 595
- bottom-up technique** A bottom-up technique analyzes a large, complex project as a series of individual tasks, called project tasks. 105
- brainstorming** A fact-finding technique for gaining information, through the use of a small group discussion of a specific problem, opportunity, or issue. 159
- brick-and-mortar** Is used to describe traditional companies whose business model predated electronic commerce. Many brick-and-mortar companies have successfully established profitable Internet storefronts. 12
- Brooks, Frederick, 124
- Brooks' Law** This interesting concept was stated by Frederick Brooks, Jr., an IBM engineer, who observed that adding manpower to a late software project only makes it later. 124
- browser** A Web browser, or browser, is a software program that allows you to access and display Web pages that are delivered to you by a Web server. 399, 690
- buffer** A segment of computer memory used for temporary storage. 433
- bug tracking software** System developers use defect tracking software, sometimes called bug tracking software, to document and track program defects, code changes, and replacement code, called patches. 529
- Bugzilla, 529
- build or buy** Choice between developing in-house software and purchasing software, often called a build or buy, or make or buy, decision. 293, 294
- bus network** In a bus network, a single communication path connects the mainframe computer, server, workstations, and peripheral devices. Information is transmitted in either direction from any workstation to another workstation, and any message can be directed to a specific device. 479
- business case** Refers to the reasons, or justification, for a proposal. 52, 58–59
- business case analysis** feasibility studies and, 66–69 overview, 52–59 project management and, 64 setting priorities, 69–71
- business continuity plan (BCP)** A plan that defines how critical business functions can continue in the event of a major disruption. 608–609
- business information systems**, 15–18
- business logic** Business logic determines how a system handles data and produces useful information. Business logic, also called business rules, reflect the operational requirements of the business. Examples include adding the proper amount of sales tax to invoices, calculating customer balances and finance charges, and determining whether a customer is eligible for a volume-based discount. 201, 464
- business model** A business model graphically represents business functions that consist of business processes, such as sales, accounting, and purchasing. 10
- business process** A business process describes specific events, tasks, and desired results. 10, 150
- business process model (BPM)** A graphical representation of one or more business processes. 10, 150
- business process modeling notation (BPMN)** A standard set of shapes and symbols used to represent events, processes, and workflows in computer-based modeling tools. 10, 150
- business process outsourcing (BPO)** The outsourcing of a basic business process. 290
- business process reengineering (BPR)** An attempt by companies to simplify operations or reduce costs. 18
- business profile** A business profile defines a company's overall functions, processes, organization, products, services, customers, suppliers, competitors, constraints, and future direction. 10
- business requirements** development strategies and, 294–295 system architecture and, 467
- business rules** Business rules determine how a system handles data and produces useful information. Business rules, also called business logic, reflects the operational requirements of the business. Examples include adding the proper amount of sales tax to invoices, calculating customer balances and finance charges, and determining whether a customer is eligible for a volume-based discount. 201
- business support systems** Business support systems (BSS) provide job-related information support to users at all levels of a company. 16
- byte** A group of eight bits is called a byte, or a character. A set of bytes forms a field, which is an individual fact about a person, place, thing, or event. 433
- C (high-level language), 318
- C++ (high-level language), 25, 250, 318, 523
- C# (high-level language), 523
- CAIT (Center for the Application of Information Technologies), 537, 538
- calendar control** A calendar control allows the user to select a date that the system will display and store as a field value. 348
- Camtasia, 543
- candidate key** Sometimes it is possible to have a choice of fields or field combinations to use as the primary key. Any field that could serve as a primary key is called a candidate key. For example, if every employee has a unique employee number, then you could use either the employee number or the Social Security number as a primary key. 402, 403
- Capability Maturity Model (CMM)** A model developed by SEI that integrates software and systems development into the process improvement framework. 508
- Capability Maturity Model Integration (CMMI)** An SEI-developed process to improve quality, reduce development time, and cut costs. A CMM tracks an organization's software development goals and practices, using five maturity levels, from Level 1 (relatively unstable, ineffective software) to Level 5 (software that is refined, efficient, and reliable). 508–509
- capacity planning** A process that monitors current activity and performance levels, anticipates future activity, and forecasts the resources needed to provide desired levels of service. 587, 588
- cardinality** A concept that describes how instances of one entity relate to instances of another entity. Described in entity-relationship diagrams by notation that indicates combinations that include zero or one-to-many, one-to-one, and many-to-many. 263, 408
- cardinality notation** Notation that shows relationships between entities. 408, 409–410
- career opportunities, 32–33
- CASE environment** A CASE environment is more than a set of CASE tools; it includes any use of computer-based support in the software development process.
- agile methods and, 148
 - described, 653
 - requirements modeling and, 144, 149–153, 158, 170
 - Zackman Framework for Enterprise Architecture and, 158
- case for action** A part of the preliminary investigation report to management that summarizes project requests and makes specific recommendations. 81
- CASE tools** Powerful software used in computer-aided systems engineering to help systems analysts develop and maintain information systems.
- construction tools, 654–656
 - data dictionaries and, 218
 - described, 20, 648
 - DFDs and, 215
 - documentation and, 217–224, 653–654
 - engineering tools, 654–655
 - example, 57
 - history, 651
 - marketplace for, 651–652
 - method-specific, 662–663
 - modeling tools, 653
 - O-O analysis and, 266, 267
 - overview, 648–666
 - systems architecture and, 481, 486
 - system implementation and, 511–512, 520, 525
 - user interface design and, 342
- category codes** Category codes identify a group of related items. For example, a local department store may use a two-character category code to identify the department in which a product is sold. 423
- certification** A credential an individual earns by demonstrating a certain level of knowledge and skill on a standardized test. 32
- Certiport, 32
- change control (CC)** A process for controlling changes in system requirements during software development; also an important tool for managing system changes and costs after a system becomes operational. 582
- channel** A chat room, also called a channel, is an online meeting place where users can interact and converse in real time. 705
- character** A group of eight bits is called a character, or a byte. A set of bytes forms a field, which is an individual fact about a person, place, thing, or event. 432
- character-based report** A character-based report is created using a single mono-spaced character set. 351

chargeback method A technique that uses accounting entries to allocate the indirect costs of running the IT department.

Most organizations adopt one of four chargeback methods: no charge, a fixed charge, a variable charge based on resource usage, or a variable charge based on volume. 673

charts, 78–79, 105–106, 150, 341, 511, 513

chat room A chat room, also called a channel, is an online meeting place where users can interact and converse in real time. 705

check box A check box is used to select one or more choices from a group. Selected options are represented by a check mark, or an X. 348

child In inheritance, a child is the object that derives one or more attributes from another object, called the parent. 216, 258

child diagram A child diagram is the lower-level diagram in an exploded data flow diagram. balancing and, 214–215 described, 211

CIA triangle The three main elements of system security: confidentiality, integrity, and availability. 589, 590

cipher codes Cipher codes use a keyword to encode a number. A retail store, for example, may use a 10-letter word, such as CAMPGROUND, to code wholesale prices, where the letter C represents 1, A represents 2, and so on. Thus, the code, GRAND, would indicate that the store paid \$562.90 for the item. 424

Cisco, 32, 481, 531–532

class A term used in object oriented modeling to indicate a collection of similar objects.

described, 24

O-O design and, 25

overview, 256–257

relationships, 258

sequence diagrams and, 264

class diagram A class diagram represents a detailed view of a single use case, shows the classes that participate in the use case, and documents the relationship among the classes. 262–263

clicks to close The average number of page views to accomplish a purchase or obtain desired information. 432

clickstream storage Recording Web visitor behavior and traffic trends for later data mining use.

432

clients Workstations that users interact with in a client/server design. These workstations, or computers, are supplied data, processing services, or other support from other computers, called servers.

LANs and, 460–461
system architecture and, 459–461

client/server architecture Generally refers to systems that divide processing between one or more networked clients and a central server. In a typical client/ server system, the client handles the entire user interface, including data entry, data query, and screen presentation logic. The server stores the data and provides data access and database management functions. Application logic is divided in some manner between the server and the clients. 395, 400–401, 427 described, 461 styles, 463 system architecture and, 461–467

closed-ended questions Questions that limit or restrict the range of responses. Used in the interview process when specific information or fact verification is desired. 160

cloud computing An overall online software and data environment in which applications and services are accessed and used through an Internet connection rather than on a local computer; refers to the cloud symbol for the Internet. 289, 470–471 COBOL, 651

code A set of letters or numbers that represents a data item. Codes can be used to simplify output, input, and data formats. 422–426, 433–434, 523–525

code generator A code generator, also called an application generator, allows you to develop computer programs rapidly by translating a logical model directly into code. 523–524

code review A code review, or structured walkthrough, is a review of a project team member's work by other members of the team to spot logic errors. Generally, systems analysts review the work of other systems analysts, and programmers review the work of other programmers, as a form of peer review. Structured walkthroughs should take place throughout the SDLC and are called requirements reviews, design reviews, code reviews, or testing reviews, depending on the phase in which they occur. 114

Cognetics Corporation, 343

cohesion Cohesion measures a module's scope and processing characteristics. A module that performs a single function or task has a high degree of cohesion, which is desirable.

described, 516, 517

object-oriented, 520

color, in user interface design, 347

columns, format of, 355

combination check A type of data validation check that is performed on two or more fields to ensure that they are consistent or reasonable when considered together. Even though all the fields involved in a combination check might pass their individual validation checks, the combination of the field values might be inconsistent or unreasonable. 368

combination key Sometimes it is necessary for a primary key to consist of a combination of fields. In that case, the primary key is called a combination key, composite key, concatenated key, or multi-valued key. 402

command. *See message*

command button Command buttons initiate an action such as printing a form or requesting Help. 348

common field An attribute that appears in more than one entity. Common fields can be used to link entities in various types of relationships. 402

communication(s)

- oral, 639–644
- skills, 31, 644
- strategies, 632–633
- tools, 630–647
- written, 633–639

Compaq, 292

composite key Sometimes it is necessary for a primary key to consist of a combination of fields. In that case, the primary key is called a combination key, composite key, concatenated key, or multi-valued key. 402

computer output to microfilm (COM) Scanning and storing images of paper documents. Often used by large firms to provide high-quality records management and archiving. 357

computer resources committee A group of key managers and users responsible for evaluating systems requests. The term "systems review committee" is also used. 65

computer-aided software engineering (CASE) A technique that uses powerful programs called CASE tools to provide an overall framework for systems development and support a wide variety of design methodologies, including structured analysis and object-oriented analysis. Also referred to as computer-aided systems engineering. 20

computer-aided systems engineering (CASE) A technique that uses powerful programs called CASE tools to provide an overall framework for systems development and support a wide variety of design methodologies, including structured analysis and

object-oriented analysis. Also referred to as computer-aided software engineering. 20

Computrace, 596

concatenated key Sometimes it is necessary for a primary key to consist of a combination of fields. In that case, the primary key is called a combination key, composite key, concatenated key, or multi-valued key. 402

concurrent task If tasks can be completed at the same time they are said to be concurrent, or parallel. 111

condition A specified action or state in a structure chart.

adding, 517–518

decision tables with, 226–227

described, 515

confidentiality One of the three main elements of system security: confidentiality, integrity, and availability (CIA). Confidentiality protects information from unauthorized disclosure and safeguards privacy. 589, 590

configuration management (CM) A process for controlling changes in system requirements during the development phases of the SDLC. Configuration management also is an important tool for managing system changes and costs after a system becomes operational. 582

connect time The total time that a user is connected actively to a remote server. Some Internet service providers use this as a basis for charges. 673

constraint A constraint or requirement is a condition that the system must satisfy or an outcome that the system must achieve.

described, 74

development strategies and, 295

examples of, 75

personnel, 302

risk management and, 108–109

construction phase A phase that focuses on program and application development tasks similar to the SDLC. 147

content The information actually contained in a Web page. 691

context diagram A top-level view of an information system that shows the boundaries and scope.

described, 209

drawing, 208–209, 210

context-sensitive A feature that is sensitive to the current conditions when it is invoked. For example, context-sensitive help offers assistance for a task in progress. 345, 346

contingency plans, 123

continuous backup A real-time streaming backup method that records all system activity as it occurs. 607, 608

control(s)

- requirements modeling and, 154–155
risk management and, 114–115
stronger, systems requests for, 60
- control break** A control break usually causes specific actions to occur, such as printing subtotals for a group of records. 354
- control break report** A detail report that focuses on control breaks. 354
- control couple** In a structure chart, a control couple shows a message, also called a flag, which one module sends to another. 515
- control field** A control field controls report output. For example, when the value of a control field changes, a control break could occur automatically. 354
- control field order** In a control break report, the records are arranged or sorted in the same order as the control fields. 354
- control module** In a structure chart, a control module is a higher-level module that directs lower-level modules, called subordinate modules. 514
- control structures** Control structures, also called logical structures, serve as the building blocks for a process. Control structures have one entry and exit point. They may be completed in sequential order, as the result of a test or condition, or repeated until a specific condition changes. 224
- control zone** The control zone contains codes, identification information, numbers, and dates that are used for storing completed forms. 360
- copyright issues, 691–592
Corel, 297, 537
- corporate culture** A set of beliefs, rules, traditions, values, and attitudes that define a company and influence its way of doing business. 33, 633
- corrective maintenance** Corrective maintenance is performed to fix errors. 575, 576–577 cost. *See also* cost-benefit analysis
analyzing, 80–81
of software packages, 295
system architecture and, 455–456, 464, 465–466, 486
systems requests and, 61
- cost center** An element that generates charges with no offsetting credits. 673
- cost-avoidance benefits** Expenses that would be necessary if the new system is not installed. Examples include handling the work with existing staff, and not replacing existing hardware or software. 674
- cost-benefit analysis** The process of comparing the anticipated costs of an information system to the anticipated benefits.
business case analysis and, 80
checklist, 300
described, 674
development strategies and, 299–300
overview, 299, 674–684
performing, 307
requirements modeling and, 155–156
system architecture and, 465–466
- coupling** Coupling measures relationships and interdependence among modules. 516–518, 520
- crawler** Search engines use a specialized computer program called a spider or crawler that travels from site to site indexing, or cataloging, the contents of the pages based on keywords. 693
- credentials** Credentials include formal degrees, diplomas, or certificates granted by learning institutions to show that a certain level of education has been achieved successfully. 32, 35, 318, 610, 611, 612
- critical path** A series of events and activities with no slack time. If any activity along the critical path falls behind schedule, the entire project schedule is similarly delayed. As the name implies, a critical path includes all activities that are vital to the project schedule. 113–114
- Critical Path Method (CPM)** The Critical Path Method (CPM) was developed by private industry, and shows a project as a network diagram. The activities are shown as vectors, and the events are displayed graphically as nodes. Although CPM developed separately from the Program Evaluation Review Technique (PERT), the two methods are essentially identical. 105
- critical risk** When risks are categorized and prioritized, critical risks (those with the highest vulnerability and impact ratings) head the list. 591
- critical success factors** Vital objectives that must be achieved for the enterprise to fulfill its mission. 57
- critical thinking skills** The ability to compare, classify, evaluate, recognize patterns, analyze cause and effect, and apply logic. Such skills are valued in the IT industry. 31
- crow's foot notation** A type of cardinality notation. It is called crow's foot notation because of the shapes, which include circles, bars, and symbols, that indicate various possibilities. A single bar indicates one, a double bar indicates one and only one, a circle indicates zero, and a crow's foot indicates many. 408, 409
- Crystal Reports**, 350–351
- customer** Primary user of a system, service, or product. *See also* customer relationship management (CRM)
business case analysis and, 63
use of the term, 520
- customer relationship management (CRM)** Many companies implement CRM systems that integrate all customer-related events and transactions including marketing, sales, and customer service activities. 63, 454–455
- cutover phase** A phase that resembles the final tasks in the SDLC implementation phase, including data conversion, testing, changeover to the new system, and user training. 147
- cyberterrorism**, 592. *See also* terrorism
- Dartmouth University, 292
- dash (-)**, 227–228, 229
- data** The raw material or basic facts used by information systems.
analyzing, 78
business case analysis and, 62, 78
considerations for systems design, 313–314
control, 435–436
deleting, 345
described, 7
duplication, 314
logging, 313
overview, 9
storage, 430–435
verifying, 313
- data capture** The identification and recording of source data. 364
- data conversion** During data conversion, existing data is loaded into the new system. Depending on the system, data conversion can be done before, during, or after the operational environment is complete. 543, 544
- data couple** In a structure chart, a data couple shows data that one module passes to another. 515
- data dictionary** A central storehouse of information about a system's data.
analyzing, 518
described, 217
overview, 217–224
reports, 223–224
- data element** A single characteristic or fact about an entity. A data element, field, or attribute is the smallest piece of data that has meaning within an information system. For example, a Social Security number or company name could be examples of a data element. The term, data item, is also used. 217, 219, 432–433
- data entry** The process of converting source data into computer-readable form and entering it into the information system. 313, 314, 346, 363–365
- described, 363
user interface design and, 343, 347, 348, 363–365
- data flow** A path for data to move from one part of the information system to another. 202–203, 206
- data flow diagram (DFD)** Diagram that shows how the system stores, processes, and transforms data into useful information. 21–22, 151, 202
balancing and, 212, 214–215
creating sets of, 206–217
data dictionaries and, 217–224
database design and, 426
described, 200
development strategies and, 314
guidelines for, 206–207
leveling and, 212–217
reviewing, 517
symbols, 200–202
system architecture and, 486
system implementation and, 511, 512, 517
- data frames** Traffic on a computer network consists of data frames. 480–481
- data integrity** Refers to the validity of data. Data integrity can be compromised in a number of ways: human errors when data is entered, errors that occur when data is transmitted from one computer to another, software bugs or viruses, hardware malfunctions, such as disk crashes and natural disasters, such as fires and floods. 394, 691–592
- data item** The smallest piece of data that has meaning within an information system. For example, a Social Security number or company name could be examples of a data element. The terms data, element and field are used interchangeably. 217
- Data link layer**, 477
- data manipulation language (DML)** A data manipulation language (DML) controls database operations, including storing, retrieving, updating, and deleting data. Most commercial DBMSs, such as Oracle and IBM's DB/2, use a DML. 398
- data mart** A data mart is designed to serve the needs of a specific department, such as sales, marketing, or finance. Each data mart includes only the data that users in that department require to perform their jobs. 431
- data mining** Data mining software looks for meaningful patterns and relationships among data. For example, data mining software could help a consumer products firm identify potential customers based on their prior purchases. 431, 432
- data model** A data model describes data structures and design. 198–247

data processing center A central location where systems perform all data input and output. Data processing centers were common in 1960s-style mainframe architecture design. 459

data redundancy Data redundancy occurs when data common to two or more information systems is stored in several places. Data redundancy requires more storage space, and maintaining and updating data in several locations is expensive.

controlled, 395

database design and, 394, 395, 410

described, 394

normalization and, 410

data replication Data replication means that in normal operating conditions, any transaction that occurs on the primary system must automatically propagate to the hot site. 609

data repository A symbol used in data flow diagrams to represent a situation in which a system must retain data because one or more processes need to use that stored data at a later time. Used interchangeably with the term, data store. 203–205, 221–222

data security Data security protects data from loss or damage and recovers data when it is lost or damaged. 371, 372

data store A symbol used in data flow diagrams to represent a situation in which a system must retain data because one or more processes need to use that stored data at a later time. Used interchangeably with the term, data repository. 203–205, 221–222

data structure A meaningful combination of related data elements that is included in a data flow or retained in a data store. A framework for organizing and storing data. 392

data type check A type of data validation check that is used to ensure that a data item fits the required data type. For example, a numeric field must have only numbers or numeric symbols, and an alphabetic field can contain only the characters A through Z or the characters a through z. 367

data validation rule A data validation rule improves input quality by testing the data and rejecting any entry that fails to meet specified conditions. 366, 367, 368

data warehouse An integrated collection of data that can support management analysis and decision making. 425–426, 430–431

database(s). *See also* database design connecting, to the Web,

400–401

punched card technology and, 5

system architecture and, 463

database administration Database administration involves database design, management, security, backup, and user access, and is usually performed by members of the IT department. 29

database administrator (DBA) A database administrator (DBA) typically manages a database management system (DBMS). The DBA assesses overall requirements and maintains the database for the benefit of the entire organization rather than a single department or user.

described, 395

overview, 397

security and, 396

database design

concepts, 392–396

data control and, 435–436

data stores and, 430–435

database models and, 427–430

normalization and, 410–422

overview, 390–451

terminology, 401–405

using codes during, 424–426

Web-based design, 398–401

database management system (DBMS) A collection of tools, features, and interfaces that enables users to add, update, manage, access, and analyze data in a database. 392–396, 544

data control and, 435–436

overview, 395–396

security and, 396

system architecture and, 456

database programmer A person who focuses on creating and supporting large-scale database systems. 579

database servers, 400, 463

dates, storing, 434

DBMS (database management system). *See also* database management system (DBMS)

DDBMS (distributed database management system). *See also* distributed database management system (DDBMS)

decimal point (.), 213, 219, 364

decision table A table that shows a logical structure, with all possible combinations of conditions and resulting actions. 226–229, 513

decision tree A graphical representation of the conditions, actions, and rules found in a decision table. 230, 513

decomposing Another way of conveying a process or system that has been broken down from a general, top-level view to more detail. The terms, exploded and partitioned, also can be used. 213. *See also* leveling

deep Web The terms invisible Web, hidden Web, or deep Web, are used to describe this valuable information source, which includes numerous text, graphics, and data files stored in

collections that are unreachable by search engines. 693, 699–701

default A value that a system displays automatically. 219, 312, 344, 364

defect tracking software System developers use defect tracking software, sometimes called bug tracking software, to document and track program defects, code changes, and replacement code, called patches. 529

deliverable A polished, deliverable product, suitable for its intended use. End products or deliverables often coincide with the completion of each SDLC phase. 22

denial of service (DOS) An online attack that occurs when an attacking computer makes repeated requests to a service or services running on certain ports. 593, 599, 600

dependent task A task is said to be dependent when it has to be completed in a serial sequence. 111, 112, 113

deployment team The deployment team installs and configures workstations. 29

derivation codes Derivation codes combine data from different item attributes, or characteristics, to build the code. Most magazine subscription codes are derivation codes. 424

description and comments section, of documentation, 220

design prototyping Prototyping of user requirements, after which the prototype is discarded and implementation continues. Also called throwaway prototyping. 315, 316

design review A design review, or structured walkthrough, is a review of a project team member's work by other members of the team. Generally, systems analysts review the work of other systems analysts, and programmers review the work of other programmers, as a form of peer review. Structured walkthroughs should take place throughout the SDLC and are called requirements reviews, design reviews, code reviews, or testing reviews, depending on the phase in which they occur. 114

design walkthrough A session with users to review the interface with a cross-section of people who will work with the new system. This is a continuation of the modeling and prototyping effort that began early in the systems development process. 525

desk checking The process of reviewing the program code to spot logic errors, which produce incorrect results. 525

detail line Each line of printed output in a detail report is called a detail line. 352, 355–356

detail report A detail report produces one or more lines of output for each record processed. 352, 354, 355–356

developmental costs Costs incurred only once, at the time a system is developed or acquired. Examples include salaries of people involved in system development or initial user training. 672–673

development strategies impact of the Internet on, 286–289

in-house options, 293–298

outsourcing and, 290

overview, 284–332

recommendations for, 307–308

role of the systems analyst in, 298–299

software development trends and, 317–318

DFD. *See* data flow diagram (DFD)

diagram 0 A diagram depicting the first level of detail below the initial context diagram. Diagram 0 (zero) zooms in on the context diagram and shows major processes, data flows, and data stores, as well as repeating the external entities and data flows that appear in the context diagram. balancing and, 214–215 overview, 209–212

dialog box A dialog box allows a user to enter information about a task that a system will perform. 348

differential backup Backup that backs up only the files that have changed since the last full backup. 607, 608

digest Digest describes the format of a mailing list. 705

digital audio, 358

digital images, 358

digital video, 358

dimensions Dimensions, or characteristics, might include the time, customer, and sales representative in a consumer products data warehouse. By selecting values for each characteristic, a user can obtain multidimensional information from the stored data. 431

direct costs Direct costs can be associated with the development of a specific system. Examples include the salaries of project team members and the purchase of hardware that is used only for the new system. 672

direct cutover The direct cutover approach causes the changeover from the old system to the new system to occur immediately when the new system becomes operational. 544, 545

disaster recovery plan A disaster recovery plan consists of an

- overall backup and recovery plan. 607
- discretionary projects** Projects where management has a choice in implementing them are called discretionary projects. For example, creating a new report for a user is an example of a discretionary project. 70
- diskless workstation** A network terminal that supports a full-featured user interface, but limits the printing or copying of data, except to certain network resources that can be monitored and controlled more easily. 371
- distributed systems** Company-wide systems that connect one or more LANs or WANs are called distributed systems. The capabilities of a distributed system depend on the power and capacity of the underlying data communication network. 460
- distributed database management system (DDBMS)** A system for managing data stored at more than one location. Using a DDBMS offers several advantages: data stored closer to users can reduce network traffic; the system is scalable, so new data sites can be added without reworking the system design; and with data stored in various locations, the system is less likely to experience a catastrophic failure. A potential disadvantage of distributed data storage involves data security. It can be more difficult to maintain controls and standards when data is stored in various locations. 467–468
- distributed denial of service (DDOS)** A service attack involving multiple attacking computers that can synchronize DOS attacks on a server. 599
- diverging data flow** A data flow in which the same data travels to two or more different locations. 211
- DNS poisoning, 593
- document review** A review of baseline documentation. A useful fact-finding technique that helps an analyst understand how the current system is supposed to work. 77, 164
- documentation** Documentation explains a system, helps people interact with it, and includes program documentation, system documentation, operations documentation, and user documentation.
- business case analysis and, 77
 - data stores and, 221–222
 - data dictionaries and, 218–222
 - described, 528
 - interviews and, 162–163
 - overview, 170–174
 - requirements modeling and, 170–174
- system implementation and, 528–533
- user interface design and, 342
- domain** The set of values permitted for a data element. 220
- DOS attack. *See* denial of service (DOS)
- dot-com (.com)** Company that bases its primary business on the Internet, rather than using traditional business channels. Internet-dependent is also used to describe this type of firm. 12
- drop-down list box** A drop-down list box displays the current selection; when the user clicks the arrow, a list of the available choices displays. 348
- dumpster diving** Raiding desks or trash bins for valuable information. 593, 606
- duration** The amount of time it will take to complete a task. 110
- eBay, 12, 13
- EBCDIC A data storage method used on most mainframe computers. 433
- Eclipse IDE, 523
- e-commerce (electronic commerce)** Transactions (e.g. buying and selling of goods and information) that occur on the internet. Includes both business-to-consumer, and business-to-business. Used interchangeably with I-commerce.
- described, 13
 - service providers, 469–470
 - solutions, developing, 468–469
 - system architecture and, 457–458, 468–469
- economic feasibility** Economic feasibility is achieved if the projected benefits of the proposed system outweigh the estimated costs involved in acquiring, installing, and operating it. 68, 670
- economically useful life** The period between the beginning of systems operation and the point when operational costs are rapidly increasing. 675
- economy of scale** The inherent efficiency of high-volume processing on larger computers. Database design allows better utilization of hardware. If a company maintains an enterprise-wide database, processing is less expensive using a powerful mainframe server instead of using several smaller computers. 395
- education, of systems analysts, 30–32. *See also* e-learning
- Educational Testing Service (ETS), 32
- e-learning** Online learning, also referred to as e-learning, is a term that refers to the delivery of educational or training content over the public Internet or intranet. 696–698, 710, 711
- electronic data interchange (EDI)** A process that involves the computer-to-computer transfer of data between companies. 14, 63, 400
- electronic product code (EPC)** Electronic product code (EPC) technology uses RFID tags to identify and monitor the movement of each individual product, from the factory floor to the retail checkout counter. 62
- electronic proof of delivery (EPOD)** Using EPOD, a supplier uses RFID tags on each crate, case, or shipping unit to create a digital shipping list. 63
- e-mail, 357–358
- empowerment** A trend that places more responsibility and accountability throughout all levels of an organization. 19
- encapsulation** The idea that all data and methods are self-contained, as in a black box. 256
- encrypted** Data that is encrypted is coded so that only those with the required authorization can access the data. 372, 597
- Encrypting File System (EFS)** A Microsoft file system that can be used to encrypt and limit access to data. EFS can be enabled or disabled at the folder or document level. EFS is fully implemented in Windows 7. 603
- encryption** A process where data is coded (converted into unreadable characters) so that only those with the required authorization can access the data (usually via decoding software). 433, 603
- database design and, 435
 - described, 60
 - overview, 372
- end product** A polished, deliverable product, suitable for its intended use. End products or deliverables often coincide with the completion of each SDLC phase. 22
- end users** Employees, customers, vendors, and others who interact with an information system. 10. *See also* users
- EndNote, 701
- engaged listening** The ability to really concentrate on what someone is saying, and avoid the temptation to hear what is expected. Also includes noticing non-verbal communication. 162
- enhancement** A new feature or capability. 576, 577
- enterprise applications** Examples of company-wide applications, called enterprise applications, include order processing systems, payroll systems, and company communications networks. 8
- enterprise computing** Information systems that support company-wide data management requirements, such as airline reservation, or credit card billing systems. 15
- enterprise resource planning (ERP)** A process that establishes an enterprise-wide strategy for IT resources. ERP defines a specific architecture, including standards for data, processing, network, and user interface design. 15, 454–455
- development strategies and, 302
 - IBM WebSphere and, 457
- entity** A person, place, thing, or event for which data is collected and maintained. For example, an online sales system may include entities named CUSTOMER, ORDER, PRODUCT, and SUPPLIER. 205, 401
- alternate name, 223
 - balancing and, 214–215
 - database design and, 401
 - documenting, 223
 - external, 205
 - input data flow, 223
 - name, described, 223
 - output data flow, 223
 - symbol, 205
- entity-relationship diagram (ERD)** A graphical model of the information system that depicts the relationships among system entities.
- creating, 426
 - described, 406
 - drawing, 406
 - overview, 405–410, 512
 - system implementation and, 511
- environment** A specific hardware and software configuration that supports IT business goals such as hardware connectivity and easy integration of future applications. Also called a platform. 454. *See also* software platform
- ergonomics** Ergonomics describes how people work, learn, and interact with computers. 343
- Ergosoft Laboratories, 337–338
- ERP (enterprise resource planning).** *See* enterprise resource planning (ERP)
- errors.** *See also* testing
- business case analysis and, 62
 - development strategies and, 317
 - O-O analysis and, 256
 - user interface design and, 343, 345, 346, 366–368
- ESS (Extended Service Set). *See* Extended Service Set (ESS)**
- evaluation and selection team** An evaluation and selection team is involved in selecting hardware and software, and includes systems analysts and users. A team approach ensures that critical factors are not overlooked and that a sound choice is made. 299
- evaluation model** A technique that uses a common yardstick to measure and compare vendor ratings. 303, 304

event An event, or milestone, is a reference point that marks a major occurrence. Events are used to monitor progress and manage a project. 106

event-driven programming language Instead of writing a series of sequential instructions, a programmer defines the actions that the program must perform when certain events occur. Also called non-procedural. 651

Excel (Microsoft), 78, 171, 297, 587–588, 678

exception report An exception report displays only those records that meet a specific condition or conditions. Exception reports are useful when the user wants information only on records that might require action, but does not need to know the details. 352, 353

existence check A type of data validation check that is used for mandatory data items. For example, if an employee record requires a Social Security number, an existence check would not allow the user to save the record until he or she enters a suitable value in the SSN field. 367

expert systems Systems that simulate human reasoning by combining a knowledge base and inference rules that determine how the knowledge is applied. Is sometimes used interchangeably with knowledge management systems. 16–17

exploding A diagram is said to be exploded if it “drills down” to a more detailed or expanded view. 213

exploit An attack that takes advantage of a system vulnerability, often due to a combination of one or more improperly configured services. 591

exporting The process of moving data from one application or environment to another. 544

Expression Studio (Microsoft), 317

Extended Service Set (ESS) A wireless network configuration made up of two or more Basic Service Set (BSS) networks, which allows wireless clients to roam from BSS to BSS. 483, 484

extensibility Refers to a system’s ability to expand, change, or downsize easily to meet the changing needs of a business enterprise. Also known as scalability

described, 155, 395, 456

development strategies and, 288

requirements modeling and, 155

extensible markup language (XML) XML is a flexible data description language that allows Web-based communication

between different hardware and software environments.

described, 14

development strategies and, 318

risk management and, 118

system implementation and, 523

extranet An extension of a company intranet that allows access by external users, such as customers and suppliers. 400

Extreme Programming (XP), 26, 512, 520–523

Facebook, 289, 702

fact-finding, 73–79, 156–159, 164–170

FAQs (frequently asked questions)

FAQs are a common method of providing guidance on questions that users are likely to ask. 531, 708

described, 703

help desks and, 573

fast-find features, 344

fat client A fat client design, also called a thick client design, locates all or most of the application processing logic at the client. 464

fault management The timely detection and resolution of operational problems. Fault management includes monitoring a system for signs of trouble, logging all system failures, diagnosing the problem, and applying corrective action. 585

fault tolerant A system or application is said to be fault tolerant if the failure of one component does not disable the rest of the system or application. 607

faxback A system that allows a customer to request a fax using e-mail, the company Web site, or a telephone. The response is transmitted in a matter of seconds back to the user’s fax machine. 358

feasibility study An initial investigation to clearly identify the nature and scope of the business opportunity or problem. Also called a preliminary investigation. 23, 66–69, 80

Federal Trade Commission, 605

feed reader Client software or Web application that aggregates syndicated Web content such as blogs, podcasts, and RSS feeds in a single location for easy viewing. Also called aggregator or RSS reader. 704

feedback, providing, to users, 342, 346

field A single characteristic or fact about an entity. A field, or attribute, is the smallest piece of data that has meaning within an information system. For example, a Social Security number or company name could be examples of a field. The terms data element, data item, and field are used interchangeably.

captions, 364

database design and, 398, 402, 410–412, 432–433

described, 402

logical storage and, 432–433

normalization and, 410–412

order, 355

repeating, 356

file Each file or table contains data about people, places, things, or events that interact with the information system.

processing, overview, 393–394

security, 603

file server In a file server design, also called a file sharing architecture, an individual LAN client has a copy of the application program, but not the data, which is stored on the server.

The client requests a copy of the data file and the server responds by transmitting the entire file to the client. After performing the processing, the client returns the data file to the server where it is stored. 460, 462, 465

file sharing architecture In a file sharing architecture, an individual LAN client has a copy of the application program, but not the data, which is stored on the server. The client requests a copy of the data file and the server responds by transmitting the entire file to the client. After performing the processing, the client returns the data file to the server where it is stored. 460

File Transfer Protocol (FTP) A familiar example of a TCP/IP protocol. FTP provides a reliable means of copying files from one computer to another over a TCP/IP network, such as the Internet or an intranet. 477, 601

file-oriented system A file-oriented system, also called a file processing system, stores and manages data in one or more separate files. 392

fill-in form Form used to collect data on the Internet or a company intranet. 167, 171, 697

financial analysis tools, 668–687

finish day/date The time that task is scheduled to be finished. 110, 116–117

firewall The main line of defense between a local network, or intranet, and the Internet. 599, 600

FireWire, 371

first normal form (1NF) A record is said to be in first normal form (1NF) if it does not contain a repeating group (a set of data items that can occur any number of times in a single record). 412–418

fishbone diagram Also called a Ishikawa diagram. It is an analysis tool that represents the possible causes of a problem as a graphical outline. 73

fixed charge method With this method, the indirect IT costs are divided among all the other departments in the form of a fixed monthly charge. 673

fixed costs Costs that are relatively constant and do not depend on a level of activity or effort. Many fixed costs recur regularly, such as salaries and hardware rental charges. 672

fixed fee model A service model that charges a set fee based on a specified level of service and user support. 291

Flesch Reading Ease score The Flesch Reading Ease score measures the average sentence length and the average number of syllables per word and rates the text on a 100-point scale. 634

Flesch-Kincaid Grade Level score

The Flesch-Kincaid Grade Level score uses the same variables as the Flesch Reading Ease score, but in a different formula that produces a rating keyed to a U.S. grade-school level. 634

flexibility, providing, 312

flowchart A diagram used to describe program logic that represents logical rules and interaction graphically using a series of symbols connected by arrows. Flowcharts can be useful in visualizing modular program designs. 513

focus In a sequence diagram, a focus indicates when an object sends or receives a message. It is indicated by a narrow vertical rectangle that covers the lifeline. 265

fonts, for presentations, 641

foreign key A field in one table that must match a primary key value in another table in order to establish the relationship between the two tables. 403, 404

form(s)

- database design and, 400–401
- security and, 371
- specialized, 359
- wizard, 298

form filling A very effective method of online data entry where a blank form that duplicates or resembles the source document is completed on the screen. The user enters the data and then moves to the next field. 364

form layout The physical appearance and placement of data on a form. Form layout makes the form easy to complete and provides enough space, both vertically and horizontally, for users to enter the data. 360

form painter An interactive tool that helps you design a custom interface, create screen forms, and handle data entry format and procedures. Also called a screen generator. 297, 342, 654, 655

- forward engineering** Forward engineering means translating business processes and functions into applications. 654
- four-model approach** Using the four-model approach means that a physical model of the current system, a logical model of the current system, a logical model of the new system, and a physical model of the new system are all developed. 231
- fourth-generation environment** Term used to describe an efficient software development environment that is created through the use of powerful CASE tools, application generators, report generators, screen generators, and fourth-generation languages (4GLs) during prototyping. 316
- fourth-generation language (4GL)** Non-procedural programming languages that are especially valuable in implementing an object-oriented system design. 316, 651
- framework** Conceptual structure that organizes and documents system development tasks. 661
- frequency, of records**, 222
- FTP (File Transfer Protocol). See File Transfer Protocol (FTP)**
- full backup** A complete backup of every file on the system. 607, 608
- functional baseline** The functional baseline is the configuration of the system documented at the beginning of the project. It consists of all the necessary system requirements and design constraints. 583
- functional decomposition diagram (FDD)** A top-down representation of business functions and processes. Also called a structure chart. 150, 341, 511
- functional primitive** A process that consists of a single function that is not exploded further. The logic for functional primitives is documented in a data dictionary process description. 211
- functionally dependent** Functional dependence is an important concept for understanding the second normal form (2NF). The field X is said to be functionally dependent on the field Y if the value of X depends on the value of Y. For example, an order date is dependent on an order number; for a particular order number, there is only one value for the order date. In contrast, the product description is not dependent on the order number. For a particular order number, there might be several product descriptions, one for each item ordered. 413
- future needs, anticipating**, 312
- fuzzy logic** An approach used in knowledge management systems
- that allows logical inferences to be drawn from imprecise relationships. 17
- Gane and Sarson** A popular symbol set used in data flow diagrams. Processes, data flows, data stores, and external entities all have a unique symbol. 200–201
- Gantt chart** A horizontal bar chart that illustrates a schedule. Gantt charts were developed many years ago by Henry L. Gantt as a production control technique and still are in common use. 104–106, 109, 119
- garbage in garbage out (GIGO)** The concept that the quality of the output is only as good as the quality of the input. 360
- Gartner, Inc.**, 292, 299
- gateway** A router or other network device used to connect to a larger, dissimilar type of network, such as the Internet. 481
- Gbps (gigabits per second)** A bandwidth or throughput measurement. 586
- global outsourcing** The practice of shifting IT development, support, and operations to other countries. 292, 293
- Goal Seek feature**, 587–588
- Google**, 12, 693–694, 697, 702, 704–705
- Apps, 472
 - Desktop, 605–606
 - Docs, 171, 637
- government regulations**, 64
- grammar checker** A software tool that can detect usage problems and offer suggestions. 634
- graphic modeling software**, 171
- graphical user interface (GUI)** A graphical user interface (GUI) uses graphical objects and techniques that allow users to communicate with a system. A well-designed GUI can help users learn a new system rapidly, and work with the system effectively. 338, 365, 459
- gray hole** A process is said to be a “gray hole” if an input is obviously insufficient to generate the shown output. 203
- group footer** A group footer appears after the last detail line of a group. Group footers could include items such as a subtotal, an average, or a count of the records in that group. 355, 356
- group header** A group header appears above the first detail line of a group. 355, 356
- groupware** Programs that run on a company intranet that enable users to share data, collaborate on projects, and work in teams. Also called workgroup software. 17
- GroupWise (Novell)**, 17
- growth, future, estimating**, 301–302
- hackers**, 592
- hardening** Making a system more secure by removing unnecessary accounts, services, and features. 601
- hardware** The physical layer of the information system, to include computers, networks, communications equipment, and other technology-based infrastructure. described, 8
development strategies and, 295, 302
- Harris Corporation**, 121
- hash totals** Hash totals, or batch control totals, are not meaningful numbers themselves, but are useful for comparison purposes. 368
- Hawthorne Effect** A phenomenon where employees who know they are being observed are more productive. 165
- HCI (human-computer interaction). See human-computer interaction (HCI)**
- heading zone** Area of a form that usually contains the company name or logo and the title and form number. 360
- help, navigating**, 345
- help desk** A centralized resource staffed by IT professionals that provides users with the support they need to do their jobs. A help desk has three main objectives: to show people how to use system resources more effectively, to provide answers to technical or operational questions, and to make users more productive by teaching them how to meet their own information needs. 29, 572–574
described, 297, 572
development strategies and, 297
outsourcing, 573
- Help dialog box**, 345
- Hewlett-Packard**, 292, 300, 470–471, 481, 537, 538, 670–671
- hidden Web** The terms invisible Web, hidden Web, or deep Web, are used to describe this valuable information source, which includes numerous text, graphics, and data files stored in collections that are unreachable by search engines. 693, 699–701
- hierarchical network** In a hierarchical network, one computer (typically a mainframe) controls the entire network. Satellite computers or servers control lower levels of processing and network devices. 478
- histogram** A common tool for showing the distribution of questionnaire or sampling results. It takes the form of a vertical bar chart. 171
- history file** In a typical file processing environment, a history file is a file copy created and saved for historical or archiving purposes. New history files, unlike new security files, do not replace the old files. 394
- hits** Although search engine indexes are incomplete and often dated, they are capable of delivering an overwhelming number of results, or hits. 693
- horizontal application** A software package that can be used by many different types of organizations. 293
- horizontal system** A basic system, such as an inventory or payroll package that is commonly used by a variety of companies. 8
- hot site** A separate IT location, which might be in another state or even another country, that can support critical business systems in the event of a power outage, system crash, or physical catastrophe. 609
- HTML (Hypertext Markup Language)** The language used to write Web pages for the Internet. 289, 318, 400–401
described, 399
system architecture and, 467
system implementation and, 523
- hub** A hub is at the center of a star network. The hub is the central computer or device that manages the network. 480, 483
- human-computer interaction (HCI)** describes the relationship between computers and the people who use them to perform business-related tasks. HCI concepts apply to everything from a PC desktop to the main menu for a global network. 338–341
- IBM (International Business Machines)**, 11, 124, 656–658, 662, 705
changes in the world foreseen by, 5, 6
DB/2, 398, 426
history of, 4–5
Lotus Organizer, 173
outsourcing and, 292
RUP and, 27
system architecture and, 457, 466–467, 481
training solutions, 537, 538
user interface design and, 336, 338–340
WebSphere, 287, 288, 289, 457, 523
- I-commerce (Internet commerce)** Transactions (e.g. buying and selling of goods and information) that occur on the internet. Includes both business-to-consumer, and business-to-business. Used interchangeably with e-commerce. 13. See also e-commerce (electronic commerce)
- Ideas International**, 296–297
- identity management** Controls and procedures necessary to identify legitimate users and system components. 604
- IEEE (Institute of Electrical and Electronics Engineers)** A

- professional organization that establishes standards for telecommunications. 482–483, 598. *See also specific standards*
- IEEE 802.11** A family of wireless network specifications developed by the IEEE. 482–485
- 802.11g** An IEEE wireless network specification introduced in 2003 based on a frequency of 2.4 GHz and maximum bandwidth of 54 Mbps; compatible with and replaces 802.11b, and will likely be replaced by the 802.11n standard. 483, 485
- IEEE 802.11i** A security standard for Wi-Fi wireless networks that uses the WPA2 protocol, currently the most secure encryption method for Wi-Fi networks. 598
- IEEE 802.11n** An IEEE wireless network specification adopted in 2009 that uses multiple-input/multiple output (MIMO) technology to achieve speeds of 200+ Mbps while increasing the wireless range, and is backward-compatible with 802.11 a, b, and g. 483
- IEEE 802.11y** An emerging IEEE wireless networking standard that uses multiple input/multiple output (MIMO) technology to increase bandwidth and range. 483
- IEEE 802.16** Specifications developed by the IEEE for broadband wireless communications over MANs (metropolitan area networks). 485
- implied Boolean Logic** In implied Boolean logic, symbols are used to represent Boolean operators, such as a plus sign (+) for AND, and a minus sign (?) for NOT. 697
- in-house application** An information system developed internally by a company's IT department. 7
- in-house software** An information center or help desk within the IT department responsible for providing user support and offering services such as hotline assistance, training, and guidance to users who need technical help. 293–295
- incremental backup** An incremental backup is faster than a full backup because it backs up only the files that have changed since the last full backup. 607, 608
- Independent Service Set (ISS)** A wireless networking topology in which no access point is used. Instead, wireless clients connect to each other directly. Also called peer-to-peer mode. 484
- indexed search engine** An indexed search engine organizes and ranks the results of a search. 694
- indexing** Search engines use a specialized computer program called a spider that travels from site to site indexing, or cataloging, the contents of the pages based on keywords. 693
- indirect costs** Indirect costs or overhead expenses cannot be attributed to the development of a particular information system. The salaries of network administrators and copy machine rentals are examples of indirect costs. 672
- inference rules** Rules that identify data patterns and relationships within a knowledge management system. 17
- informal structure** An informal structure usually is based on interpersonal relationships and can develop from previous work assignments, physical proximity, unofficial procedures, or personal relationships. 159
- information** Data that has been changed into a useful form of output. 7
- information center (IC)** An information center or help desk supports users by training them on application software. User support specialists answer questions, troubleshoot problems, and serve as a clearinghouse for user problems and solutions. 29, 287, 572, 573
- information system** System that combines information technology, people, and data to support business requirements. The five key components are hardware, software, data, processes, and people. 7, 17–18
- information technology (IT)** A combination of hardware, software, and telecommunications systems that support business operations, improve productivity, and help managers make decisions. 4–7
- Information Technology Association of America (ITAA)** A professional organization that sponsors seminars and training. 709
- information technology (IT) community** When you require IT information, you can access a huge assortment of sites and resources that can be called the information technology (IT) community. 708
- Infotivity Technologies, 302, 303
- InfoWorld, 168, 289, 703
- infrastructure mode** A wireless network configuration in which a central wireless device called an access point is used to serve all wireless clients; also called Basic Service Set (BSS). 483
- inheritance** A type of object relationship. Inheritance enables an object to derive one or more of its attributes from another object (e.g., an INSTRUCTOR object may inherit many traits from the EMPLOYEE object, such as hire date). 258
- input** Necessary data that enters a system, either manually or in an automated manner.
- described, 142
 - hardware, 368–369
 - requirements modeling and, 142, 154
 - security, 371–372
 - user interface design and, 368–369
 - validation, 602
 - volume reduction, 370
- input control** Input control includes the necessary measures to ensure that input data is correct, complete, and secure. A systems analyst must focus on input control during every phase of input design, starting with source documents that promote data accuracy and quality. 371
- input masks** Templates or patterns that make it easier for users to enter data. Often used in automated forms to guide an unfamiliar user. 346, 365–366
- instance** A specific member of a class. 251
- instant messaging (IM)** Instant messaging allows online users to exchange messages immediately, even while they are working in another program or application. 357–358, 706, 707
- Institute of Electrical and Electronics Engineers (IEEE)** A professional organization that establishes standards for telecommunications. 482–483, 598. *See also specific standards*
- instruction zone** The instruction zone contains instructions for completing a form. 361
- intangible benefits** Benefits that are difficult to measure in dollars. However, intangible benefits can be very important in the calculation of economic feasibility. An example of an intangible benefit might be a new Web site that improves a company's image. 68
- intangible costs** Intangible costs involve items that are difficult to measure in dollar terms, such as employee dissatisfaction. 672
- integer format** A type of binary storage format. The integer format requires two bytes to store numbers from 32,768 to 32,767. 434
- integrated development environment (IDE)** An integrated development environment (IDE) uses a built-in CASE tool that a software vendor has included to make it easier to plan, construct, and maintain a specific software product. An IDE is designed to allow the easy integration of system components with less time being spent on developing code for interactive modules. 523, 656, 656–658
- Internet** A worldwide network that integrates many thousands of other networks, which in turn link millions of government, business, educational, and personal users around the globe.
- based architecture, 467–473
 - based information delivery, 357
 - communication channels, 702–707
 - described, 690
 - development strategies and, 304–306
 - impact of, 12–13, 286–289
 - as a platform, concept of, 473
 - research, 168–169, 690–692
 - resources, overview of, 688–714
 - terminology, 399–400
 - user interface design and, 357–359
- Internet business services (IBS)** Services that provide powerful Web-based support for transactions such as order processing, billing, and customer relationship management. 291
- Internet operating system** Part of the Web 2.0 model, an online computing environment created by online communities and services, based on layers of shared information that can contain text, sound bytes, images, and video clips. 473
- Internet Relay Chat (IRC)** The chat room concept originated with Internet Relay Chat, or IRC. IRC is a multi-channel system supported by servers that enable group and individual

- conversations to occur on a worldwide basis. 705
- Internet-dependent** Company that bases its primary business on a commercial Web site, rather than using traditional business channels. Dot-com (.com) is also used to describe this type of firm. 12
- interpersonal skills** "People" skills that help a systems analyst work with personnel at all organizational levels, and balance sometimes conflicting user needs. 143
- Intershop**, 469
- interview** A planned meeting during which information is obtained from another person. conducting, 76–77 described, 159 documenting, 162–163 evaluating, 163 objectives, 159–160 preparation for, 161–162 questionnaires versus, 169 questions, 160–161 requirements modeling and, 159–164 unsuccessful, 163–164
- intranet** A private, company-owned network that provides Web-based access to internal users. 399–400
- invisible Web** The terms invisible Web, hidden Web, or deep Web, are used to describe this valuable information source, which includes numerous text, graphics, and data files stored in collections that are unreachable by search engines. 693, 699–701
- IP** (Internet Protocol) packets, 481
- iPhone** (Apple), 173–174
- IRC** IRC, or Internet Relay Chat, is a multi-channel system supported by servers that enable group and individual conversations to occur on a worldwide basis. 705
- Ishikawa diagram** Also called a fishbone diagram. It is an analysis tool that represents the possible causes of a problem as a graphical outline.
- ISO** (International Organization for Standardization). *See* International Organization for Standardization (ISO)
- ISO 90003:2004** A set of guidelines established and updated by the International Organization for Standardization (ISO) to provide a quality assurance framework for developing and maintaining software. 510
- iteration** The completion of a process step that is repeated until a specific condition changes. 225
- iteration cycle** An agile development cycle that includes planning, designing, coding, and testing one or more features based on user stories. 522
- iteration planning meeting** In agile development, a meeting held at the beginning of each iteration cycle to break down user stories into specific tasks that are assigned to team members. 522
- iterative** An adaptive method typically uses a spiral development model, which builds on a series of iterations. 25
- Java**, 25, 318, 651 O-O analysis and, 250 system architecture and, 457 system implementation and, 523
- JDBC** (Java database connectivity) JDBC enables Java applications to exchange data with any database that uses SQL statements and is JDBC-compliant. 398
- job titles**, 33
- Johnson, Jim**, 102
- joint application development (JAD)** A popular systems development technique that uses a cross-matrixed task group of users, managers and IT professionals that work together to gather information, discuss business needs, and define the new system requirements. 26–27, 58, 143–145
- just-in-time (JIT)** The exchange or delivery of information when and where it is needed. For example, just-in-time inventory systems rely on computer-to-computer data exchange to minimize unnecessary inventory. 63
- Karat, Clare-Marie, 340–341
- Kbps (kilobits per second)** A bandwidth or throughput measurement. 586
- key fields** Key fields are used during the systems design phase to organize, access, and maintain data structures. The four types of key fields are primary keys, candidate keys, foreign keys, and secondary keys. 402–404
- Keynote** (Apple), 171
- keystroke logger** A device that can be inserted between a keyboard and a computer to record keystrokes. 594
- keywords** Words used by a spider to catalog or index pages from Web sites. 693
- knowledge base** A large database that allows users to find information by clicking menus, typing keywords, or entering text questions in normal phrases. 17
- knowledge management systems** Systems that simulates human reasoning by combining a knowledge base and inference rules that determine how the knowledge is applied. Is sometimes used interchangeably with expert systems. 16–17
- knowledge workers** Includes professional staff members such as systems analysts, programmers, accountants, researchers, trainers, and human resource specialists. 19
- Kyocera**, 173
- LAN**. *See* local area network (LAN)
- language compilers**, 525
- leading questions** Questions that suggest or favor a particular reply. 160
- legacy data** Data associated with an older, less technologically advanced legacy system. 462
- legacy systems** Term used to describe older systems that are typically less technologically advanced than currently available systems. database design and, 392–394 described, 9, 457 development strategies and, 295 system architecture and, 457, 462, 466
- length** The maximum number of characters for an alphabetic or character data element, or the maximum number of digits and number of decimal positions for a numeric data element. 219
- letters, tips for writing**, 634–635
- leveling** The process of drawing a series of increasingly detailed diagrams to reach the desired level of detail. 212–217
- library module** In a structure chart, a library module is a module that is reusable and can be invoked from more than one point in the chart. 514
- lifeline** In a sequence diagram, a lifeline is used to represent the time during which the object above it is able to interact with the other objects in the use case. An x marks the end of a lifeline. 264
- limit check** A limit check occurs when a validation check involves a minimum or a maximum value, but not both. Checking that a payment amount is greater than zero, but not specifying a maximum value, is an example of a limit check. 367
- link testing** Testing two or more programs that depend on each other is called link testing, or integration testing. 526
- LinkedIn**, 702
- Linux**, 318
- list box** A list box displays a list of choices that the user can select. 348
- list server** A computer that directs e-mail to people who subscribe to, or join, a particular mailing list. 704
- listserv** A listserv, also called a mailing list, is similar to a newsgroup in that it provides a forum for people who want to exchange information about specific topics. 704
- local area network (LAN)** A local area network (LAN) allows the sharing of data and hardware, such as printers and scanners. Advances in data communication technology have made it possible to create powerful networks that use satellite links, high-speed fiber-optic lines, or the Internet to share data. described, 460 file sharing architecture and, 360 protocols and, 477 routers and, 481 security, 592, 600 topology, 478, 479, 483
- log** Record typically kept by operating systems and applications that documents all events, including dates, times, and other specific information. Logs can be important in understanding past attacks and preventing future intrusions. 313, 602
- logic errors** Errors in the underlying logic that produce incorrect results. 525
- logical design** The logical design of an information system defines the functions and features of a system and the relationships among its components. 311
- logical model** A logical model shows what a system must do, regardless of how it will be implemented physically. 175, 198, 200–205, 231–232
- logical operators** The logical operators OR, AND, and NOT are used to create combinations of search terms to improve search success greatly. 695, 696
- logical record** A logical record contains field values that describe a single person, place, thing, or event. Application programs see a logical record as a set of fields, regardless of how or where the data is stored physically. 433
- logical rules**, 225
- logical storage** Refers to information as seen through a user's eyes, regardless of how or where that information is organized or stored. 432, 433
- logical structures** Logical structures, or control structures, serve as the building blocks for a process. Logical structures have one entry and exit point. They may be completed in sequential order, as the result of a test or condition, or repeated until a specific condition changes. 224
- logical topology** A view of a network that describes the way the components interact, rather than the actual network cabling and connections. 477
- long integer format** A type of binary storage format. The long integer format can store numbers from 2,147,483,647 to

- 2,147,483,647 using only four bytes of storage. 434
- loop** In a structure chart, a loop indicates that one or more modules are repeated. 318, 515, 517–518
- looping** Looping, or repetition, refers to a process step that is repeated until a specific condition changes. For example, a process that continues to print paychecks until it reaches the end of the payroll file is looping. 225
- loose coupling** Loose coupling means that the objects can interact, but are essentially independent. 318
- loosely coupled** Modules that are relatively independent. Loosely coupled modules are easier to maintain and modify, because the logic in one module does not affect other modules. 516
- Lowe's, 12, 13
- lower-level diagrams, 212–217
- Macintosh, 341
- magnetic data strip** A magnetic data strip is used for automated data input. 369
- mail bombing, 593
- mailing list** A mailing list, also called a listserv, is similar to a newsgroup in that it provides a forum for people who want to exchange information about specific topics. 704
- mainframe architecture** A system design where the server performs all the processing. client/server architecture and, comparison of, 462 described, 458 history of, 459 overview, 458–459
- maintenance** management, 578–584 requests, 580–582 system architecture and, 464, 471 tasks, 574–578 tools, 588–589
- maintenance activities** Maintenance activities include changing programs, procedures, or documentation to ensure correct system performance; adapting the system to changing requirements; and making the system operate more efficiently. Those needs are met by corrective, adaptive, perfective, and preventive maintenance. 574
- maintenance agreement** A maintenance agreement specifies the conditions, charges and time frame for users to contact the vendor for assistance when they have system problems or questions. 307
- maintenance expenses** Maintenance expenses vary significantly during the system's operational life and include spending to support maintenance activities. 574
- maintenance release** A formal release of a new system version that contains a number of changes. 583
- maintenance release methodology** A system of numbered releases used by organizations (especially software vendors) that helps organize maintenance changes and updates. 583
- maintenance team** A maintenance team consists of one or more systems analysts and programmers. 578, 579–580
- make or buy (build or buy) decision** The choice between developing in-house software and purchasing software often is called a make or buy, or build or buy, decision. 293, 294
- malware** Malicious software that might jeopardize your security or privacy. 593, 601, 692
- man in the middle attacks, 593
- MAN (metropolitan area network)** MANs (metropolitan area networks) use 802.16 standards, which are broadband wireless communications protocols. 485
- managed hosting** Another term for Internet business services (IBS). An operation is managed by the outside firm, or host. 291
- management.** See also managers information systems, described, 16 presentation of systems analysis to, 309–310, 311 system implementation and, 533, 549
- managers.** See also management interaction with, 71–72 middle, 18–19 preliminary investigation and, 71–72 presenting results/ recommendations to, 81 requirements modeling and, 144 top, 18
- many-to-many relationship** A type of entity relationship. A many-to-many relationship, abbreviated M:N, exists when one instance of the first entity can be related to many instances of the second entity, and one instance of the second entity can be related to many instances of the first entity. 407, 419
- market basket analysis** Market basket analysis can detect patterns and trends in large amounts of data. 432
- master file** In a typical file processing environment, a master file stores relatively permanent data about an entity. For example, a PRODUCT master file might contain one logical record for each product a company sells. 394
- MAU (Multistation Access Unit), 480
- Mbps (megabits per second)** A bandwidth or throughput measurement. 482, 586
- memory**, 433
- menu bar** A bar of user-selectable software application options, usually located across the top of the screen. 344, 347, 348
- mergers**, 292
- mesh network** A network design in which each node connects to every other node. While this design is very reliable, it is also expensive to install and maintain. 480–481
- message** An object-oriented command that tells an object to perform a certain method. 255–256, 346 described, 25, 250 O-O design and, 25 sequence diagrams and, 264
- meta-search engine** A tool that can use multiple search engines simultaneously. 692, 694
- method** A method defines specific tasks that an object must perform. A method describes what and how an object does something. described, 25, 250 overview, 519, 254–255 representing objects and, 253
- metrics** Workload measurements, also called metrics, include the number of lines printed, the number of records accessed, and the number of transactions processed in a given time period. 585
- Microsoft.** See also specific applications certifications and, 32 development strategies and, 305, 317 network diagrams and, 105 outsourcing and, 292 turnkey systems, 469 user interface design and, 338–339, 341
- Microsoft Access**, 171, 298 database design and, 405, 426, 428–430, 433 Help screen, 345 input masks and, 365–366 physical storage and, 433 referential integrity and, 405 report design tools, 350–351 system implementation and, 523–524 user interface design and, 356
- Microsoft Dynamics**, 454–455
- Microsoft Excel**, 78, 171, 297, 587–588, 678
- Microsoft Expression Studio**, 317
- Microsoft Live Meeting**, 643
- Microsoft Management Console (MMC)** A collection tools for administering networks, computers, services, and other components. The MMC includes built-in security tools such as password and lockout policies, user rights, audit policies, and more. 590
- Microsoft Office**, 170–171, 293, 297, 298. *See also specific applications*
- Microsoft Outlook**, 173, 635, 637
- Microsoft PowerPoint**, 171, 537, 640–641, 643
- Microsoft Project** A powerful, full-featured program that holds the dominant share of the project management software market. 64, 109, 113 described, 118 network diagrams and, 119–120 risk management and, 122
- Microsoft Solutions Framework (MSF)** A Microsoft approach to systems development. The objective of MSF is to define and analyze business requirements and provide IT solutions. 27
- Microsoft Visio**, 10, 19–20, 172, 481
- Microsoft Visual Basic**, 318, 523, 651
- Microsoft Visual Studio**, 317, 656–657
- Microsoft Web Apps**, 171
- Microsoft Windows** Azure, 472 Event Viewer, 602 Live MovieMaker, 541 user interface design and, 347
- Microsoft Word**, 167, 171, 297
- middleware** Software that connects dissimilar applications and enables them to communicate and exchange data. For example, middleware can link a departmental database to a Web server that can be accessed by client computers via the Internet or a company intranet. 289, 400–401, 457, 465, 466
- milestone** A milestone, or event, is a reference point that marks a major occurrence. Milestones are used to monitor progress and manage a project. 106
- military computers**, 477, 480
- mission statement** A document or statement that describes the company for its stakeholders and briefly states the company's overall purpose, products, services, and values. 55–56
- mission-critical system** An information system that is vital to a company's operations. 7
- mitigation** One of four risk control strategies. Mitigation reduces the impact of a risk by careful planning and preparation. For example, a company can prepare a disaster recovery plan to mitigate the effects of a natural disaster should one occur. 122, 592
- M:N** A type of entity relationship. A many-to-many relationship, abbreviated M. 407, 419
- mnemonic codes** Mnemonic codes use a specific combination of letters that are easy to remember. Many three-character

- airport codes are mnemonic codes. For example, LAX represents Los Angeles International Airport or DFW for Dallas/Ft. Worth Airport. 423
- mobile device platforms, 173–174
- mock-up** When designing a report, you should prepare a sample report, which is a mock-up, or prototype, for users to review. The sample should include typical field values and contain enough records to show all the design features. 656
- mock-up report** A mock-up report is a report that contains sample field values for users to review and approve. 656
- modeling** A process that produces a graphical representation of a concept or process that systems developers can analyze, test, and modify. 19–20, 342
- modular design** A design that can be broken down into logical blocks. Also known as partitioning, or top-down design. 224, 314, 514
- module** A module consists of related program code organized into small units that are easy to understand and maintain. A complex program could have hundreds or even thousands of modules. 511–512, 517
- Moore, Gordon, 8
- Moore's Law** Accurately predicted that computer processing power would double every 18 to 24 months. 7, 8
- Motorola, 173
- multipath design** A network design that relies on multiple data paths to increase bandwidth and range, using MIMO (multiple input/multiple output) technology. 483
- multiple input/multiple output (MIMO)** A wireless networking technology incorporated in the IEEE 802.11n standard that uses multiple data streams and multiple antennas to achieve maximum speeds of 200+ Mbps and substantially increase wireless range over earlier standards. 483
- Multistation Access Unit (MAU)** A networking device that allows the physical wiring of a ring network to resemble a star pattern by internally wiring clients into a logical ring and managing data flow among clients. 480
- multivalued key** Sometimes it is necessary for a primary key to consist of a combination of fields. In that case, the primary key is called a combination key, composite key, concatenated key, or multivalued key. 403
- MySpace, 289, 702
- natural language** A software feature that allows users to type commands or requests in normal English (or other language) phrases. 344, 396
- net present value (NPV)** The NPV of a project is the total value of the benefits minus the total value of the costs, with both the costs and benefits being adjusted to reflect the point in time at which they occur. 299, 682.
- .NET** Microsoft's Web-based development environment. 287, 288, 289, 317, 523, 654–658, 662
- NetBeans IDE, 523
- NetBIOS, 477
- Netflix, 12
- netiquette** A term that combines the words Internet and etiquette. Web guidelines for protocol and courtesy that exist on a particular newsgroup or site. In many cases, FAQs describe the netiquette of a given newsgroup or site. 635, 636, 703
- network** Two or more devices that are connected for the purpose of sending, receiving, and sharing data. *See also specific types*
- black boxes and, 201–202
 - cloud computing and, 289
 - described, 597
 - licensing issues, 482
 - managers, 19
 - security overview, 597–601
 - software acquisition and, 301
 - standards, 482–483
 - Web 2.0 and, 289
- network administration** An IT function that includes hardware and software maintenance, support, and security. In addition to controlling user access, network administrators install, configure, manage, monitor, and maintain network applications. 29
- network diagram** A PERT chart also is referred to as a network diagram. 105, 119
- network interface** A combination of hardware and software that allows the computer to interact with the network. 597
- network intrusion detection system (NIDS)** Software that monitors network traffic to detect attempted intrusions or suspicious network traffic patterns, and sends alerts to network administrators. Can be helpful in documenting the efforts of attackers and analyzing network performance. 600, 601, 602
- Network layer, 477
- network model** A network model portrays the design and protocols of telecommunications links. 476–482
- network topology** The way a network is configured. LAN and WAN networks typically are arranged in one of four patterns: hierarchical, bus, star, and ring. 477, 478, 483–484
- neural architectures** Computer and database models that aim to resemble human brain functions. 427
- newsgroup** The electronic equivalent of the everyday bulletin board. 305, 702, 703
- newsletters** Newsletters are published by numerous commercial and non-profit groups that offer membership subscriptions to users who are interested in specific topics. 703
- no charge method** Some organizations treat information systems department indirect expenses as a necessary cost of doing business. 673
- node** A physical device, wired or wireless, that can send, receive, or manage network data. 456
- nondiscretionary projects** Projects where no choice exists are called nondiscretionary projects. An example of such a project is adding a report required by a new federal law. 70
- nonkey field** Any field that is not a primary key or a candidate key is called a nonkey field. 402, 403, 416
- non-procedural programming language** Instead of writing a series of sequential instructions, a programmer defines the actions that the program must perform when certain events occur. Also called event-driven. 651
- normalization** A process by which analysts identify and correct inherent problems and complexities in their record designs. 410–422
- North Carolina State University, 432
- NOT** The NOT operator can be used to exclude certain records. 694, 696, 697–698
- notebook computers**, 595–596
- Novell, 32, 477, 637
- n-tier** The term, n-tier, indicates a multi-level design or architecture. For example, three-tier designs also are called n-tier designs, to indicate that some designs use more than one intermediate layer. 464, 465
- object** An object represents a real person, place, event, or transaction.
- described, 24
 - managers, 19
 - relationships among, described, 258
 - representation of, 251–254
 - state, 254
- object model** An object model describes objects, which combine data and processes. Object models are the end product of object-oriented analysis.
- described, 250
- organization**, 267
- overview, 248–283
- requirements modeling and, 142–143
- object-oriented (O-O) analysis** Object-oriented (O-O) analysis describes an information system by identifying things called objects. An object represents a real person, place, event, or transaction. Object-oriented analysis is a popular approach that sees a system from the viewpoint of the objects themselves as they function and interact with the system. 21, 24–25, 224, 250–251, 519–520
- object-oriented analysis and design (OOAD)** Object-oriented analysis and design (OOAD) is used to create objects called actors, which represent the human users who will interact with the system. 663
- object-oriented development (OOD)** The process of translating an object model directly into an object-oriented programming language. 518
- object-oriented programming languages (OOPL)** Non-procedural programming languages that are especially valuable in implementing an object-oriented system design. 518–520, 651
- objectives, defining**, 640
- observation** A fact-finding technique where an analyst sees a system in action. Observation allows the verification of statements made in interviews. 164–166
- obsolete** A system is said to be obsolete when users no longer require its functions or when the platform becomes outmoded. 609
- ODBC (open database connectivity)** *See open database connectivity (ODBC)*
- Office (Microsoft)**, 170–171, 293, 297, 298. *See also specific applications*
- offshore outsourcing** The practice of shifting IT development, support, and operations to other countries. 292, 293
- offshoring** Offshoring refers to the practice of storing backup media away from the main business location, in order to mitigate the risk of a catastrophic disaster such as a flood, fire, or earthquake. 607
- one-to-many relationship** A type of entity relationship. A one-to-one relationship, abbreviated 1:1, exists when exactly one of the second entity occurs for each instance of the first entity. 406, 419
- one-to-one relationship** A type of entity relationship. A one-to-many relationship, abbreviated 1:M, exists when one occurrence of the first entity can be related to many occurrences of the second entity, but each occurrence of the second entity can be associated with only one occurrence of the first entity. 406

online data entry A data entry method used for most business activity. The online method offers major advantages, including the immediate validation and availability of data. 369

online documentation Online documentation provides immediate help when users have questions or encounter problems. 531

online learning Online learning, also referred to as e-learning, is a term that refers to the delivery of educational or training content over the public Internet or intranet. 710, 711

online presentation A presentation delivered to an online audience, usually through a Web browser and/or a third-party application such as Cisco's WebEx or Microsoft's Live Meeting. 643, 644

online system An online system handles transactions when and where they occur and provides output directly to users. Because it is interactive, online processing avoids delays and allows a constant dialog between the user and the system. 474, 475–476

open database connectivity (ODBC) An industry-standard protocol that makes it possible for software from different vendors to interact and exchange data. 398, 544

Open Workbench Open Workbench project management software is available as free software, complete with manuals and sample projects. 118–120

open-ended questions Questions that allow for a range of answers. They encourage spontaneous and unstructured responses, and are useful in understanding a larger process. 160

open-source software Software that is supported by a large group of users and developers. 118, 318

OpenOffice.org, 171, 537

operational costs Operational costs are incurred after a system is implemented and continue while the system is in use. Examples include system maintenance, supplies, equipment rental, and annual software license fees. 574, 673

operational environment The environment for the actual system operation. It includes hardware and software configurations, system utilities, and communications resources. Also called the production environment. 534, 535

operational feasibility A system that has operational feasibility is one that will be used effectively after it has been developed. 67, 80

operational security Also called procedural security, is concerned with managerial policies and controls that ensure secure operations. 606, 607

operations documentation Operations documentation contains all the information needed for processing and distributing online and printed output. 529, 530

option button Option buttons, or radio buttons, represent groups of options. The user can select only one option at a time; a selected option contains a black dot. 348

OR The OR operator can be used when you need a wide search net. 694, 696, 697

Oracle, 290–291, 300, 398, 426

oral presentation A presentation that is presented orally and is required at the end of the preliminary investigation and again at the conclusion of the systems analysis phase. 639, 640–644

O'Reilly, Tim, 473

organization charts, 76

organizational models, 18–19

orphan An unassociated or unrelated record or field. An orphan could be created if you entered a customer order in an order table where that customer did not already exist in the customer table. Referential integrity would prevent the creation of this orphan. 404

OSI (Open Systems Interconnection) model OSI describes how data actually moves from an application on one computer to an application on another networked computer. The OSI consists of seven layers, and each layer performs a specific function. 476–477, 481

output Electronic or printed information produced by an information system. 142

output control Methods to maintain output integrity and security. For example, every report should include an appropriate title, report number or code, printing date, and time period covered. Reports should have pages that are numbered consecutively, identified as Page xx of xx, and the end of the report should be labeled clearly. 370, 371–372

output security Output security protects privacy rights and shields the organization's proprietary data from theft or unauthorized access. 370, 371–372

outsourcing The transfer of information systems development, operation, or maintenance to an outside firm that provides these services, for a fee, on a temporary or long-term basis.

described, 290
fees, 291
growth of, 290–293
issues/concerns, 291–292
offshore/global, 292, 293
options, identifying, 304–306
technical support, 573

overhead expenses Overhead expenses or indirect costs cannot be attributed to the development of a particular information system. The salaries of network administrators and copy machine rentals are examples of indirect costs. 672

page footer A page footer appears at the bottom of the page and is used to display the name of the report and the page number. 355

page header A page header appears at the top of the page and includes the column headings that identify the data. 341, 355

parallel operation The parallel operation changeover method requires that both the old and the new information systems operate fully for a specified period. Data is input into both systems, and output generated by the new system is compared with the equivalent output from the old system. 545

parallel programming A practice in Extreme Programming in which two programmers work on the same task on the same computer; one drives (programs) while the other navigates (watches). 522

parameter In system design, a parameter is a value that the user enters when a query or report is run, which provides flexibility, enables users to access information easily, and costs less than hard-coding all possible report or query values. 312

parent In inheritance, a parent is the object from which the other object, the child, derives one or more attributes. 256

parent diagram The higher or more top-level diagram in an exploded data flow diagram. 211

parent process, 214–215

Pareto chart Named for a 19th century economist, a Pareto chart is drawn as a vertical bar graph. The bars, which represent various causes of a problem, are arranged in descending order, so the team can focus on the most important causes. 78

partitioning The breaking down of overall objectives into subsystems and modules. 213, 514

passive voice Passive voice refers to using sentences with the actor being the direct object. For example, "The system was designed by Tom" is in passive voice. 633

password A method of limiting access to files and databases to protect stored data.
cracking, 593
described, 435
protection, overview of, 604
social engineering attacks and, 604

patch Replacement code that is applied to fix bugs or security holes in software. 529, 576, 602

pay for performance An arrangement between a search engine company and a commercial site that boosts a sites ranking in search results in return for a fee. 693

payback analysis Payback analysis determines how long it takes an information system to pay for itself through reduced costs and increased benefits. 299, 675, 676–678, 683

payback period The time it takes to recover a system's cost. 675, 676–677

PC Magazine, 708

PCMCIA slots, 371

PDAs (personal digital assistants).
See personal digital assistants (PDAs)

PDF (Portable Document Format), 637, 692

peer-to-peer mode A wireless networking topology in which no access point is used. Instead, wireless clients connect to each other directly, also called Independent Service Set (ISS). 484

perfective maintenance Perfective maintenance improves efficiency. 575, 577

performance System characteristics such as speed, volume, capacity, availability, and reliability. *See also* benchmark

described, 142

requirements modeling and, 142, 154

system architecture and, 466–467

systems requests for better, 60

Perl, 25, 250, 318, 523

permissions User-specific privileges that determine the type of access a user has to a database, file, or directory. Also called user rights. 435, 601, 603

person-days The amount of work that one person can complete in one day. 107

personal digital assistants (PDAs)

Handheld computers that accept handwritten input or may have small keyboards. 173, 358, 485

personal information manager (PIM)

(PIM) A tool such as Microsoft Outlook or Lotus Organizer that helps manage tasks and schedules. Many handheld devices also are available for this function. 173

PERT/CPM The Program Evaluation Review Technique (PERT)

- was developed by the U.S. Navy to manage very complex projects, such as the construction of nuclear submarines. At approximately the same time, the Critical Path Method (CPM) was developed by private industry to meet similar project management needs. The important distinctions between the two methods have disappeared over time, and today the technique is called either PERT, CPM, or PERT/CPM. 105–106, 110, 115–117, 119–120
- phased operation** The phased operation method allows you to implement a new system in stages, or modules. 546
- phrase** A phrase is more specific than an AND operator, because it specifies an exact placement of terms. 697
- physical design** The physical design of an information system is a plan for the actual implementation of the system. 311
- Physical layer**, 477
- physical model** A model that describes how a system will be constructed. 198, 231–232
- physical record** A physical record, or a block, is the smallest unit of data that is accessed by the operating system. 433
- physical security**, 594–597
- physical storage** Storage that is strictly hardware-related, because it involves the process of reading and writing binary data to physical media such as a hard drive or CD-ROM. 432, 433
- physical topology**, 477
- pilot operation** The pilot operation changeover method involves implementing the complete new system at a selected location of the company. 546
- pilot site** In a pilot operation, the group that uses the new system first is called the pilot site. 546
- plain text** Data that is not encrypted. 597
- plain text passwords**, 597
- platform** A specific hardware and software configuration that supports IT business goals such as hardware connectivity and easy integration of future applications. Also called an environment. 454
- podcast** A Web-based broadcast that allows a user to receive audio or multimedia files using music player software such as iTunes, and listen to them on a PC or download them to a portable MP3 player or smart phone. 358, 537, 703–704
- point-of-sale (POS)** The part of an information system that handles daily sales transactions and maintains the online inventory file. 475, 476
- polymorphism** The concept that a message gives different meanings to different objects (e.g., a GOOD NIGHT message might produce different results depending if it is received by a child or the family dog). 255
- port** A positive integer that is used for routing incoming traffic to the correct application on a computer. 599
- port protector** Network-based security application that controls access to and from workstation interfaces. 371
- port scan** An attempt to detect the services running on a computer by trying to connect to various ports and recording the ports on which a connection was accepted. 599
- portal** An entrance to a multifunction Web site. After entering a portal, a user can navigate to a destination, using various tools and features provided by the portal designer. 470, 698, 700
- positive benefits** Positive benefits increase revenues, improve services, or otherwise contribute to the organization as a direct result of the new information system. Examples include improved information availability, faster customer service, and higher employee morale. 674
- post-implementation evaluation** A post-implementation evaluation assesses the overall quality of the information system. The evaluation verifies that the new system meets specified requirements, complies with user objectives, and achieves the anticipated benefits. In addition, by providing feedback to the development team, the evaluation also helps improve IT development practices for future projects. 547, 548–549
- pound sign (#), 356**
- power-on password** A password that must be entered before the computer can be started. It prevents an unauthorized person from booting a computer by using a USB device or a CD-ROM. Also called a BIOS-level password or a boot-level password. 595
- PowerPoint (Microsoft)**, 171, 537, 640–641, 643
- predecessor task** Often, two or more concurrent tasks depend on a single prior task, which is called a predecessor task. 111, 112, 113
- predictive** Because structured analysis is based on a detailed plan, similar to a blueprint for constructing a building, it is called a predictive approach. 22
- preliminary investigation** An initial investigation to clearly identify the nature and scope of the business opportunity or problem. Also called a feasibility study. described, 23, 71 overview, 71–82 planning, 72–73
- present value** The present value of a future dollar is the amount of money that, when invested today at a specified interest rate, grows to exactly one dollar at a certain point in the future. 681
- present value analysis** A technique that allows analysts to plan for future growth goals based on present value. 680, 681–683
- present value tables** Tables that help analysts perform value analysis. 681
- Presentation layer**, 477
- presentation software** Presentation software is used to create slides with sounds, animation, and graphics. 640, 641
- presentations**, 309–311, 487
- pretexting** Obtaining personal information under false pretenses. 604
- preventive maintenance** Preventive maintenance reduces the possibility of future system failure. 575, 577–578
- primary key** A field or combination of fields that uniquely and minimally identifies a particular member of an entity. For example, in a customer table the customer number is a unique primary key because no two customers can have the same customer number. That key also is minimal because it contains no information beyond what is needed to identify the customer. 402, 403, 411–414
- priorities, setting**, 69–71, 582
- private key encryption** A common encryption technology called public key encryption (PKE). The private key is one of a pair of keys, and it decrypts data that has been encrypted with the second part of the pair, the public key. 597
- private network** A dedicated connection, similar to a leased telephone line. 599
- privilege escalation attack** An unauthorized attempt to increase permission levels. 593, 603
- probable-case estimate** The most likely outcome is called a probable case estimate. 107
- problems, understanding**, 73
- procedural** A procedural language requires a programmer to create code statements for each processing step. 651
- procedural security** Also called operational security, is concerned with managerial policies and controls that ensure secure operations. 606, 607
- process** Procedure or task that users, managers, and IT staff members perform. Also, the logical rules of a system that are applied to transform data into meaningful information. In data flow diagrams, a process receives input data and produces output that has a different content, form, or both.
- described, 9, 200 documenting, 222 names/labels, 222 numbers, 222 requirements modeling and, 142, 154
- process control** Process control allows users to send commands to a system. A process control screen (also known as a dialog screen) is part of the user interface, and enables a user to initiate or control system actions. 336
- process description** A documentation of a functional primitive's details, which represents a specific set of processing steps and business logic. 222, 224–230
- process improvement** The framework used to integrate software and systems development by a new SEI model, Capability Maturity Model Integration (CMMI). 509
- process model** A process model describes system logic and processes that programmers use to develop necessary code modules. 198–247
- process 0** In a data flow diagram, process 0 (zero) represents the entire information system, but does not show the internal workings. 208, 216
- process-centered** An analytic approach that describes processes that transform data into useful information. 22
- product baseline** The product baseline describes the system at the beginning of system operation. The product baseline incorporates any changes made since the allocated baseline and includes the results of performance and acceptance tests for the operational system. 583
- product-oriented** Product-oriented firms manufacture computers, routers, or microchips. 11
- production environment** The environment for the actual system operation. It includes hardware and software configurations, system utilities, and communications resources. Also called the operational environment. 534, 535
- productivity software** Software such as word processing, spreadsheet, database management, and presentation graphics programs. 170

products, support for new, 60
profit center A department expected to break even, or show a profit. 673

program documentation Program documentation starts in the systems analysis phase and continues during systems implementation. Systems analysts prepare overall documentation, such as process descriptions and report layouts, early in the SDLC. Programmers provide documentation by constructing modules that are well-supported by internal and external comments and descriptions that can be understood and maintained easily. 529

Program Evaluation Review Technique (PERT) The Program Evaluation Review Technique (PERT) was developed by the U.S. Navy to manage very complex projects, such as the construction of nuclear submarines. At approximately the same time, the Critical Path Method (CPM) was developed by private industry to meet similar project management needs. The important distinctions between the two methods have disappeared over time, and today the technique is called either PERT, CPM, or PERT/CPM. 105–106

programmer/analyst A designation for positions that require a combination of systems analysis and programming skills. 579

Project (Microsoft), 64, 109, 113
described, 118

network diagrams and,

119–120

risk management and, 122

project coordinator The project coordinator handles administrative responsibilities for the development team and negotiates with users who might have conflicting requirements or want changes that would require additional time or expense. 103

project creep The process by which projects with very general scope definitions expand gradually, without specific authorization. 74, 123

project management The process of planning, scheduling, monitoring, controlling, and reporting upon the development of an information system. 22, 28, 101–138, 514

project manager The project manager, or project leader, usually is a senior systems analyst or an IT department manager if the project is large. An analyst or a programmer/analyst might manage smaller projects. 103, 115–116, 144–145

project monitoring Project monitoring requires guiding,

supervising, and coordinating the project team's workload. 103, 114–115

project planning Project planning includes identifying project tasks and estimating completion time and costs. 103–104

project reporting Project reporting tasks include regular progress reports to management, users, and the project team itself. 103, 115–116

project scope A specific determination of a project's boundaries or extent. 74

project scheduling Project scheduling involves the creation of a specific timetable to facilitate completion of a project. Scheduling also involves selecting and staffing the project team and assigning specific tasks to team members. 103

properties Characteristics that objects inherit from their class or possess on their own. 24–25

protocol A set of standards that govern network data transmission. Also, preset conditions used by firewalls to determine whether or not to allow traffic to pass. 400, 477

prototype An early, rapidly constructed working version of the proposed information system. 20, 315

agile methods and, 25
limitations of, 317

user interface design and, 342

prototyping The method by which a prototype is developed. It involves a repetitive sequence of analysis, design, modeling, and testing. It is a common technique that can be used to design anything from a new home to a computer network. 315–317

proxy server A networking device that provides Internet connectivity for internal LAN users. 481

pseudocode A technique for representing program logic. 225, 513

public key encryption (PKE) A common encryption technique. Each user on the network has a pair of keys: a public key and a private key. The public key encrypts data that can be decrypted with the private key. 597

punched card system, 4–5

Python, 25, 318, 523

qualitative risk analysis Evaluating risk by estimating the probability that it will occur and the degree of impact. 121

quality assurance (QA) A process or procedure for minimizing errors and ensuring quality in products. Poor quality can result from inaccurate requirements, design problems, coding errors, faulty documentation, and ineffective testing. A quality

assurance (QA) team reviews and tests all applications and systems changes to verify specifications and software quality standards. 29, 508–510

quantitative risk analysis Evaluating risk in terms of the actual impact in terms of dollars, time, project scope, or quality. 122

Quanttro Pro (Corel), 171

query by example (QBE) A query-by-example (QBE) language allows the user to provide an example of the data requested. 396, 397

query language A query language allows a user to specify a task without specifying how the task will be accomplished. Some query languages use natural language commands that resemble ordinary English sentences. 396

questionnaire A document containing a number of standard questions that can be sent to many individuals. Also called a survey. 166–167, 169, 171

radio button A radio button, or option button, represents a group of options. The user can select only one option at a time; a selected option contains a black dot. 348

radio frequency identification (RFID) Radio frequency identification (RFID) technology uses high-frequency radio waves to track physical objects. 16, 62, 454

RAID (redundant array of independent disks) A RAID system may be part of an organization's backup and recovery plans. A RAID system mirrors the data while processing continues.

RAID systems are called fault-tolerant, because a failure of any one disk does not disable the system. 607

random sample A random sample is taken in a random, unplanned manner. For example, a random sample might be a sample that selects any 20 customers. 168

range check A type of data validation check that tests data items to verify that they fall between a specified minimum and maximum value. The daily hours worked by an employee, for example, must fall within the range of 0 to 24. 367

range-of-response questions

Closed-ended questions that ask the person to evaluate something by providing limited answers to specific responses or on a numeric scale. 160

rapid application development (RAD) A team-based technique that speeds up information systems development and produces a functioning information system. RAD is similar in concept

to joint application development (JAD), but goes further by including all phases of the System Development Life Cycle (SDLC). 58, 143, 315

described, 26–27

objectives, 147

overview, 145–147

Rapid Economic Justification (REJ), 156

Rational System Architect, 658–660

Rational Unified Process (RUP)

According to IBM, RUP offers a flexible, iterative process for managing software development projects that can minimize risk, ensure predictable results. 26

read-only properties Elements of an application that can be configured so users can view, but not change the data. 298

readability Readability analyzes ease of comprehension by measuring specific characteristics of syllables, words, and sentences. 634

reasonableness check A type of data validation check that identifies values that are questionable, but not necessarily wrong. For example, input payment values of \$0.05 and \$5,000,000.00 both pass a simple limit check for a payment value greater than zero, and yet both values could be errors. 367

record A record, also called a tuple, is a set of related fields that describes one instance, or member of an entity, such as one customer, one order, or one product. A record might have one or dozens of fields, depending on what information is needed.

alternate name, 223

attributes, 223

definition/description, 223

documenting, 223

name, 223

overview, 217, 402

security and, 372

user interface design and, 365

records retention policy A records policy that is designed to meet all legal requirements and business needs for keeping records. 372

recovery The process of restoring data and restarting a system after an interruption. 607

recovery procedures Recovery procedures involve restoring data and restarting a system after an interruption. Recovery procedures can be used to restore a file or database to its current state at the

time of the last backup. 607

referential integrity A type of validity check. Referential integrity is a set of rules that avoids data inconsistency and quality problems. 367, 404, 405

- relational database** A database in which tables are related by common fields, creating a unified data structure that provides improved data quality and access. 392, 427–430
- relational model** A model used in relational databases. The relational model was introduced during the 1970s and became popular because it was flexible and powerful. 427–430
- relationships** Relationships enable objects to communicate and interact as they perform the business functions and transactions required by a system. Relationships describe what objects need to know about each other, how objects respond to changes in other objects, and the effects of membership in classes, superclasses, and subclasses. 258, 406–408, 517
- release plan** In agile development, a plan that specifies when user stories will be implemented and the timing of the releases. Releases are relatively frequent, and each release is treated as a system prototype that can be tested and modified as needed. 521
- reliability**, of software packages, 296
- remote control software** Software that allows IT staff to take over a user's workstation and provide support and troubleshooting. 573
- repeating group** A set of one or more fields that can occur any number of times in a single record, with each occurrence having different values. 411
- report(s)**
 - data dictionary, 223–224
 - design, 350–357
 - to management, 81
 - risk management and, 115–116
 - security and, 370–372
 - system implementation and, 549
 - types of, 352–354
- report analysis form** A report analysis form contains information about the fields, data types and lengths, report frequency and distribution, and other comments. 353
- report footer** The report footer, which appears at the end of the report, can include grand totals for numeric fields and other end-of-report information. 354
- report generator** A report generator, also called a report writer, is a tool for designing formatted reports rapidly. 297, 298, 656
- report header** A report header appears at the beginning of a report and identifies the report as well as the report title, date, and other necessary information. 354
- Report Wizard**, 298, 350–351
- report writer** A report writer, also called a report generator, is a tool for designing formatted reports rapidly. 637–639
- repository** A repository is a database that serves as a central storage location for all information about a system being developed. 653
- request for proposal (RFP)** A written list of features and specifications given to prospective vendors before a specific product or package has been selected. 302–307, 536
- request for quotation (RFQ)** A request for quotation (RFQ) is used to obtain a price quotation or bid on a specific product or package. 304, 536
- requirements model** A requirements model describes business functions that an information system must support. 16
- requirements modeling** Modeling that is used in the systems planning phase of the SDLC. It involves fact-finding to describe the current system and identify the requirements for the new system. Requirements modeling involves various fact-finding techniques, such as interviews, surveys, observation, and sampling.
- fact-finding and, 156–159, 164–170
- described, 23–24, 142
- interviews and, 159–164
- techniques, 149–153
- overview, 140–197
- system requirements and, 153–155
- tools, 149–153
- requirements planning phase** A phase that combines elements of the systems planning and systems analysis phases of the SDLC. 146
- research** An important fact-finding technique. Research can include the review of journals, periodicals, and books to obtain background information, technical material, and news about industry trends and developments. 168–169
- resource allocation** The charging of indirect costs based on the resources used by an information system. 673
- response time** The overall time between a request for system activity and the delivery of the response. In the typical online environment, response time is measured from the instant the user presses the ENTER key or clicks a mouse button until the requested screen display appears or printed output is ready. 586
- responsible user**, use of the term, 220. *See also users*
- retention period** Backups are stored for a specific retention period after which they are either destroyed or the backup media is reused. 608
- return on investment (ROI)** A percentage rate that measures profitability by comparing the total net benefits (the return) received from a project to the total costs (the investment) of the project. $ROI = (\text{total benefits} - \text{total costs}) / \text{total costs}$. 299, 678, 679–680
- reverse engineering** Reverse engineering allows you to examine an existing application and break it down into a series of diagrams, structure charts, and, in some cases, source code. 654
- RFID scanners**, 313
- RFID tag** An input device used in source data automation. 369
- ring network** A ring network resembles a circle of computers that communicate with each other. A ring network often is used when processing is performed at local sites rather than at a central location. 479, 480
- risk** An event that could affect the project negatively.
- analysis, 26
- described, 591
- risk assessment** Measures the likelihood and impact of risks. 590–591
- risk control** Develops safeguards that reduce the likelihood and impact of risks. 590, 592
- risk identification** Listing each risk and assessing the likelihood that it could affect a project. 121, 590, 591–592
- risk management** The process of identifying, evaluating, tracking, and controlling risks to minimize their impact. 121–123, 590
- risk management plan** Includes a review of the project's scope, stakeholders, budget, schedule, and any other internal or external factors that might affect the project. The plan should define project roles and responsibilities, risk management methods and procedures, categories of risks, and contingency plans. 121
- risk response plan** A proactive effort to anticipate a risk and describe an action plan to deal with it. An effective risk response plan can reduce the overall impact by triggering a timely and appropriate action. 122
- roaming** A process that allows wireless clients to move from one access point to another, automatically associating with the stronger access point and allowing for uninterrupted service. 483
- router** A device that connects network segments, determines the most efficient data path, and guides the flow of data. 481
- RSS (Really Simple Syndication)** A format for publishing frequently updated content to users who subscribe to an RSS download, also called a feed, RSS feed, or a Web feed. 704
- RSS feed** Data format for providing users with frequently updated Web content on all kinds of topics, available by subscription. Also called a feed or Web feed. 704
- RSS reader** Client software or Web application that aggregates syndicated Web content such as blogs, podcasts, and RSS feeds in a single location for easy viewing. Also called feed reader or aggregator. 704
- Ruby**, 318, 523
- SaaS (Software as a Service)**. *See Software as a Service (SaaS)*
- salaries**, 33, 108
- sampling** As it relates to information systems, sampling is a process where an analyst collects examples of actual documents which could include records, reports, or various forms. 167–168
- SAP**, 470, 471
- scalability** Scalability means that a system can be expanded, modified, or downsized easily to meet the rapidly changing needs of a business enterprise. 24, 155, 395, 456
- development strategies and, 288
- requirements modeling and, 155
- scalable** A design is said to be scalable if it can expand to meet new business requirements and volumes. 24
- scaling on demand** The ability to match network resources to needs at any given time; a feature of cloud computing. For example, during peak loads, additional cloud servers might come on line automatically to support increased workloads. 472
- scannable text** In Web-based form design, scannable text is text that is created with the idea that readers of online material scan the text rather than reading it. Scannable text is created with this in mind. 361
- scatter diagram** Also called an XY chart, a tool used by system analysts to graphically show the correlation between two variables. 78–79
- schedule(s)**. *See also schedule feasibility*
- business case analysis and, 80
 - evaluating, 80
 - risk management and, 115, 123–124
- schedule feasibility** Schedule feasibility means that a project

- can be implemented in an acceptable time frame. 69
- schema** The complete definition of a database, including descriptions of all fields, records, and relationships. 398
- SCM (supply chain management).** See supply chain management
- screen generator** A screen generator is an interactive tool that helps you design a custom interface, create screen forms, and handle data entry format and procedures. Also called a form painter. 297, 342, 654, 655
- script kiddies.** 592
- scroll bar** In user interface design, a scroll bar allows the user to move through the available choices for an input field. 348
- Scrum** A popular process with agile developers; refers to a powerful effort to achieve short-term goals, derived from a rugby term. In Scrum, team members play specific roles and interact in intense sessions. 26, 148
- SDLC (systems development life cycle). See** systems development life cycle (SDLC)
- search engine** An application that uses keywords and phrases to locate information on the Internet and list the results of the search. 693–698, 701
- second normal form (2NF)** A record design is in second normal form (2NF) if it is in 1NF and if all fields that are not part of the primary key are dependent on the entire primary key. If any field in a 1NF record depends on only one of the fields in a combination primary key, then the record is not in 2NF. A 1NF record with a primary key that is a single field is automatically in 2NF. 413–418, 420, 421
- secondary key** A field or combination of fields that can be used to access or retrieve records. Secondary key values are not unique. For example, if you need to access records for only those customers in a specific ZIP code, you would use the ZIP code field as a secondary key. 404
- security** Hardware, software, and procedural controls that safeguard and protect a system and its data from internal or external threats.
- concepts, 589–590
 - data conversion and, 544
 - data dictionaries and, 220
 - database design and, 396, 399, 401
 - described, 142, 220, 589
 - development strategies and, 288, 317, 318
 - levels, 594–600
 - overview, 589–593
 - requirements modeling and, 142
- system architecture and, 458, 485
- user interface design and, 370–372
- wireless networks and, 485
- security file** A file that is created and saved for backup and recovery purposes. Examples of security files include audit trail files and backups of master, table, and transaction files. 394
- security hole** Created by a combination of one or more improperly configured services. 601
- security policy** A policy that addresses the three main elements of system security: confidentiality, integrity, and availability. 590
- security token** A physical device that authenticates a legitimate user, such as a smart card or keychain device. 605
- SEI (Software Engineering Institute),** 508, 650
- selection** A control structure in modular design, it is the completion of two or more process steps based on the results of a test or condition. 224
- separator** A character such as a slash (/) that is used to format inputted data. 364
- sequence** The completion of steps in sequential order, one after another. 224, 231
- sequence check** A type of data validation check that is used when the data must be in some predetermined sequence. If the user must enter work orders in numerical sequence, for example, then an out-of-sequence order number indicates an error. If the user must enter transactions chronologically, then a transaction with an out-of-sequence date indicates an error. 367
- sequence codes** Numbers or letters assigned in a specific order. Sequence codes contain no additional information other than an indication of order of entry into a system. 423
- sequence diagram** A diagram that shows the timing of transactions between objects as they occur. 152–153, 264–265
- server** Computer in a client/server design that supplies data, processing, and services to client workstations.
- based processing, 459
 - described, 458
 - security and, 594–595
 - system architecture and, 458–459
- server processing time** The time that the server actually requires to respond to client requests for processing. 673
- service** An application that monitors, or listens on, a particular port.
- described, 599
- security and, 601
- support for new, 60
- service pack** A maintenance release supplied by commercial software suppliers. 583
- service provider** A firm that offers outsourcing solutions. Two popular outsourcing options involve application service providers and firms that offer Internet business services. 290
- service-oriented** A company that primarily offers information or services, or sells goods produced by others. 11
- service-oriented architecture (SOA)**
- Service oriented architecture (SOA) is an architectural style whose goal is to achieve loose coupling among interacting software objects that can provide services. 318
- Session layer,** 477
- significant digit codes** Significant digit codes distinguish items by using a series of subgroups of digits. ZIP codes, for example, are significant digit codes. 424
- simulation** A simulation is a dress rehearsal for users and IT support staff. Organizations typically include all procedures, such as those that they execute only at the end of a month, quarter, or year, in their simulations. 543
- sink** An external entity that receives data from an information system. 205
- site visit** A visit to a physical location to observe a system in use at another location. 169
- skills**
- communication, 31, 644
 - of systems analysts, 30–31
- slack time** The slack time for an event is the amount of time by which an event can be late without delaying the project. The slack time for an event is the difference between its latest completion time (LCT) and earliest completion time (ECT). 114
- Slaughter, Matthew,** 292
- Smarttalk,** 25, 250
- smart phone** A cell phone with built-in applications and Internet access. 173
- sniffing,** 593
- social engineering** An intruder uses social interaction to gain access to a computer system. 593, 604
- social networking** Using online communication channels such as Facebook, MySpace, Twitter, and LinkedIn to connect to personal and professional contacts and groups. 289, 702
- soft skills** Skills such as communications, interpersonal skills, and perceptive abilities, and critical thinking skills. IT professionals must have soft skills as well as technical skills. 31, 644
- software** A program run by computers for a specific function or task.
- acquisition process, 301–308
 - described, 8
 - development trends, 317–318
 - documentation, 170–171
 - overview, 8–9
 - upgrades, 296
 - usability studies, 338–339
- software engineering** A software development process that stresses solid design, effective structure, accurate documentation, and careful testing. 508
- Software Engineering Institute,** 508, 650
- software license** A software license gives users the right to use the software under certain terms and conditions. 307
- software package** Software that is purchased or leased from another firm; a commercially produced software product, or family of products.
- customizing, 296–297
 - described, 7, 293
 - development, 293–294
 - purchasing, 295–297, 310
- software reengineering** Uses analytical techniques to identify potential quality and performance improvements in an information system. 577
- software requirements specification**
- A software requirements specification, or system requirements document, contains the requirements for the new system, describes the alternatives that were considered, and makes a specific recommendation to management. It is the end product of the systems analysis phase. 309
- Software as a Service (SaaS)** Software as a Service (SaaS) is redefining the way that companies develop and deploy their information systems. SaaS is a model of software delivery that cuts across all market segments, including homes and business of all sizes.
- cloud computing and, 289
 - described, 286
 - overview, 472
 - trends, 286–287
- software vendor** Company that develops software for sale. 293, 536
- evaluating, 306–307
 - identifying, 304–306
 - purchasing software from, 295–297
- source** An external entity that supplies data to an information system. 205, 220
- source data automation** A popular online input method that combines online data entry and automated data capture using

- input devices** such as magnetic data strips, or swipe scanners. 369
- source document** A form used to request and collect input data, trigger or authorize an input action, and provide a record of the original transaction. During the input design stage, you develop source documents that are easy to complete and inexpensive. 360–362
- spam**, 593
- spell checker** A component of most word processing programs, a spell checker is a tool that identifies words in a document that do not appear in the program's dictionary. 634
- spider** Search engines use a specialized computer program called a spider or crawler which travels from site to site indexing, or cataloging, the contents of the pages based on keywords. 693
- spiral model** A spiral model represents a series of iterations, or revisions, based on user feedback. 26
- sponsored links** Links that are subsidized by companies are called sponsored links. 693
- spontaneous generation** A term used to describe an unexplained generation of data or information. With respect to data flow diagrams, processes cannot spontaneously generate data flows. They must have an input to have an output. 203
- spoofing**, 593
- spreadsheets**
 - computing payback analysis with, 677–679
 - present value and, 683
- SQL (Structured Query Language)** A query language that allows PC users to communicate with servers and mainframe computers. 397, 463, 465, 523
- stakeholder** Anyone who is affected by the company's performance, such as customers, employees, suppliers, stockholders, and members of the community. 10
- stand-alone** When an individual user works in a stand-alone mode, the workstation performs all the functions of a server by storing, accessing, and processing data, as well as providing a user interface. 460
- standard notation format** A standard notation format makes designing tables easier as it clearly shows a table's structure, fields, and primary key. 411
- Standish Group**, 102
- star network** A star network has a central computer with one or more workstations connected to it in a way that forms a star pattern. The central computer could be a mainframe, a midrange computer, or a server. 480–481
- start day/date** The time that a task is scheduled to begin. 110, 116–117
- state** An adjective that describes an object's current status (e.g. a student could be a CURRENT, FUTURE, or PAST student). 254
- state transition diagram** A state transition diagram shows how an object changes from one state to another, depending on the events that affect the object. 265
- status flag** In structured application development, an indicator that allows one module to send a message to another module. 515
- Storyboard** Sketches used during prototyping to show the general screen layout and design. 342
- strategic plans** The long-range plans that define the corporate mission and goals. Typically defined by top management, with input from all levels. 18, 54, 62
- stratified sample** A sample where a set metric is collected across functional areas. For example, a certain percentage of transactions from every work shift, or five customers from each of four zip codes, could be a stratified sample. 168
- structure chart** A top-down representation of business functions and processes. Also called a functional decomposition diagram. 514–515, 517–518
- structured analysis** A traditional systems development technique that uses phases to plan, analyze, design, implement, and support an information system. Processes and data are treated as separate components. 21, 663
- structured brainstorming** A group discussion where each participant speaks when it is his or her turn, or passes. 159
- structured English** A subset of standard English that describes logical processes clearly and accurately. 225–226
- structured walkthrough** A review of a project team member's work by other members of the team. Generally, systems analysts review the work of other systems analysts, and programmers review the work of other programmers, as a form of peer review. Structured walkthroughs should take place throughout the SDLC and are called requirements reviews, design reviews, code reviews, or testing reviews, depending on the phase in which they occur. 114, 525
- stub testing** In stub testing, the programmer simulates each program outcome or result and displays a message to indicate whether or not the program executed successfully. Each stub represents an entry or exit point that will be linked later to another program or data file. 526
- subclass** A further division of objects in a class. Subclasses are more specific categories within a class. 256
- subject directory** A subject directory or topic directory is a Web site that allows you to access topics by using a hierarchy, starting with general headings and proceeding to more specific topics. 693, 698–699, 701
- subordinate module** A lower-level module in a structure chart. 514
- subschema** A view of the database used by one or more systems or users. A subschema defines only those portions of the database that a particular system or user needs or is allowed to access. 398
- subscribers** Users of podcasts who listen to them anywhere, anytime. 537
- subscription model** A service model that charges a variable fee for an application based on the number of users or workstations that have access to the application. 291
- subsearch** A subsearch can include the option to search within returned results and the ability to search within specific areas, such as newsgroups. 691
- successor task** Each of the concurrent tasks of a predecessor task is called a successor task. 111, 112, 113
- summary report** A report used by individuals at higher levels in the organization that includes less detail than reports used by lower-level employees. 353
- Sun Microsystems**, 32
- superclass** A more generalized category to which objects may belong (e.g., a NOVEL class might belong to a superclass called BOOK). 257
- superuser** Account that allows essentially unrestricted access to the application. 601
- supplier relationship management (SRM)** Supplier relationship management (SRM) allows online B2B interaction where buyers, sellers, distributors, and manufacturers can offer products, submit specifications, and transact business. 14
- supply chain management** The coordination, integration, and management of materials, information, and finances as they move from suppliers to customers, both within and between companies. In a totally integrated supply chain, a customer order could cause a production planning system to schedule a work order, which in turn could trigger a call for certain parts from one or more suppliers. 14, 454–455
- survey** A document containing a number of standard questions that can be sent to many individuals. Also called a questionnaire. 78, 80
- swim lanes** In a business process diagram, the overall diagram is called a pool, and the designated customer areas are called swim lanes. 151
- switch** Central networking device in a star network, which manages the network and acts as a conduit for all network traffic. 480
- switchboard** In a user interface, a switchboard uses command buttons that enable users to navigate a system and select from groups of related tasks. 348, 349
- SWOT analysis** It examines a company's strengths (S), weaknesses (W), opportunities (O), and threats (T). 54–67
- Sybase**, 470
- symbols**, 200–202, 207–217
- syntax errors** Programming language grammar errors. 525
- system** A set of related components that produces specific results.
- described, 7
 - installation, 534
 - obsolescence, 609
 - performance management, 584–589
 - requests, evaluation of, 65–66
- system administrator** A person who is responsible for the configuration management and maintenance of an organization's computer networks. 578, 579
- system architecture** System architecture translates the logical design of an information system into a physical structure that includes hardware, software, network support, and processing methods.
- checklist, 454–458
 - completion, 485–486
 - Internet-based, 467–473
 - network models and, 476–482
 - overview, 452–503
 - planning, 458–461
 - processing methods, 474–476
 - system implementation and, 511
 - processing options, 458
 - Web integration and, 456–457
- system boundary** A system boundary shows what is included and excluded from a system. It is depicted by a shaded rectangle in use case diagrams. 262
- system changeover** The process of putting the new information

- system online** and retiring the old system. Changeover can be rapid or slow, depending on the method. 545–547
- system design specification** The system design specification, also called the technical design specification or the detailed design specification, is a document that presents the complete design for the new information system, along with detailed costs, staffing, and scheduling for completing the next SDLC phase, systems implementation. 24, 311, 486, 511
- system documentation** System documentation describes a system's functions and how they are implemented. The analyst prepares most of the system documentation during the systems analysis and systems design phases. System documentation includes data dictionary entries, data flow diagrams, object models, screen layouts, source documents, and the systems request that initiated the project. 529
- system prototyping** System prototyping produces a full-featured, working model of the information system being developed. 315, 316
- system requirement** A characteristic or feature that must be included in an information system to satisfy business requirements and be acceptable to users. checklist, 153–155 described, 143, 153 review of, 311
- system requirements document** A system requirements document, or software requirements specification, contains the requirements for the new system, describes the alternatives that were considered, and makes a specific recommendation to management. It is the end product of the systems analysis phase. described, 24 formal, 307–308
- system software** Software that controls the computer and includes the operating system, device drivers that communicate with hardware, and utilities. 8
- system testing** System testing involves an entire information system and includes all typical processing situations. During a system test, users enter data, including samples of actual, or live data, perform queries, and produce reports to simulate actual operating conditions. All processing options and outputs are verified by users and the IT project development team to ensure that the system functions correctly. Also known as an acceptance test. 527, 528
- systematic sample** A sample that occurs at a predetermined periodicity. For example, every tenth customer record might be selected as a systematic sample for review. 168
- systems analysis and design** The process of developing information systems that effectively use hardware, software, data, processes, and people to support the company's business objectives. 7, 310–311
- systems analysis phase** The second SDLC phase. The purpose of this phase is to build a logical model of the new system. 7, 23–24, 142–145, 309–310
- systems analyst** A person who plans, analyzes, and implements information systems. He or she may work internally within a company's IT department, or be hired by a company as an independent consultant. 30–33, 298–299, 340, 530, 579
- Systems Analyst's Toolkit
CASE tools, overview of, 648–666
communications tools, 630–647
financial analysis tools, 668–687
Internet resource tools, 688–714
overview, 629–714
parts of, 299
- systems design** The goal of systems design is to build a system that is effective, reliable, and maintainable. 311–314
- systems design phase** The third SDLC phase. The purpose of systems design is to create a blueprint for the new system that will satisfy all documented requirements, whether the system is being developed in-house or purchased as a package. 24, 313–314
- systems development life cycle (SDLC)** Activities and functions that systems developers typically perform, regardless of how those activities and functions fit into a particular methodology. The SDLC model includes the following steps: 1. Systems planning, 2. Systems analysis, 3. Systems design, 4. Systems implementation, 5. Systems support and security. 21–24, 231
- systems evaluation** An assessment conducted during the systems implementation phase to determine whether the system operates properly and if costs and benefits are within expectations. 24
- systems implementation phase** The fourth phase of SDLC. During this phase the new system is constructed - programs are written, tested, and documented, and the system is installed.
- described, 24 documentation and, 528–533 managing, 506–567 system changeover and, 544–547 tasks after, 547–550 testing and, 525–528 training and, 535–543
- systems planning phase** Begins with a formal request to the IT department that describes problems or desired changes in an information system or a business process. 23
- systems programmer** A person who concentrates on operating system software and utilities. 579
- systems request** A formal request to the IT department that describes problems or desired changes in an information system or business process. It might propose enhancements for an existing system, the correction of problems, or the development of an entirely new system. 59–61, 65, 81
- systems review committee** A group of key managers and users responsible for evaluating systems requests. The term computer resources committee is also used. 65, 66, 581–582
- systems support and security** Systems support and security provides vital protection and maintenance services for system hardware and software, including enterprise computing systems, networks, transaction processing systems, and corporate IT infrastructure. 24, 29, 570–628
- systems support and security phase** During the systems operation, support, and security phase, the IT staff maintains, enhances, and protects the system. 24, 570–628
- table** Each file or table contains data about people, places, things, or events that interact with the information system. 402
- table design** A table design specifies the fields and identifies the primary key in a particular table or file. 410
- table file** In a typical file processing environment, a table file contains reference data that is used by the information system. As with master files, table files are relatively permanent and are not updated by the information system. Examples of table files include tax tables and postage rate tables. 394
- tags** Markup language codes. Tags are the building blocks of HTML and XML. 399
- tamper-evident case** A case designed to show any attempt to open or unlock the case. 595
- tangible benefits** Benefits that can be measured in dollars. Tangible benefits result from a decrease in expenses, an increase in revenues, or both. 68
- tangible costs** Costs that have a specific dollar value. Examples include employee salaries and hardware purchases. 672
- Target** 12
- task** A task, or activity, is any work that has a beginning and an end, and requires the use of company resources including people, time, and/or money. Examples include conducting a series of interviews, designing a report, selecting software, waiting for the delivery of equipment, and training users.
duration estimates, 107–108, 110
identifying, 106
listing, 106
- task box** In project management, a task box is a component of a PERT/CPM chart that contains important scheduling and duration information about a task. Each task in a project is represented by its own task box in the PERT/CPM chart. 110
- task group** In task groups, each task represents several activities. 104
- task pattern** In any project, large or small, tasks depend on each other and must be performed in a sequence, not unlike the commands in a software program. Task patterns can involve sequential tasks, multiple successor tasks, and multiple predecessor tasks. 110–112
- task ID** A number or code that uniquely identifies a task. 110
- task name** A brief descriptive name for a task, which does not have to be unique in the project. For example, a task named Conduct Interviews might appear in several phases of the project. 110
- TCP/IP (Transmission Control Protocol/Internet Protocol)**. See Transmission Control Protocol/Internet Protocol (TCP/IP)
- technical feasibility** A project or request is said to have technical feasibility if the organization has the resources to develop or purchase, install, and operate the system. 67–68
- technical support** Technical support is necessary to support the wide variety of IT systems and users. It includes six main functions: application development, systems support, user support, database administration, network administration, and Web support. These functions overlap considerably and often have different names in different companies. 28, 66, 155, 357
- TechRepublic Web site**, 31
- template** A standard format for documents, presentations and

- other output, with specific layouts, fonts, margin and other formatting settings. Templates are used to give work a consistent look. 635
- terminal** A keyboard and display screen that are used to handle input and output from a remote location to a central computer. A terminal lacks independent processing capability. 459
- terminator** A data flow diagram symbol that indicates a data origin or final destination. Also called an external entity. 205
- terrorism** 317, 592
- test data** Data that is used in unit testing. Test data should contain both correct data and erroneous data and should test all possible situations that could occur. 526
- test environment** The environment that analysts and programmers use to develop and maintain programs. 534, 535
- test plan** A plan designed by a systems analyst that includes test steps and test data for integration testing and system testing. 526, 608, 609
- test-driven design** An Extreme Programming (XP) concept that unit tests are designed before code is written, focusing on end results and preventing programmers from straying from their goals. 522, 523
- testing.** *See also* system testing; testing review; unit testing development strategies and, 317, 318 system implementation and, 525–528
- testing review** A testing review, or structured walkthrough, is a review of a project team member's work by other members of the team. Generally, systems analysts review the work of other systems analysts, and programmers review the work of other programmers, as a form of peer review. Structured walkthroughs should take place throughout the SDLC and are called requirements reviews, design reviews, code reviews, or testing reviews, depending on the phase in which they occur. 114
- text box** A text box can display messages or provide a place for a user to enter data. 348
- text messaging** Sending text messages via cell phone. Also called texting. 706
- texting** Sending text messages via cell phone. 706
- thick client** A thick client design, also called a fat client design, locates most or all of the application processing logic at the client. 464
- thin client** A thin client design locates most or all of the processing logic at the server. 464
- third normal form (3NF)** A record design is in third normal form (3NF) if it is in 2NF and if no nonkey field is dependent on another nonkey field. A nonkey field is a field that is not a candidate key for the primary key. 416, 417, 419, 421
- third-party software** An application that is not developed in-house. 602
- threat** In risk management, an internal or external or external entity that could endanger an asset. 590
- three-tier** In a three-tier design, the user interface runs on the client and the data is stored on the server, just as in a two-tier design. A three-tier design also has a middle layer between the client and server that processes the client requests and translates them into data access commands that can be understood and carried out by the server. 464, 465
- throughput** Throughput measures actual system performance under specific circumstances and is affected by network loads and hardware efficiency. Throughput, like bandwidth, is expressed as a data transfer rate, such as Kbps, Mbps, or Gbps. 586
- throwaway prototyping** Prototyping of user requirements, after which the prototype is discarded and implementation continues. Also called design prototyping. 315, 316
- tightly coupled** If modules are tightly coupled, one module refers to internal logic contained in another module. 516
- time value of money** A concept that recognizes that a given sum of money, over time, historically will increase in value. 680
- toggle button** A toggle button is used to represent on or off status. Clicking the toggle button switches to the other status. 348
- toolbar** A toolbar contains icons or buttons that represent shortcuts for executing common commands. 348
- top-down approach** A design approach, also called modular design, where the systems analyst defines the overall objectives of the system, and then breaks them down into subsystems and modules. This breaking-down process also is called partitioning. 514
- topic directory** A subject directory or topic directory is a Web site that allows you to access topics by using a hierarchy, starting with general headings and proceeding to more specific topics. 693, 698–699, 701
- total cost of ownership (TCO)** A number used in assessing costs, which includes ongoing support and maintenance costs, as well as acquisition costs. 68, 155–156, 293, 455–456, 464, 670–671 calculating, 307 development strategies and, 295 forecasts, importance of, 299–300
- totals zone** If a form has data totals, they will appear in this section of the form. 361
- trade barriers**, 6
- train-the-trainer** A strategy where one group of users has been trained and can assist others. Users often learn more quickly from coworkers who share common experience and job responsibilities. 539
- training.** *See also* education; training plan interactive, 539–540 system implementation and, 535–543
- training plan** A successful information system requires training for users, managers, and IT staff members. The entire systems development effort can depend on whether or not people understand the system and know how to use it effectively. The training plan is a document that details these requirements. 535
- transaction file** In a typical file processing environment, a transaction file stores records that contain day-to-day business and operational data. A transaction file is an input file that updates a master file; after the update is completed, the transaction file has served its purpose. 394
- transaction model** A service model that charges a variable fee for an application based on the volume of transactions or operations performed by the application. Also called a usage model. 291
- transaction processing (TP) systems** Operational systems used to process day-to-day recurring business transactions, such as customer billing. 15–19
- Transaction Processing Performance Council (TPC)**, 307, 308
- transference** One of four risk control strategies. In transference, risk is shifted to another asset or party, such as an insurance company. 592
- Transmission Control Protocol/Internet Protocol (TCP/IP)** A popular network protocol. TCP/IP is the backbone of the Internet. 477, 599
- transparent** A network is transparent if a user sees the data as if it were stored on his or her own workstation. 460
- Transport layer**, 477
- tunnel** A secure network connection established between the client and the access point of the local intranet. 599
- tuple** A tuple (rhymes with couple), or record, is a set of related fields that describes one instance, or member of an entity, such as one customer, one order, or one product. A tuple might have one or dozens of fields, depending on what information is needed. 402
- turnaround document** Output document that is later entered back into the same or another information system. A telephone or utility bill, for example, might be a turnaround document printed by the company's billing system. When the bill is returned with payment, it is scanned into the company's accounts receivable system to record the payment accurately. 350
- turnaround time** Turnaround time applies to centralized batch processing operations, such as customer billing or credit card statement processing. Turnaround time measures the time between submitting a request for information and the fulfillment of the request. Turnaround time also can be used to measure the quality of IT support or services by measuring the time from a user request for help to the resolution of the problem. 587
- turnkey systems**, 293, 469
- tutorial** A series of online interactive lessons that present material and provide a dialog with users. 537
- Twitter**, 289, 702
- two-tier** In a two-tier design, the user interface resides on the client, all data resides on the server, and the application logic can run either on the server or on the client, or be divided between the client and the server. 464, 465
- type** In data dictionaries, type refers to whether a data element contains numeric, alphabetic, or character values. 219
- Undo key**, 345
- unencrypted** Data that is not encrypted. 597
- Unicode** Unicode is a relatively recent coding method that represents characters as integers. Unlike EBCDIC and ASCII, which use eight bits for each character, Unicode requires 16 bits per character, which allows it to represent more than 65,000 unique characters. 434
- Unicode Consortium**, 434
- Unified Modeling Language (UML)** A widely used method of visualizing and documenting software systems design. UML uses object-oriented design concepts, but it is independent of any specific programming language and can be used to

- describe business processes and requirements generally.** 151, 250, 663
 cardinality and, 263, 408
 overview, 259–266
 representation of objects, 251–54
 requirements modeling and, 151–152
 use case modeling overview, 259–261
- uninterruptible power supply (UPS)** Battery-powered backup power source that enables operations to continue during short-term power outages and surges. 595
- unit testing** The testing of an individual program or module. The objective is to identify and eliminate execution errors that could cause the program to terminate abnormally, and logic errors that could have been missed during desk checking. 525, 526
- Universal Security Slot (USS)** Can be fastened to a cable lock or laptop alarm. 595
- unnormalized** An unnormalized record is one that contains a repeating group, which means that a single record has multiple occurrences of a particular field, with each occurrence having different values. 411
- unstructured brainstorming** A group discussion where any participant can speak at any time. 159
- U.S. Commerce Department, 121
 U.S. Defense Department, 477
 U.S. Navy, 105
- usability metrics** Data that interface designers can obtain by using software that can record and measure user interactions with the system. 342
- usage model** A service model that charges a variable fee for an application based on the volume of transactions or operations performed by the application. Also called a transaction model. 291
- USB (Universal Serial Bus), 371
- use case** A use case represents the steps in a specific business function or process in UML (Unified Modeling Language). 259–261
- use case description** A description in UML (Unified Modeling Language) that documents the name of the use case, the actor, a description of the use case, a step-by-step list of the tasks required for successful completion, and other key descriptions and assumptions. 260
- use case diagram** A visual representation that represents the interaction between users and the information system in UML (Unified Modeling Language). 151–152, 261–262
- user(s)** Employees, customers, vendors, and others who interact with an information system. Sometimes referred to as end users.
 business case analysis and, 71–72
 considerations, for systems design, 312–313
 database design and, 396–397
 described, 10
 groups, 603
 involvement, 71–72, 144, 315, 346, 353, 487
 notification, 582
 prototypes and, 315, 316
 requirements modeling and, 144
 responsible, use of the term, 220
 security and, 603–606
 surveys, 78
 “thinking like,” 341–342
- user application** User applications utilize standard business software, such as Microsoft Office 2003, that has been configured in a specific manner to enhance user productivity. 297–298
- user design phase** In this phase, users interact with systems analysts and develop models and prototypes that represent all system processes, outputs, and inputs. 146
- user documentation** Instructions and information to users who will interact with the system. It includes user manuals, help screens, and tutorials. 510–533
- user ID** A method of limiting access to files and databases to protect stored data. 435
- user interface** A user interface includes screens, commands, controls, and features that enable users to interact more effectively with an application. *See also graphical user interface (GUI)*
 consistency in, 356
 control features, 347–349
 described, 297
 development strategies and, 297–298
 easy to learn, 344
 evolution of, 336–337
 guidelines, 342–349
 overview, 334–338
 security issues, 370–372
 transparent, 343
- user productivity systems** Systems that provide employees of all levels a wide array of tools to improve job performance. Examples include e-mail, word processing, graphics, and company intranets. 17
- user rights** User-specific privileges that determine the type of access a user has to a database, file, or directory. Also called permissions. 435, 601, 603
- user story** In agile development, a short, simple requirements definition provided by the customer. Programmers use user stories to determine a project's requirements, priorities, and scope. 521
- user support** A function typically performed by individuals within an IT department. User support provides users with technical information, training, and productivity support. 29, 572–574
- user training package** The main objective of a user training package is to show users how the system can help them perform their jobs. 572
- user-centered** A term that indicates the primary focus is upon the user. In a user-centered system, the distinction blurs between input, output, and the interface itself. 337, 341–342
- user-selected** Under the control of the system or application user. For example, user-selected help displays information when the user requests it. 345
- validation**, 367, 404–405, 602
- validity check** A type of data validation check that is used for data items that must have certain values. For example, if an inventory system has 20 valid item classes, then any input item that does not match one of the valid classes will fail the check. 367
- validity rules** Rules that are applied to data elements when data is entered to ensure that the value entered is valid. For example, a validity rule might require that an employee's salary number be within the employer's predefined range for that position. 220
- value-added reseller (VAR)** A firm that enhances a commercial package by adding custom features and configuring it for a particular industry. 293
- variable charge method based on resource usage** Resource allocation that is based upon the connect time, the server processing time, the network resources required, printer use, or a combination of similar factors. 673
- variable charge method based on volume** In this method, the indirect information systems department costs are allocated to other departments based on user-oriented activity, such as the number of transactions or printing volume. 674
- variable costs** Costs that vary depending on the level of activity. For example, the cost of printer paper or telephone line charges are variable costs. 672
- vendor.** *See software vendor*
- Venn diagram** A Venn diagram uses circular symbols to illustrate Boolean logic. Venn diagrams are named after John Venn, a nineteenth-century scholar who devised a scheme for visualizing logical relationships. 695
- version control** The process of tracking system releases. 583, 584
- vertical application** A software package that has been developed to handle information requirements for a specific type of business. 294
- vertical system** A system designed to meet the unique requirements of a specific business or industry, such as a Web-based retailer or video rental chain. 8
- video tutorials**, 540–543
- virtual private network (VPN)** Uses a public network to connect remote users securely. Allows remote clients to use a special key exchange that must be authenticated by the VPN. 599
- Visible Analyst, 10, 20, 57, 215, 218–224, 658–660
 ERDs and, 409, 410
 process models and, 22
 requirements modeling and, 151, 158
- visible Web** Refers to Web sites that are indexed by major search engines and are publicly accessible. 699
- Visio (Microsoft), 10, 19–20, 172, 481
- visual aids** Tools such as whiteboards, flip charts, overhead transparencies, slides, films, and videotapes used to enhance a presentation. 640
- Visual Basic (Microsoft), 318, 523, 651
- Visual Studio (Microsoft), 317, 656–657
- volume**
 of records, described, 222
 of transactions, estimating, 301–302
- vulnerability** A security weakness or soft spot. 591
- Wal-Mart, 12, 15
- waterfall model** A type of graph that depicts the result of each SDLC phase flowing down into the next phase. 22–23
- Web** The Internet allows you to visit the World Wide Web, usually referred to as the Web, which contains billions of text and multimedia documents called Web pages. 690
- Web 2.0** A second generation of the World Wide Web that enables people to collaborate, interact, and share information much more dynamically, based on continuously available user applications rather than static HTML Web pages. Interactive experience is a hallmark of Web 2.0. 289, 472–473
- Web browser** An application that enables the user to navigate, or browse the Internet and display Web pages on his or her local computer. 399, 690
- Web feed** Data format for providing users with frequently

- updated Web content on all kinds of topics, available by subscription. Also called a feed or RSS feed. 704
- Web Host Industry Review (WHIR)**, 287
- Web page** Text and multimedia documents that are found on the World Wide Web. 399, 690
- Web server** A computer that is used to store and house Web sites. 400, 465, 467
described, 399, 690
system architecture and, 463
- Web services** Internet-based support programs that can be executed as an integral part of an information system; Web-based modular applications that can perform functions that can be quite simple or more complex. 318
- Web site** A collection of related Web pages. 399, 690
- Web support** Web support involves design and construction of Web pages, monitoring traffic, managing hardware and software, and linking Web-based applications to the company's existing information systems. 29
- Web-based database design**, 398–401
- Web-based discussion group** An online community that combines features of mailing lists and newsgroups. 705
- Webcast** A one-way transmission of information or training materials, such as a Webinar session, available on demand or for a specific period to online participants. 305, 537
- Web-centric** A strategy or approach that emphasizes a high degree of integration with other Web-based components. A Web-centric architecture follows Internet design protocols and enables a company to integrate the new application into its e-commerce strategy. 400
- WebEx (Cisco)**, 643
- Webinar** A Webinar, which combines the words Web and seminar, is an Internet-based training session that provides an interactive experience. 537, 704
- WebSphere** IBM's Web-based development environment. 287, 288, 289, 457, 523
- weight** Weight is an important value that managers add to estimates so they can be analyzed. 107
- what-if** A feature of business support systems that allows analysis to define and account for a wide variety of issues (including issues not completely defined). 16–18, 31
- what-if analysis** What-if analysis allows you to vary one or more elements in a model in order to measure the effect on other elements. 587
- why, who, what, when, and how of communications** Good communications must answer these basic questions: Why is one communicating? Who is the target audience? What is expected? When is detail required? How does one communicate effectively? 157, 632
- Wi-Fi (wireless fidelity)** Family of popular IEEE local area network wireless networking standards, also known as 802.11, including 802.11a, b, g, and n. 802.11n is the most recent standard. 371, 482–484
- Wi-Fi Alliance** A nonprofit international association formed in 1999 to certify interoperability of wireless network products based on IEEE 802.11 specifications. 484, 598
- Wi-Fi Protected Access (WPA)** A common method used to secure a wireless network. This approach requires each wireless client be configured manually to use a special, pre-shared key, rather than key pairs. The most recent and more secure version is WPA2. 598
- wide area network (WAN)** A wide area network (WAN) spans long distances and can link users who are continents apart. 460, 478, 481
- wiki** A Web-based repository of information that anyone can access, contribute to, or modify. 289, 473, 531–532
- Wikipedia**, 432, 597
- WiMAX** IEEE 802.16 specifications, which are expected to enable wireless multimedia applications with a range of up to 30 miles. 485
- Windows (Microsoft)**
Azure, 472
Event Viewer, 602
Live MovieMaker, 541
user interface design and, 347
- Wired Equivalent Privacy (WEP)**
One of the earliest methods used to secure a wireless network, superceded by WPA and WPA2. 598
- wireless access point (WAP)** A central wireless device that provides network services to wireless clients. Also called an access point. 483
- wireless local area network (WLAN)** A wireless network that is relatively inexpensive to install and is well-suited to workgroups and users who are not anchored to a specific desk or location. 482, 483, 484
- wireless network(s)**
communication devices, 173–174
overview, 482–485
security, 598
standard, 482–483
topologies, 483–484
user interface design and, 357–358
- Word (Microsoft)**, 167, 171, 297
- WordPerfect (Corel)**, 171
- work breakdown structure (WBS)**
Breaking a project down into a series of smaller tasks. 104, 106, 109, 116–119
- work file** In a typical file processing environment, a work file is a temporary file created by an information system for a single task. Most often a work file is created by one process in the information system and used by another process within the same system. Work files also are called scratch files. 394
- workgroup software** Workgroup software offers many features in addition to basic e-mail capability. These features include calendars, task lists, schedules, contact lists, and document management, among others. Also called groupware. 637
- World Wide Web** The Internet allows you to visit the World Wide Web, usually referred to as the Web, which contains billions of text and multimedia documents called Web pages. 690
- worst-case estimate** The most pessimistic outcome is called the worst-case estimate. 107
- WPA2** WPA2 is based on a new standard called 802.11i that provides a significant increase in protection over WEP and WPA. 598
- written communications**, 633–639.
See also communication
- XML**. *See Extensible Markup Language (XML)*
- XP (Extreme Programming)**, 26, 512, 520–523
- XY chart** Also called a scatter diagram, a tool used by system analysts to graphically show the correlation between two variables. 78–79
- Y2K issue** A problem faced by many firms in the year 2000 because their computer systems used only two digits to represent the year; most dates now use a four-digit format for the year (YYYYMMDD). 312, 434
- Yahoo!**, 12, 694, 698, 704–705
- Yourdon** A type of symbol set that is used in data flow diagrams. Processes, data flows, data stores, and external entities each have a unique symbol in the Yourdon symbol set. 200–201
- Zachman Framework for Enterprise Architecture** A model that asks the traditional fact-finding questions in a systems development context. 157, 158, 661
- zero or many relation**, 263

