ESSENTIALS OF SYSTEMS ANALYSIS AND DESIGN

FOURTH EDITION

VALACICH   GEORGE   HOFFER

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Essentials of
Systems Analysis
and Design

To Jackie, Jordan, and James
for your sacrifices, encouragement,
and support.

—Joe

To Karen, Evan, and Caitlin.

—Joey

To Patty, for her sacrifices,
encouragement, and support.
To my students, for being receptive
and critical, and for challenging me
to be a better teacher.

—Jeff

Preface

Our Approach

In today's information- and technology-driven business world, students need to be aware of three key factors. First, it is more crucial than ever to know how to organize and access information strategically. Second, success often depends on the ability to work as part of a team. Third, the Internet will play an important part in their work lives. *Essentials of Systems Analysis and Design, Fourth Edition*, addresses these key factors.

More than 50 years' combined teaching experience in systems analysis and design have gone into creating *Essentials of Systems Analysis and Design, Fourth Edition*, a text that emphasizes hands-on, experimental learning. We provide a clear presentation of the concepts, skills, and techniques students need to become effective systems analysts who work with others to create information systems for businesses. We use the systems development life cycle model as an organizing tool throughout the book to provide a strong conceptual and systematic framework.

Internet coverage is provided in each chapter via an integrated, extended illustrative case (Pine Valley WebStore), an end-of-chapter case (Broadway Entertainment Company, Inc.), and a margin feature (Net Search).

Many systems analysis and design courses involve lab work and outside reading. Lecture time can be limited. Based on market research and our own teaching experience, we understand the need for a book that combines depth of coverage with brevity. So we have created a 10-chapter book that covers key systems analysis and design content without overwhelming students with unnecessary detail.

Essentials of Systems Analysis and Design, Fourth Edition, is characterized by the following themes:

- *Systems development is firmly rooted in an organizational context.* The successful systems analyst requires a broad understanding of organizations, organizational culture, and operations.

- *Systems development is a practical field.* Coverage of current practices as well as accepted concepts and principles is essential for today's systems analyst.

- *Systems development is a profession.* The text presents standards of practice, and fosters a sense of continuing personal development, ethics, and a respect for and collaboration with the work of others.

- *Systems development has significantly changed with the explosive growth in databases, data-driven architecture for systems, and the Internet.* Systems development and database management can be taught in a highly coordinated fashion. The Internet has rapidly become a common development platform for database-driven electronic commerce systems.

- *Success in systems analysis and design requires not only skills in methodologies and techniques, but also in the management of time, resources, and risks.* Learning systems analysis and design requires a thorough understanding of the process as well as the techniques and deliverables of the profession.

Given these themes, the text emphasizes these approaches:

- A business rather than a technology perspective
- The role, responsibilities, and mind-set of the systems analyst as well as the systems project manager, rather than those of the programmer or business manager
- The methods and principles of systems development rather than the specific tools or tool-related skills of the field

Audience

The book assumes that students have taken an introductory course on computer systems and have experience writing programs in at least one programming language. We review basic system principles for those students who have not been exposed to the material on which systems development methods are based. We also assume that students have a solid background in computing literacy and a general understanding of the core elements of a business, including basic terms associated with the production, marketing, finance, and accounting functions.

Organization

The outline of the book follows the systems development life cycle:

- Part I, "Foundations for Systems Development," gives an overview of systems development and previews the remainder of the book.
- Part II, "Systems Planning and Selection," covers how to assess project feasibility and build the baseline project plan.
- Part III, "Systems Analysis," covers determining system requirements, process modeling, and conceptual modeling.
- Part IV, "Systems Design," covers how to design the human interface and databases.
- Part V, "Systems Implementation and Operation," covers system implementation, operation, closedown, and system maintenance.
- Appendix A, "Object-Oriented Analysis and Design," and Appendix B, "Agile Methodologies," can be skipped or treated as advanced topics at the end of the course.

Distinctive Features

Here are some of the distinctive features of *Essentials of Systems Analysis and Design, Fourth Edition:*

1. The grounding of systems development in the typical architecture for systems in modern organizations, including database management and Web-based systems.
2. A clear linkage of all dimensions of systems description and modeling—process, decision, and data modeling—into a comprehensive and compatible set of systems analysis and design approaches. Such broad coverage is necessary for students to understand the advanced capabilities of many systems development methodologies and tools that are automatically generating a large percentage of code from design specifications.

3. Extensive coverage of oral and written communication skills including systems documentation, project management, team management, and a variety of systems development and acquisition strategies (e.g., life cycle, prototyping, rapid application development, object orientation, joint application development, participatory design, and systems reengineering).
4. Coverage of rules and principles of systems design, including decoupling, cohesion, modularity, and audits and controls.
5. A discussion of systems development and implementation within the context of management of change, conversion strategies, and organizational factors in systems acceptance.
6. Careful attention to human factors in systems design that emphasize usability in both character-based and graphical user interface situations.

New to the Fourth Edition

The following features are new to the Fourth Edition:

- ***Emphasis on current changes in systems analysis and design.*** The move to structured analysis and design in the late 1970s was considered to be a revolution in systems development. We are undergoing another revolution now, as we move away from complex, plan-driven development to new approaches called "Agile Methodologies." Although the best-known Agile Methodology is eXtreme Programming, many other approaches are also available. The Agile revolution in systems development is acknowledged and briefly explained in Chapter 1 and then explored in much greater depth in Appendix B.

- ***Increased focus on make versus buy and systems integration.*** More and more systems development involves the use of packages in combination with legacy applications and new modules. Coverage of the make versus buy decision and of the multiple sources of software and software components has been moved forward in the book to highlight the importance of these topics. Chapter 2 shows how companies deal with these issues.

- ***A reorganized text.*** The Fourth Edition retains the same number of chapters and appendices as previous editions, but some content has shifted and other content has been dropped. The material on make versus buy and on the sources of software has been moved to Chapter 2. Likewise, the chapter on selecting the best design strategy has been dropped; relevant information has been integrated into the end of systems analysis section.

- ***Updating of the end-of-chapter running case.*** Broadway Entertainment Company, Inc. (BEC), a fictional video and record retailer, is a student project case that allows students to study and develop a Web-based customer relationship management system in the world of Netflix and movie downloading.

- ***Updated illustrations of technology.*** Screen captures have been updated throughout the text to show examples using the latest versions of programming and Internet development environments, and user interface designs.

Many references to Web sites are provided for students to stay current with technology trends that affect the analysis and design of information systems.

- **New ER notation.** We now use a new notation for entity-relationship diagramming in Chapter 9 and elsewhere. This notation is consistent with that used in *Modern Database Management, Ninth Edition,* by Hoffer, Prescott, and Topi (2009).

- **Project management updates.** Chapters 3 and 4 no longer use the terminology or concept of a statement of work. Instead, to be consistent with the Project Management Institute's Project Management Body of Knowledge (PMBOK), these chapters now refer to the project charter and project scope statement. Chapter 3 also now includes a discussion of software cost estimation, focusing on COCOMO, or the COnstructive COst MOdel.

- **Updated Content.** Throughout the book, the content in each chapter has been updated where appropriate.

Pedagogical Features

The pedagogical features of *Essentials of Systems Analysis and Design, Fourth Edition,* reinforce and apply the key content of the book.

SDLC Framework

Although several conceptual processes can be used for guiding a systems development effort, the systems development life cycle (SDLC) is arguably the most widely applied method for designing contemporary information systems. We highlight four key SDLC steps (Figure P-1):

- Planning and selection
- Analysis
- Design
- Implementation and operation

FIGURE P-1
SYSTEMS DEVELOPMENT LIFE CYCLE (SDLC)
Project management occurs throughout the systems development life cycle (SDLC).
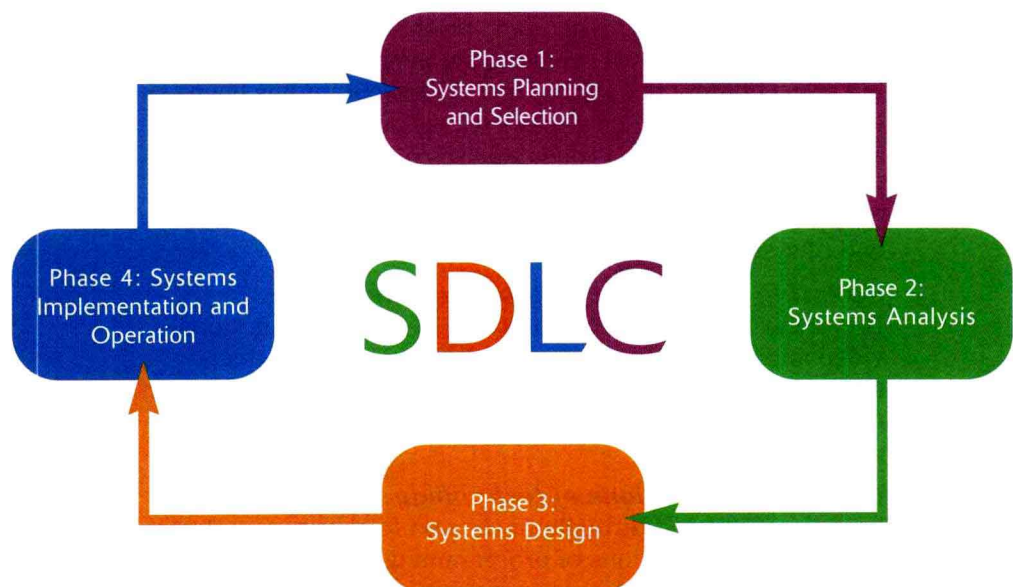
We use the SDLC to frame the part and chapter organization of our book. Each chapter opens with an SDLC figure with various parts highlighted to show students how each chapter, and each step of the SDLC, systematically builds on the previous one.

Internet Coverage and Features

Pine Valley Furniture WebStore. A furniture company founded in 1980 has decided to explore electronic commerce as an avenue to increase its market share. Should this company sell its products online? How would a team of analysts work together to develop, propose, and implement a plan? Beginning in Chapter 3, we explore the step-by-step process.
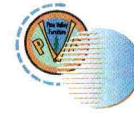
Broadway Entertainment Company, Inc. This end-of-chapter fictional case illustrates how a video and music retailer develops a Web-based customer relationship management system. This case first appears at the end of Chapter 3 and concludes at the end of Chapter 10.

Net Search. Each chapter includes a margin feature entitled "Net Search." Students can access www.pearsonhighered.com/valacich to link to a specific site related to the topic within the chapter and complete an exercise.

NET SEARCH
Visit http://www.pearsonhighered.com/valacich

Three Illustrative Fictional Cases

Pine Valley Furniture (PVF). This case is introduced in Chapter 3 and revisited throughout the book. As key systems development life cycle concepts are presented, they are applied and illustrated. For example, in Chapter 3, we explore how PVF implements the purchasing fulfillment system, and in Chapter 4, we explore how PVF implements a customer tracking system. A margin icon identifies the location of the case. A case problem related to PVF is included in the end-of-chapter material.

Hoosier Burger (HB). This second illustrative case is introduced in Chapter 6 and revisited throughout the book. Hoosier Burger is a fictional fast-food restaurant in Bloomington, Indiana. We use this case to illustrate how analysts would develop and implement an automated food ordering system. A margin icon identifies the location of these case segments. A case problem related to HB is included in the end-of-chapter material.

Broadway Entertainment Company, Inc. (BEC). This fictional video rental and music company is used as an extended case at the end of each chapter, beginning with Chapter 3. Designed to bring the chapter concepts to life, this case illustrates how a company initiates, plans, models, designs, and implements a Web-based customer relationship management system. Discussion questions are included to promote critical thinking and class participation. Suggested solutions to the discussion questions are provided in the Instructor's Manual.

End-of-Chapter Material

We have developed an extensive selection of end-of-chapter material designed to accommodate various learning and teaching styles.

Key Points Review. This section repeats the learning objectives that appear at the opening of the chapter and summarizes the key points related to the objectives.

Key Terms Checkpoint. In this self-test feature, students match each key term in the chapter with its definition.

Review Questions. These questions test students' understanding of key concepts.

Problems and Exercises. These exercises test students' analytical skills and require them to apply key concepts.

Discussion Questions. These questions promote class participation and discussion.

Case Problems. These problems require students to apply the concepts of the chapter to three fictional cases from various industries. The two illustrative cases from the chapters are revisited—Pine Valley Furniture and Hoosier Burger. Other cases are from various fields such as medicine, agriculture, and technology. Solutions are provided in the Instructor's Manual.

Margin Term Definitions

Each key term and its definition appear in the margin. A glossary of terms appears at the back of the book.

References

Located at the end of the text, references are organized by chapter and list more than 200 books and journals that can provide students and faculty with additional coverage of topics.

Software Packaging Options

To enhance the hands-on learning process, Prentice Hall offers packages of this text with Visible Analyst, Oracle, Microsoft Visio, Microsoft Project, and Popkin System Architect software. Your Prentice Hall sales representative can provide you with additional information on pricing and ordering.

The Supplement Package: www.pearsonhighered.com/valacich

A comprehensive and flexible technology support package is available to enhance the teaching and learning experience. Student supplements are available on the text Web site: www.pearsonhighered.com/valacich. Instructor supplements are available at www.pearsonhighered.com.

For Students

- *Net Searches* are Web-based exploratory exercises, referenced in the text margin with icons.
- *Destinations* include many useful Web links to help students explore systems analysis and design, CASE tools, and information systems on the Web.
- A full *Glossary of Terms* is available both alphabetically and by chapter, along with a *Glossary of Acronyms*.

For Instructors

- An *Instructor's Resource Manual* provides chapter-by-chapter instructor objectives, teaching suggestions, and answers to all text review questions, problems, and exercises.

- The *Test Item File* and *TestGen* include a comprehensive set of more than 3,000 test questions in multiple-choice, true-false, and short-answer format; questions are ranked according to level of difficulty and referenced with page numbers and topic headings from the text. The Test Item File is available in Microsoft Word and as the computerized Prentice Hall TestGen software. TestGen is a comprehensive suite of tools for testing and assessment. It allows instructors to easily create and distribute tests for their courses, either by printing and distributing through traditional methods or by online delivery via a Local Area Network (LAN) server. TestGen features Screen Wizards to assist you as you move through the program, and the software is backed with full technical support.

- *PowerPoint Presentation Slides* 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.

- The *Image Library* is a collection of the text art organized by chapter. This collection includes all of the figures, tables, and screenshots (as permission allows) from the book. These images can be used to enhance class lectures and PowerPoint slides.

Materials for Your Online Course

Prentice Hall supports our adopters using online courses by providing files ready for upload into both WebCT and Blackboard course management systems for our testing, quizzing, and other supplements. Please contact your local Prentice Hall representative for further information on your particular course.

Acknowledgments

The authors have been blessed by considerable assistance from many people on all aspects of preparation of this text and its supplements. We are, of course, responsible for what eventually appears between the covers, but the insights, corrections, contributions, and proddings of others have greatly improved our manuscript. The people we recognize here all have a strong commitment to students, to the IS field, and to excellence. Their contributions have stimulated us, and frequently rejuvenated us during periods of waning energy for this project.

We would like to recognize the efforts of the many faculty and practicing systems analysts who have been reviewers of the four editions of this text and its associated text, *Modern Systems Analysis and Design.* We have tried to deal with each reviewer comment, and although we did not always agree with

specific points (within the approach we wanted to take with this book), all reviewers made us stop and think carefully about what and how we were writing. The reviewers were:

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The writing of this text has involved thousands of hours of time from the authors and from all of the people listed. Although our names will be visibly associated with this book, we know that much of the credit goes to the individuals and organizations listed here for any success this book might achieve.

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Joseph S. Valacich is The George and Carolyn Hubman Distinguished Professor of MIS and was the inaugural Marian E. Smith Presidential Endowed Chair at Washington State University. He was previously an Associate Professor with tenure (early) at Indiana University, Bloomington, and was named the Sanjay Subhedar Faculty Fellow. He has had visiting faculty appointments at the University of Arizona, City University of Hong Kong, Buskerud College (Norway), Norwegian University of Life Sciences, Riga Technical University (Latvia), and Helsinki School of Economics and Business. He received a Ph.D. degree from the University of Arizona (MIS), and M.B.A. and B.S. (computer science) degrees from the University of Montana. His teaching interests include systems analysis and design, collaborative computing, project management, and management of information systems. Professor Valacich served on the national task forces to design *IS '97 and 2002: The Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems* as well as *MSIS 2000 and 2006: The Master of Science in Information Systems Model Curriculum*. He is currently co-chairing the task force designing *IS 2008*. He also served on the Executive Committee, funded by the National Science Foundation, to define the *IS Program Accreditation Standards* and on the Board of Directors for CSAB (formally, the Computing Sciences Accreditation Board), representing the Association for Information Systems (AIS). He was the general conference co-chair for the 2003 International Conference on Information Systems (ICIS) in Seattle, Washington, and was the vice-chair of ICIS 1999 in Charlotte, North Carolina.

Prior to his academic career, Dr. Valacich worked in the information systems field as a programmer, systems analyst, and technical product manager. He has conducted numerous corporate training and executive development programs for organizations, including AT&T, Boeing, Dow Chemical, EDS, Exxon, FedEx, General Motors, Microsoft, and Xerox.

Dr. Valacich serves on the editorial board of *Decision Sciences, MIS Quarterly*, and *Small Group Research* and was formerly an associate editor for *Information Systems Research*. His research has appeared in publications such as *MIS Quarterly, Information Systems Research, Management Science*, and *Academy of Management Journal*. He is a coauthor of the best-selling *Modern Systems Analysis and Design* (Fifth Edition), as well as *Object-Oriented Systems Analysis and Design, Information Systems Today* (Fourth

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Joey F. George is professor and Thomas L. Williams Jr. Eminent Scholar in Information Systems in the College of Business at Florida State University. Dr. George earned his bachelor's degree at Stanford University in 1979 and his Ph.D. in management at the University of California at Irvine in 1986. He was previously the Edward G. Schlieder Chair of Information Systems in the E. J. Ourso College of Business Administration at Louisiana State University. He also served at Florida State University as Chair of the Department of Information and Management Sciences from 1995 to 1998.

Dr. George has published more than 50 articles in such journals as *Information Systems Research, Communications of the ACM, MIS Quarterly, Journal of MIS*, and *Communication Research*. His research interests focus on the use of information systems in the workplace, including computer-based monitoring, computer-mediated deceptive communication, and group support systems.

Dr. George is co-author of the textbooks *Modern Systems Analysis and Design, Fifth Edition*, published in 2008, and *Object-Oriented Systems Analysis and Design, Second Edition*, published in 2007, both from Prentice Hall. He served as an associate editor for *MIS Quarterly* and *Information Systems Research*, and as a senior editor at *MIS Quarterly*. He is currently the editor-in-chief of the *Communications of the AIS*. Dr. George was the conference co-chair for the 2001 ICIS, held in New Orleans, Louisiana, and the doctoral consortium co-chair for the 2003 ICIS, held in Seattle, Washington.

Jeffrey A. Hoffer is the Sherman–Standard Register Professor of Data Management for the Department of MIS, Operations Management, and Decision Sciences in the School of Business Administration at University of Dayton. He also taught at Indiana University and Case Western Reserve University. Dr. Hoffer earned his B.A. from Miami University in 1969 and his Ph.D. from Cornell University in 1975.

Dr. Hoffer has co-authored all editions of three college textbooks: *Modern Systems Analysis and Design*, with George and Valacich; *Managing Information Technology: What Managers Need to Know*, with Brown, DeHayes, Martin, and Perkins; and *Modern Database Management*, with Prescott and McFadden, all published by Prentice Hall. His research articles have appeared in numerous journals, including the *MIS Quarterly–Executive, Journal of Database Management, Small Group Research, Communications of the ACM*, and *Sloan Management Review*. He has received research grants from Teradata (Division of NCR), IBM Corporation, and the U.S. Department of the Navy.

Dr. Hoffer is cofounder of the International Conference on Information Systems and Association for Information Systems and has served as a guest lecturer at Catholic University of Chile, Santiago, and the Helsinki School of Economics and Business in Mikkeli, Finland.

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