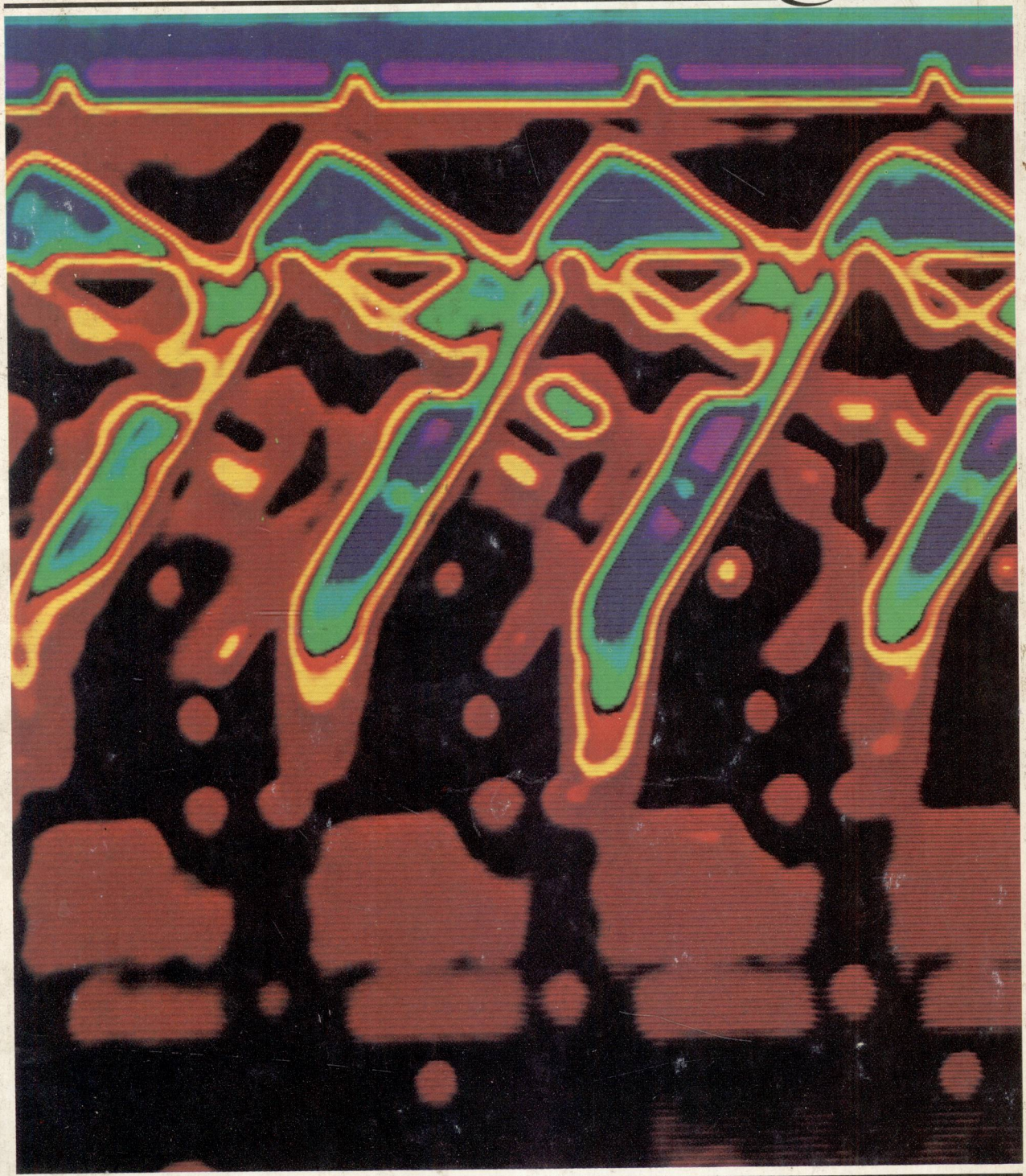
Computers in Action

Data Processing



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Computers in Action

Data Processing

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Preface to the Instructor

Approach

Data Processing: Computers in Action is designed for introductory data processing and information systems courses. It is written for students who have no prior knowledge of computing concepts, terminology, or programming languages. Its organization into modules allows maximum flexibility for use in courses of differing emphasis and organization.

With so many introductory computing texts already on the market, writing yet another might seem like processing another IBM card. However, we feel our book offers many unique features that can improve students' learning.

In hardware/software books, the opening chapters often present the history of computing. We decided to spread this material throughout the text so the history can be linked to particular topics. That way students not only remember the history better because they see a reason for studying it, but they get immediately to contemporary, state-of-the-art topics.

Many textbooks display an "either/or" treatment of programming–it is either stressed at the expense of other topics or virtually ignored. In contrast, we combine student-written programs with class material to make both more interesting and understandable. For instance, we use a program on files to illustrate the concepts of file creation, deletion, and update in a discussion of magnetic disk and tape files. Programming helps students visualize records and fields.

Still other texts offer a computers-in-society approach. Such "computer appreciation" courses often present too little material to show how or why computers do what they do. They introduce a term like *data file*, describe it, and analyze it, but only in an abstract manner. We wonder how students can relate to such concepts without actually experiencing file processing in a program. Though some might argue that writing an actual program to create and access a file is too hard for the average student, we do not think this is the case with interactive computer systems.

In essence, our approach combines the *general study* of the computer with a study of *specific language*, so that students experience a sense of immediacy and learn about the computer directly. Through such immediacy our students have gained the perspective and background to understand what computer use is really all about.

Organization

We divided our text into four modules: Introduction, Hardware, Language, and Management; three supplements; and a group of problems for programming. Since everyone teaches differently, we have written the modules and many of the chapters to be used independently. Thus, you can "customize" our book to fit your favorite course structure and emphasis. If you believe that programming should be taught first, you might assign the chapters as shown by approach 1 on the following page. If you want to present hardware first and programming second, you might use the modules as shown in approach 2. If you like to mix the two approaches (as we do), see the pathway through the text shown in approach 3. Approach 4 shows you how you can use a language other than BASIC with our book. Other approaches are possible, and the module concept gives you the flexibility to develop your own.

The first module, Introduction, establishes the essential terms, definitions, and concepts. It also covers how computers actually retrieve and process data.

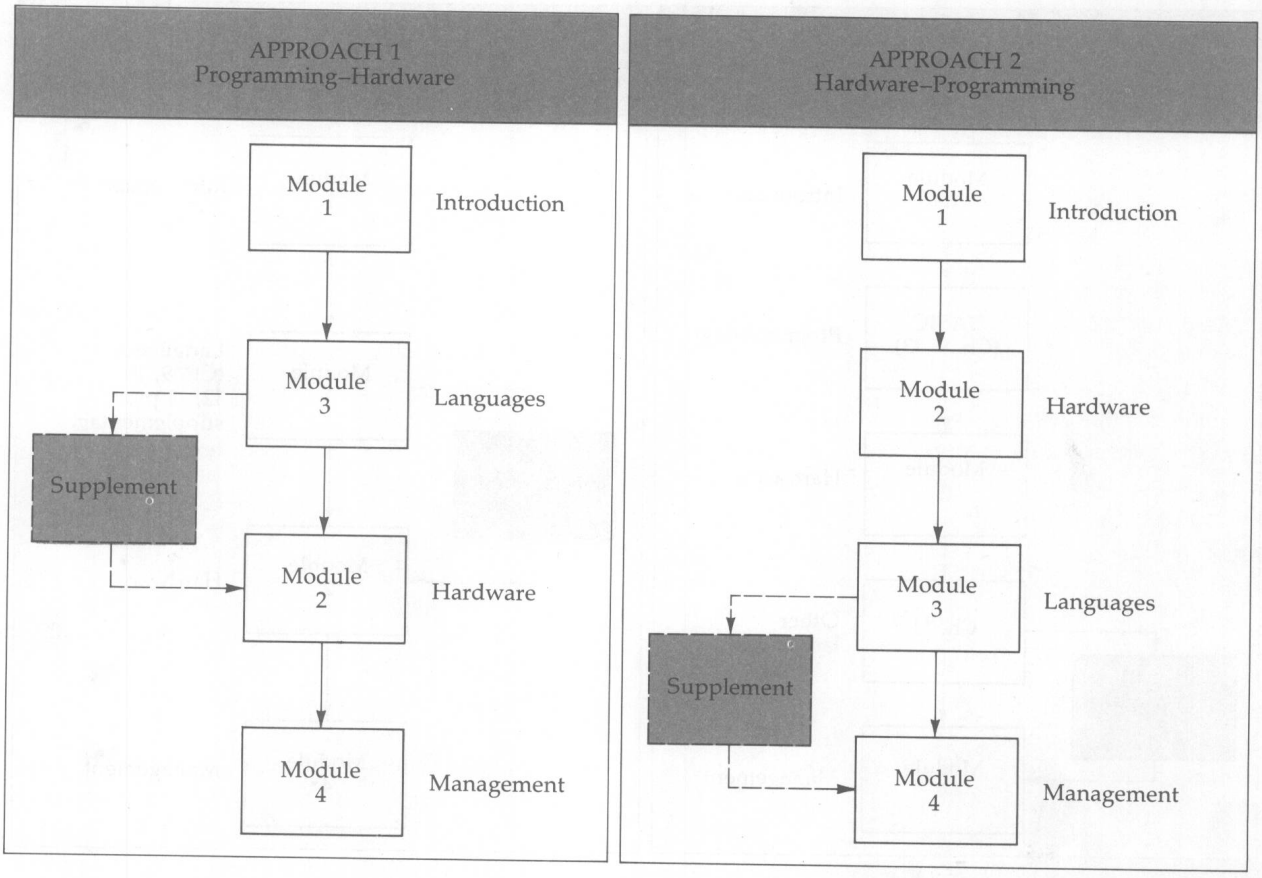
The second, Hardware, concerns data processing equipment and functions. It explains how people enter data into the computer, how the computer stores and outputs data, and how data are stored on external file devices. We also compare methods of processing

data: batch, time-sharing, multiprogramming, real-time/on-line, virtual storage, networks, and others.

The third module, Language, covers flowcharting, Job Control Language (JCL), BASIC, and an overview of FORTRAN IV, Structured COBOL, RPG-II, PL/1, and APL. We have programmed a single application in each language to show students how the languages differ. We use check digits as the common example because so many businesses use the check digit procedure in their credit card systems. The module ends with a tabular and graphical comparison of these languages.

We emphasize BASIC because of its wide availability and its popularity on time-sharing, small business, and personal computers. Also, students can learn to use BASIC easily and quickly, thus rapidly gaining a positive first-time computer experience. The modular organization of our book does not mandate BASIC as the langauge, however. *If you want to substitute FORTRAN, COBOL, or RPG-II for BASIC simply choose a supplementary text and use it in place of the BASIC material. The flowcharting chapters are designed to allow this substitution easily.*

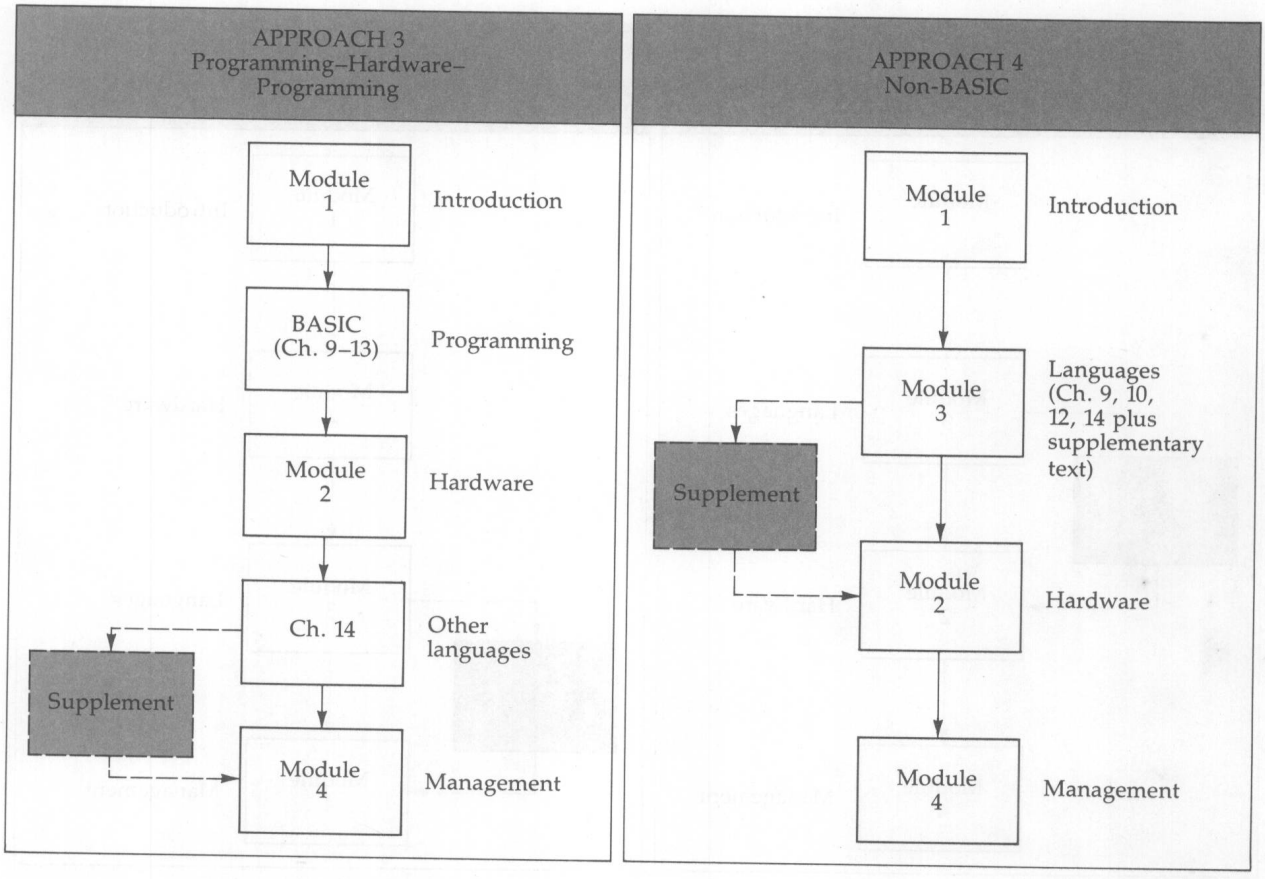
The fourth module, Management, begins with a bird's-eye view of several social issues including automation, privacy, and security. Next, we examine trends and developments in computer technology and look



at projections up to 1985. The last chapter gives an overview of the computer industry, both within the United States and internationally.

In addition to the four modules, we include problems and three supplements. The supplements concern decision tables as an alternate to flowcharting; a survey of data preparation devices ranging from the standard keypunch to multistation key-to-disk systems; and a summary of ANSI Minimal BASIC. "The Challenge of Programming: Problems to Solve" contains 57 widely varied problems, all of which have been classroom tested. The problems have been categorized by type and rated for programming complexity. They are drawn from the fields of accounting, finance, marketing, personnel, economics, science, statistics, and many more.

The book ends with a glossary and two indexes. The glossary lists terms used in the book and their American National Standards Institute "formal" definition. It also highlights 60 key terms that students should master during the course and defines these terms in an expanded, nontechnical way as well. The first index, the "Index of Business Examples, Applications, and Exercises," lists the pages where a certain business term, for example, *payroll*, is discussed in our book (pp. 2, 3, 4, 12, 13, 14, 17, 43, 216, 372, 380). When



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you examine this index, we think you will be pleased by the large number of entries. As an example, we present *accounts receivable* along with disk/tape concepts in Chapter 7 as a means of showing how the hardware and an application are intertwined (pp. 132-145). The second index uses boldface page numbers to allow you to locate the definition of a term in context.

Features

A very special feature of our book is a fictional story "Shake Hands with the Machine" (found at the beginning of each module). John Daniel wrote this story especially for introductory students, to show what happens when a computer is brought into a work area. The story also covers the duties, responsibilities, and employment potentials of programmers, analysts, and the overall manager.

Each chapter in our book offers a rich assortment of teaching and learning devices:

1. A Chapter Outline, giving chapter content at a glance
2. A Preview that introduces the topics to be discussed
3. New material, with key terms emphasized with **boldface** type
4. A History Capsule, describing a person or event that had an impact on the material in this chapter
5. Cartoons by Sidney Harris, spaced at pertinent locations
6. A Summary that reinforces the concepts presented in the chapter
7. A Case Study, a reprint of a recent journal article that focuses on the concepts presented in the chapter by describing how real people interact with computers and examining the various jobs that people involved with computers actually do
8. A list of Key Terms for review
9. Exercises, arranged by level of difficulty, that offer practice in chapter material

Teaching and Learning Aids

To accompany the text we have an instructor's manual and a student study guide. For each chapter the instructor's manual includes:

1. Behavioral objectives
2. A summary
3. Teaching suggestions
4. Answers to all end-of-chapter exercises
5. Multiple choice and true/false questions
6. Overhead transparencies

The student study guide is written by William L. Harrison (Oregon State University) and produced by P.S. Associates. For each chapter the study guide includes:

1. Chapter objectives
2. A synopsis
3. Self-evaluation questions and a review of terminology
4. A short-answer integrative problem
5. A self-test

Acknowledgments

Many people think that a book is solely the creation of its authors. Our experience has shown how invaluable others are in such a creation. To list them all would be impossible, yet we want to acknowledge them.

Over 1,000 of our students at Sierra College have used this material in prepublication form and have given us feedback. We thank them for their helpful comments, their candor, and their "debugging."

Before publication of our book, the following individuals also reviewed the manuscript. Our thanks to: David R. Adams, Arkansas State University; Ray V. Alford, John Carroll University; Gerald H. Anderson, Cowley County Community College; James D. Brainerd, Lansing Community College; N. D. Brammer, Colorado State University; Scott Brown, Burroughs Corporation; Chuanyu E. Chen, Montclair State College; Rosemary W. Damon, Cañada College; Stephen Deam, Milwaukee Area Technical College;

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The contributions of William Harrison and John Daniel were particularly important to us. Bill developed the student study guide, which we feel is a great asset in helping students learn and practice the concepts we present. The continuing story that John wrote ties people and life to our book.

Besides our students and colleagues, the support provided by Wadsworth Publishing Company has been enormous. Mike Snell, our editor, and Sheryl Fullerton and Autumn Stanley, our writing analysts, were most helpful.

The tasks of typing and duplicating were performed by Pat Brophy and Don Skewis. They conscientiously met our deadlines without complaint.

Without support from our families we never would have made it. Many hours that could have been spent with them were sacrificed toward the creation of this book. Our acknowledgment of them should have come first, not last.

Perry Edwards
Bruce Broadwell

Preface to the Student

Among today's fastest changing fields are electronics and computers. To realize how fast they are changing, think back to the early 1970s when a handheld calculator was physically the size of this book, cost around $100, and could only add, subtract, multiply, and divide. Today a four-function calculator is small enough to fit inside a wrist watch (and still have the watch, too) and may cost as little as $3.50. In fact, the size of a calculator depends more on the size of the buttons we humans need to push than on the electronic needs of the calculator itself.

Change is a big part of our lives and computers are one reason why. We believe you should realize the capabilities and limitations of computers. We have tried here to give you knowledge on which to base a philosophy of the computer's role in business and society. This same knowledge should also give you insight into the impact of the computer in helping to shape society's future.

This course will bring you some skills and techniques in problem solving that can be transferred to other disciplines and to your everyday life. You will see how simple and logical you must be when trying to get the computer to do something. You will be forced to consider every possible alternative the computer will encounter, and plan for it.

Most colleges offer computer courses more advanced than the one you are now taking. This book will prepare you for advanced courses in computer science or data processing if you choose to take them.

Besides a computer philosophy, some insight, and technical skills, you will also receive an historical perspective of the social and technological state of the art. Since the first commercial computer was installed in the early 1950s, the history is brief, but it is also very significant.

One final word before you turn to Chapter 1 and begin your study of an exciting and unique field. We believe you will learn the most by doing. We do not think you will fully grasp the concepts in this book unless you get involved with computers. That may mean solving a problem wrong sometimes, but you can learn from that experience, too. When you write a program you will inevitably make mistakes. Just remember that only you and the computer know of these mistakes, and the computer can't tell anyone.

Perry Edwards
Bruce Broadwell

To our wives, Kathleen and Celia, and to our children, Marcella, Lyman, James, Rosalie, Jennifer, Sarah, and Benjamin, who went with unanswered questions and unfinished chores, but who gave us encouragement and shared in our efforts.

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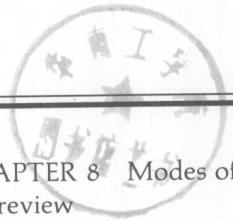

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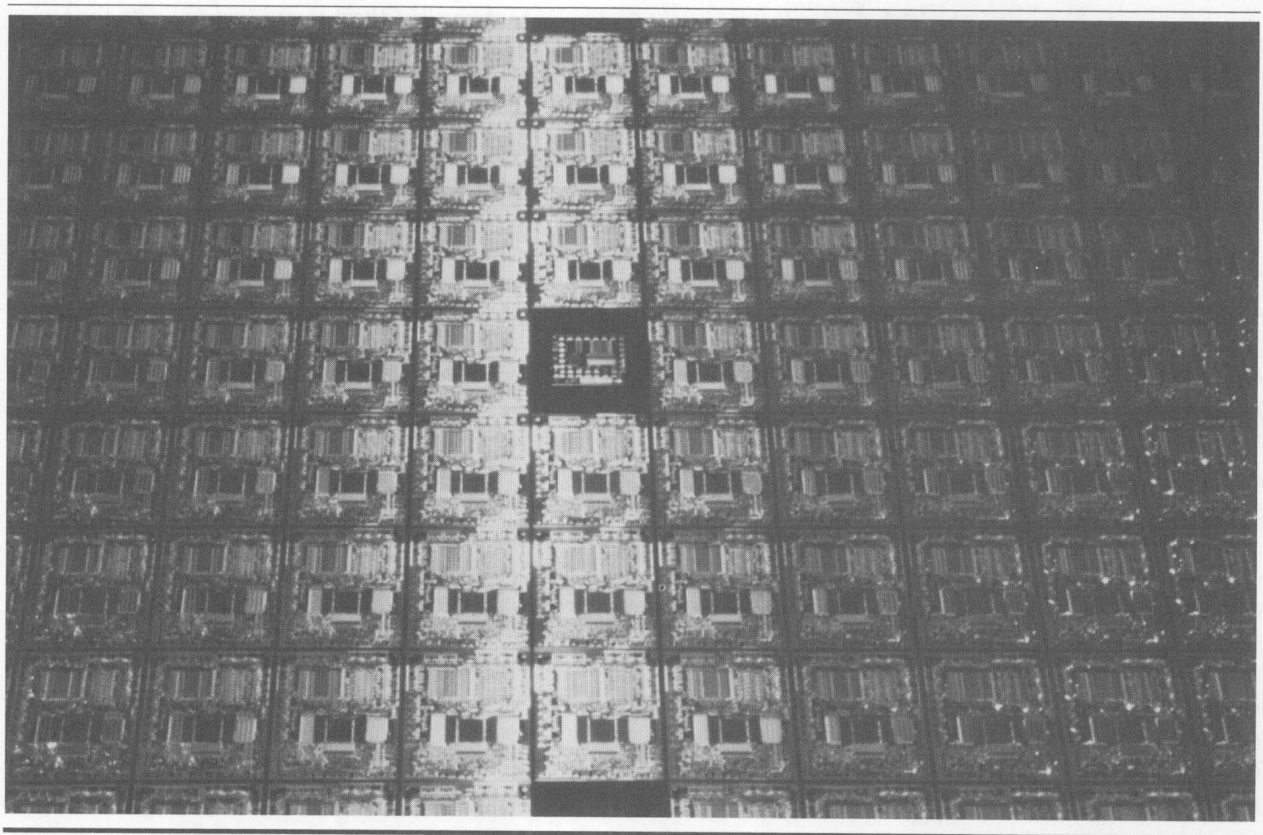
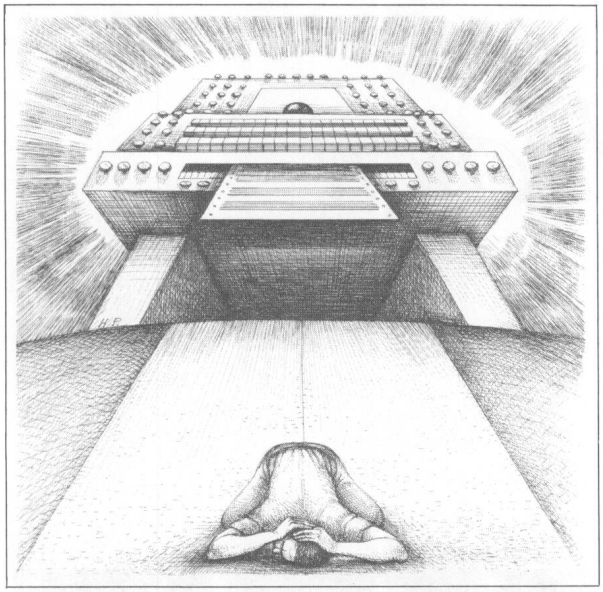
Module

Introduction





Shake Hands with the Machine
Introduction Module: Elton's Office

"I quit."

Jim Cedric looked up from his desk. Elton Pool stood in the doorway, nervously flicking a short pencil he held between his fingers like a cigarette. Elton was usually the friendliest person in the office. Today his glare was electric. Jim said, "Sit down, Elton."

"Sit-down-Elton?" Elton said. "Why should I sit-down-Elton? As far as I'm concerned, I don't work here any more. I'm here to resign, Mr. Cedric."

Why me? *Jim thought. The joys of seniority. Jim was in charge of accounts receivable for Cullen Publishing Company, a fast-growing textbook company on the West Coast. That meant he had to keep track of all the money that came into the company for all the books they sold. He'd been with Cullen since it began twenty years ago, and, as senior accountant, he'd been made manager of all accounting. So he was in charge of everything from office scheduling to the financial statement and the company budget.*

Payroll was also his responsibility, but that was handled for Jim by Florence Gordon, a meticulous, old-fashioned green-eye-shaded bookkeeper who loved, respected, and understood payroll.

Order processing and customer service was also in the accounting wing, and that at times was the biggest headache of all. Certainly the most paperwork. Which meant Cullen Publishing Company and Jim Cedric were both lucky to have Elton Pool. Elton was the paperwork champion of the West Coast publishing world. He had been with the company eleven years, and it would take anyone else at least fifteen to learn his skills. You can't resign, *Jim thought. But of course he could.*

"Paperwork, right?" Jim said. "What happened, Elton? Did the ledger card machine break down again?" Cullen used the ledger card machine to process information so that much of their accounting could be done by a service bureau—a firm that prepared invoices and kept track of inventory records for them.

"Ledger card machine—that thing's a joke," Elton said. "In fact that whole service bureau is more trouble than it's worth." He came into the office. "Jim, I don't know what I'm going to do. Four shipments were returned this week, six since October first. Wrong books. In one case, it was right book, wrong edition. If those meatballs in the Saint Louis shipping department don't shape up, we'll be operating a hotdog stand in two years. Professors are calling collect, demanding that we ship the right books air freight at our expense. And of course the statements just went out last week. You're going to have a lovely time with the next invoices. Pity I won't be around to enjoy the fun."

"I know it's a mess," Jim said. "I never enjoy this time of year. And think of the poor students, standing in long lines to pay almost twenty bucks for a late book they'll use for only half a semester. But Elton, we've been through it before; you've managed, and because you've managed, we've managed. You can't say we don't appreciate you. Besides, we're doing something about the warehouse. By next year, your job will be a lot simpler, thanks to . . ."

"I know," Elton said. "The computer.*" The electricity was back, and Jim knew that paperwork was not the cause of Elton's explosion.*

"The computer?" he said. "Is that it?"

"That's right. The computer."

"Mind if I join this?" Flo Gordon walked into the office. "One of my favorite subjects, computers," she said. "And the same goes for everybody else since the company signed that contract."

Oh brother, *Jim thought,* two against one. *"Look," he said. "I know what you're thinking, and you're both wrong. At least reserve judgment until the first of the year. Then you'll get to meet the computer. It doesn't bite. It's really going to be a great worker, believe me. Why, within five years we'll be able to double our operations, without adding a single . . ."*

"Just don't let it get its hands on my payroll," Flo said.

"Don't be ridiculous," Jim replied. "The paychecks are printed by Bank of America, aren't they?"

"Banks are supposed *to use computers," Flo snapped. "They always have. But not the payroll department."*

Hopeless. Jim turned back to Elton. "Just think, Elton. The computer will be able to post, add, and sort. *Within a few months we'll never have to deal with the ledger card machine* or *the service bureau again. And within a year, we'll teach it to deal with royalties, and how to process returns . . ."*

Elton tossed his pencil in the air and caught it. "Great. Terrific. It doesn't matter if I quit. I'd just be an extra human being."

"Don't be silly. You know more about this department than anybody else, including me," Jim said. "Do you think that computers are going to replace you? Do you think computers work all by themselves?"

Elton's eyes widened. "You expect me to work *it? Forget it. I have enough trouble relating to the keypunch operator at the service bureau, and she's a human being. Some days I can't even find the carriage return on my Selectric. Between that and the ledger cards . . ."*

"I'm the same way," Flo Gordon added. "I have to call a mechanic or a Boy Scout to get my lawn mower started. It took me a year to learn standard shift."

Cedric sighed. "Nobody's asking either of you to operate the machine. We'll be hiring an operator and a programmer for that. But Elton, they won't know anything about the publishing industry or about Cullen Publishing Company. We're counting on you to tell them—especially the programmer—what needs to be done."

"Fine," Elton said. "First you give the computer my office and then you ask me to train the programmer to do my job. The trouble is, I won't be around. Sorry."

Jim paused. "Nobody can do your job but you, Elton," he said. "The machine won't get your job, and neither will the programmer. They'll just make it easier for you to do it yourself."

There was a moment's silence, and then Elton said, "They still get my office, and I still quit."

"Your office?"

Flo cleared her throat and said, "Maybe you haven't seen the memo, Jim?"

"What memo? I haven't gone through my mail yet. Maybe it's at the bottom of this pile of . . ."

Elton said, "Save yourself the trouble. Follow me. There's a copy on what used to be my desk."

The three of them paraded out of Jim's office and through a large room of busy desks, ending up in a bright office at the end of the big room, where, under a faded Hawaiian surfing poster, Elton had worked for the past year. He picked up the memo from Lee Reimers, the vice-president, and handed it to Jim.

Elton's office was a monument to neatness and efficiency. One thing Jim had always admired about Elton was that he didn't try to make himself necessary. Anyone could find anything on his desk or in his files, and it all made sense. But Elton understood it best, and that's why he was necessary.

But, *Jim thought,* he could do the same in any office. They're all about the same. *That's why he'd suggested to the vice-president yesterday that they put the new computer and the programmer in that office, the one with the Hawaii poster. According to the architect, that would be the easiest office to air-condition. And, as Lee Reimers's memo pointed out, the computer would be halfway between Jim's office and Flo's. Should Flo ever*

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