

# THE NATURE OF COMPUTERS

SECOND EDITION



JAMES A. O'BRIEN

# THE NATURE OF COMPUTERS

**Second Edition**

**James A. O'Brien**

**Northern Arizona University**



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and those who teach  
about the  
nature of computers  
and to Erika  
with love and light*

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# Preface

The nature of computer literacy and the courses designed to teach it continue to change. Dynamic developments in computer technology and applications have required us to rethink and retool the content and pedagogy of introductory computer education. The content, organization, and teaching methodology of just a few years ago no longer meet current student and industry needs. Today it is not enough to teach students about the most current software and hardware. Students must learn how problem-solving principles are enhanced by harnessing the power of the computer. Part of this instruction must prepare students to understand that change is a constant in the world of computers. It is not enough for students to learn the keystrokes of a spreadsheet program, they must also learn the principles of how spreadsheet programs can solve business problems. It is not sufficient for students to learn a finite set of definitions and protocol, they must learn to think as end users of computer tools that change as quickly as do current events. This is the premise on which both the first and second editions of *The Nature of Computers* were written.

So many current textbooks are simply updated “introduction to data processing” texts, enhanced with coverage of microcomputer technology, productivity software, and other recent technological advancements. Many textbooks include far too many chapters on the details of computer hardware, programming languages, file and database processing, traditional systems development, and BASIC programming. Others resemble updated “computers and society” texts overflowing with so many topical items that it is difficult for students to read and comprehend the fundamental conceptual content of each chapter. Still others are simply enhanced software lab manuals whose conceptual content is replaced by their cookbook, hands-on content. Few of these approaches meet the educational needs of the majority of today’s students. Most students will be end users in the workplace and in society—no matter what their majors are or what their careers will be.



## A New Generation

Today's students need a new generation of computer literacy textbooks. The goal of the many instructors and Dryden Press specialists who have worked with me to produce this book has been to meet this growing need. I think we have succeeded in *The Nature of Computers*—we have developed a textbook that

- Truly uses an end user orientation in its organization and presentation.
- Effectively and personally introduces students to computing concepts and applications.
- Uses simple models and examples to illustrate the components of computer systems and information systems.
- Organizes its content into twelve nontraditional chapters that reflect changing technology and end user computing needs.
- Integrates coverage of the major functions of both system and application software packages.

*The Nature of Computers* represents an innovative, flexible, and “right-sized” new generation of computer literacy textbooks. It can be used as a stand-alone concepts text, or it can be paired with one or more of the many software-specific lab manuals available through the Dryden Press's EXACT custom publishing program. The text is written for the general end user of any academic major; it features up-to-date coverage of technical developments and examples of real-world end user applications, and it stresses ethical issues in each chapter that are directly related to the chapter's contents.

## Modular Organization

The twelve chapters of this book are organized into four parts. After covering the material in “Part I: Foundations” the other three parts (“Part II: Software,” “Part III: Hardware,” and “Part IV: Applications and Issues”) can be covered in any order, depending on the teaching preferences of the instructor.

The text also contains a Viewpoints section at the end of each part. Viewpoints use photo essays and text to dramatize “Computers in the Real World,” “The World of Computer Graphics,” “An End User's Guide to Computer Selection,” and “Computers Past and Future.” An appendix entitled “Computer Codes and Number Systems,” a glossary, and an in-depth index complete the book.

## Chapter Components

Each chapter begins with an outline and learning objectives; and each ends with an end note; a summary; key terms and concepts; a review quiz of true/false, multiple-choice, and fill-in questions; questions for thought and discussion; and review quiz answers. Each chapter also contains three brief Real-World Examples that illustrate how the chapter's topics apply to real people and organizations in today's workplace. Finally, each chapter features a section entitled Ethics that challenges students to think about ethical issues related to the chapter's contents.

**Part I: Foundations** The first two chapters of the text serve as a *core module* of foundation concepts on computer hardware, software, and information systems. This enables instructors to cover the chapters of the remaining modules in any order that supports their instructional preferences. Chapter 1 introduces students to basic concepts of computers, their hardware, software, and capabilities, and a few key issues that affect end users working in a global information society. Chapter 2 introduces students to the basic components and types of information systems in the real world and discusses the importance of career and ethical issues in information systems.

**Part II: Software** The four chapters of Part II cover software and its use in a variety of important end user applications such as office automation, desktop publishing, electronic spreadsheets, expert systems, and database management. This approach differs from others, which cover major types of software packages with only brief generic descriptions or detailed hands-on tutorials. This module is also placed early in the text to provide chapters on software concepts and applications, which supports early hands-on instruction and assignments using software-specific tutorial lab manuals.

Chapter 3 covers operating systems and other system software concepts and issues important to end users. Chapter 4 focuses on office automation software and applications, especially their use for word processing, desktop publishing, computer graphics, electronic mail, and office management. Chapter 5 focuses on decision-support software and applications, including electronic spreadsheets, what-if analysis, integrated packages, and expert systems. Finally, Chapter 6 covers database management software and its use for database development, information retrieval, and report generation. Personal information managers, text and image databases, and hypertext and hypermedia applications are also discussed in this chapter.

**Part III: Hardware** The three chapters of Part III cover computer systems, peripherals, and telecommunications topics in more detail but from an end user perspective. Part III can be assigned before Part II if instructors prefer to discuss hardware concepts before covering software topics. Chapter 7 stresses the importance of major types of computer systems and also covers other computer concepts such as how computers execute instructions and represent data. Chapter 8 surveys the many types of peripheral devices used for input, output, and storage by end users. Chapter 9 discusses telecommunications network resources as well as many other important telecommunications topics end users should know.

**Part IV: Applications and Issues** The three chapters of Part IV cover topics in application development by end users, computer applications in the workplace, and security and societal issues. Chapter 10 introduces students to application development from an end user perspective and covers related topics such as computer-aided development, prototyping, programming, and programming languages. Chapter 11 introduces a variety of computer applications in the workplace including applications in business, management, manufacturing, engineering and design, health care, and government. Chapter 11 includes a discussion of issues involved in managing end user and organizational computing in the workplace. Finally, Chapter 12 presents a lively

discussion of computer crime and security, the impact of computers on society, and privacy, health, and ethical issues in computing.

## New to the Second Edition

**Software Coverage** New and expanded coverage in Part II, “Software,” includes sections on Windows and Windows NT, planning for word processing, designing spreadsheet applications, and using database management packages.

**Hardware Coverage** Chapter 7, “Computer Systems: Machines for End User and Organizational Computing,” has been reorganized for better flow. The chapter now includes a Technical Note on how computers work that gives an explanation of how computers execute instructions. This material is optional for those instructors who do not wish to cover it.

**Telecommunications Coverage** A new section on the Internet and the Information Superhighway has been added to Chapter 9, “Telecommunications Networks: Sharing Information and Computing Resources.” This chapter has also been reorganized and includes a Technical Note on communications alternatives, covering such topics as transmission speeds, single versus multiple transmissions of data, and switching and access methods.

**Quick Quizzes** Each chapter now has three self-test quizzes appearing after major sections within the chapter to help students check their reading comprehension. Answers are provided at the end of each quiz.

**What Do You Think? Questions** These thought-provoking questions at the end of each Ethics box give students the opportunity to apply the material on ethics to their own lives.

**Currency** Many of the Real-World Examples, photos, and technical material have been replaced with new, up-to-date examples.

## Support Materials

*The Nature of Computers* is accompanied by an impressive supplement package worthy of a new-generation computer textbook. The various components utilize current software technology and new learning techniques, which together provide an integrated, innovative set of teaching tools.

**Instructor’s Manual** The *Instructor’s Manual*, by Harvey Kaye of the City College of CUNY, utilizes an innovative learning methodology called *Integrated Skills Reinforcement*. Each chapter of the *Instructor’s Manual* not only includes detailed lecture notes, a list of key terms, and teaching suggestions, but also includes exercises that enhance students’ basic reading, writing, listening, and speaking skills while reinforcing the text’s contents. Also included is a section on how to assign and evaluate student writing and collaborative activities.

**Study Guide** The *Study Guide*, by Denis Titchenell of Los Angeles Community College, provides chapter summaries that include definitions of all key

terms, additional questions for students to use in quizzing themselves on the text material, and numerous experiential exercises to enhance their learning experiences.

**Information Systems Interactive Tutorial** This tutorial software, available for IBM-compatible computers on 3.5-inch diskettes, helps students review important concepts presented in classroom lectures. The program addresses the four major components of computers: hardware, software, systems, and computers in society. Each learning module has three parts: a content section, a practice section that includes a brief review of the concepts followed by multiple-choice questions, and a Flash Card Review that allows the student to make a “flash card” of any particular content screen for easy review. The flash card section lets the student review all the flash cards created for the module.

Other features include a notepad function, allowing students to take notes that they can print as hard copy, “hot” words that when double-clicked give a definition, and a pretest and final test that can be used by the instructor for tracking purposes.

**LectureActive Software with Laserdisc** This package, featuring a laserdisc and software, is notable for its ease of use and time savings in creating vivid classroom presentations. The laserdisc includes video segments from CBS News and CSTV, hundreds of full-color electronic transparencies, and bulleted lecture outlines of the text for display in the classroom.

The laserdisc is driven by LectureActive, a user-friendly software program that lets the instructor create custom lectures swiftly and simply. A browse function helps the instructor search through the hundreds of stills and nearly 58 minutes of motion-video entries on the laserdisc. Once any video segment or still has been selected, the instructor can choose to attach the visual material to a lecture notecard on the computer screen. Instructors can use existing notecard prompts, editing or revising as needed, or create their own. Lecture notes from other sources can be brought over to the notecard lectures, so previous work is not lost. LectureActive is available for both Microsoft Windows and Macintosh platforms.

**Transparencies and Testbook** More than 100 four-color overhead *Transparencies* are also available. A *Testbook* by Charles Beard of Blinn College includes more than 2,500 true/false, multiple-choice, and fill-in questions that are rated by type and difficulty. *Computerized Testbanks* by EXAMASTER are available in both 3.5-inch and 5.25-inch DOS, Windows, and Macintosh formats.

**Videos** The 1995 Information Systems Video Series is currently available to adopters. This series, produced by Beverly Amer of Northern Arizona University, has been custom-developed specifically for classroom use. The series includes 14 videos ranging from 8 to 14 minutes in length. This informative, thought-provoking new series contains segments on the use of information technology in a variety of businesses such as United Parcel Service, Dell Computer Corporation, Alamo Rent A Car, and The Seagram Company. Accompanying the series is a detailed instructor’s guide. Ask your Dryden Press sales representative for details on adoption criteria.

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James A. O'Brien





## About the Author



James A. O'Brien is a professor of computer information systems at Northern Arizona University. He completed his undergraduate studies at the University of Hawaii and Gonzaga University and earned an M.S. and Ph.D. in business administration from the University of Oregon. He has been coordinator of the computer information systems area at Northern Arizona University, professor of finance and management information systems and chairman of the department of management at Eastern Washington University, and a visiting professor at the University of Alberta and the University of Hawaii.

Dr. O'Brien's business experience includes the Marketing Management Program of the IBM Corporation and General Electric's Financial Management Program. He spent several years as a financial analyst for the General Electric Company. He has also served as an information systems consultant to several banks and computer services firms.

Dr. O'Brien has written eight books, including several that have been translated into Dutch, French, and Japanese. He has contributed to a wide variety of business and academic journals and participates actively in academic and industry associations in information systems.





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