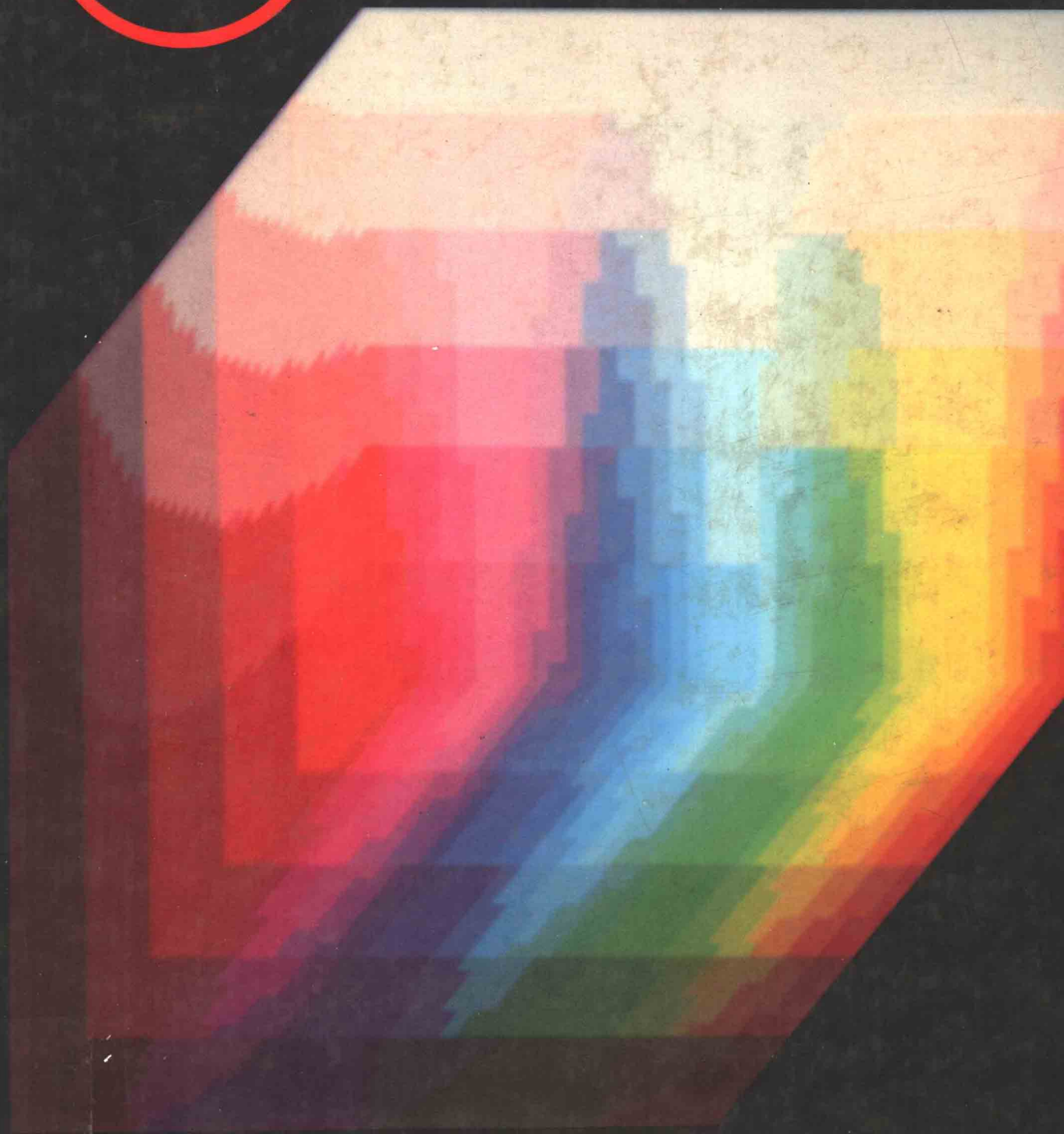


COMPUTERS



Larry Long — Nancy Long

COMPUTERS

Larry Long

Nancy Long

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Melvin L. Prueitt, Los Alamos National Laboratory
Chapter 4—Aydin Controls
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Chapter 9—Intergraph Corporation
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Chapter 15—Program of Computer Graphics, Cornell
University
Chapter 17—TRW Inc.



ABOUT THE AUTHORS

Dr. Nancy Long and **Dr. Larry Long**, partners at Long and Associates, work as a team. Nancy has a decade of teaching and administrative experience at all levels of education: elementary, secondary, college, and continuing education. Her wealth of knowledge in the areas of pedagogy and reading education is evident throughout the text.

Larry is a lecturer, author, columnist, consultant, and educator in the field of information services. His many books cover a broad spectrum of computer and information services topics, from BASIC to MIS strategic planning. He has also written numerous articles on management, computers, and information services. Larry's "Turnaround Time" column appears in *Computerworld* and in several sister affiliates throughout the world. He is the editor of *INTRO*, a newsletter for introductory computer education. Larry presents a variety of MIS seminars in the United States and abroad and is a frequent speaker at professional conferences. His consulting practice enables him to interact with all levels of management in virtually every industry type. Larry has over a decade of classroom experience at Lehigh University and the University of Oklahoma, and continues to be an active lecturer at Lehigh.

The authors met and married while students at the University of Oklahoma, where they received their degrees. Nancy received a Ph.D. in Reading Education and Educational Psychology, an M.S. in Personnel Services, and a B.S. in Elementary Education. Larry received Ph.D., M.S., and B.S. degrees in Industrial Engineering and holds certification as a C.D.P. and a Professional Engineer.

PREFACE TO THE STUDENT

The computer revolution is upon us and computers are fast becoming a way of life. The material in this text offers an overview of this exciting and challenging field. Once you have read and understood its content, you will be poised to play an active role in this revolution.

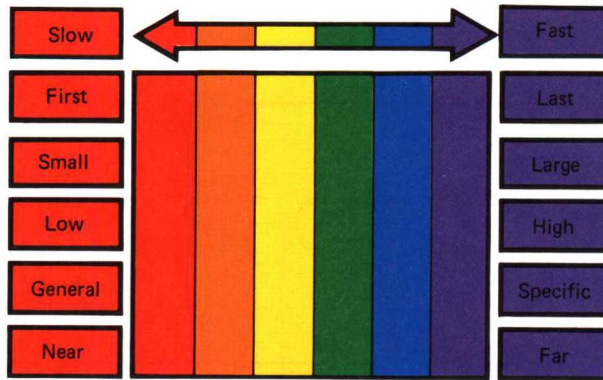
Getting the Most from This Text

Every sentence, every piece of art, and every photo was selected with you in mind. The layout and organization of the text and its content are designed to be interesting; to present concepts in a logical and informative manner; and to provide a reference for the reinforcement of classroom lectures.

Reading a Chapter. A good way to approach each chapter is to:

1. Look over the Student Learning Objectives.
2. Turn to the back of the chapter and read the Summary and Important Terms.
3. Read over major headings and subheadings and think how they are related.
4. Read the chapter and note the important terms that are in **boldface** type and in *italic* type.
5. Relate photos and photo captions to the textual material (a picture is worth a thousand words).
6. Go over the Summary Outline and Important Terms again, paying particular attention to the boldface terms.
7. Take the Self Test.
8. Reread those sections that you do not fully understand.
9. Answer the questions in the Review Exercises.

The Rainbow. Color is used throughout the book to add another dimension to the learning process. There are many instances where concepts can be reinforced and made easier to understand with a spectrum of colors. We call this the *functional use of color*. For example, the spectrum of discussion items often runs:



These spectrums are visually represented in the book by the spectrum of prismatic colors in the *rainbow*. Red, the first color in the rainbow, would represent such concepts as the first step, the smallest portion, or the general concept. Each increment in a conceptual spectrum is represented by the subsequent colors of the rainbow: orange, yellow, green, blue, and violet. In an illustration that has three steps, for example, the last step would always be represented with yellow (the third color). This functional use of color is designed to help you relate the textual material to the illustrations.

The text is supported by an optional *Study Guide*, *Software Supplements*, and *Videotapes*. Ask your instructor about the availability of these learning supplements.

You, Computers, and the Future

Whether you are pursuing a career as a writer, social worker, computer specialist, dancer, attorney, physician, shop supervisor, politician, or are involved in virtually any other career, the knowledge you gain from this course will ultimately prove beneficial. Keep your course notes and this book because they will provide valuable reference material in other courses and in your career. The chapter material addresses a broad range of computer concepts which pop up frequently in other classes, at work, and even at home. The skills sections on *Integrated Microcomputer Software* and *BASIC Programming* will prove valuable if you anticipate working with electronic spreadsheets, doing word processing, or writing programs.

The career opportunities are there for those with an understanding and a working knowledge of computers. Less than 5% of the population is computer literate, yet employers of virtually every discipline are seeking to hire people who can take advantage of the computer revolution.

The use of computers for information processing is in its infancy. By taking this course, you are getting in on the ground floor. Each class you attend and each page you turn will present a learning experience that will let you advance one step closer to an understanding of how computers are making the world a better place in which to live and work. Most importantly, you will be gaining the knowledge necessary to become an active participant in what is the most exciting decade of technological innovation and change in recorded history.

PREFACE TO THE INSTRUCTOR

Instructors of every discipline are keenly aware of the tremendous impact that computers have had on their fields of study and on society in general. In most colleges and universities, this faculty awareness has led to recommendations that a course on “computers” be made a general education requirement. For some, such a course is a reality; for others, students flock in mass to take the “intro computer course” as an elective. Whether required or an elective, the introductory computer course is consistently one of the most popular courses and is taken by students from every curriculum. This text and its comprehensive support package are designed especially to meet the teaching and learning needs of such a course.

We have been fortunate in that we have talked with hundreds of your colleagues in academe. Your feedback was loud and clear: write a book that can be used in a class of students who have a variety of skill levels, interests, and career orientations. In this book, we accommodate a breadth of students by addressing a broad range of computer concepts, applications, issues, and concerns. And we have attempted to write in a style that can be understood by average learners, yet challenges the more advanced students.

Learning about computers can be an exciting journey. This theme is evident throughout the book. When we wrote this book we wanted students to turn the page because they want to, not because they had to.

Concepts, Awareness, and Skills

The textual material is designed to strike a balance between concepts, awareness, and skills. Most will agree that the computer literate must have a grasp of certain computer concepts. But it is also important that the students have a heightened sensitivity to the impact of computers on society, both now and in the future. Learning a computer skill is also important because it helps the students to gain confidence in computers and in their ability to effectively use them.

Chapters 1–17. The focus of Chapters 1–17 is on *concepts* and developing the students’ computer *awareness*, but always within the context of *application*. Introductory computer concepts are discussed and illustrated throughout the text by using applications from a wide variety of working environments and disciplines. Controversial issues, problems, and trends are presented with candor to heighten the students’ awareness of the social implications of the implementation of more and more computer technology.

Integrated Microcomputer Software. The special sections at the back of the book on *Integrated Microcomputer Software* and *BASIC Programming* have a skills orientation. The section on micro software provides generic, yet detailed coverage of data management, electronic spreadsheets, graphics, word processing, and communications software. Once the student has read and understood the principles, the student can easily relate what has been learned to the specifics of your hardware/software environment. With a little practice, the student has a computer skill.

When used in conjunction with hands-on exposure to specific operational software packages, there is sufficient material and exercises in the *Integrated Microcomputer Software* section, Chapter 4 (Computer Systems—Micros), Chapter 6 (Inside the Computer), Chapter 7 (Data Storage Devices and Media), Chapter 8 (Input/Output Devices), and the *Software Supplements* to support a complete course in the use and application of common microcomputer software packages.

BASIC Programming. BASIC is presented in a special section to permit you the flexibility to introduce BASIC at any point in the course. The *BASIC Programming* section is divided into nine learning modules so that the student can systematically progress through increasingly sophisticated levels of understanding. If you only wish to expose the student to BASIC and assign a few simple programs, then Modules I, II, and III will suffice. Modules IV, V, and VI take the student up to an intermediate skill level. Modules VII and VIII introduce advanced features and techniques, and Module IX presents an overview and examples of the 1985 ANS BASIC.

The material and exercises in the *BASIC Programming* section, Chapter 15 (Programming Concepts), and the *Software Supplement* are sufficient to support a complete course in BASIC.

Software Supplement. The *Software Supplement* (see “Support Material” section of this preface) enables the student to gain skills in the use and operation of a computer.

Approach

Functional Use of Color. The design of this book is integral to its pedagogy. Rather than simply use color for splash, we decided to take advantage of the four-color design and add another dimension to the presentation of the material. We call it the *functional use of color*. Throughout the book a “spectrum” of ideas is related to a spectrum of prismatic colors so that the student can more easily relate the ideas to one another and to illustrations and textual material. The functional use of color is explained and illustrated in more detail in the “Preface to the Student.”

Level of Detail. Content material is presented at a *consistent level of detail*. That is, we carefully avoided going off the deep end on some topics. Considerable thought was given by us and by your colleagues as to whether a topic should be covered and at what level it should be covered. Also, the reading level was carefully monitored to avoid the problems associated with inappropriate levels of presentation.

Ahead of Date. Advances in computer technology continue to come in rapid succession. Because a book is often used in the classroom for several

years, being “up-to-date” isn’t good enough—you have to be *ahead-of-date*. That is exactly what we have attempted to do. To be in a position to do this, we have maintained a close association with people who are working on the perimeters of computer technology. They have provided us with a solid perspective on what we might anticipate in the near future and during the last half of the 1980s. These perspectives are reflected in the text: today’s computers are “generationless”; “workstation” is preferred to “terminal”; the new ANS BASIC is introduced; programming languages are placed in six generations; the QWERTY/Dvorak keyboard changeover is addressed; proto-typing is part of systems development; and the list goes on. We avoided clinging to tradition for tradition’s sake. Things are moving too fast.

Photos. The *photographs* are an integral part of the text and the learning experience. Computers and the people who use them are more than words and diagrams—they are dynamic and alive. We wanted to project this energy to the student and one way to do this is through photos and their captions. We carefully selected over 400 photos that enhance understanding of the core material and create a visually stimulating text. Photo placement is key to the design of the book. When we talk about an application, a situation, a computing device, or perhaps a person, there is usually a support photo and descriptive caption on the same page.

Flexibility in Assignment of Material

We recognize that no two colleges (or even instructors) will emphasize the same mix of concepts, awareness, and skills in an introductory computer course. To provide you and your colleagues with as much flexibility as possible, we have included more than enough material for a single course. This gives you plenty of latitude to “pick and choose” those parts of the chapters or the special sections on integrated micro software and BASIC that are most appropriate to your teaching environment. Chapters often assigned out of sequence (e.g., Chapter 15, *Programming Concepts*) were written to be relatively independent of other chapters. Sections within chapters are numbered for ease of selective assignment.

Organization

The concepts and awareness portion of the text is divided into five parts.

Part I—Computers: Today and Yesterday presents background information to help clarify the student’s perspective on computers. Trends, fundamental concepts of a computer system, myths, categories of computer usage, an overview of computer applications, controversial issues, and the history of computers are discussed.

Part II—Hardware and Data Communications Technology presents an overview of a variety of computer systems (micros, minis, mainframes), an operational description of computers and computer peripheral devices, and an introduction to data communications.

Part III—Software and Data Management presents a survey of programming languages, software concepts, and approaches to data manipulation and information retrieval.

Part IV—Information Systems expands on computer-based information systems and applications of the computer by examining how computers are used in business and industry, and in government, health, and education. This part also includes a discussion of a systematic procedure by which information systems are conceived, designed, developed, implemented, and evaluated. The concepts and activity of programming are introduced in some detail.

Part V—Opportunity, Responsibility, and Challenge presents the student with the breadth of career opportunities awaiting those with an interest in pursuing a computer-related career and for those with a computer knowledge who pursue other careers. A perspective is given on how computers will be used and how they will impact society in the future.

The *Integrated Microcomputer Software* and *BASIC Programming* sections are positioned at the end of the text so that these skill topics can be introduced at any point in the course.

Chapter organization is consistent throughout the text. The *chapter body* is prefaced by *Student Learning Objectives*. In the body of the chapter, all major headings are numbered (i.e., 1-1, 1-2, and so on) to facilitate selective assignment and to provide an easy crossreference to all related material in the supplements. Important terms and phrases are highlighted in **boldface** print. Informative photos, interesting box items, “Memory Bits” (outlines of key points), and cartoons are interspersed throughout each chapter. Words and phrases to be emphasized appear in *italics*. Each chapter concludes with a *Summary Outline and Important Terms, Review Exercises* (concepts and discussion), and a *Self Test*.

Support Material

The *Instructor’s Resource Manual* contains (for each chapter): Student Learning Objectives, Teaching Hints, Lecture Notes, Supplementary Material, Answers to End-Of-Chapter Review Exercises, and Exercises and Project Assignments. The lecture notes are in an outline format. Any detailed explanation is supplementary to the text and is included as a teaching tool. Boldface terms, discussion questions, and references to appropriate transparencies are embedded in the outline. The format is similar for the special sections on micro software and BASIC.

The *Instructor’s Resource Manual* also includes the *test bank*. The test bank is organized by numbered section heads within each chapter to facilitate question selection and uniform coverage of the material. A computerized version of the *test bank* is available on *diskettes* for popular microcomputers. Instructors can select specific questions or request that the exams be generated randomly. When printed, the exam is ready for duplication. An answer sheet is also produced.

The two-color student *Study Guide* is organized to support the chapter objectives. Each chapter contains: Student Learning Objectives, Chapter Overview, Reinforcement Activities (list of important terms, and completion, true/false, and multiple choice questions), Application Questions, Stimulation Activities (discussion questions and projects), and Software Exercises to accompany the *Software Supplement*. It also has comprehensive sections on *Integrated Microcomputer Software* and *BASIC Programming*. A “Guide to the Videotape Series” is included in the *Study Guide*.

The comprehensive *Software Supplement*, called “SuperSoftware,” is designed to instruct, intrigue, and motivate. The design philosophy of this supplement is to actively involve students through interactive communication with the computer. Graphic images and icons enhance the software’s “user friendliness.” SuperSoftware has two main menus: one is organized by chapter and the other by topic.

Interesting programs such as “Introduction to the PC” and “Internal Operation of the Computer” provide instruction on the hardware. A number of programs are designed to encourage students to become familiar with the computer. For example, the student can draw with “Compu-Sketch,” compose and play music, or journey through computer history on a time machine. There are also plenty of application simulations, such as airline reservation systems and home banking.

The concepts underlying microcomputer software are demonstrated through imaginative simulations of data management software, electronic spreadsheets, word processing, graphics, communications, and an idea processor. Some of these programs are partially functional. The BASIC programming software is organized by learning module. For each learning module, the software demonstrates the BASIC concepts introduced in that module, has syntax and logic debugging exercises, and contains the example programs in the book.

SuperSoftware even has a full-blown tutorial on keyboarding. And there is much, much more. The software supplement contains enough material for a full term’s worth of laboratory activities.

All of the above software is available for the IBM PC (and IBM PC compatibles). A substantial subset is available for the Apple II. Any institution adopting this book for educational use will be awarded a site license to use “SuperSoftware.” For others, the software is available on an annual rental agreement.

Eight *Videotapes* set the material in the text in motion. Each video addresses a particular facet of the use and application of computers.

Color Transparency Acetates (70) and black-line *Transparency Masters* (150), which support material in the text and the *Instructor’s Resource Manual*, are provided to facilitate in-class explanation.

PC-Write (word processing), *PC-Calc* (electronic spreadsheet), and *PC-File* (database management) freeware (for IBM PC) will be made available to adopters of *Computers* at a substantially reduced rate.

INTRO, the newsletter for introductory computer education, is distributed periodically to adopters of this text. *INTRO* is intended to help instructors keep abreast of teaching innovations for introductory computer courses and of a rapidly changing technology. Surveys of what others are teaching and how they are teaching it are taken and reported in the newsletter. The newsletter also provides a forum for the exchange of ideas.

Acknowledgements

We are very proud of *Computers* and its comprehensive support package. And so are hundreds of others that have made significant contributions: editors, artists, programmers, set designers, professors, cartoonists, production schedulers, dummies, proofreaders, and many more. We thank them, one and all, for their untiring effort and commitment to excellence.

A publishing tradition is to place only the names of the authors on the

cover of the book—but if this ever changes, we think a few other names should be included, for *Computers* is their book too. Marcia Horton, our editor, spearheaded this project with the perfect blend of passion, compassion, and sense of purpose. Three very wise men, Executive Editors Jim Fegen and Chuck Iossi, and President of Technical Publishing, Hank Kennedy, were always happy to share their editorial and fiscal wisdom when we needed it. Production Editor Nancy Milnamow, Buyer Ed O'Dougherty, and Manufacturing Manager David Hetherington used their magic to transform a manuscript into a book. Janet Schmid's imaginative art direction is apparent on every page. Gail Cocker and Bob Lentz added their special touch to the text. Joe Heider, Niels Nielsen and the marketing team assembled a very imaginative marketing package. Rick Smith produced and directed a set of video tapes that perfectly complement the book. Super Martin Chamberlain did the programming for SuperSoftware. Editorial Assistant Karen Grant performed some logistical wizardry. Andy Kreutzer co-authored the *Study Guide* and gave us a lot of good ideas during the development of the manuscript.

Over 400 companies have in some way participated in this project. They have provided information, photos, software, examples, and, most of all, their precious time. We wish to thank them for their valuable contribution.

Computers is a product of collective thinking—and a lot of thinking went into this book. In that regard, we are truly grateful for the committed efforts of our colleagues: Sally Anthony, San Diego State University; Harvey R. Blessing, Essex Community College; Wayne Bowen, Black Hawk Community College; Michael Brown, DeVry Institute of Technology, Chicago; J. Patrick Fenton, West Valley College; Ken Griffin, University of Central Arkansas; Nancy Harrington, Trident Technical College; Grace C. Hertlein, California State University; Shirley Hill, California State University; Cynthia Kachik, Santa Fe Community College; Sandra Lehmann, Moraine Park Technical Institute; Michael Lichtenstein, DeVry Institute of Technology, Chicago; Dennis R. Martin, Kennebec Valley Vocational Technical Institute; William McDaniel, Jr., Northern Virginia Community College at Alexandria; Edward L. Nock, DeVry Institute of Technology, Columbus; Louis Noe, Ivy Technical Institute; Frank O'Brien, Milwaukee Area Technical College; Alvin Ollenburger, University of Minnesota; Beverly Oswald, University of Central Arkansas; James Phillips, Lexington Community College; Nancy Roberts, Lesley College; Richard Siebert, Morton College; Bob Spear, Prince George's Community College; and Thomas Voight, Franklin University.

Dedication

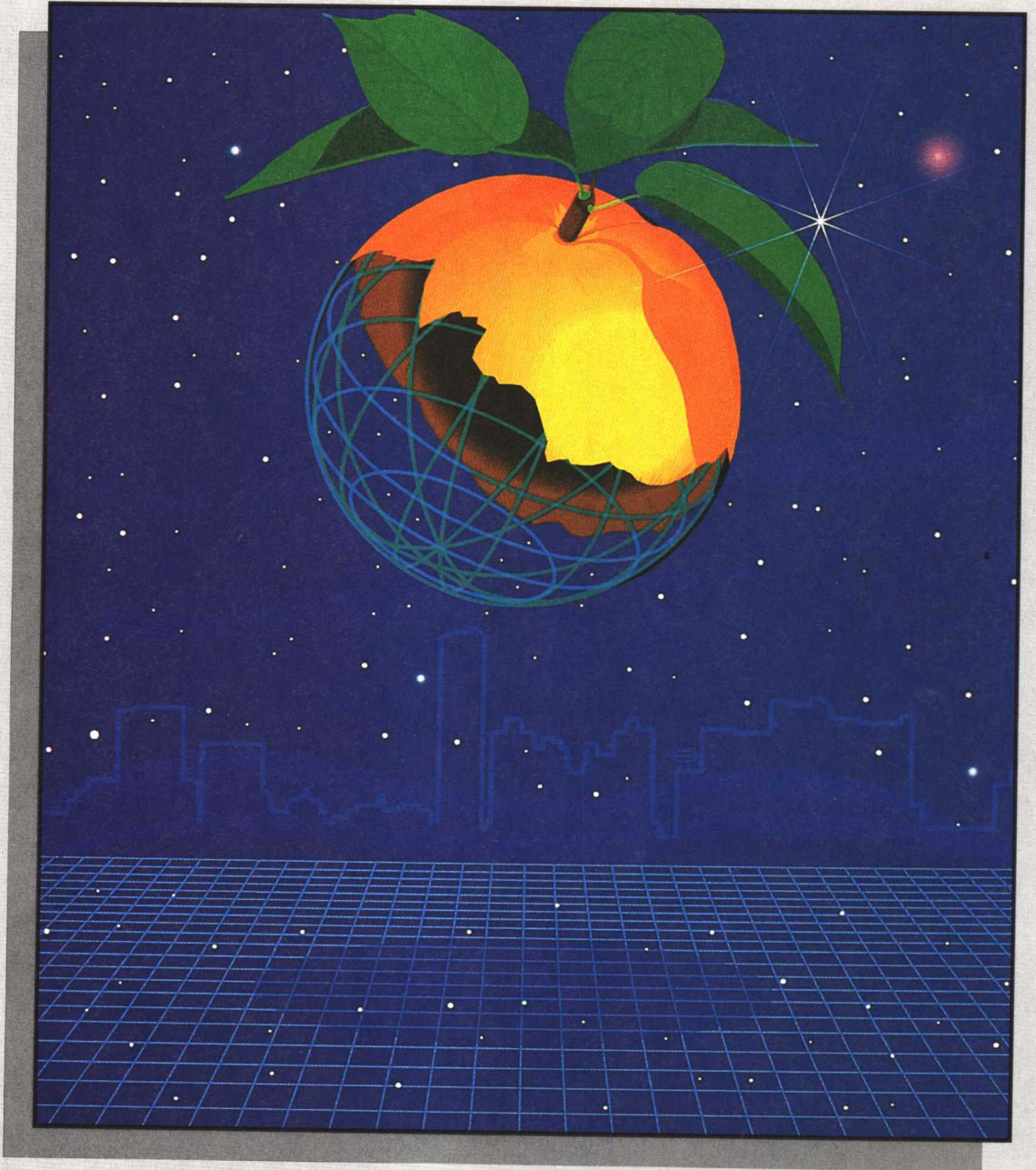
We dedicate this book to our wonderful and loving parents—Carl and Barbara Rothlisberger, and Pete and Marie Long.

Nancy Long, Ph.D.

Larry Long, Ph.D.

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COMPUTERS: TODAY AND YESTERDAY



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