

# MODERN SYSTEMS ANALYSIS AND DESIGN

FOURTH EDITION



Jeffrey A. Hoffer • Joey F. George • Joseph S. Valacich

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**FOURTH EDITION**

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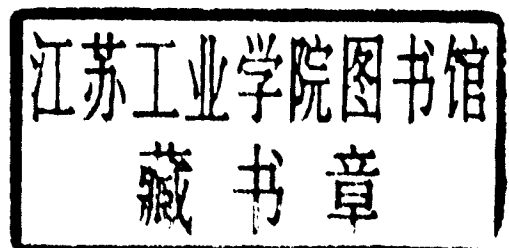
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*To Patty, for her sacrifices, encouragement, and support.*

*To my students, for being receptive and critical, and challenging me to be a better teacher.*

—Jeff

*To Karen, Evan, and Caitlin, for your love, support, and patience.*

—Joey

*To Jackie, Jordan, James, and the rest of my family. Your love and support are my greatest inspiration.*

—Joe

# Preface

## Description

**M**odern Systems Analysis and Design covers the concepts, skills, methodologies, techniques, tools, and perspectives essential for systems analysts to successfully develop information systems. The primary target audience is upper-division undergraduates in a management information systems (MIS) or computer information systems curriculum; a secondary target audience is MIS majors in MBA and MS programs. Although not explicitly written for the junior college and professional development markets, this book can also be used by these programs.

We have over 50 years of combined teaching experience in systems analysis and design and have used that experience to create this newest edition of *Modern Systems Analysis and Design*. We provide a clear presentation of the concepts, skills, and techniques that students need to become effective systems analysts who work with others to create information systems for businesses. We use the systems development life cycle (SDLC) model as an organizing tool throughout the book to provide students with a strong conceptual and systematic framework. The SDLC in this edition is new, with five phases instead of six, and a circular design instead of the old “waterfall” design.

With this text, we assume that students have taken an introductory course on computer systems and have experience designing programs in several programming languages. 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.

*Modern Systems Analysis and Design* is characterized by the following themes:

1. Systems development is firmly rooted in an organizational context. The successful systems analyst requires a broad understanding of organizations, organizational culture, and organizational operations.
2. Systems development is a practical field. Coverage of current practices as well as accepted concepts and principles is essential in a textbook.
3. Systems development is a profession. Standards of practice, a sense of continuing personal development, ethics, and a respect for and collaboration with the work of others are general themes in the textbook.
4. Systems development has significantly changed with the explosive growth in databases, data-driven systems architectures, Rapid Application Development (RAD), and the Internet. Systems development and database management can be and should be taught in a highly coordinated fashion. We show when RAD methods should and should not be applied. The Internet has rapidly become a common development platform for database-driven electronic commerce systems. This text is compatible with the Hoffer, Prescott, and McFadden database

text, *Modern Database Management*, Seventh Edition, also published by Prentice Hall. The proper linking of these two textbooks is a strategic opportunity to meet the needs of the IS academic field.

5. Success in systems analysis and design requires not only skills in methodologies and techniques, but also project management skills for managing time, resources, and risks. Thus, 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, this textbook emphasizes the following:

- A business, rather than a technology, perspective
- The role, responsibilities, and mindset 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

## Distinctive Features

The following are some of the distinctive features of *Modern Systems Analysis and Design*:

1. This book is organized in parallel to the Hoffer, Prescott, and McFadden database text, *Modern Database Management*, Seventh Edition, which will facilitate consistency of frameworks, definitions, methods, examples, and notations to better support systems analysis and design and database courses adopting both texts. Even with the strategic compatibilities between this text and *Modern Database Management*, each of these books is designed to stand alone as a market leader.
2. The grounding of systems development in the typical architecture for systems in modern organizations, including database management and Web-based systems.
3. 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 a broad coverage is necessary so that students understand the advanced capabilities of the many systems development methodologies and tools that are automatically generating a large percentage of code from design specifications.
4. 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, RAD, object orientation, Joint Application Development (JAD), and systems reengineering).
5. Coverage of rules and principles of systems design, including decoupling, cohesion, modularity, and audits and controls.
6. Consideration of standards for the methodologies of systems analysis and the platforms on which systems are designed.
7. Discussion of systems development and implementation within the context of change management, conversion strategies, and organizational factors in systems acceptance.
8. Careful attention to human factors in systems design that emphasize usability in both character-based and graphical user interface situations.
9. A variety of CASE and visual development products are illustrated and the current limitations of CASE technologies are highlighted.



10. The text includes a separate chapter on systems maintenance. Given the type of job many graduates first accept and the large installed base of systems, this chapter covers an important and often neglected topic in systems analysis and design texts.

## New to the Fourth Edition

The following features are new to the Fourth Edition:

- *The text reflects 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 how systems development was conducted. We are undergoing another revolution in systems development 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, there are many other approaches. The Agile revolution in systems development is acknowledged and explained primarily in Chapters 1, 6, 13, and 15.
- *A revised systems development life cycle model.* Former editions of this book featured a six-phase systems development life cycle (SDLC). This six-phase life cycle was in the shape of the much maligned “waterfall” SDLC, although feedback and reiteration were possible and encouraged within this particular SDLC design. The current edition features a revised SDLC that is circular and has five phases, simplifying all preanalysis phases into a single “planning” phase. As in earlier editions, the SDLC is used as a way to organize the text as well as embody the spirit of the systems development process.
- *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 salience of these topics. Chapter 2 shows how companies deal with these issues. Chapter 2 is based on material that was originally in a chapter about selecting the best design strategy. The design strategy chapter no longer exists.
- *The text has been extensively reorganized.* Instead of twenty chapters, as was the case in the Third Edition, this edition has sixteen chapters and three appendices. Gone are the chapters on selecting the best design strategy and on RAD. Three original chapters have been converted to appendices. And a new chapter on the sources of software has been added. The original Chapter 2, on succeeding as a systems analyst, is now the first of three appendices. Our chapter on CASE tools is now our second appendix. The third appendix is on object-oriented analysis and design, and it is a modified version of the chapter on object-orientation we featured in previous editions.
- *Integration of object-oriented approach.* In this edition, we have integrated two aspects of the object-oriented approach to systems development into the text. Coverage of use case diagrams now appears at the end of Chapter 7, where we discuss structuring process requirements. Coverage of object and class diagrams now appears in Chapter 9, where we discuss structuring data requirements. This material is presented alongside material on relational databases and entity-relationship diagrams. The object-oriented appendix is for those who want to go further; it features sequence and state transition diagrams.
- *Coverage of Internet-based systems.* We have redesigned the distributed systems design chapter (now Chapter 14) to address Internet-based application design topics not covered in the other chapters. We cover Internet application design standards, how to maintain site consistency, security issues, and data warehousing, among other topics. We believe that *Modern*

*Systems Analysis and Design* now has one of the most extensive treatments of Internet application design among its competitors.

- *Integration of electronic commerce into the running cases.* One of the three fictional running cases in the text, Pine Valley Furniture, is a furniture company founded in 1980 that now, in the Fourth Edition, has decided to explore electronic commerce as an avenue to increase its market share. Broadway Entertainment Company, Inc. (BEC), a fictional video and record retailer, is a student project case that allows your students to study and develop a Web-based customer relationship management system.
- *Updated illustrations of technology.* Screen captures have been updated throughout the text to show examples using the latest versions of CASE tools, including Rational Rose, programming and Internet development environments, and user interface designs. Many references to Websites are provided for students to stay current with technology trends that affect the analysis and design of information systems.
- *Expanded coverage of process modeling techniques.* Chapter 7 includes an introduction to business process modeling and use case diagrams as alternatives to data flow diagramming.

## Pedagogical Features

The pedagogical features of *Modern Systems Analysis and Design* reinforce and apply the key content of the book.

### Three Illustrative Fictional Cases

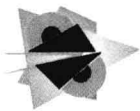
The text features three fictional cases, described below.



*Pine Valley Furniture (PVF):* In addition to demonstrating an electronic business-to-consumer shopping Website, several other systems development activities from Pine Valley Furniture are used to illustrate key points. Pine Valley Furniture is introduced in Chapter 3 and revisited throughout the book. As key systems development life cycle concepts are presented, they are applied and illustrated with this descriptive case. For example, in Chapter 5, we explore how PVF plans a development project for a customer tracking system. A margin icon identifies the location of the case segments.



*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 the case segments.



*Broadway Entertainment Company, Inc. (BEC):* This fictional video rental and music company is used as an extended project case at the end of fourteen of the sixteen chapters, 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.

### Net Search Exercises

Net Search exercises can be found in every chapter. An icon signals when a topic in the text has a corresponding Net Search exercise on the book's Website. Students can access the exercises from [www.prenhall.com/hoffer](http://www.prenhall.com/hoffer) and e-mail their findings to their instructors.



### End-of-Chapter Material

We developed an extensive selection of end-of-chapter materials that are designed to accommodate various learning and teaching styles.



- *Chapter Summary.* Reviews the major topics of the chapter and previews the connection of the current chapter with future ones.
- *Key Terms.* Designed as a self-test feature, students match each key term in the chapter with a definition.
- *Review Questions.* Tests students' understanding of key concepts.
- *Problems and Exercises.* Tests students' analytical skills and requires them to apply key concepts.
- *Field Exercises.* Gives students the opportunity to explore the practice of systems analysis and design in organizations.
- *Margin Term Definitions.* Each key term and its definition appear in the margin. Glossaries of terms and acronyms appear at the back of the book.
- *References.* References are located at the end of each chapter. The total number of references in this text amounts to over 100 books, journals, and Websites that can provide students and faculty with additional coverage of topics.

## Using This Text

As stated earlier, this book is intended for mainstream systems analysis and design courses. It may be used in a one-semester course on systems analysis and design or over two quarters (first in a systems analysis and then in a systems design course). Because this book parallels *Modern Database Management*, chapters from this book and from *Modern Database Management* can be used in various sequences suitable for your curriculum. The book will be adopted typically in business schools or departments, not in computer science programs. Applied computer science or computer technology programs may also adopt the book.

The typical faculty member who will find this book most interesting is someone who

- Has a practical, rather than technical or theoretical, orientation
- Has an understanding of databases and the systems that use databases
- Uses practical projects and exercises in their courses

More specifically, academic programs that are trying to better relate their systems analysis and design and database courses as part of a comprehensive understanding of systems development will be especially attracted to this book.

The outline of the book generally follows the systems development life cycle, which allows for a logical progression of topics. However, the book emphasizes that various approaches (e.g., prototyping and iterative development) are also used, so what appears to be a logical progression often is a more cyclic process. Part I of the book provides an overview of systems development and previews the remainder of the book. Part I also introduces students to the many sources of software that they can draw on to build their systems and to project management. The remaining four sections provide thorough coverage of the five phases of a generic systems development life cycle, interspersing coverage of alternatives to the SDLC as appropriate. Some chapters may be skipped depending on the orientation of the instructor or the students' background. For example, Chapter 3 (managing the information systems project) can be skipped or quickly reviewed if students have completed a course on project management. Chapter 4 (project identification and selection) can be skipped if the instructor wants to emphasize systems development once projects are identified or if there are fewer than 15 weeks available for the course. Chapters 9 (conceptual data modeling) and 10 (database design) can be skipped or quickly scanned (as a refresher) if students have already had a thorough coverage of these topics in a previous database or data structures course. The sections on object orientation in Chapters 7 and 9 can be skipped if faculty wish to avoid object-oriented topics; these sections and Appendix C can be quickly reviewed if students have already

had a course on object-oriented systems development. Finally, Chapter 16 (maintenance) can be skipped if these topics are beyond the scope of your course.

Because the material is presented within the flow of a systems development project, it is not recommended that you attempt to use the chapters out of sequence, with a few exceptions: Chapters 7 (process modeling), 8 (logic modeling), and 9 (conceptual data modeling) can be taught in any sequence; Chapter 10 (database design) can be taught after Chapters 11 (output design) and 12 (interface design), but Chapters 11 and 12 should be taught in sequence.

## Software Packaging Options

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

## The Supplement Package: [www.prenhall.com/hoffer](http://www.prenhall.com/hoffer)

A comprehensive and flexible technology support package is available to enhance the teaching and learning experience. All instructor and student supplements are available on the text Website: [www.prenhall.com/hoffer](http://www.prenhall.com/hoffer).

### For Students

- An *Interactive Study Guide* by Lisa Miller of the University of Central Oklahoma, contains multiple-choice, true-false, and essay questions. Students receive automatic feedback to their answers. Responses to the essay questions and results from the multiple-choice and true-false questions can be e-mailed to the instructor after a student finishes a quiz.
- *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.
- *PowerPoint Presentation Slides* feature lecture notes that highlight key text terms and concepts.
- 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. Lecture notes on how to use the video series (described on page xxxi) are also included.
- The *Test Item File* and *TestGen* by Lisa Miller of the University of Central Oklahoma, includes a comprehensive set of over 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 or [mis\\_service@prenhall.com](mailto:mis_service@prenhall.com) for further information on your particular course.

## Video Series

Four of the five clips on this video were prepared by Electronic Data Systems Corporation (EDS) and cover topics such as Joint Application Design (JAD) and application engineering; the fifth clip covers the application of object-oriented analysis and design in a municipal government agency. Each clip is approximately 15 minutes in length and includes an introduction and prologue from the text authors. Lecture notes and suggestions on how to use the videos are included in the Instructor's Resource Manual.

## 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, frequently prompting us to include new topics and innovative pedagogy.

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Our unique supplement to this text is a series of five videotapes that illustrate common activities and situations encountered by systems analysts. We are very excited about the pedagogical value of these tapes and compliment EDS Corporation for the sizable commitment of human and financial resources it took to develop and produce four of these tapes for exclusive use with our book. Specifically, we thank Stu Bailey, Michael Cummings, Vern Olsen, Chris Ryan, and Terry Zuechow of EDS; Bob Tucker of Antares Alliance; and Bill Satterwhite of Whitecap Productions for all of their work on this project. The fifth tape was scripted and produced by the Center for Business and Economics Research at the University of Dayton and addresses the analysis of needs for a new information system using object-oriented principles. We thank Mike Kurtz and the rest of the CBER staff for their outstanding work.

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*Jeffrey A. Hoffer*, Dayton, Ohio

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# Brief Contents

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Preface xxv

## **Part I** Foundations for Systems Development 1

- 1 The Systems Development Environment 4
- 2 The Origins of Software 31
- 3 Managing the Information Systems Project 47

## **Part II** Planning 89

- 4 Identifying and Selecting Systems Development Projects 92
- 5 Initiating and Planning Systems Development Projects 121

## **Part III** Analysis 157

- 6 Determining System Requirements 160
- 7 Structuring System Process Requirements 197
- 8 Structuring System Logic Requirements 244
- 9 Structuring System Data Requirements 266

## **Part IV** Design 325

- 10 Designing Databases 328
- 11 Designing Forms and Reports 374
- 12 Designing Interfaces and Dialogues 402
- 13 Finalizing Design Specifications 441
- 14 Designing Distributed and Internet Systems 465

## **Part V** Implementation and Maintenance 503

- 15 System Implementation 506
- 16 Maintaining Information Systems 547

Appendix 1 Succeeding as a Systems Analyst 569  
Appendix 2 Automated Tools for Systems Development 600  
Appendix 3 Object-Oriented Analysis and Design 621  
Glossary of Terms 649  
Acronym Glossary 659  
Credits 661  
Index 665



# Contents

Preface xxv

## **Part I**

### Foundations for Systems Development 1

#### AN OVERVIEW OF PART I 2

#### **1 The Systems Development Environment**

**3**

Learning Objectives 3

Introduction 3

A Modern Approach to Systems Analysis and Design 6

Types of Information Systems and Systems Development 7

Transaction Processing Systems 7

Management Information Systems 8

Decision Support Systems 8

Summary of Information Systems Types 9

Developing Information Systems and the Systems Development Life Cycle 10

The Heart of the Systems Development Process 15

The Traditional Waterfall SDLC 17

Different Approaches to Improving Development 18

Prototyping 18

CASE Tools 19

Joint Application Design 19

Rapid Application Development 20

Agile Methodologies 21

eXtreme Programming 23

Object-Oriented Analysis and Design 23

Our Approach to Systems Development 25

Summary 26

Key Terms 27

Review Questions 28

Problems and Exercises 28

Field Exercises 28

References 29


## 2 The Origins of Software

31

- Learning Objectives 31
- Introduction 31
- Systems Acquisition 32
  - Outsourcing 32
  - Sources of Software 34
    - Hardware Manufacturers 34
    - Packaged Software Producers 35
    - Custom Software Producers 36
    - Enterprise Solutions Software 37
    - Application Service Providers 38
    - In-House Development 39
  - Choosing Off-the-Shelf Software 40
  - Validating Purchased Software Information 41
- Reuse 42
- Summary 45
- Key Terms 45
- Review Questions 45
- Problems and Exercises 45
- Field Exercises 46
- References 46

## 3 Managing the Information Systems Project

47

- Learning Objectives 47
- Introduction 47
-  Pine Valley Furniture Company Background 48
- Managing the Information Systems Project 49
  - Initiating a Project 52
  - Planning the Project 56
  - Executing the Project 62
  - Closing Down the Project 64
- Representing and Scheduling Project Plans 66
  - Representing Project Plans 68
  - Calculating Expected Time Durations Using PERT 68
  - Constructing a Gantt Chart and Network Diagram at Pine Valley Furniture 69
- Using Project Management Software 73
  - Establishing a Project Starting Date 73
  - Entering Tasks and Assigning Task Relationships 74
  - Selecting a Scheduling Method to Review Project Reports 75
- Summary 76
- Key Terms 77
- Review Questions 77
- Problems and Exercises 78
- Field Exercises 79
- References 80



## **BEC CASE: COMPANY BACKGROUND 81**

- Case Introduction 81
- The Company 81
- Company History 82
- Company Organization 82
- Development of Information Systems 83
- Information Systems at BEC Today 83
- In-Store Systems 84
- Corporate Systems 85
- Status of Systems 85
- Case Summary 86
- Case Questions 87

## **Part II**

## **Planning 89**

### **AN OVERVIEW OF PART II 90**

## **4 Identifying and Selecting Systems Development Projects 92**

- Learning Objectives 92
- Introduction 92
- Identifying and Selecting Systems Development Projects 93
  - The Process of Identifying and Selecting IS Development Projects 93
  - Deliverables and Outcomes 99
- Corporate and Information Systems Planning 100
  - Corporate Strategic Planning 101
  - Information Systems Planning 103
- Electronic Commerce Applications: Identifying and Selecting Systems Development Projects 110
  - Internet Basics 110
  - Pine Valley Furniture WebStore 112
- Summary 112
- Key Terms 113
- Review Questions 113
- Problems and Exercises 114
- Field Exercises 114
- References 115



## **BEC CASE: IDENTIFYING AND SELECTING THE CUSTOMER RELATIONSHIP MANAGEMENT SYSTEM 116**

- Case Introduction 116
- The Idea for a New System 116
- Formalizing a Project Proposal 117
- Case Summary 120
- Case Questions 120

## **5 Initiating and Planning Systems Development Projects 121**

- Learning Objectives 121
- Introduction 121
- Initiating and Planning Systems Development Projects 122