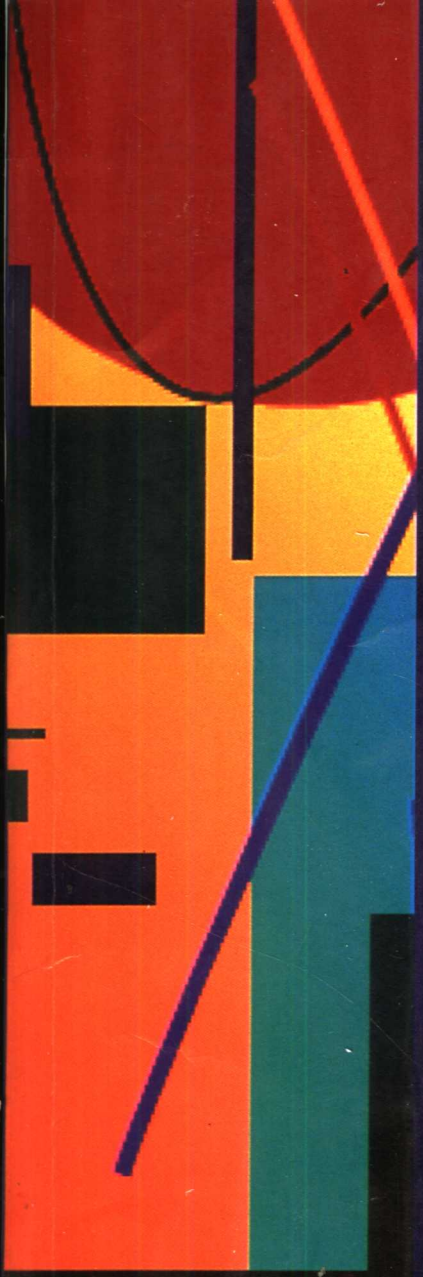


Computers & Information Systems

Robert A. Szymanski

Donald P. Szymanski

Donna M. Pulschen

Library of Congress Cataloging-in-Publication Data

Szymanski, Robert A.
Computers and information systems / Robert A. Szymanski, Donald P. Szymanski, Donna M. Pulschen.
p. cm.
Includes index
ISBN 0-02-418767-4
1. Computers. 2. Computer software. I. Szymanski, Donald P. II. Pulschen, Donna M.
QA76.5.S98 1994
004—dc20

94-16833
CIP

Cover art: Marjory Dressler
Editor: P. J. Boardman
Production Editor: Christine M. Harrington
Photo Editor: Chris Migdol
Text/Cover Designer: Julia Zonneveld Van Hook
Production Buyer: Pamela D. Bennett

A Simon & Schuster Company
Englewood Cliffs, New Jersey 07632

Printed in the United States of America

10 9 8 7 6 5 4 3 2 1

ISBN: 0-02-418767-4

Prentice-Hall International (UK) Limited, *London*
Prentice-Hall of Australia Pty. Limited, *Sydney*
Prentice-Hall of Canada, Inc., *Toronto*
Prentice-Hall Hispanoamericana, S.A., *Mexico*
Prentice-Hall of India Private Limited, *New Delhi*
Prentice-Hall of Japan, Inc., *Tokyo*
Simon & Schuster Asia Pte. Ltd., *Singapore*
Editora Prentice-Hall do Brasil, Ltda., *Rio de Janeiro*

Part opening artwork courtesy of: Alias Research Inc., pp. 258, 524; Michael Miller, Head Spin Studio, p. 2; Lasergraphics LFR, p. 400; Reginald Wickham, pp. 3, 259, 401, 525.

Chapter opening artwork courtesy of: Alias Research Inc., pp. 48 (top); 494 (top, bottom); David E. Breen, p. 208 (bottom); Luz Bueno, p. 434 (bottom); Digital Equipment Corporation, pp. 123, 298 (top); Marjory Dressler, pp. 4 (middle), 48 (middle), 80 (middle), 122 (middle), 164 (middle), 208 (middle), 260 (middle), 298 (middle), 328 (middle), 370 (middle), 402 (middle), 434 (middle), 460 (middle), 494 (middle), 526 (middle); David S. Ebert, p. 208 (top); Michael Miller, Head Spin Studio, pp. 5, 49, 80 (top), 165, 209, 261, 299, 329, 371, 403, 435, 461, 495, 527; Lasergraphics LFR, pp. 4 (top), 80 (bottom), 164 (top), 260 (top), 328 (top, bottom), 370 (top, bottom), 402 (bottom), 434 (top), 526 (top, bottom); Marsha McDevitt, p. 122 (top); PIXAR, pp. 81, 260 (bottom), 460 (bottom); S.K. Robinson, K.C. Hu, P.R. Spalart, NASA Ames Research Center, p. 402 (top); Bob Sabiston, p. 122 (bottom); Time Arts, p. 48 (bottom); Reginald Wickham, p. 4 (bottom); John S. Willette/Emerald City, p. 164 (bottom).

Profile artwork courtesy of: Marjory Dressler.

Miscellaneous photos courtesy of: Albertson's, Inc., p. 141; Brooks Shoe, Inc., and Michigan State University, p. 359; Burlington Industries Inc., p. 93 (top, right); The Babcock and Wilcox Co., p. 362; Cobalt Productions/ Merrill, pp. 29, 93 (bottom, right); Daimler-Benz and Evans & Sutherland, p. 8; Honda America, Marysville, Ohio, p. 361; Honeywell, Inc., p. 363; International Business Machines Corp., p. 447 (bottom); Mattel Toys, p. 98; Gene Moore/Phototake/NYC, and Inset: Joseph Klemp and Richard Rotunno/National Center for Atmospheric Research, p. 34; National Semiconductor Co., p. 86 (bottom); Preston Lyon/Index Stock, Inc., p. 365 (top, left); Time Arts, p. 499 (bottom); TRW, Inc., p. 134.

For Laura and Eric, your love has brought true happiness and joy into my life

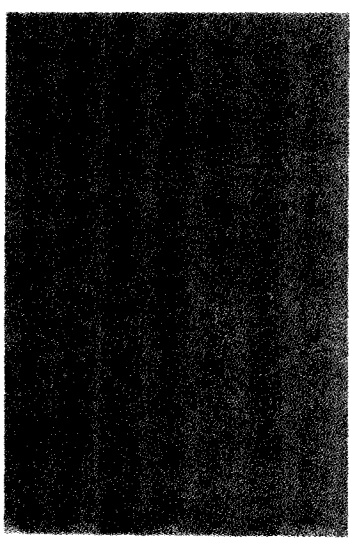
R. A. S.

For the truly meaningful part of my life, my wife Sue and children Paul, Stacy, and Michael

D. P. S.

For the Chip in my main memory and my dear Mother "bored"

D. M. P.



Preface

This textbook presents a thorough and nontechnical guide for the practical use of computers and information systems to acquire, manage, and use information that will be vital to your personal and professional lives. We'll look at how technology works and describe how that technology is applied. Current examples are found throughout this text to illustrate these applications. Because there is no consensus in the way that various instructors prefer to present this material, the book has been designed with a unique organization through the use of Infomodules (subchapters). This makes it possible to cover all the current, important topics, but allows the instructor to choose and order them.

Note to the Student

How does this book prepare you for the future? Using computers and information systems to achieve your information needs will be an important part of your professional and personal lives. Some experts think that if you do not know how to use a computer, you will be just as handicapped in performing your job as the person who cannot read.

It is important to be both information- and computer-literate. You must understand what information you need and how to use it effectively once you have acquired it. To remain competitive in today's computerized world, you also need to know how and where computers and information systems can be used to help you acquire the needed information. *Computers and Information Systems* is an interesting and informative guide on your journey to understanding the world of computers and information systems. If you intend to become a computer professional, this book gives you the broad-based background you need to pursue more advanced course work.

After you have completed this course, your book will remain a handy reference. When you select and purchase your own personal computer system, you can use the consumer information and checklists in the Infomodule "Buying and Caring for a Microcomputer System." The chapters on popular application packages will provide additional information when you are ready to evaluate and select your own software. The Infomodules that describe document and spreadsheet design as well as the creation of

business graphs and charts will be valuable references as you use these applications in your education and career. The primers on MS-DOS 6.0, Microsoft Windows 3.1 and SQL offer a solid foundation, allowing you to begin experimenting with and using these applications.

Although computers played an important role in the preparation of this text, so did a talented group of publishing professionals. Computers and people working together made this book possible.

Key Features of the Text

To present thorough coverage of concepts, hardware, software, computer systems, information systems, and related topics that educators have indicated are important, we have included these key features:

Unique organization through the use of subchapters called Infomodules, which allow for flexibility and expandability in structuring a course.

Readability at the appropriate level, and a conversational writing style to hold the student's interest.

Sound and effective pedagogy designed to facilitate student understanding and interest in the subject matter.

Current examples of computer applications that relate concepts to actual situations.

Comprehensive coverage which, beyond the usual core coverage, includes discussions of contemporary issues such as:

Information and its value

Ethics and legal issues

Artificial intelligence, neural networks, and virtual reality

Expert systems

Trends in technology, such as optoelectronics, parallel processing, and communication

Object-oriented programming language, object-oriented databases, and computer-assisted systems engineering (CASE)

Popular types of application software

Tips on document design, spreadsheet design, and business graph and chart design

Increasing use of communication technology

Thorough coverage of local-area networks

Increasing use of networks, commercial information services, and database services by professionals, organizations, businesses, and home users

Increasing home use of computers and helpful microcomputer and software buyers' tips

Career information about computer professions and about noncomputer professions that use computers

DOS 6.0, Windows 3.1, and SQL primers

International issues focusing on the current global nature of businesses and information systems

Written for everyone—not only introductory-level students who may be interested in continuing their study of computers and information systems as a career, but also for those who plan to pursue other career opportunities

Pedagogy

The following pedagogical devices were chosen with both student and instructor in mind:

Chapter objectives alert students and instructor to the major points or concepts to be gleaned from the chapter.

Chapter outlines preview chapter topics and organization so students can see the relationships among the topics covered.

Profiles acquaint students with people who have made major contributions to the Information Age.

Highlight boxes focus on current computer uses and issues.

Sidebars, placed in the margin near relevant text, reiterate key points and serve as memory joggers.

Summaries review major concepts in the chapter.

Vocabulary self-tests spotlight words that are important to understanding the material. These key words are boldfaced and defined in the text at their first usage and listed alphabetically at the end of the chapter or Infomodule with text page numbers for reference and review. They are also listed in the glossary.

Review questions check the student's understanding of the main topics in the chapter. They appear at the end of each chapter as a self-test comprised of about 30 questions.

Issues for thought encourage discussion and instill group participation in problem solving.

Infomodules provide significant coverage of special-interest topics. These subchapters (one per chapter) offer flexibility in structuring course content. Most include key terms in boldface as well as review questions.

Glossary, a handy reference at the end of the book, defines all of the key terms.

Index, a detailed guide to text and Infomodule topics.

Finally, full-color functional illustrations and more than 220 photographs clarify concepts, depict applications, and show equipment.

Expandability/Flexibility

The unique feature of this text is the series of subchapters called Infomodules. These enable instructors to modify courses by expanding or deleting topics according to time constraints and individual preference. The Infomodules present succinct but significant coverage of additional topics, such as ethics, crime and privacy, buying and caring for a microcomputer system, document design, spreadsheet design, hypertext and multimedia, creating business graphs and charts, among others. Infomodules include key terms and review questions so the material can be treated as separate chapters. If preferred, the material can be assigned as outside reading.

Organization

The text is divided into four parts:

- Part One (Chapters 1 through 6) is an overview of computing and computers.
- Part Two (Chapters 7 through 10) describes information system concepts.
- Part Three (Chapter 11 through 14) describes popular application software.
- Part Four (Chapter 15) examines international computing, trends in technology, and history of computers.

Here is a quick look at the topics discussed in each chapter and Infomodule.

Chapter 1, "Computers in Your World," introduces students to the concept of information, how it is created, managed, and used. It also introduces them to the powerful tools of computers and information systems used in the creation and management of information. The chapter provides examples of where computers are used and briefly explains how they work, what they can and cannot do, and the need to become computer and information literate. The **Infomodule, "Computer Ethics, Crime, and Privacy,"** defines ethics and looks at it in the context of corporate, individual, and government responsibility; it discusses crimes, legislation, and privacy issues.

Chapter 2, "The Processing Unit," overviews the internal design and operation of the processing unit. The chapter also explains data representation. The **Infomodule, "Number Systems,"** describes various number systems used to represent data, including the binary system used by computers.

Chapter 3, "Input," explains input concepts and describes devices, including those used for physically challenged users. The **Infomodule, "MS-DOS 6.0 Primer,"** provides an overview of the concepts and commands required to work with MS-DOS 6.0.

Chapter 4, "Output," explains output concepts and describes both hard and soft copy output devices; ports and device drivers are also covered. The **Infomodule, "Microsoft Windows 3.1 Primer,"** provides an overview of the concepts and commands required to work with Microsoft Windows 3.1.

Chapter 5, Secondary Storage," describes various secondary storage media and ways to organize and access data on these media; it addresses

common secondary storage problems and solutions. The **Infomodule, "Buying and Caring for a Microcomputer System,"** offers suggestions for selecting and purchasing hardware and software for a microcomputer system and gives helpful tips on maintaining and protecting systems and data.

Chapter 6, "Computer Software," describes systems and application software, emphasizing operating systems and their importance. The **Infomodule, "Developing Computer Programs,"** looks at different levels of computer programming languages; introduces the latest programming techniques, including object-oriented programming; and lists criteria for choosing a programming language.

Chapter 7, "Data Communication," explains what data communication is and how data are transferred from one computer to another. The chapter introduces computer networks and distributed data processing and covers some of the challenges presented by the use of data communications. The **Infomodule, "Putting Data Communication to Work for You,"** describes applications of data communications, including bulletin boards, electronic mail, facsimile, voice messaging, teleconferencing, commercial online services, and gateway services.

Chapter 8, "Local-Area Networks," provides detailed coverage of a technology gaining widespread use in business and describes the components and benefits of using LANs. The **Infomodule, "Microcomputer Communications,"** describes the uses and features of typical communications software.

Chapter 9, Information Systems and the System Development Life Cycle," defines information systems and describes the different levels of management—their information needs and the basic types of information systems used, the systems development life cycle, prototyping, and the use of computer-aided systems engineering (CASE) software. The **Infomodule, "Applications of Information Systems,"** examines the application of information systems in various functional areas of business and selected industries.

Chapter 10, "Files and Databases," describes the use of files and databases. It covers file management systems, database management systems, database models, and concerns about developing and managing a database. The **Infomodule, "A Structured Query Language (SQL) Primer,"** presents the basic SQL concepts and commands to build a foundation for further study for those individuals who will be required to access information from a database.

Chapter 11, "Document Preparation: Word Processing and Desktop Publishing Software," describes the uses and features of a typical word processor and examines the features and benefits of using desktop publishing. The **Infomodule, "Document Design,"** describes the elements to consider when designing a document for the effective communication of ideas.

Chapter 12, "Managing Data: Database Management Systems," describes the uses and features of a typical database management system. The **Infomodule, "Hypertext and Multimedia,"** looks at software that allow text, graphs, pictures, sound, and video to be combined into one application.

Chapter 13, "Manipulating Numeric Data: The Spreadsheet," describes the uses and features of a typical electronic spreadsheet. The

Infomodule, "Spreadsheet Design," prescribes some basic rules for designing effective spreadsheets.

Chapter 14, "Data Presentation and Graphics Software," features applications of typical graphics software. The **Infomodule, "Creating Business Graphs and Charts,"** describes factors to consider when creating graphs and the appropriate type of graphs and methods to convey particular information.

Chapter 15, "International Computing and Trends in Technology," looks at the increasing global use of computers and information systems in business and government, and examines some technological trends—chip technologies, neural networks, virtual reality, parallel processing, and optoelectronics. The **Infomodule, "A History of Computers,"** provides a summary of events, significant people, and their contributions throughout the history of computers and computing.

The Instructional Package

Instructor's Resource Manual contains chapter-by-chapter lecture outlines, answers to questions in the text, suggestions for using alternative instructional material, and a list of sources for additional reading.

Computerized Test Bank includes true/false, short answer, multiple choice, and fill-in questions. All questions are coded with the chapter or Infomodule number and organized by objective. This versatile test bank program allows the instructor to generate tests, edit existing questions, and add new questions.

Printed Test Bank is a hard-copy version of all questions in the computerized test bank.

Transparency Package consists of overhead transparencies that illustrate concepts presented in the text.

Electronic Transparency Package utilizing Powerpoint allows instructors to present transparencies in the classroom using their personal computer.

Data Diskettes are files that save keyboarding time for instructors and eliminate the possibility of introducing incorrect data during rekeyboarding.

Videotapes can be purchased by adopters of *Computers and Information Systems* directly from American Micro Media at a discounted rate:

"Electronic Words"—Word processing and microcomputers

"Keeping Track"—Database management and microcomputers

"Computer Calc"—Electronic spreadsheets and microcomputers

"Computer Talk"—Microcomputer communications

"Computer Images"—Computer graphics

ABC News/Prentice Hall Video Library, which consists of interviews, critical analyses, and network news reports drawn from the ABC news library, is available to instructors who adopt this book for their classes and have their bookstore order it from the publisher. The videos, chosen for their widespread applicability to business and their usefulness and appeal to students, draw on such ABC News programs as *Nightline, World News Tonight,* and *This Week With David Brinkley.*

The *New York Times* "Themes of the Times." Computers and information systems are constant themes in the news, both because of developments in the computer industry itself and because of the ways businesses use them on a day-to-day basis. To enhance access to important news items, the *New York Times* and Prentice Hall are sponsoring "Themes of the Times." Twice a year, Prentice Hall will deliver complimentary copies of a "mini newspaper" containing reprints of selected *Times* articles to instructors who use this book for their classes. "Themes of the Times" is an excellent way of keeping students abreast of the ever-changing world of computers and information systems.

Multimedia Toolkit. The CD-ROM package that accompanies *Computers and Information Systems* is designed to support the text through visuals, sound, and motion. More information is available from your PH sales representative.

Reviewers

We wish to thank the following people who reviewed the manuscript and provided thoughtful and helpful suggestions for this edition of *Computers and Information Systems:* Professor Bennett, Nashville State Technical Institute; Diane Delisio, Miami University; Richard Ender, University of Alaska; James Gatza, Insurance Institute of America; Robert Harris, Holmes Junior College; Richard Hatch, San Diego State University; Judy Ann Hill, Purdue University, Calumet; Sharon Hill, Prince George Community College; Carl Hommer, Purdue University; Sandy Juergens, Great Falls Vocational Technical Center; C. Kiklas, Anoka Ramsey Community College; Diane Larsan, Purdue University, Calumet; Chang-Yang Lin, Eastern Kentucky University; Mack Lundy, Trident Technical College; Ron Mummaw, Antelope Valley College; Jon Persavich, Kennebec Valley Vocational Technical College; Jerry Ralya; Al Schroeder, Richland College; Dorothy Smalley, Arizona Western College; Wanda Staggers, Anderson College; Ralph Szweda, Monroe Community College; Pat Tormey, University of Wisconsin, Madison; Marianne P. Vakalis, Western Michigan University; Lister Wayne, Pensicola Junior College; and Paul Wolotikin, State University of New York at Farmingdale.

Acknowledgments

Once again, we have had the pleasure of working with a very professional and friendly group of individuals throughout this endeavor. So many people were involved in the development, production, and creative aspects of this project that the list of names would go on and on. Special acknowledgment, however, goes to the professionals at Prentice Hall who provided support, enthusiasm, and helpful suggestions: P. J. Boardman, administrative editor; Christine Harrington, production editor; and Julia Zonneveld Van Hook, designer. Thanks also to Sheryl Rose for her fine copyediting.

Brief Contents

Contents