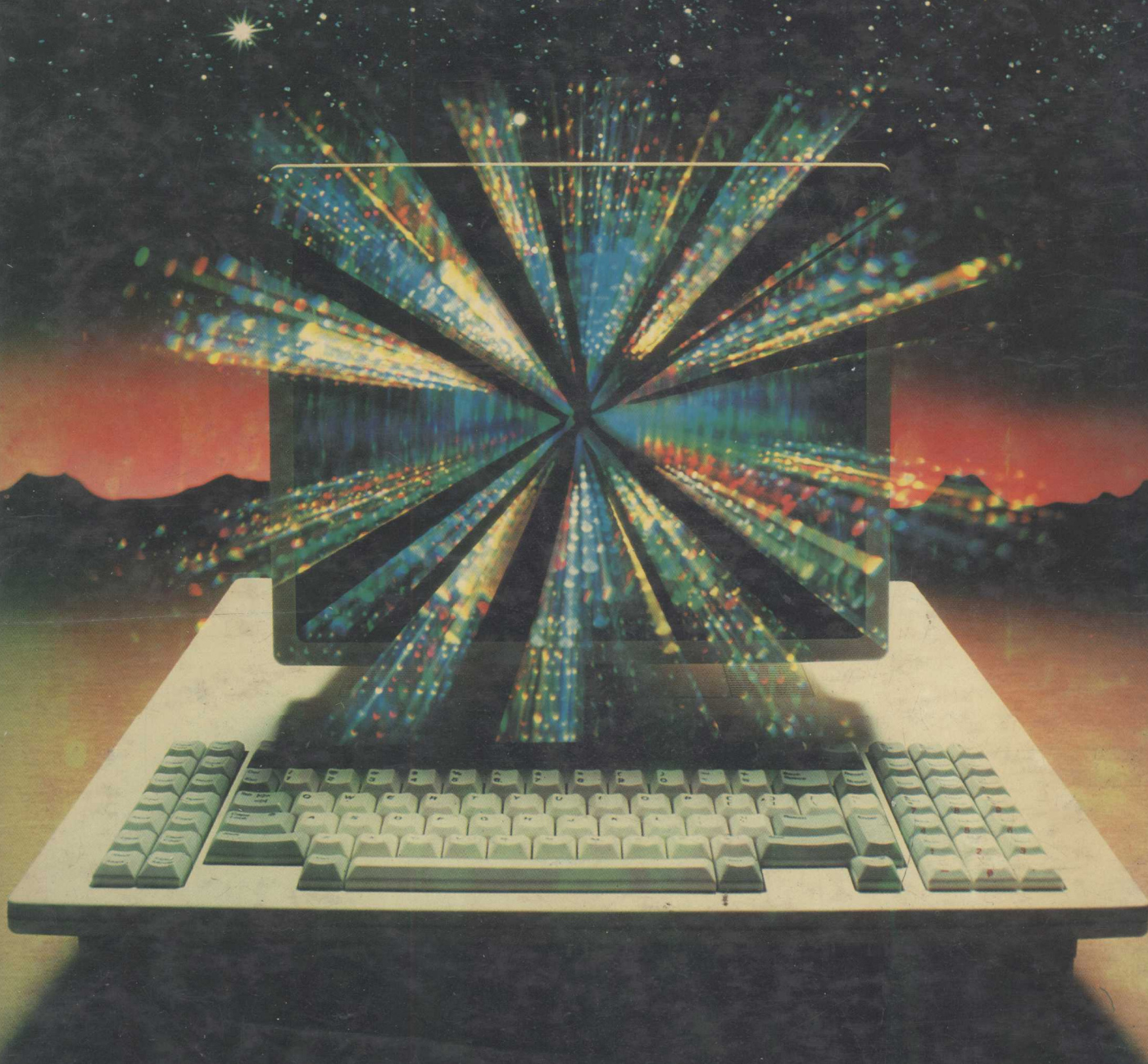


Introduction to Computers and Information Systems

Thomas H. Athey
Robert W. Zmud.



TP274
A 869

8062490

4+2

贈閱

9062490



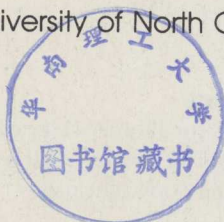
Introduction to Computers and Information Systems

Thomas H. Athey

California State Polytechnic University at Pomona

Robert W. Zmud

The University of North Carolina at Chapel Hill



The Foundation for Books to China

美国友好书刊基金会



E9062490

Scott, Foresman and Company

Glenview, Illinois

London, England

A Study Guide to Accompany Introduction to Computers and Information Systems has been prepared to help you master the concepts discussed in your text. The *Guide* contains chapter summaries, detailed annotated chapter outlines, drill sections made up of multiple-choice, true/false, fill-in-the-blank, matching, and essay questions, as well as practice tests made up of true/false and multiple-choice questions. Page-referenced answers are provided for all questions. If the *Guide* (ISBN 0-673-18168-5) is not available in your bookstore, your bookstore manager will be able to order it for you.

Acknowledgments

Acknowledgments for literary selections, charts and graphs, illustrations, and photographs appear in a section at the back of the book beginning on page R-1, an extension of the copyright page.

Copyright © 1986 Scott, Foresman and Company.

All Rights Reserved.

Printed in the United States of America.

Library of Congress Cataloging-in-Publication Data

Athey, Thomas H.

Introduction to computers and information systems.

Bibliography: p. R-5

Includes index.

1. Computers 2. Information storage and retrieval systems. I. Zmud, Robert W., 1946-

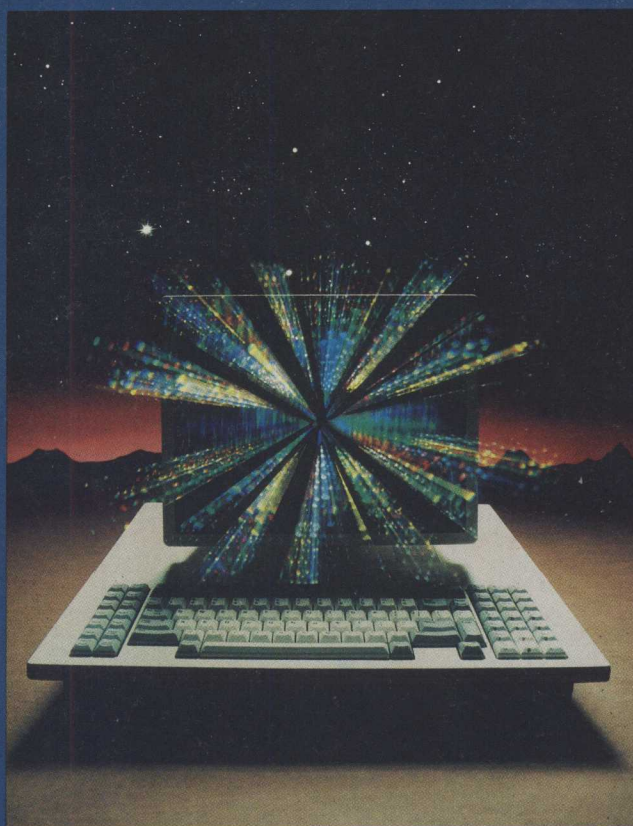
II. Title. QA76.A8423 1986 004 85-22064

ISBN 0-673-15961-2

12345-VHJ-9089888786



Introduction to
Computers and Information Systems



The Scott, Foresman Series in
Computers and Information Systems

Thomas H. Athey, Consulting Editor

Athey and Zmud

INTRODUCTION TO COMPUTERS AND INFORMATION SYSTEMS

Day

MICROCOMPUTERS IN BUSINESS

Pierson and Horn

STRUCTURED COBOL PROGRAMMING

Tom

MANAGING INFORMATION RESOURCES

Zmud

INFORMATION SYSTEMS IN ORGANIZATIONS

Zmud and Eagle Software, Inc.

BASIC PROGRAMMING

PREFACE

In this, the Information Age, educators are finding it increasingly easy to convince students they should learn about computers. Indeed, the demand for this knowledge is growing almost as fast as the number of computer products and applications. It is not so easy to decide what—or how—to teach these students. Many textbooks focus on the “what”—computers and information systems in and of themselves. We call this the “computer literacy” approach and feel that it neglects the “why”—the reasons we use computers.

We wanted to write a book that was different. Both of us feel a strong conviction that today’s students need *computing literacy*, the ability to use the computer as a tool to enrich their personal and professional lives. As computers become more common, the likelihood increases that students will need to understand and use computers in their careers, even if they do not become computer professionals. Like many employees, they may someday find themselves on a steering committee charged with developing or evaluating a computer application.

Our goal in this book is to help students become good consumers of computer technology and information systems. This goal is expressed in three major ways.

1. *Understandable depth.* First, we made a commitment to present each topic in understandable depth. This means that we are careful to focus on the information that students need to be able to understand how and why computers and information systems can be used to simplify and improve our lives. This does not mean that we avoid technical detail or ignore recent advances, however. As required by today’s computing environment, we explain the workings of the most recent technological advances, including pointing devices, flat-panel displays, local area networks, and the Fifth Generation Computing Project. We are careful, though, to highlight trends and show students what these technologies mean to the users of computers and information systems.

2. *Integration of technology and its applications.* We also made a commitment to focus on applications and to explain how technology affects our use of computers. Thus, every major discussion of technology is illustrated by an application. This deliberate integration can also be seen in the section entitled “Special Feature: A Systems Approach to Selecting a Microcomputer,” which shows students how to apply systems development techniques to their own computer-selection decisions.

3. *Focus on the microcomputer.* Microcomputer systems are used in almost every chapter to illustrate and explain concepts that are relevant to our discussion of larger systems. In addition, “Special Feature: A Systems Approach to Selecting a Microcomputer” offers practical advice for students contemplating the purchase of a microcomputer. We chose this strategy for two reasons. First, the importance of the microcomputer in today’s business world is undeniable. Second, the microcomputer is probably the first computer students will use, either at home or in the micro lab at school. For many students, the micro is a convenient way to get hands-on experience—something we feel is important in helping students understand computers and information systems.

We also developed some recurring features to help us meet our goal.

"Professional Issue" sections within chapters address concerns that will affect students as business professionals and provide further insight into a variety of issues. Computing literacy, computer classification, the human-computer interface, printer selection, local area networks, fitting microcomputers into an MIS plan, cultivating the human touch in systems development, promoting and managing end-user computing, and telecommuting are some of the topics discussed.

"Computers at Work" features in each chapter excerpt articles from business and computer magazines that show the varied, real-world uses computers in product inventory, motel reservations, talent agency bookings, film, telecommunications, medicine, product design, and the music industry.

Full-color illustrations explain and clarify both technical processes and business procedures. We also feel that color photographs of computer applications are most useful when integrated within the text, rather than grouped in isolated collages. Thus, the text features a functional, as well as attractive, illustration program that is interwoven with the text.

In addition, we have provided a number of study aids to reinforce important text concepts, such as chapter outlines, bold-faced key terms, detailed chapter summaries with key terms reviewed in context, end-of-chapter review questions, and a bibliography of sources for further reading. Our text is also offered in two versions: one with extensive appendices on BASIC programming and one without these appendices.

THE SUPPLEMENT PROGRAM

We were also aware that a good book alone is not enough, given the demands of today's teaching environment. Understanding computers and information systems can be challenging for both instructor and student. Instructors must keep abreast of developments and trends, as well as offer students opportunities for hands-on experience through computer exercises that reflect real-world applications. Thus, our text provides a full range of supplements, designed to meet the needs of both instructors and students. These supplements include innovative software teaching aids, outstanding paper-based supplements, and the *CIS Profiles in Excellence* newsletter that showcases outstanding CIS programs around the nation.

Innovative Software Teaching Aids

1. The Scott, Foresman Electronic Bulletin Board is an online resource designed to meet the dynamic and diverse needs of data processing and information systems instructors nationwide. The Bulletin Board offers the following features to users of this text:

- regularly updated information on computer technology and its application to business information systems;

- an electronic mail and message system to allow instructors to leave messages for and interact with other instructors as well as Scott, Foresman marketing and editorial personnel; and

- file transfer capabilities. Files available for transfer from the Bulletin Board to your computer include the following:

—fully functioning and documented spreadsheet, word processing, and data base management software for the IBM PC, as well as a variety of utilities and games

—class-tested assignments, exercises, problems, and applications for major software packages such as Lotus 1-2-3, VisiCalc/SuperCalc, DBase II and III, etc.

—BASIC programming assignments and exercises for the IBM PC, along with solutions

—additional teaching material for both the classroom and the microcomputer lab

The Scott, Foresman Electronic Bulletin Board is a resource designed to grow and become more useful with time. We encourage instructors to use the Electronic Bulletin Board to exchange ideas and to share successful teaching strategies and materials by uploading their own teaching materials into the Bulletin Board. The Bulletin Board will support baud rates up to 2400 and can be accessed by any computer. For instructors' convenience, microlab exercises and assignments, as well as spreadsheet, word processing, data base management, and telecommunications software, will also be made available on diskettes upon request.

2. A complete, interactive BASIC programming tutorial for the IBM PC, *BASIC Programming* by Robert W. Zmud, with the PC-Professor software tutorial by Eagle Software, Inc., features the most sophisticated and useful BASIC programming educational software available, along with a 128-page text on BASIC programming reprinted from the text and referenced to corresponding lessons in the software tutorial.

3. For the Apple IIe and IIc, an integrated spreadsheet, word processing, and data base management software package, available Spring 1986.

4. A revolutionary new electronic classroom management system, DIPLOMA, consists of four programs that assist instructors in testing, grading, and course management. DIPLOMA operates on IBM, Apple IIe and IIc, and compatible microcomputers.

EXAM provides almost 2000 true/false and multiple-choice questions keyed to our text. In addition, EXAM lets you create and edit questions, allowing you to develop personalized test files. EXAM accommodates an unlimited number of multiple-choice, true/false, matching, and short-answer/essay questions. Fourteen test-printing options can be used to leave space for figures or graphs, set margins, minimize page count, insert page headings, number pages, scramble questions and/or answers, generate answer keys, and provide student answer sheets.

GRADEBOOK, an electronic grade book, provides a work area that looks like the familiar grid of traditional paper grade books. In addition, GRADEBOOK offers these four advantages: (1) Student records can be located by name or ID number and can be sorted using combinations of four sorting options. In addition, comments about students, tests, or classes can be entered. (2) GRADEBOOK automatically calculates running averages for both students and tests and can be tailored to display letter grades, percentage averages, GPA, or points earned. (3) Tests can be given independent weights and curved using a variety of options. The program automatically generates and displays a test's bell curve during curving operations. (4) Graphic report screens monitor the effectiveness of a test or a student's progress.

STUDY GUIDE allows students to take tests generated by EXAM at a computer. As with tests given on paper, students can browse, skip difficult ques-

tions, and review or alter their answers. Upon completion, STUDY GUIDE will grade each test and present results in the form of graphs that depict overall performance, as well as performance by subtopic.

CALENDAR is a free-form scheduling tool that allows instructors to enter up to nine events or messages for any particular date. Messages can be easily entered, edited, saved, and displayed, while a transfer feature allows recurring events to be entered for several dates without retyping. The program can be set up to automatically load and save information.

Paper-Based Supplements

5. An Exercise/Case Book, *Microcomputers in Business: Spreadsheet, Word Processing, and Data Base Management Systems*, by John Day, Ohio University, was designed for use as a microcomputer lab manual. Through business-oriented problems and assignments, students learn how to use the microcomputer as a business tool. Unlike other lab manuals, *Microcomputers in Business* contains general problem descriptions and can be used with any available hardware and software.

6. Instructor's Manual provides an overview and summary of each text chapter, as well as lecture outlines, ideas for lecture and discussion, answers to in-text review questions, class projects and activities, additional essay and review questions, and abstracts from popular and academic literature.

7. Test File contains approximately 2000 questions, 30 true/false and 70 multiple-choice items for each chapter. These same questions are available through the DIPLOMA class management software.

8. One hundred full-color **Transparency Acetates** plus an additional fifty **Transparency Masters** have been prepared to enhance classroom lectures.

9. Study Guide includes chapter summaries, detailed annotated chapter outlines, drill sections made up of multiple-choice, true/false, fill-in-the-blank, matching, and essay questions, as well as practice tests made up of true/false and multiple-choice questions. Page-referenced answers are provided for all questions.

A Newsletter to Keep You Informed

10. The Scott, Foresman CIS Profiles in Excellence Newsletter, published three times annually, showcases outstanding CIS programs in two-year, undergraduate, and graduate schools around the nation, allowing readers to see how their colleagues have coped with the challenges of establishing curricula, developing courses, choosing hardware and software, and obtaining the funding for such programs.

ACKNOWLEDGMENTS

To Our Publisher and Family

It is a rare experience for authors to work with a team of professionals who are committed to excellence in everything that they do. We were privileged to become part of the Scott Foresman team.

Our appreciation goes to the top management of Scott, Foresman—to Jim Levy, Senior Vice-President and General Manager, College Division, Dick Welna, Vice-President and Editor-in-Chief, and Jim Sitlington, Editorial Vice-President, Business and Economics. From the beginning, they shared our commitment to create a new type of introductory text and provided the people and money to support our effort.

We must also thank: Jim Boyd, Acquisitions Editor in Computer Information Systems, whose innovativeness and charm enabled him to orchestrate the overall project; Linda Muterspaugh, Developmental Editor, who worked beyond the call of duty to make certain text explanations were integrated and clear; Elizabeth Fresen, Project Editor, who did the copy editing and kept smiling while keeping track of a million details; Barbara Schneider, Art Director, who created a stunning design and clear and attractive illustrations; and Cheryl Kucharzak, Picture Researcher, who found the perfect photos to clarify our concepts.

But, most important, Tom Athey had the understanding and support of his wife, Nancy, and children, Tim, Jay, and Carol, and Bob Zmud had the understanding and support of his wife, Jo Anne, and children, Danny and Jana. Their contributions were invaluable.

To Our Colleagues

We owe a special debt to the many colleagues who reviewed our manuscript and gave us valuable feedback. Special thanks must go to Kate Kaiser, University of Wisconsin at Milwaukee, for her contribution to the "Special Feature: A Systems Approach to Selecting a Microcomputer," to Robert F. Zant for his excellent technical comments, and to James Wynne and Fred Scott for their insightful comments on content. To all our reviewers, we extend our gratitude.

James Adair	<i>Bentley College</i>
Virginia Bender	<i>William Rainey Harper College</i>
Kathy Blicharz	<i>Pima Community College</i>
James Buxton	<i>Tidewater Community College</i>
Frank E. Cable	<i>Pennsylvania State University</i>
Mary J. Culnan	<i>University of California, Berkeley</i>
M. H. Goldberg	<i>Pace University</i>
Jean Margaret Hynes	<i>University of Illinois, Chicago</i>
Durward P. Jackson	<i>California State University, Los Angeles</i>
Richard Kapperman	<i>El Camino College</i>
James Kasum	<i>University of Wisconsin, Milwaukee</i>
James Kho	<i>California State University, Sacramento</i>

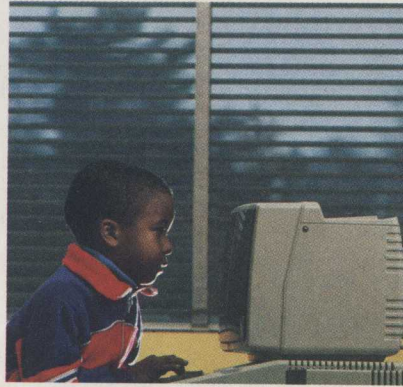
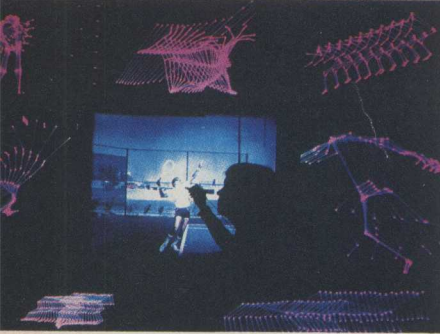
Lyle Langlois	<i>Glendale Community College</i>
Jeffrey I. Mock	<i>Diablo Valley College</i>
Christopher W. Pidgeon	<i>California State Polytechnic University</i>
Janet Pipkin	<i>University of South Florida</i>
Leonard Presby	<i>William Patterson College</i>
Herbert F. Rebhun	<i>University of Houston</i>
Leonard C. Schwab	<i>California State University, Hayward</i>
Fred Scott	<i>Broward Community College</i>
Sumit Sircar	<i>University of Texas, Arlington</i>
Vince Skudrna	<i>Baruch College (CUNY)</i>
Glenn Smith	<i>James Madison University</i>
Bob Tesch	<i>Northeast Louisiana University</i>
James Wynne	<i>Virginia Commonwealth University</i>
Robert F. Zant	<i>North Texas State University</i>

Thomas H. Athey

Robert W. Zmud

CONTENTS

PART I THE INFORMATION SOCIETY



CHAPTER 1

Welcome to the Information Society 1

PROFESSIONAL ISSUE Computing Literacy in an Information Society 3

Computing, Not Computer, Literacy

The Purpose of This Text

WHAT A COMPUTER IS 10

Hardware

Software

People

WHAT A COMPUTER DOES 15

Inputs Data

Processes Data

Stores and Retrieves Data and Information

Outputs Information

Summarizing the Computer's Basic Capabilities

COMPUTERS AT WORK

PCs Polish a PR Firm's Image 2

Super-Smart Cars 6

Thumbs Up for Hands-On 11

The Automated Agent Helps Performers Get Gigs 25

CHAPTER 2

Computers in Business 29

WHY BUSINESS COMPUTER USE IS GROWING 31

Advances in Computer Systems

Progress in Achieving Computing Literacy

OVERVIEW

PART I THE INFORMATION SOCIETY

- Chapter 1 Welcome to the Information Society
- Chapter 2 Computers in Business

PART II COMPUTER SYSTEM HARDWARE

- Chapter 3 The Central Processing Unit
- Chapter 4 Input
- Chapter 5 Output
- Chapter 6 Secondary Storage

PART III SYSTEM SUPPORT SOFTWARE

- Chapter 7 Operating Systems
- Chapter 8 File and Data Base Systems
- Chapter 9 Data Communications

PART IV COMPUTER-BASED INFORMATION SYSTEMS

- Chapter 10 Management Information Systems
- Chapter 11 Systems Development I
- Chapter 12 Systems Development II
- Special Feature
- A Systems Approach to Selecting a Microcomputer

PART V APPLICATIONS SOFTWARE

- Chapter 13 Program Development
- Chapter 14 Programming Languages
- Chapter 15 Application Development Without Programmers

PART VI COMPUTERS AND SOCIETY

- Chapter 16 The Information Age Society
- Chapter 17 Issues and Concerns
- Chapter 18 The Computer and Information Industry

PART VII APPENDICES

- Appendix A The History of the Computer
- Appendix B Arithmetic Operations and Number Systems

COMPUTERS IN BUSINESS 35

- What Doing Business Involves
- How Business Uses Computers
- How Information Systems Interact

PERSONAL COMPUTING IN BUSINESS 43

- Electronic Spreadsheets
- Word Processing
- Business Graphics
- File Management
- Communications Software
- Integrated Software Packages

PROFESSIONAL ISSUE Deciding When Computers Should Be Used 49

- Analyzing the Task
- Weighing the Benefits and Costs

COMPUTERS AT WORK

- Computers Keep Details Clean and Colorful 30
- From Bigger to Better 35
- Keeping "Fun" in Stock 38
- PC Support for Transportation-Technology Managers 47
- For McKesson, Computers Are the Magic in Profit Margins 53

PART II COMPUTER SYSTEM HARDWARE

CHAPTER 3

The Central Processing Unit 57

THE PROBLEM-SOLVING PROCESS 59

THE COMPUTER AT WORK 62

- Computer Processing Overview
- The CPU and the Machine Cycle

CODING DATA AND INSTRUCTIONS FOR COMPUTER USE 68

- The Binary Number System
- Data Encoding Schemes
- Instruction Encoding
- Binary Arithmetic-Logic Operations

MICROCOMPUTER ARCHITECTURE 71

- Semiconductor Chip Technology
- Primary Memory Chips



Microprocessor Chips
Support Units

PROFESSIONAL ISSUE Understanding Computer Classification 75

Computer Power
Evolutionary Path
Future Performance Increases

COMPUTERS AT WORK

Computerizing the Olympic Games 58
Supercomputers Make Way for Teams of Micros 82

CHAPTER 4

Input 85

THE DATA ENTRY PROCESS 87

Batch Processing Examples
Transaction Processing Examples

KEY-TO-MEDIA DEVICES 93

SOURCE DATA AUTOMATION DEVICES 94

Optical Character Recognition
Magnetic Ink Character Recognition
Voice Recognition

COMPUTER TERMINALS 100

Special Function Terminals
General-Purpose Terminals

PROFESSIONAL ISSUE Human-Computer Interface 107

Keyboard
Alternatives to the Keyboard

COMPUTERS AT WORK

Ramada Inn Uses Personal Computers to Take Reservations 86
Hand-Held Computers Speed Service Reports 113

CHAPTER 5

Output 117

CLASSIFYING COMPUTER OUTPUT 119

VISUAL DISPLAY DEVICES 122

Cathode-Ray Tube Displays
Flat-Panel Displays

PRINT AND FILM DEVICES 130

Alphanumeric Printers
Graphics Printers and Plotters
Computer Output Microform

SPEECH SYNTHESIS DEVICES 138

PROFESSIONAL ISSUE Printer Selection Criteria 140

COMPUTERS AT WORK

Stevie Wonder: Computers Are Changing His Life 118
Filming by Computer 144

CHAPTER 6

Secondary Storage 147

CLASSIFYING COMPUTER STORAGE 149

- Volatile Versus Nonvolatile Storage
- Sequential-Access Versus Direct-Access Storage
- Fixed Versus Removable Storage

DIRECT-ACCESS STORAGE DEVICES 153

- Magnetic Disks
- Optical Disks
- Bubble Memory

SEQUENTIAL-ACCESS STORAGE DEVICES 162

- Magnetic Tape
- Cartridge and Cassette Tapes

MASS STORAGE DEVICES 164

PROFESSIONAL ISSUE The Memory Hierarchy 165

- The Traditional Memory Hierarchy
- Storage Trends

COMPUTERS AT WORK

- Putting Intelligence In Your Wallet 148
- Whence the Name Winchester 160
- Resuscitation on Videodisc 170

PART III SYSTEM SUPPORT SOFTWARE

CHAPTER 7

Operating Systems 173

THE ROLE OF SYSTEM SOFTWARE 175

- System Software Functions
- How Operating Systems Differ

OPERATING SYSTEM FUNCTIONS 180

- Master Control
- Resource Management
- Monitoring Activities

TYPES OF OPERATING SYSTEMS 189

- Single Program
- Multiprogramming
- Time-Sharing
- Multiprocessors
- Virtual Machines

PROFESSIONAL ISSUE Microcomputer Operating Systems 193

- De facto Standard Operating Systems
- Software Portability



COMPUTERS AT WORK

- Microsoft's Drive to Dominate Software 174
- Why Software Won't Run on All PC Clones 196

CHAPTER 8

File and Data Base Systems 199

THE ROLE OF DATA MANAGEMENT SOFTWARE 201

FILE SYSTEMS 205

- File Organization and Access Methods
- Sharing Files

DATA BASE MANAGEMENT SYSTEMS 212

- Logical Versus Physical Views
- Data Base Organization Models
- Data Base Administration

THE DBMS IN ACTION 218

- Relational MicroDBMS
- Accessing the Data Base

PROFESSIONAL ISSUE File Systems Versus Data Base Management Systems 222

COMPUTERS AT WORK

- Junkyards Aren't So Junky Anymore 200
- The PC Moves into Real Estate 225

CHAPTER 9

Data Communications 229

DATA COMMUNICATIONS FUNDAMENTALS 231

- External Data Paths
- Interface Units

TELECOMMUNICATION FUNDAMENTALS 234

- Carrier Signals
- Data Packets
- Communication Channels

TELECOMMUNICATION NETWORKS 241

- Telephone Network
- Transmission Media
- Telephone Voice Network Alternatives

PROFESSIONAL ISSUE Local Area Network 246

- Topology
- Network Access
- Transmission Media
- LAN Characteristics
- Connecting Networks

ROLE OF COMMUNICATION SUPPORT SOFTWARE 251

COMPUTERS AT WORK

- Data Communication Aids Ohio Police in Doing Their Jobs 230
- Federal Express Spends Millions for Its Telecommunications Networks 255