

GLOBAL
EDITION



Systems Analysis and Design

NINTH EDITION

Kenneth E. Kendall • Julie E. Kendall

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*To the memory of Julia A. Kendall and the memory
of Edward J. Kendall, whose lifelong example of working
together will inspire us forever.*

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NEW TO THIS EDITION

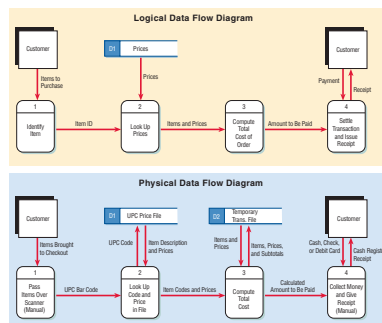
The ninth edition of *Systems Analysis and Design* includes extensive changes inspired by the swift transformations in the IS field over the past three years, and they are included as a response to the thoughtful input of our adopters, students, and reviewers. Many innovative and upgraded features are incorporated throughout this new edition. In particular:

- New coverage of how systems analysts and organizations can participate in open source communities (Chapter 1)
- Expanded coverage of the analyst role in ERP (enterprise systems) (Chapter 2)
- New in-depth coverage of project management techniques (Chapter 3)
- Expanded coverage of when to use cloud services versus purchasing hardware and software (Chapter 3)
- New coverage of time estimation techniques for project management (Chapter 3)
- New coverage of the work breakdown structure (WBS) for project management (Chapter 3)
- New material on designing corporate and ecommerce sites to include Web 2.0 technologies and social media (Chapter 11)
- Innovative treatment of designing apps for smartphones and tablets (Chapter 11)
- Expanded coverage of designing input for intranets, the Web, smartphones, and tablets (Chapter 12)
- New material on the relationship of business intelligence to data warehouses, big data, business analytics, and text analytics (Chapter 13)
- Innovative coverage on designing gesture-based interfaces for smartphones and tablets (Chapter 14)
- Additional material on designing alerts, queries, and notices for smartphones and tablets (Chapter 14)
- Innovative handling of designing two-dimensional (2D) codes such as Microsoft Tags and QR codes for input (Chapter 15)
- New material on how service-oriented architecture and cloud computing are changing the nature of information systems design (Chapter 16)
- Expanded coverage of ERP systems and their relationship to cloud computing (Chapter 16)

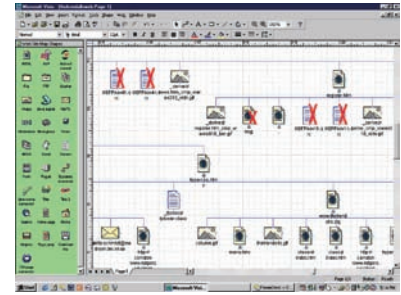
DESIGN FEATURES

Figures have a stylized look in order to help students more easily grasp the subject matter.

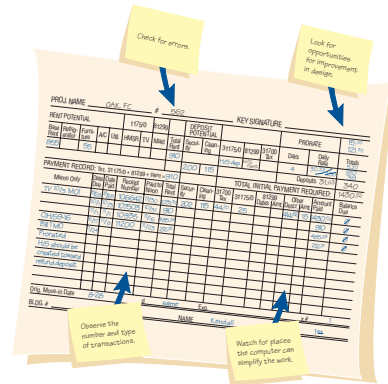
Conceptual diagrams are used to introduce the many tools that systems analysts have at their disposal. This example shows the differences between logical data flow diagrams and physical data flow diagrams. Conceptual diagrams are color coded so that students can distinguish easily among them, and their functions are clearly indicated. Many other important tools are illustrated, including use case diagrams, sequence diagrams, and class diagrams.



Computer displays demonstrate important software features that are useful to the analyst. This example shows how a website can be evaluated for broken links by using a package such as Microsoft Visio. Actual screen shots show important aspects of design. Analysts are continuously seeking to improve the appearance of the screens and Web pages they design. Colorful examples help to illustrate why some screen designs are particularly effective.



Paper forms are used throughout to show input and output design as well as the design of questionnaires.



Blue ink is always used to show writing or data input, thereby making it easier to identify what was filled in by users. Although most organizations have computerization of manual processes as their goal, much data capture is still done using paper forms. Improved form design enables analysts to ensure accurate and complete input and output. Better forms can also help streamline new internal workflows that result from newly automated business-to-consumer (B2C) applications for ecommerce on the Web.

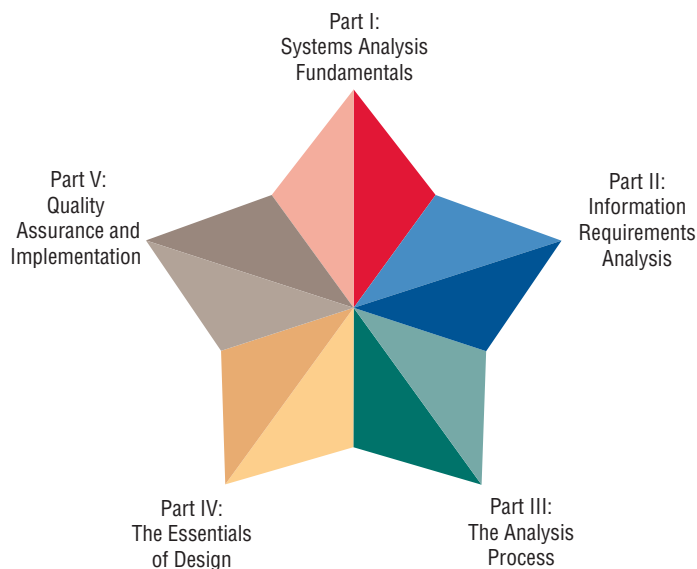
Tables are used when an important list needs special attention or when information needs to be organized or classified. In addition, tables are used to supplement the understanding of the reader in a way that departs from how material is organized in the narrative portion

of the book. Most analysts find using tables a useful way to organize numbers and text into a meaningful “snapshot.”

This example of a table from Chapter 3 shows how analysts can refine their activity plans for analysis by breaking them down into smaller tasks and then estimating how much time it will take to complete them. This book is built on the idea that systems analysis and design is a process that integrates the use of many tools with the unique talents of the systems analyst to systematically improve business through the implementation or modification of computerized information systems. Systems analysts can grow in their work: by taking on new IT challenges, whether they are posed by designing for multiple platforms, new types of users, or implementing cloud-based systems, and by keeping up to date in their profession through the application of new methods, software, and alternative tools.

Activity	Detailed Activity	Weeks Required
Data gathering	Conduct interviews	3
	Administer questionnaires	4
	Read company reports	4
	Introduce prototype	5
Data flow and decision analysis	Analyze data flow	8
	Observe reactions to prototype	3
Proposal preparation	Perform cost-benefit analysis	3
	Prepare proposal	2
	Present proposal	2

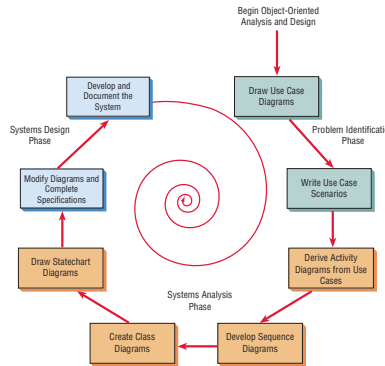
A BRIEF TOUR OF THE NINTH EDITION



Systems analysis and design is typically taught in one or two semesters. This book may be used in either situation. The text is appropriate for undergraduate (junior or senior) curricula at a four-year university, graduate school, or community college. The level and length of the course can be varied and supplemented by using real-world projects, HyperCase, The CPU Case online, or other materials available on the Instructor Resource Center.

The text is divided into five major parts: Systems Analysis Fundamentals (Part I), Information Requirements Analysis (Part II), The Analysis Process (Part III), The Essentials of Design (Part IV), and Quality Assurance and Implementation (Part V).

Part I (Chapters 1–3) stresses the basics that students need to know about what an analyst does and introduces the three main methodologies of the systems development life cycle (SDLC), agile approaches, and object-oriented analysis with UML, along with reasons and situations for when to use them. Part I introduces the three roles of a systems analyst—consultant, supporting expert, and agent of change—along with ethical issues and professional guidelines for serving as a systems consultant. There is also material on virtual teams and virtual organizations, and the concept of human–computer interaction (HCI) is introduced. The use of open source software (OSS) and how analysts and organizations can participate in open source communities is also introduced. Chapter 2 includes how to initially approach an organization by drawing context-level data flow diagrams, using entity-relationship models, and developing use cases and use case scenarios. It views the organization as a system through the description of enterprise systems (ERP). Chapter 3 focuses on project management. It introduces new material on when to use cloud services versus purchasing hardware and software. Expanded coverage of project management techniques is also included, including new time estimation techniques for project management. Chapter 3 also includes new material to help students approach projects using the work breakdown structure (WBS). Creating a problem definition, developing a project charter, and determining feasibility are also covered. Chapter 3 guides students in professionally writing and presenting an effective systems proposal, one that incorporates figures and graphs to communicate with users.



Part II (Chapters 4–6) emphasizes the use of systematic and structured methodologies for performing information requirements analysis. Attention to analysis helps analysts ensure that they are addressing the correct problem before designing a system. Chapter 4 introduces a group of interactive methods, including interviewing, Joint Application Design (JAD), listening to user stories, and constructing questionnaires. Chapter 5 introduces a group of unobtrusive methods for ascertaining information requirements of users. These methods include sampling, investigating hard and archival data, and observation of decision makers’ behavior and their physical environment. Chapter 6 on agile modeling and prototyping is innovative in its treatment of prototyping as another data-gathering technique that enables the analyst to solve the right problem by getting users involved from the start. Since agile approaches have their roots in prototyping, this chapter begins with prototyping to provide a proper context for understanding, and then takes up the agile approach. The values and principles, activities, resources, practices, processes, and tools associated with agile methodologies are presented.

Prototype Evaluation Form					
Observer Name	Michael Cornejo			Date	10/6/2010
System or Project Name	Cloud Computing (ITC) Center		Company or Location		Acquitar Water Station
Program Name or Number	Peer-User	Version			
User Name	USER 1	USER 2	USER 3	USER 4	
Period Observed	10/6/2010	10/6/2010			
User Reactions	Generally favorable, not excited about project	(Neutral)			
User Suggestions	Add the date when requirements were performed.	Place a firm number on top for reference.			
Interviews					
Revision Phase	Modify on 10/6/2010	Review on 10/6/2010			
	Analy and Form				

Part III (Chapters 7–10) details the analysis process. It builds on the previous two parts to move students into analysis of data flows as well as structured and semistructured decisions. It provides step-by-step details on how to use structured techniques to draw data flow diagrams (DFDs). Chapter 7 provides coverage of how to create child diagrams; how to develop both logical and physical data flow diagrams; and how to partition data flow diagrams. Chapter 8 features material on the data repository and vertical balancing of data flow diagrams. Chapter 8 also includes extensive coverage of Extensible Markup Language (XML) and demonstrates how to use

data dictionaries to create XML. Chapter 9 includes material on developing process specifications. A discussion of both logical and physical process specifications shows how to use process specifications for horizontal balancing. Chapter 9 also covers how to diagram structured decisions with the use of structured English, decision tables, and decision trees. In addition, the chapter covers how to choose an appropriate decision analysis method for analyzing structured decisions and creating process specifications.

Part III concludes with Chapter 10 on object-oriented systems analysis and design. This chapter includes an in-depth section on using Unified Modeling Language (UML). There is detailed coverage of the use case model, creating the class model diagram with UML, sequence diagrams, creating gen/spec diagrams, use case scenarios, and activity diagrams. Through several examples and Consulting Opportunities, this chapter demonstrates how to use an object-oriented approach. Consulting Opportunities, diagrams, and problems enable students to learn and use UML to model systems from an object-oriented perspective. Students learn the appropriate situations for using an object-oriented approach. This chapter helps students to decide whether to use the SDLC, the agile approach, or object-oriented systems analysis and design to develop a system.

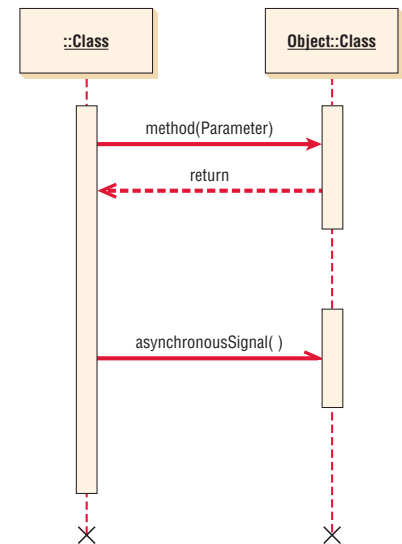
Part IV (Chapters 11–14) covers the essentials of design. It begins with designing output because many practitioners believe systems to be output driven. The design of Web-based forms is covered in detail. Particular attention is paid to relating output method to content, the effect of output on users, and designing good forms and screens. Chapter 11 considers output, including Web displays, audio, and electronic output such as Web pages, email, and RSS feeds. Designing a website for ecommerce purposes is emphasized, and the importance of adding Web 2.0 technologies and social media to corporate and ecommerce websites is explored. Designing apps for smartphones and tablets is included, along with storyboarding, wireframing, and mockups. Output production and XML are covered.

Chapter 12 includes innovative material on designing for smartphones and tablets as well as designing Web-based input forms and other electronic forms design. Also included is computer-assisted forms design. Chapter 12 also features in-depth coverage of website design, including guidelines on when designers should add video, audio, and animation to website designs. There is detailed consideration of how to create effective graphics for corporate websites and ways to design effective onscreen navigation for website users.

Coverage of intranet and extranet page design is also included. Consideration of database integrity constraints has been included as well, in addition to how the user interacts with the computer and how to design an appropriate interface. The importance of user feedback is also found in Part IV. How to design accurate data entry procedures that take full advantage of computer and human capabilities to assure entry of quality data is emphasized here.

Chapter 13 demonstrates how to use an entity-relationship diagram to determine record keys, as well as providing guidelines for file/database relation design. Students are shown the relevance of database design for the overall usefulness of the system, and how users actually use databases. The concepts of business intelligence (BI) and its relationships to big data, business analytics, and text analytics are also introduced in the context of data warehouses.

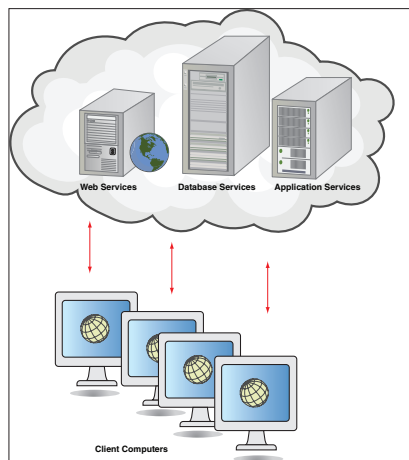
Chapter 14 emphasizes human-computer interaction (HCI), especially as it relates to interface design. It discusses the importance of HCI in designing systems that suit individuals and assisting them in achieving personal and organizational goals through their use of information technology. The concept of usability is introduced, so that systems analysis students can knowledgeably incorporate HCI practices into their designs. Chapter 14 introduces material on how to



design gesture-based (multitouch) interfaces for smartphones and tablets, as well as designing alerts, notices and queries. Material on designing easy onscreen navigation for website visitors is also included. The chapter presents innovative approaches to searching on the Web, highlights material on GUI design, and provides innovative approaches to designing dialogs. Chapter 14 articulates specialized design considerations for ecommerce websites. Mashups, new applications created by combining two or more Web-based application programming interfaces, are also introduced. Chapter 14 also includes extensive coverage on how to formulate queries, all within the framework of HCI.

Part V (Chapters 15 and 16) concludes the book.

Chapter 15 focuses on designing accurate data entry procedures and includes material on managing the supply chain through the effective design of business-to-business (B2B) ecommerce. It includes suggestions for incorporating two-dimensional codes, such as QR codes and Microsoft Tags, into data entry designs. It also considers the usefulness of RFID for automatic data collection. Chapter 16 emphasizes taking a total quality approach to improving software design and maintenance. In addition, material on system security and firewalls is included. Testing, auditing, and maintenance of systems are discussed in the context of total quality management. This chapter helps students understand how service-oriented architecture (SOA) and cloud computing combined with ERP are significantly altering the landscape of information systems design. In addition, students learn how to design appropriate training programs for users of the new system, how to recognize the differences among physical conversion strategies, and how to be able to recommend an appropriate one to a client. Chapter 16 also presents techniques for modeling networks, which can be done with popular tools such as Microsoft Visio.



Material on security and privacy in relation to designing ecommerce applications is included. Coverage of security, specifically firewalls, gateways, Public Key Infrastructure (PKI), Secure Electronic Transaction (SET), Secure Sockets Layer (SSL), virus protection software, URL filtering products, email filtering products, and virtual private networks (VPN) is included. In addition, current topics of interest to designers of ecommerce applications, including the development and posting of corporate privacy policies, are covered.

Important coverage of how the analyst can promote and monitor a corporate website is included in this section, which features Web activity monitoring, website promotion, Web traffic analysis, and audience profiling to ensure the effectiveness of new ecommerce systems. Techniques for evaluating the completed information systems project are covered systematically as well.

This ninth edition contains an updated **Glossary** of terms and a separate list of updated **Acronyms** used in the book and in the systems analysis and design field.

PEDAGOGICAL FEATURES

Chapters in this ninth edition contain:

- **Learning Objectives** at the beginning of each chapter
- **Summaries** that tie together the salient points of each chapter while providing an excellent source of review for exams
- **Keywords and Phrases**
- **Review Questions**
- **Problems**
- **Group Projects** that help students work together in a systems team to solve important problems that are best solved through group interaction
- **Consulting Opportunities**, now with more than 50 minicases throughout the book
- **Mac Appeal** columns that inform students on design software available on the Mac and iPhone
- **HyperCase Experiences**

CONSULTING OPPORTUNITIES

This ninth edition presents more than 50 Consulting Opportunities, and many of them address significant and emerging topics arising in information systems, including designing systems from an HCI perspective, ecommerce applications for the Web, cloud computing decisions, and using UML to model information systems from an object-oriented perspective. Consulting Opportunities can be used for motivating thoughtful in-class discussions or assigned as homework or take-home exam questions.

Because not all systems work demands extended two- or three-year projects, our book contains many Consulting Opportunities that can be solved in 20 to 30 minutes of group discussion or individual writing. These minicases, written in a humorous manner to enliven the material, require students to synthesize what they have learned up to that point in the course, ask students to mature in their professional and ethical judgment, and expect students to articulate the reasoning that led to their systems decisions.

HYPERCASE EXPERIENCES

HyperCase[®] Experiences that pose challenging student exercises are present in each chapter. HyperCase 2.9 has organizational problems featuring state-of-the-art technological systems. HyperCase represents an original virtual organization that allows students who access it to become immediately immersed in organizational life. Students will interview people, observe office environments, analyze their prototypes, and review the documentation of their existing systems.

HyperCase 2.9 is Web-based, interactive software that presents an organization called Maple Ridge Engineering (MRE) in a colorful, three-dimensional graphics environment. HyperCase permits professors to begin approaching a systems analysis and design class with exciting multimedia material. Carefully watching their use of time and managing multiple methods, students use the hypertext characteristics of HyperCase on the Web to create their own individual paths through the organization.

Maple Ridge Engineering is drawn from the actual consulting experiences of the authors of the original version (Raymond Barnes, Richard Baskerville, Julie E. Kendall, and Kenneth E. Kendall). Allen Schmidt joined the project for version 2.0 and has remained with it. Peter Schmidt was the HTML programmer, and Jason Reed created the images for the initial Web version.

Each chapter contains HyperCase Experiences that include assignments (and even some clues) to help students solve difficult organizational problems including developing new systems, merging departments, hiring of employees, security, ecommerce, and disaster recovery planning they encounter at MRE. HyperCase has been fully tested in classrooms and was an award winner in the Decision Sciences Institute Innovative Instruction competition.



FIGURE 3.1 HCI

The reception screen resembles a typical corporation. While you are in this HyperCase screen, find the directory if you want to visit someone.

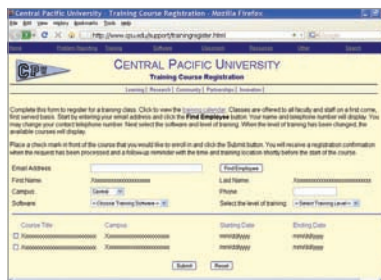
EXPANDED WEB SUPPORT

Systems Analysis and Design, ninth edition, features Web-based support for solid but lively pedagogical techniques in the information systems field:

- The website, located at www.pearsonglobaleditions.com/kendall, contains a wealth of critical learning and support tools, which keep class discussions exciting.



- **HyperCase 2.9** is an award-winning, interactive organization game. Students are encouraged to interview people in the organization, analyze problems, drill down into and modify data flow diagrams and data dictionaries, react to prototypes, and design new input and output.
- **Entire Central Pacific University (CPU) case now online** In keeping with our belief that a variety of approaches are important, the entire Central Pacific University (CPU) case, accompanied by partially solved Student Exercises, is now available online. There is an episode to accompany each chapter of the ninth edition. The CPU case makes use of Microsoft Access, Microsoft Visio, and the popular CASE tool Visible Analyst by Visible Systems, Inc., for the sample screen shots and the student exercises. The CPU case takes students through all phases of the systems development life cycle. The CPU case has been fully tested in classrooms around the world with a variety of students over numerous terms. The case is detailed, rigorous, and rich enough to stand alone as a systems analysis and design project spanning one or two terms.
- **Student Exercises based on the online CPU case** This running case gives students an opportunity to solve problems on their own, using a variety of tools and data that users of the book can download from the Web containing Microsoft Visio, Microsoft Access, and Visible Analyst exercises specifically keyed to each chapter of the book. Partially solved problems and examples stored in Microsoft Access and Visible Analyst files allow students to develop a Web-based computer management system.



EXPANDED INSTRUCTOR SUPPLEMENTAL WEB SUPPORT

Extended support for instructors using this edition can be found at the official website located at www.pearsonglobaleditions.com/kendall. Resources include:

- **Instructor's Manual**—The Instructor's Manual contains answers to problems, solutions to cases, and suggestions for approaching the subject matter.
- **Solutions to Student Exercises**—These exercises are based on the ongoing CPU case, with solutions and examples stored in Visible Analyst files and Microsoft Access files.
- **PowerPoint Presentations**—The PowerPoints feature lecture notes that highlight key text terms and concepts. Professors can customize the presentation by adding their own slides or by editing the existing ones.
- **Test Item File**—The Test Item File is an extensive set of multiple-choice, true/false, and essay-type questions for each chapter of the text. Questions are ranked according to difficulty level and referenced with page numbers from the text. The Test Item File is available in Microsoft Word format and as the computerized Prentice Hall TestGen software, with course management system conversions.
- **TestGen**—Pearson Education's test-generating software is available from www.pearsonglobaleditions.com/kendall. The software is PC/Mac compatible and preloaded with all the Test Item File questions. You can manually or randomly view test questions and drag and drop to create a test. You can add or modify test-bank questions as needed.
- **Image Library**—This collection of the text art is organized by chapter. This collection includes all the figures, tables, and screenshots from the book. These images can be used to enhance class lectures and PowerPoint slides.
- **CourseSmart eTextbooks Online**—CourseSmart eTextbooks were developed for students looking to save on required or recommended textbooks. Students simply select their eText by title or author and purchase immediate access to the content for the duration of the course using any major credit card. With a CourseSmart eText, students can search for specific keywords or page numbers, take notes online, print out reading assignments that incorporate lecture notes, and bookmark important passages for later review. For more information or to purchase a CourseSmart eTextbook, visit www.coursesmart.co.uk

ACKNOWLEDGMENTS

The field of information systems was transforming astonishingly as we were writing the ninth edition of *Systems Analysis and Design*. We are thrilled that this edition is being published at the right time for us to capture many of these innovations in systems development.

One major change is the rapidly increasing use of the Web as a platform for information systems. Cloud computing will dramatically change the way that analysts approach designing systems solutions.

Another major change addressed in this edition is the emergence of smartphones and tablets as corporate platforms for IT. With the advent of BYOD (bring your own device) systems, analysts face new challenges in developing successful and secure systems that can easily traverse multiple platforms.

Throughout the book you will learn and apply numerous techniques, methods, tools, and approaches to help visually capture a system. But when the time comes to interpret what is happening in the organization and to develop meaningful information systems from the application of rules to your analysis, your training combines with creativity to produce a system that is in some ways a surprise: It is structured, yet intuitive, multilayered, and complex, in keeping with the character of the organization and uniquely reflective of you as a systems analyst and a human being.

The artist Richard Kalina, who created the colorful collage on the cover of the ninth edition, writes, “*P3 Vega* is inspired by the representation of scientific phenomena, ranging from astronomy, chemistry and physics to cybernetics and information theory. The painting is not a literal depiction, but rather an abstracted map or chart, a way of thinking and observing. *P3 Vega* is a set of interlocking connections, a network of circular nodes joined by colored lines. It feels stable but shifting—a static depiction of a changeable state. I am trying to find a visual corollary to the beauty that underlies logical systems, and to make something beautiful, hopefully, in the process.” We hope that you as a student will also appreciate, through this book, the beauty that underlies logical systems.

It is, in fact, our own students who deserve recognition for this new edition because of their feedback and recommendations for improvements and requests for increased depth in certain topics. Students told us that they quickly put to use the new material on designing apps and interfaces for smartphones and tablets as well as the material on new project management techniques and cloud computing. We are indebted to their quest to continually improve their skills. We want to thank our coauthor, Allen Schmidt, who once again worked with us on the HyperCase 2.9 and *CPU Case Episodes* for all his dedication, insight, and humor during our collaboration. He is a superb human being. Our appreciation also goes to Peter Schmidt and Jason Reed for their improvements to the early HyperCase. In addition, we want to thank the other two original authors of HyperCase, Richard Baskerville and Raymond Barnes, who contributed so much.

We would like to thank our ninth edition production team, especially our executive editor, Bob Horan, whose intelligence and tranquil demeanor are always inspiring. We are also grateful to Kelly Loftus, who is our extremely capable senior project manager for MIS, for her composed competency and for her enthusiasm in keeping the project going. Ilene Kahn, our production project manager, also deserves thanks for helping us succeed in making this a robust, inclusive, and accurate revision. Their help and keen interest in our book facilitated the completion of this project in a smooth and timely manner.

We also appreciate the encouragement and support of the entire Rutgers community, including our chancellor, Wendell Pritchett, and our colleagues and staff in the School of Business—Camden and throughout all of Rutgers. They have been very enthusiastic about this edition as



Julie and Ken Kendall personally thank all of our friends in the theatre and the performing arts. Here are the Kendalls at the 2012 Tony Awards afterparty with Tony-Award winning Actor James Corden (*right*). Photo by Anita & Steve Shevett.

well as the many translations and versions of *Systems Analysis and Design* available in Spanish, Chinese, English for the Indian subcontinent, and Indonesian.

All the reviewers for the ninth edition deserve our thanks as well. Their thoughtful comments and suggestions helped to strengthen the book. They are:

Ron Davis, University of North Alabama
 Chang-tseh Hsieh, University of Southern Mississippi
 Sukgon Kim, Northern Illinois University
 Angela Marsh, University of Arkansas–Monticello
 Keng Siau, Missouri University of Science and Technology
 Mead Bond Wetherbe, Jr., Texas Tech University

Many of our colleagues and friends have encouraged us through the process of writing this book. We thank them for their comments on our work. They include: Ayman Abu Hamdieh, Macedonio Alanis, Michel Avital, the Ciupeks, Roger T. Danforth, Gordon Davis, John Drozdal, EgoPo, Matt Germonprez, Nancy V. Gulick, Andy Hamingson, Blake Ives, Richard Kalina, Colleen Kelly-Lawler, Carol J. Latta, Ken and Jane Laudon, Josh Lawler, Lars Mathiassen, Joel and Bobbie Porter, Caryn Schmidt, Marc and Jill Schniederjans, Gabriel Shanks, Detmar W. Straub, Jr., the Vargos, Merrill Warkentin, Brian Warner, Jeff and Bonnie Weil, Arlene and Paul Wolfling, Brett Young, Ping Zhang and all of our friends and colleagues in The Drama League, The Actors Fund, the American Theatre Wing, The New York Marriott Marquis, the Association for Information Systems, the Decision Sciences Institute, IFIP Working Group 8.2, and all those involved in the PhD Project (founded by the KPMG Foundation), which serves minority doctoral students in information systems.

Our heartfelt thanks go to the memory of Julia A. Kendall and to the memory of Edward J. Kendall. Their belief that love, goals, and hard work are an unbeatable combination continues to infuse our every endeavor.

Systems, Roles, and Development Methodologies

LEARNING OBJECTIVES

Once you have mastered the material in this chapter you will be able to:

1. Understand the need for systems analysis and design in organizations.
2. Realize what the many roles of a systems analyst are.
3. Comprehend the fundamentals of three development methodologies: SDLC, the agile approach, and object-oriented systems analysis and design.



Organizations have long recognized the importance of managing key resources such as people and raw materials. Information has now moved to its rightful place as a key resource. Decision makers now understand that information is not just a by-product of conducting business; rather, it fuels business and can be the critical factor in determining the success or failure of a business.

To maximize the usefulness of information, a business must manage it correctly, just as it manages other resources. Managers need to understand that costs are associated with the production, distribution, security, storage, and retrieval of all information. Although information is all around us, it is not free, and its strategic use for positioning a business competitively should not be taken for granted.

The ready availability of networked computers, along with access to the Internet and the Web, has created an information explosion throughout society in general and business in particular. Managing computer-generated information differs in significant ways from handling manually produced data. Usually there is a greater quantity of computer information to administer. Costs of organizing and maintaining it can increase at alarming rates, and users often treat it less skeptically than information obtained in different ways. This chapter examines the fundamentals of different kinds of information systems, the varied roles of systems analysts, and the phases in the systems development life cycle (SDLC) as they relate to human–computer interaction (HCI) factors; it also introduces computer-aided software engineering (CASE) tools.

Need for Systems Analysis and Design

Systems analysis and design, as performed by systems analysts, seeks to understand what humans need to analyze data input or data flow systematically, process or transform data, store data, and output information in the context of a particular organization or enterprise. By doing thorough analysis, analysts seek to identify and solve the right problems. Furthermore, systems analysis and design is used to analyze, design, and implement improvements in the support of users and the functioning of businesses that can be accomplished through the use of computerized information systems.

Installing a system without proper planning leads to great user dissatisfaction and frequently causes the system to fall into disuse. Systems analysis and design lends structure to the analysis and design of information systems, a costly endeavor that might otherwise have been done in a haphazard way. It can be thought of as a series of processes systematically undertaken to improve a business through the use of computerized information systems. Systems analysis and design involves working with current and eventual users of information systems to support them in working with technologies in an organizational setting.

User involvement throughout a systems project is critical to the successful development of computerized information systems. Systems analysts, whose roles in the organization are discussed next, are the other essential component in developing useful information systems.

Users are moving to the forefront as software development teams become more international in their composition. This means that there is more emphasis on working with software users; on performing analysis of their business, problems, and objectives; and on communicating the analysis and design of the planned system to all involved.

New technologies also are driving the need for systems analysis. Ajax (Asynchronous JavaScript and XML) is not a new programming language but a technique that uses existing languages to make web pages function more like a traditional desktop application program. Systems analysts will increasingly need to build and redesign web pages that utilize Ajax technologies. New programming languages, such as the open source Web framework *Ruby on Rails* (“*Rails*” for short), which is a combination programming language and code generator for creating Web applications, will require more analysis.

Roles of a Systems Analyst

A systems analyst systematically assesses how users interact with technology and how businesses function by examining the inputting and processing of data and the outputting of information with the intent of improving organizational processes. Many improvements involve better support of users’ work tasks and business functions through the use of computerized information systems. This definition emphasizes a systematic, methodical approach to analyzing—and potentially improving—what is occurring in the specific context experienced by users and created by a business.

Our definition of a systems analyst is necessarily broad. An analyst must be able to work with people of all descriptions and be experienced in working with computers. An analyst plays many roles, sometimes balancing several at the same time. The three primary roles of a systems analyst are consultant, supporting expert, and agent of change.

Systems Analyst as Consultant

A systems analyst frequently acts as a systems consultant to humans and their businesses and, thus, may be hired specifically to address information systems issues within a business. Such hiring can be an advantage because outside consultants can bring with them a fresh perspective that other people in an organization do not possess. It also means that outside analysts are at a disadvantage because an outsider can never know the true organizational culture. As an outside consultant, you will rely heavily on the systematic methods discussed throughout this text to analyze and design appropriate information systems for users working in a particular business. In addition, you will rely on information systems users to help you understand the organizational culture from others’ viewpoints.

Systems Analyst as Supporting Expert

Another role that you may be required to play is that of supporting expert within a business for which you are regularly employed in some systems capacity. In this role, an analyst draws on professional expertise concerning computer hardware and software and their uses in the business.