

大学计算机教育丛书（影印版）

OBJECT-ORIENTED SYSTEMS ANALYSIS AND DESIGN

面向对象系统
分析与设计
Ronald J. Norman



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San Diego State University



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出版前言

我们的大学生、研究生毕业后,面临的将是一个国际化的信息时代。他们将需要随时查阅大量的外文资料;会有更多的机会参加国际性学术交流活动;接待外国学者;走上国际会议的讲坛。作为科技工作者,他们不仅应有与国外同行进行口头和书面交流的能力,更为重要的是,他们必须具备极强的查阅外文资料获取信息的能力。有鉴于此,在国家教委所颁布的“大学英语教学大纲”中有一条规定:专业阅读应作为必修课程开设。同时,在大纲中还规定了这门课程的学时和教学要求。有些高校除开设“专业阅读”课之外,还在某些专业课拟进行英语授课。但教、学双方都苦于没有一定数量的合适的英文原版教材作为教学参考书。为满足这方面的需要,我们挑选了7本计算机科学方面最新版本的教材,进行影印出版。首批影印出版的6本书受到广大读者的热情欢迎,我们深受鼓舞,今后还将陆续推出新书。希望读者继续给予大力支持。Prentice Hall公司和清华大学出版社这次合作将国际先进水平的教材引入我国高等学校,为师生们提供了教学用书,相信会对高校教材改革产生积极的影响。

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About the Author

Ronald J. Norman is currently a Professor of Information and Decision Systems at San Diego State University. He teaches executive, graduate, and undergraduate level courses in information systems management, software engineering/systems analysis and design, and information as an organizational resource. He received a Ph.D. in Management Information Systems and Organizational Behavior from the University of Arizona in 1987. He is also a Certified Computer Professional (CCP) and has over 25 years of industry MIS experience including software development, consulting, and management.

Dr. Norman's research interests are object-oriented systems development, organizational behavior related to the introduction of technology, and CASE technology. He has served as facilities chairman for the International Conference on Information Systems and was the program committee chairman for CASE '88, the Second International Workshop on Computer-Aided Software Engineering. He was the General Chairman for CASE '90, co-sponsored by the IEEE Computer Society, a mini-track coordinator on IPSE/Software Development Environments, and a mini-track coordinator on CASE technology for the Hawaiian International Conference on Systems Sciences (HICSS-24) in 1991 and repeated the CASE mini-track at HICSS-25 in January 1992. He was guest editor for the March 1992 issue of IEEE Software focusing on integrated CASE and was also guest editor for the April 1992 issue of the Communications of the ACM on a similar topic. He served as program co-chair for CASE '95 in Toronto, Canada and was on the program committee for the European CASE conference in 1995 and again in 1996. He is also co-editor of a special CASE theme issue of the Automated Software Engineering Journal to appear in 1996.

Dr. Norman has published or co-published over two dozen articles which have appeared in journals including the Communications of the ACM, IEEE Software, International Journal of Software Engineering and Knowledge Engineering, CIO JOURNAL, Information & Software Technology, Journal of Computer Information systems, and Journal of Systems Management.

Dr. Norman's industry work/consulting engagements include several international, national, and local organizations, such as Avco Finance, Unisys Corporation, Tymshare, Inc., NCR Corporation, BASF, US Navy, American Management Systems, Performance Research Corporation, Science Applications Inc, University of California Medical Center, San Diego Police Department, Solar Turbines International, General Dynamics Corporation, National Liberty Corporation, and INJOY.



Preface

Information systems. They are everywhere. But you can't touch them, see them, or hold them in the same sense that you can touch a statue, see a sunset, or hold a hamburger in your hand. For the most part, information systems are invisible except for the human-computer interface portion such as a keyboard, joystick, monitor, mouse, or printer.

Business and government rely heavily on information systems to support their missions and goals. In fact it is almost impossible to conduct substantial business these days without "computers." Many people use the word "computers" as a surrogate for the information system on which they are relying. Keeping track of names and addresses, paying bills, playing games, creating term papers, and doing income tax returns are just a few of the information systems for which people use their computer.

The purpose of this book is to be an introductory resource for systems analysis, design, and implementation of information systems. Systems analysis, design, and implementation are, in the broadest sense, the processes used by professional men and women to create or maintain information systems.

THE INTENDED AUDIENCE FOR THIS BOOK

Object-Oriented Systems Analysis and Design is intended to be used in a single-term course or a two-term sequence of courses (e.g., semester or quarter) in information systems development. Four-year universities and colleges, community or junior colleges, and trade-technical/vocational schools that have one or more courses devoted to information systems development or software engineering are perhaps the best candidates for its use. Master's programs that also have one or more courses in

information systems development or software engineering would also benefit from this book although the writing style is admittedly geared primarily to undergraduate students.

I recommend that students have basic computer literacy skills prior to taking such a course. In addition, experience with a programming language such as COBOL, Visual (anything), or C/C++ would contribute to a better understanding and appreciation of the information systems development process.

WHY I WROTE THIS BOOK

My sole goal for writing this book is to provide my own students with a systems analysis, design, and implementation resource textbook that would effectively communicate the essence of these activities in the most meaningful way possible. The anonymous feedback that I have received on earlier drafts of this book from my students has encouraged me to pursue its formal publication so that other students may benefit from it as well.

The current generation of students taking computer-related courses has come to expect more than just theory in the classroom because many students have grown up with computers at school and in their homes. In almost every instance, they have had plenty of “hands-on” experiences with the computer and video games. Computer theory without practical hands-on application is a little like peanut butter without jelly or graham crackers without milk—some things are just made for each other.

I have used many good systems analysis and design textbooks over the years, none of which were perfect. This one isn't either. However, in this book, I have tried to address some of the perceived issues that my students consistently bring up as shortcomings in other textbooks. Chief among their complaints are books that:

- are intended to be introductory yet assume a high degree of related background knowledge.
- are too conceptual or theoretical.
- minimize concepts and theories and substitute anecdotal experiences.
- use examples that students have a difficult time relating to.
- claim to be presenting the best systems analysis and design methodology with the implication that everybody should be using it.

A FEW WORDS ABOUT INFORMATION SYSTEMS JARGON

Jargon is a way of life. Understanding of and use of jargon is equated with knowledge of the subject area. Misuse of jargon can distinguish the fake from the real. Doctors, attorneys, accountants, engineers, mechanics, and surfers all have their jargon. Even young people have their own jargon.

Information systems and computer technology have jargon also. Lots of it! The accepted name of the field itself has changed over the years. A few of the accepted (at

least at one time) names for this field are: data processing, management information systems, business information systems, information systems, software engineering, systems engineering, and information systems engineering. For purposes of this book these terms are synonymous. Information systems is the preferred one for use throughout this book. Is this the best term? Who knows! My goal is to be consistent throughout the book.

Systems analysis and design is known by a few other terms also, such as software engineering, systems engineering, information systems development, and information systems engineering. You probably noticed that some of these terms were included as accepted terms for this field of study. Not surprising for a field of study as young (about 50 years) and as diverse as this one. I have selected systems analysis and design as the preferred term for use in this book. On rare occasion, due to sentence structure, I may use one of the other terms.

The titles assigned to the people who do systems analysis and design are also diverse. Titles such as systems analyst, analyst/programmer, software engineer, and systems engineer are quite common. This book will use systems analyst as the preferred term.

Finally, there is the ongoing discussion of the most appropriate term used to classify the people who use information systems, such as knowledge worker, user, and customer. Knowledge worker appears to have a very small following these days. Perhaps the oldest term is the word "user." This term conjures up all kinds of thoughts. So, the term "customer" has become popular in recent years. This term has a positive connotation that is good. However, students tend to think of themselves as customers—customers of banks, restaurants, stores, super markets, and even the university. They, in turn, may even wait on customers in their role as employees of a bank, restaurant, store, and so on. Because of this potential confusion, I have chosen the term "user" for this book. When used, the term can refer to a single person or a group of people.

HOW TO USE THIS BOOK

Object-Oriented Systems Analysis and Design is divided into three parts. My personal experience with several other systems analysis and design books suggests that instructors can readily omit sections of chapters or entire chapters and modules to suit their own teaching style and content preferences. Rearranging of chapter and module order to meet instructional goals is also an option. Instructors can do the same with this book.

Part I, Systems Analysis and Conceptual Design, is made up of seven chapters. Chapter 1 presents an introduction to systems analysis and design that introduces the reader to the systems development process, most often referred to as the systems development life cycle. Foundational information related to the systems development process is covered along with additional foundational information related to systems analysts, the people who perform the systems development process. Chapter 2 introduces the reader to feasibility analysis and the requirements determination activities

within systems analysis. Chapter 3 presents an object-oriented methodology and model in its entirety. This shows the reader the “big picture” before moving on to necessary details. Chapters 4-7 present the details of the object-oriented methodology and model.

Part II, Physical Design and Implementation, consists of six chapters. Chapter 8 presents an overview of the design portion of systems analysis and design. Chapter 9 focuses on output design. Chapters 10 and 11 address input design and file and database design. Chapter 12 presents software construction and testing concepts followed by presentation of information systems implementation from both a technical and organizational behavior perspective in Chapter 13.

Part III, Miscellaneous Systems Analysis and Design Topics, presents eight supplementary and complementary topics that either enable systems analysis and design or are additional aspects of systems analysis and design. For example, Module A, Information Systems Planning, is an additional aspect of systems analysis and design, while Module G, Communication and Electronic Meetings, presents these topics which contribute in an enabling way to systems analysis and design. Each of the other six modules—Prototyping, CASE, Software Process Improvement, The Systems Development Challenge, Project Management, and Business Process Reengineering—presents topics that are important to the systems analysis and design process. These eight modules are intended to be used at the instructor's discretion and at the point in time during the course that best fits his or her course goals.

SUPPLEMENTS

As you, the instructor, knows one of the significant differences between textbooks and trade books is the supplemental materials that accompany the former. *Object-Oriented Systems Analysis and Design* has four supplements including:

- An instructor's guide (with sample object models)
- A test item file
- Classroom presentation materials
- Object Modeling software
- Electronic communication with the author

The instructor's guide contains suggestions for presenting each of the chapters and modules in the book along with the answers to the end of chapter questions. The test item file contains objective (e.g., true and false/multiple-choice) and subjective (e.g., short answers required) questions and answers. The classroom materials include overhead transparencies of most figures and other important chapter concepts that may not have figures in the book. In addition, a full-color electronic version of the classroom materials in Microsoft PowerPoint (IBM) format is available by contacting the publisher.

Another supplement is object-oriented modeling software. Object International, Inc. (OI) graciously makes its object-oriented modeling whiteboard software package called Playground™ available to both students and instructors. Playground™ is an

easy-to-use tool for building object models. It uses the same modeling notation presented in this book.

The “classroom and personal study only” version is available at no cost to a student or an instructor. Playground™ requires the Microsoft Windows operating system. Due to constant upgrades from both Microsoft and OI, specific system requirements are not listed here. Specific requirements are available at the time of downloading the Playground™ software directly from OI’s world-wide web home page which is <http://www.oi.com/business/object/>. The file that is downloaded is a self-extracting file and at the time of this book’s publication took between 1 and 2 megabytes of disk space to download.

Again, each student is allowed his or her own personal copy of Playground™. The instructor may choose to download Playground™ and then make copies available to students in a manner he or she chooses. The only difference between the “classroom and personal study only” version of Playground™ and the registered (fee) version is the “classroom and personal study only” watermark that appears at the bottom of the display screen and on printed output.

The final supplement is one that is not generally found in textbooks—electronic addresses to communicate directly with the author. Recognizing that change is a constant, these addresses are correct as of the publication date for this book; however there is no guarantee that these addresses will be correct in the future. If you, the instructor who adopts this text or is considering its adoption, send me electronic communication, I will do my best to reply back to you as soon as possible. I welcome your comments and questions, feedback and suggestions, as well as corrections for a future revision of the book.

My World Wide Web Home Page Universal Resource Locator (URL) address is: <http://rohan.sdsu.edu/dept/cbaweb/IDS/RNorman.html> (case sensitive)

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SDSU’s College of Business Administration (CBA) Home Page URL is: <http://rohan.sdsu.edu/dept/cbaweb/>

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I am grateful to the following reviewers of preliminary versions or portions of this book. My only regret is that I could not include all of their suggestions for a variety of reasons:

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I would like to thank Dr. Gail Corbitt, Associate Professor at California State University, Chico, for her support and contributions during the years we worked together at San Diego State University. She crystallized a significant part of the organizational behavior portion of the implementation chapter for me.

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I apologize to any contributing person I may have overlooked at this time.

Finally, I hope that you will derive value from this book. Any shortcomings, errors, omissions, or inconsistencies attributed to the book are the sole responsibility of me. Best wishes for your career.

Ronald J. Norman
1995



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