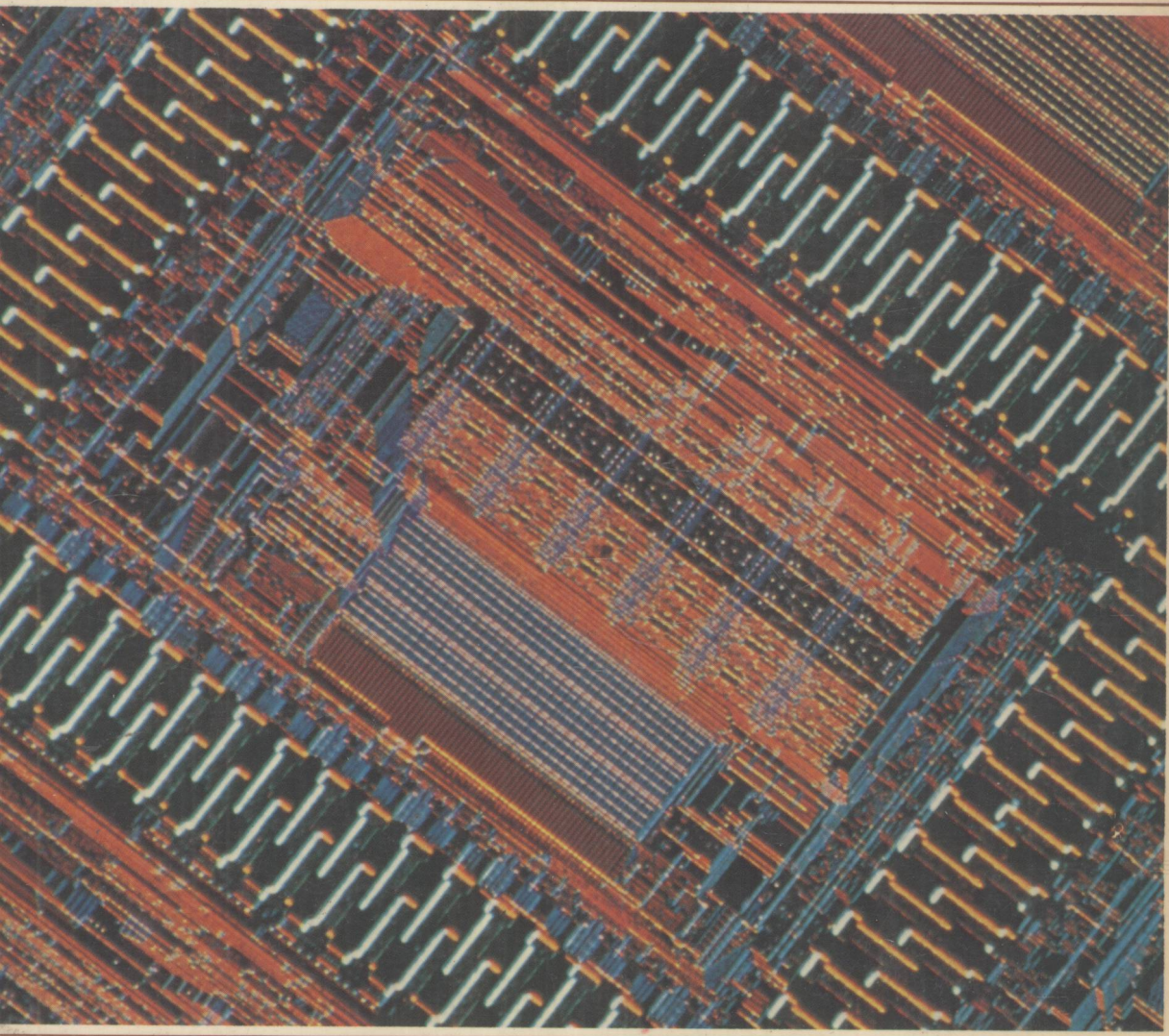


Introduction to Computers and Information Processing

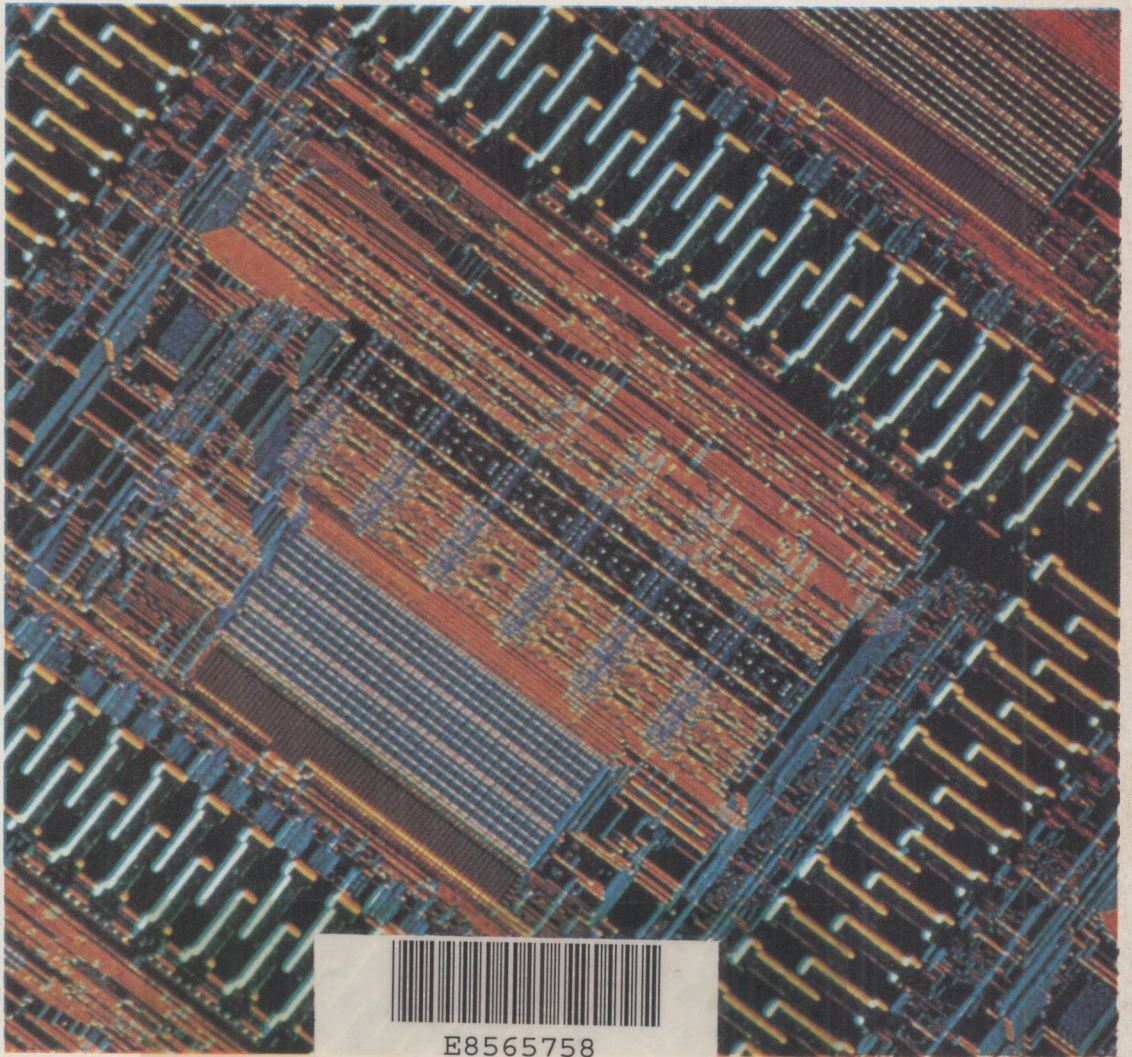


Larry Long

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Introduction to
**Computers and
Information Processing**



To the **instructors** whose dedication to the principles of education has enabled thousands to enter the age of information with confidence.

To the **students** with the will to accept challenge and the foresight to seize opportunity.

Preface to the Student

Computers and information processing are now a part of our way of life. Moreover, society's commitment to computers is expanding with each passing year. The effects of this commitment have been positive and can be seen in both our private and professional lives.

The computer is more than a tool for alleviating the monotony of routine data processing tasks, such as printing grade reports and posting accounting transactions. Industry, government, and education are turning to the computer and to information processing professionals for help in managing the *resource of information*.

This textbook is designed to give you an overview of the exciting and challenging field of computers and information processing. Breadth, not depth, is emphasized. The text material may be used as effectively as a *stepping stone* for more advanced courses and a career in information systems/data processing as it may be as an *overview* for other career orientations.

Getting the Most from This Text

Every sentence in this text was written with you in mind. The text was organized and the content was written: to excite you; to be interesting; to present fundamental concepts in a logical and straightforward manner; and to provide a reference for the reinforcement of classroom lectures.

A good way to approach each chapter is to:

1. Look over the Chapter Highlights
2. Turn to the back of the chapter and read the Summary and Important Terms
3. Read over major headings and subheadings and think about the way they are related
4. Read the chapter and note the important terms that are in **boldface** type and in *italic* type
5. Go over the Summary and Important Terms again, paying particular attention to the boldface terms
6. Answer the questions in the Review Exercises
7. Reread those sections that you do not fully understand.

You, Computers, and the Future

Whether you are pursuing a career as a computer specialist, an accountant, an attorney, a physician, a shop foreman, a writer, a politician, or vir-

tually any other, the knowledge you gain from this course will ultimately prove beneficial. Keep your course notes and this book, since they will provide valuable reference material in other courses and in your career.

Career opportunities have never been better for those interested in programming, systems analysis, computer center operations, and related fields. Opportunities also exist in other fields for those with an understanding of the fundamentals of computers and information processing.

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 enable you to 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

Any statement I could make with regard to the effect of computers on society would be an understatement. We, as academicians, have inherited the responsibility of preparing a new generation to cope with a rapidly changing way of life. This text and its accompanying support materials were designed with this responsibility in mind.

I have tried to present the computer not as a black box, but in context with its relationship to the people who use it, its applications, the opportunities it produces, its history, and to society in general. This approach to presentation is intended to heighten not only the students' knowledge and understanding but also their awareness of how computers have, can, and will impact their lives.

Objectives

The fundamental objective of the text is to present a survey of computers and information processing in a logical, informative, and interesting manner. There are, of course, several subordinate student-oriented objectives. These are to help students: to appreciate the problems, potential, and real-world applications of computers; to bridge the "reality gap" between video games and inventory systems; and to "turn on" and "tune in" to the computer revolution.

The Course and This Text

A successful introductory text is a result of collective thinking and a bit of compromise. This one is no exception. The thoughts and suggestions of your colleagues were documented in over 2,000 pages of review and in the results of a comprehensive survey. Untold hours were spent in interactive debate on content, organization, and level of detail. This painstaking review process has instilled in us a confidence that the end result will be complementary to your introductory information processing course.

Since the "intro" course is usually taught as a general education course for all students, there are no prerequisite courses or experiences required to understand the concepts and principles embodied in this text. The topics are written for the student being exposed to the subject matter for the first time. Each topic, and its accompanying explanation, was carefully evaluated as to applicability and purpose. For any given topic, there is information that is "nice to know" but inappropriate for the skill-level goals of an introductory course. This material was omitted and left for presentation in advanced courses.

Although certain topics must be covered, the character of the course is a reflection of your interests, experience, and expertise. Since the emphasis is on concepts and principles, you have the flexibility to present complementary material more germane to personal and local circumstances. There is no such thing as a totally independent chapter in this or any other book, but certain chapters can be omitted or assigned in part without much loss in continuity. Chapters 2 (history), 5 (processor), 8 (data communications), 11 (information systems overview), 13 (programming), 14 (implementation and operation), 15 (jobs and careers), and 16 (computers in society) are the most independent. Section headings are numbered to make it easy to assign portions of chapters.

All subject areas listed in the curriculum guidelines set forth by the DPMA Education Foundation's Model Curriculum for Computer Information Systems Education (CIS-1, *Introduction to Computer-Based Systems*) are covered in this text. The text also includes coverage of other subject areas needed to reflect the current state of the technology.

Many instructors introduce BASIC to give students the opportunity to get hands-on experience. In this text, BASIC is presented in an appendix to offer you the flexibility to introduce BASIC at any point in the course. The BASIC Appendix is divided into five 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. The more advanced features and techniques presented in modules IV and V support a more in-depth coverage of BASIC.

Approach

Five guidelines were followed in the compilation of this text. These are: to motivate the student to learn; to facilitate the building block approach to learning; to emphasize concepts and principles; to adhere to the 80/20 rule; and to present the material at a level that is consistent with the intended audience.

Computers, information systems, and the people who develop and use them are exciting. The excitement of becoming a part of "the age of information" becomes more intense at each new level of understanding. This theme is maintained both graphically and verbally throughout the text.

The material in critical chapters is ordered so that an understanding of what was read will facilitate the understanding of subsequent material. When possible, the relationship between various segments of the book or of a chapter are graphically illustrated to help the student to assimilate related material (e.g., the hierarchy of data organization).

The content is generic, with a minimum of references to specific hardware, software, or vendors. The emphasis is on concepts and principles that can be applied in any hardware/software environment.

The 80/20 rule is particularly applicable to an introductory survey text

where so much must be covered in so few pages. Just as 20 percent of the records account for 80 percent of a file's activity, 20 percent of the computer/information processing subject areas contribute to 80 percent of a student's general understanding of this area of study. The challenge is to concentrate on topics that are part of the "critical 20 percent." These are the topics that the students will see in practice and need to master before progressing to more advanced courses. Coverage of the critical 20 percent is a realistic objective for an introductory course, but slight deviations from the critical 20 percent result in inconsistencies in level of detail. Any overkill on a particular topic violates the 80/20 rule and results in another critical topic being deleted or insufficiently covered. This text is designed to maximize the dissemination of practical knowledge by concentrating on the critical 20 percent. The other 80 percent is addressed in more advanced courses.

The material is presented at a level that is consistent with the intended audience. Since there is a fine line between confusion and boredom, the readability level of this text was carefully monitored to avoid the problems associated with inappropriate levels of presentation.

Features

The most outstanding feature of this book is its *content and organization*. The content is comprehensive, yet consistently presented at the introductory level. The material is organized to complement its use in practice and to facilitate the learning process. The graphic overview of the text presented in the *Instructor's Resource Manual* confirms the attention given to topics and their relationship to one another.

The text emphasizes the positive aspects of computers and information processing while maintaining touch with reality.

Approaches (e.g., punched cards) and concepts (e.g., numbering systems) on their downswing are given limited coverage. This enables more text to be devoted to current trends (e.g., DDP, query languages, microcomputers, CAD/CAM, DBMSs, on-line systems, interactive program development, and so on).

Computers and the people who use them are more than words and diagrams, they are dynamic and alive. Over 350 full color photographs are included to help project this energy to the student. These photos, almost 100 full color figures, and over 100 additional figures create a visually stimulating text. A variety of "scrapbook" items are included to help make reading the text fun and interesting. Each photograph, figure, and scrapbook item was carefully selected and placed to enhance understanding of the core material.

If a topic is introduced, it is sufficiently explained so that the student should be able to comprehend the fundamental concept. Detail superfluous to introductory course objectives is avoided.

Numerous innovations in the way material is presented have been integrated into the text. Computers, printers, files, and many other devices and

concepts have been categorized to enhance learning. The student is given a brief overview of the variety of information systems, including I/O examples, by type of industry. A system development responsibility matrix is used to graphically depict the relationship between the people and the activities in the system development process. The matrix approach is also used to introduce possible information systems career paths. Data and programming language concepts are presented as hierarchies. The BASIC Appendix follows one easily understandable application—so that the student can focus on the syntax and the features of the language. These are just a few of scores of innovations that make this text an excellent learning and teaching tool.

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 outline format, with space provided for additional instructor notes. I want to stress that the outline is just that, an outline, not a rehash of content material. Any detailed explanation is supplementary to the text and is included as a teaching tool. Boldface terms, discussion questions, and references to appropriate transparency masters are embedded in the outline.

The student *Study Guide* is organized to support the chapter objectives. Each chapter contains: Student Learning Objectives, a Chapter Overview, Reinforcement Activities (list of important terms, and completion, true/false, and multiple-choice questions), and Stimulation Activities (discussion topics and projects). It also has a comprehensive section on BASIC (explanations and illustrations, problems, and assignments), including a "Module VI" (the text has five modules) that provides coverage of more advanced topics.

Two hundred and forty *Transparency Masters* and 214 transparency acetates which support material in the text and the *Instructor's Resource Manual*, are provided as aids to facilitate in-class explanation.

Prentice-Hall's *Computerized Testing Service* is available to colleges adopting this text. Prentice-Hall will generate exams composed of the *Test Bank* questions that you select. The *Test Bank* is organized by numbered sections within each chapter to facilitate question selection and uniform coverage of the material. Requests for exams will be filled by return mail. The *Test Bank* is also available on magnetic tape and diskette.

A newsletter called "*Intro*," distributed periodically to adopters of this text, will help instructors keep abreast of teaching innovations for the introductory course and of a rapidly changing technology. Surveys of what others are teaching and how they teach the introductory course will be taken and reported in the newsletter. The newsletter will also provide a forum for the exchange of ideas.

Organization

The text is divided into five parts. Each part is designed to accomplish a specific purpose and provide a foundation for the next.

- *Part I—Computers: Now and Then* presents background information important to clarification of the student's perspective on computers and information processing. Trends, fundamental concepts of a computer system, myths, categories of computer usage, an overview of computer applications, and the history of computers are discussed.
- *Part II—Hardware and Data Communications Technology* presents an overview of a variety of computer systems, 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 the topic of computer-based information systems and examines systems by industry type. This part also includes a systematic procedure by which information systems are conceived, designed, developed, implemented, and evaluated. The concepts and activity of programming are introduced in the appropriate sequence in the systems development process—however, Chapter 13, Programming, is sufficiently independent to be assigned out of sequence.
- *Part V—Opportunity, Responsibility, and Challenge* presents the student with a variety of career opportunities in the field of computers and information processing. A perspective is given on the influence of those careers on society, both now and in the future.

Chapter organization is consistent throughout the text. The *chapter body* is prefaced by *Chapter Highlights* and concludes with the *Summary and Important Terms* and *Review Exercises*. Important terms and phrases unique to computers and information processing are highlighted in the body of the chapter in **boldface** print. Words and phrases to be emphasized appear in *italics*.

- The *Chapter Highlights* provide a preview of chapter content and present the student with specific learning challenges.
- The *Summary and Important Terms* recap the key points, considerations, concepts, and vocabulary contained in the chapter. To make it easier for students to find more detailed explanations in the body of the chapter, the summary is organized by chapter section headings. Important terms are used in context and highlighted in **boldface** print.
- The *Review Exercises* help the student reinforce the overall text objectives of understanding and retention. The exercises are divided into short answer and discussion questions.

Acknowledgments

A major four-color introductory text and its ancillary materials are not simply written. Writing is the easy part. The efforts of hundreds of people and scores of companies were needed to make this text a reality.

Anything that I could say would understate the contribution made by my wife Nancy. She has coordinated or been active in every facet of this project. I and everyone involved wish to extend our appreciation and a big hug to Nancy.

I would like to single out a few of the many people at Prentice-Hall for their encouragement—and for their blood, sweat, and tears. My “high-energy” editor, Jim Fegen, initiated the project and infused a steady flow of motivational electricity. Editorial Directors Hank Kennedy and Ed Stanford and Executive Editor Chuck Iossi committed themselves and the resources of Prentice-Hall to the success of this project. A special team of Prentice-Hall’s top people coordinated the production effort. The end product is testimony to their creative abilities—kudos to: Managing Editor Martha Goldstein of the Book Project Division; also to Florence Silverman (Art Director), Susanna Lesan (Director), and Anita Duncan (Photo Research). Thanks to Janice Marcus, who tied all the loose ends. And thanks to Marketing Manager Robin Bartlett and to the Prentice-Hall sales force, for no matter how good a text may be, it is not a success unless someone reads it.

I would like to thank those who wrote or tested programs for the text and the ancillary materials: Robert Fletcher, Juvadee Wongthanavimok, Carol Riggan, Sandra Johnson, and Dean Oberman. I also wish to thank Carl and Barbara Rothlisberger for compiling the crossword puzzles in the *Study Guide*, Bill and Congetta Humphries for their daily literature research, and Elsie Hamel for transcribing several of the manuscripts.

Andy Kreutzer, my colleague and the co-author of the *Study Guide*, provided valuable feedback throughout the development of the text manuscript. He and his wife Sandy are also responsible for the development of the software that accompanies the text. I thank them both.

I spent a good deal more time rewriting and fine tuning this text than I did writing it. You might say that this is a second-edition first edition. In continuous review for over a year, the manuscript evolved to what you have in your hands through the committed efforts of many of your colleagues. I am forever grateful to: Fred Scott, Broward Community College, Ft. Lauderdale, FL; Pete Kokoros, Broward Community College, Pompano Beach, FL; Jacques Vail, Burlington County College, Pemberton, NJ; Lance Eliot, California State University–Dominguez Hills, CA; Grazina Metter, Catonsville Community College, Catonsville, MD; Seth A. Hock, Columbus Technical Institute, Columbus, OH; Maria Kolatis, County College of Morris, NJ; Allan Escher, DeVry Institute of Technology, Irving, TX; Ed Nemeth, DeVry Institute of Technology, Atlanta, GA; A. Peter Nardis, DeVry Institute of Technology, Tucker, GA; David Wen, Diablo Valley Community College, Pleasant Hill, CA; W. Leon Pearce, Drake University, Des Moines, IA; Richard Kerns,

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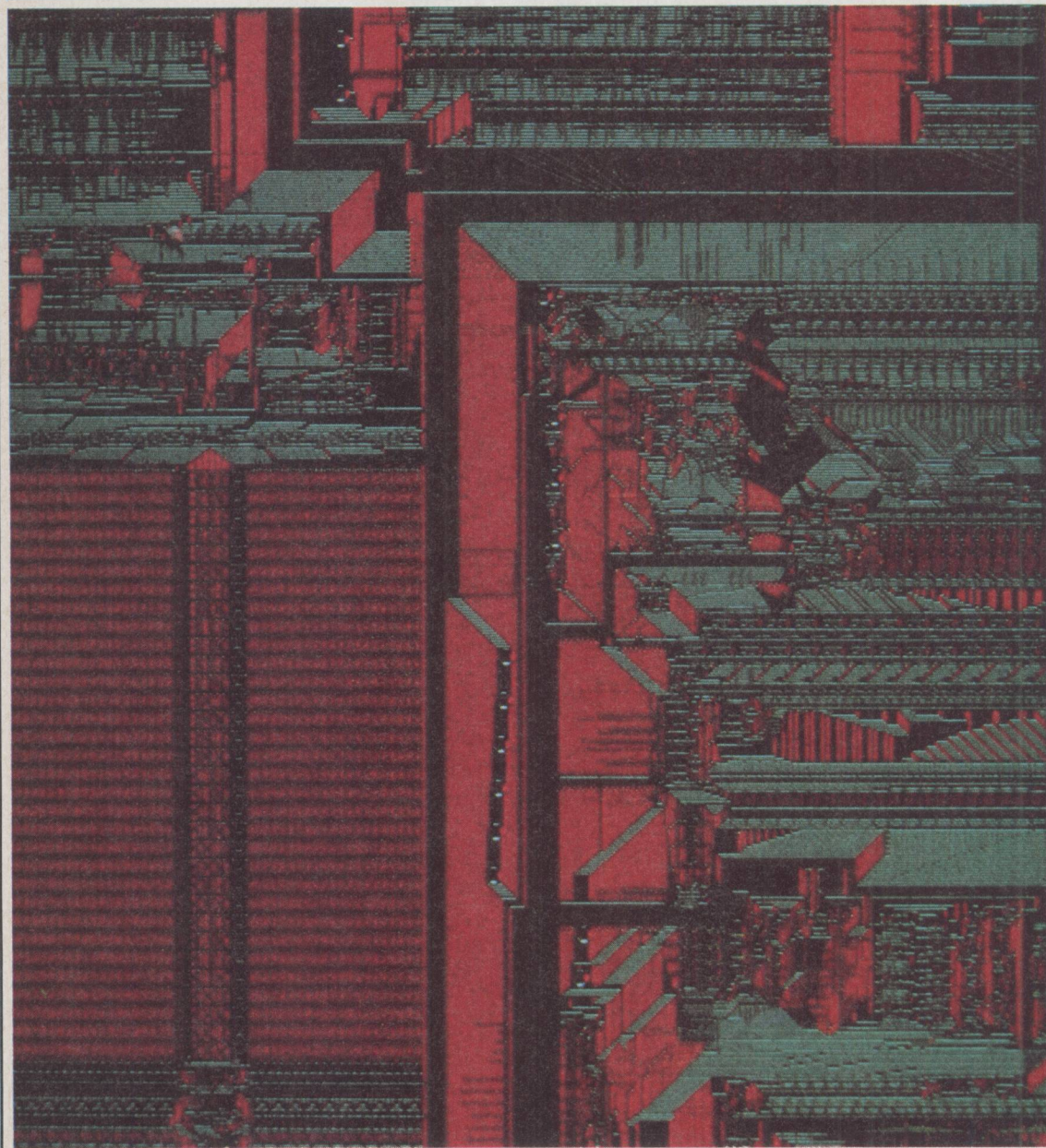
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The "Intro" Course

The "Intro" course is always popular because it has a tradition of being informative, helpful, and interesting. This book is designed to uphold this tradition. I wish student and instructor success with this text and with computers and information processing.

Larry Long, Ph.D., C.D.P

PART I COMPUTERS: NOW AND THEN



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