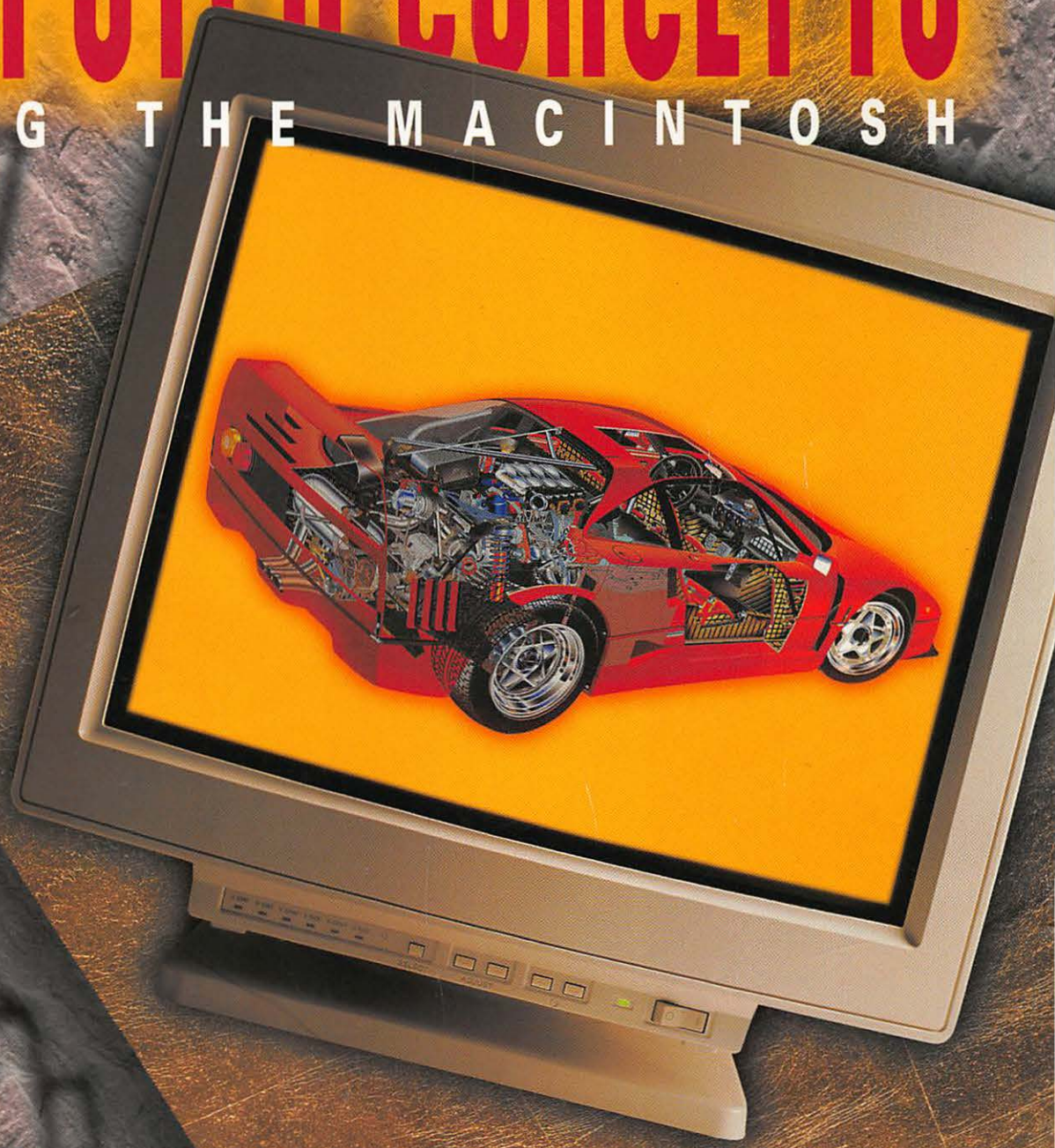
DANNY GOODMAN'S

COMPUTER CONCEPTS

USING THE MACINTOSH



Cover Photo Credits:

Computer Monitor - Doug Martin

Original FerrariF40 illustration by David Kimble. Electronically recreated in CANVAS, the High-Performance Drawing Enviroment from Deneba Software.

Deneba Software
7400 S.W. 87th Ave.
Miami, FL 33173
(305) 596-5644

Danny Goodman's Computer Concepts

Using the Macintosh

with Pete Alcorn

GLENCOE
McGraw-Hill
New York, New York Columbus, Ohio Woodland Hills, California Peoria, Illinois

Library of Congress Cataloging-in-Publication Data

Goodman, Danny.
Danny Goodman's Computer Concepts Using the Macintosh.
p. cm.
Includes index.
ISBN 0-02-801051-5
1. Microcomputers. 2. Macintosh (Computer) I. Title
QA76.5.G623 1994 94-8361
004.165--dc20 CIP

Danny Goodman's Computer Concepts Using the Macintosh

Send all inquiries to:
Glencoe/McGraw-Hill
936 Eastwind Drive
Westerville, OH 43081

ISBN 0-02-801051-5

Concept, development, and production:
BMR, Corte Madera, CA
Writer, developmental editor, and art director: Pete Alcorn
Design, page layout, and art direction: YO, San Francisco
Production manager: Janet Andrews
Illustrator: Laurie Wigham
Photo researcher: Monica Suder
Copy editor: Mark Woodworth
Color Separation: Four Lakes Colorgraphics Inc.

3 4 5 6 7 8 9 10 066 03 02 01 00 99 98 97

Contents

Chapter 1: Introduction to Personal Computers 1
What's It Like to Use a Computer? 2
The Four Parts of a Computer System 4
Types of PCs and Macs 6
The Evolution of the Computer 8
Computers at Work 10
Computers at Home 11
Computers in Education 12
Computers Where You Least Expect Them 13

Chapter 2: The Basics of Microcomputer Hardware 17
Getting Data into the Computer 18
Getting Information out of the Computer 22
How the Computer Processes Data 26
Storing Programs and Files 30
Connecting Peripherals 34
Ergonomics 36
Protecting Your Hardware 37

Chapter 3: System 7 and other Operating Systems 41
What Is an Operating System? 42
Five Operating Systems for Microcomputers 44
The Macintosh Desktop 46
File Management with Windows and Folders 48
Extending the GUI with Menus and Dialog Boxes 50
The File and Apple Menus 52
Multimedia and QuickTime 54
Utility Software 56

Chapter 4: Application Software 61
Buying and Installing Software 62
Using Software 64
Word Processing 66
Spreadsheets 68
Database Software 70
Graphics Software 72
Desktop Publishing 74
Other Applications 76
Combining Applications 78

Chapter 5: Connecting Computers to Each Other 83
The Evolution of Networking 84
The Advantages of a Network 86
Network Hardware 88
Network Software for the Macintosh 90
Modems and Communication Software 92
Getting Online 94
The Dangers of Connectivity 96
Ever-Increasing Flexibility 98

Chapter 6: How Software Is Made: Programming 103
A History of Programming: The First 40 Years 104
Traditional Programming with Third-Generation Languages 106
Object-Oriented Programming 107
Fourth-Generation Languages 108
The Power of HyperCard 110
AppleScript: System-Level Scripting 112
Freedom 113

Basic Mac Skills 117
Turning On the Macintosh 118
Parts of the Macintosh Desktop 118
Using the Mouse 119
Menu Options and Dialog Boxes 122
Manipulating Windows 125
Creating and Moving Folders 128
Viewing Files and Folders By Name 129
The Apple, Help, and Application Menus 132
Turning Off the Macintosh 135

Photo Credits 138

Glossary and Index 139

Preface

WELCOME TO COMPUTER CONCEPTS, the core text of the Danny Goodman computer education series. This book will give you a firm grounding in computer literacy. You'll learn what a computer is, how it works, and what you can do with it.

This book and the tutorials that go with it are designed to be used at schools that have Macintosh computer labs, so most of the examples in this book relate to the Mac. But that doesn't mean that you'll finish the course knowing only about Macs. The material you'll learn here applies equally well to all kinds of personal computers, so you'll be well prepared for using any type of machine, whether it is a Mac, an IBM, a clone, or a CAD workstation.

The Macintosh's (and This Book's) Philosophy

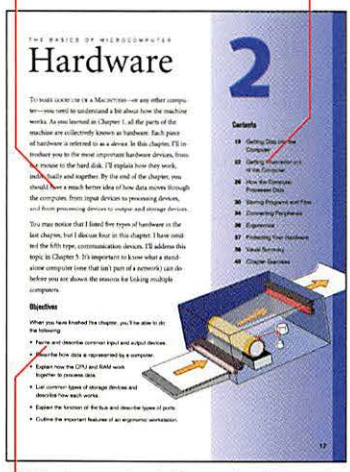
Computer Concepts is based on the same philosophy as the Macintosh itself, namely, that a picture is worth a thousand words.

Before the Mac was introduced in 1984, using a computer was a matter of typing words and commands at the keyboard. The computer responded by displaying more words on the screen. The Mac changed all that. When they designed the first Mac, the people at Apple decided that computers would be easier to use if you gave commands by clicking and moving objects on the screen using a device called a mouse. Sure enough, the Mac and its "graphical user interface" proved immensely popular and much easier to understand than the old, text-based user interfaces.

When we designed this book, we started with the same philosophy. With most textbooks, the text is written, then someone gathers up the pictures and drawings (collectively known as art), and finally, a designer puts the two parts together. With this book, the design came first. We started by thinking about how you would use the book and what kind of layout would be easiest to understand. Then we created the art and the text as a combined effort.

As a result, the art in this book isn't just thrown in to spice up a lot of words. The two parts work together to explain the ideas. We call this approach information design. You'll see how it works as soon as you start to read the main part of the book. I think you'll find this book's information design makes sense and makes the material easy to understand.

Elements of Each Chapter and How to Use Them



In addition to the integration of text and art, there are several other elements of this book's information design that make the material easier to read, understand, and remember.

Each chapter opens with a page that lists the contents of the chapter and the things you should know when you're through reading it. The opening page also has a short overview that tells you what the chapter is about and how it fits together with the other chapters.

The body of each chapter is divided into page spreads (a page spread consists of two pages that face each other). In most cases, each section of the chapter takes up one spread, so turning the page usually starts a new section.

As you read, take note of the terms that appear in bold. These are new computer terms, and you'll find the definition accompanies the bold term. Once it's defined, the term may be used frequently, so it pays to read the definition carefully. However, if you come across a computer term that you don't understand, you can look it up in the combined Glossary and Index at the back of the book. There you'll find all of the bold terms (plus a few more), as well as the page where they are defined.

In addition to the regular text, there are also some notes mixed in. They appear in a different color than the rest of the text and stick out into the margins. The notes include tips, anecdotes, and bits of unusual information from my years of learning about the Mac.

There are three pages at the end of each chapter that can help you review the material that was covered and save you time as you prepare for tests and quizzes.

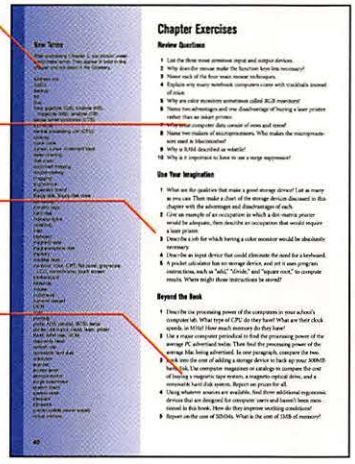
The first two pages, the Visual Summary, list the most important points of the chapter.

The last page of the chapter lists the new terms that were defined and presents three types of exercises.

The first ten questions test your knowledge of the facts covered in the chapter.

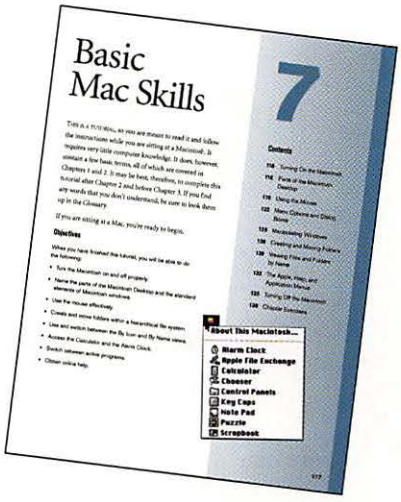
The Use Your Imagination exercises push you a little further, encouraging you to think about what you have learned and apply it to what you know.

Finally, the Beyond the Book activities ask you to find computer-related information outside the book and the classroom.



The Basic Mac Skills Chapter

The last chapter in the book is a lot different than the others. It's called Basic Mac Skills, and it's structured as a tutorial. In other words, you don't just read it, you do it. Take this book to the computer lab, sit down in front of a Mac, and follow the steps in the chapter. By the end, you'll know how to



- turn the Mac on and off correctly
- use a mouse
- give commands to the computer using menus and dialog boxes
- control how and where information appears on the screen
- create folders and move files between them

Just because the Basic Mac Skills chapter is at the back of the book doesn't mean you should wait until the end to complete it. The skills you'll learn in it are indeed basic, so the earlier you learn them, the better. You can even start the course with the Basic Mac Skills chapter. However, it's probably easiest to complete it after reading Chapters 1 and 2, if you can wait that long. On the other hand, if you already have some experience using a Mac, you may not even need the Basic Mac Skills chapter. That's why I put it at the back of this book: Different students will want to walk through the chapter at different times, and some won't bother with it at all.

By the way, the same chapter appears as the Introduction for each tutorial in the Danny Goodman computer education series. If you have one of the tutorials, you might want to step through its introduction rather than the Basic Mac Skills chapter in this book. You don't need to do both.

Acknowledgments

Each of the books in this series has been carefully crafted by my unique authoring team: Pete Alcorn, who wrote and edited most of the text, created most of the screen captures, and guided the development of the illustrations; Lee Cline and Rod O'Neal, who wrote the QuarkXPress book; Lynne Stiles and Maria Giudice of YO, who designed the series and created the pages for this book; Laurie Wigham, who created the illustrations in this book; Monica Suder, who researched the photos; and Janet Andrews, who managed the production of the series and checked the accuracy of the tutorials. I want to thank all of them, as well as Gary Schwartz and his associates at Glencoe Macmillan/McGraw-Hill, who had the commitment to serve the needs of Macintosh users.

The series was also made possible by the Macintosh and some of the best programs available today: Microsoft Word, QuarkXPress, Adobe Illustrator and Photoshop, and Mainstay Capture.

In addition to the authoring team, I want to thank several others who helped create a great product. First, thanks are due to the reviewers of the manuscript, who checked my work and offered truly valuable insights and suggestions on how to improve it:

Metha Schuler, Santa Rosa Junior College
Don Busche, Saddleback College
Jeff Stuyt, Texas Tech. University

Matt Lusher was an invaluable source of technical know-how and bizarre humor (and the source for a few of the most difficult screen captures). Brian Curless also provided technical assistance and is remarkable for his aplomb when working with Unix. Josiah Fizer helped create many of the obscure screen captures that I called for. Thanks also to Karen Lamoreux for remaining suspiciously cheerful while coordinating all the pieces of the project. And, finally, thanks to Nick Keefe for initiating the entire project and guiding it all the way to completion.

Thanks to all,

Danny Goodman

INTRODUCTION TO PERSONAL

Computers

1

PEOPLE'S REACTIONS TO COMPUTERS are as varied as their own personalities. One person might see a computer as a high-tech toy and be as excited as a child with a new game. Another might see a mysterious box and imagine a dreary existence of typing and staring at an electronic screen. Just so that you understand my bias, those of us who write about these machines tend more toward excitement than dread. Even so, this book is a textbook, and I won't be portraying the Macintosh, or any other computer, as a toy. For our purposes, the computer is a tool—an immensely powerful one. The reason I call the computer powerful is not that it helped to put people on the moon or chart the bottoms of the oceans. My outlook is a little more down-to-earth. The computer is powerful simply because it can make your life easier. Whatever it is you want to accomplish, there's a good chance that you can do a better job of it, and do it faster, if you use a computer as a tool.

Objectives

When you have finished this chapter, you'll be able to do the following:

- Name the four parts of a computer system.
- Explain the function of the five types of computer hardware.
- Explain the differences between application software and system software.
- Define the terms microcomputer, mainframe, minicomputer, and supercomputer.
- Explain the advantages of connecting computers in a network.
- Name the most common types of application software, and describe how these programs can be used.

Contents

2 What's It Like to Use a Computer

4 The Four Parts of a Computer System

6 Types of PCs and Macs

8 The Evolution of the Computer

10 Computers at Work

11 Computers at Home

12 Computers in Education

13 Computers Where You Least Expect Them

14 Visual Summary

16 Chapter Exercises

What's It Like to Use a Computer?

These two pages present an imaginary scenario that illustrates some of the ways in which a computer can be used. Don't worry if you don't understand all the vocabulary—you'll know most of it by the end of the chapter and all of it by the end of the book. If you're curious about a specific term, though, you can look it up in the Glossary at the back of the book.

Imagine that you are the manager of Shades, a retail store in Virginia Beach that specializes in sunglasses. Your boss, Paul Nervin, is the owner of the store and several others like it. The store you manage was his first, and under your management it became very successful. In the last five years, he has opened several more: one in South Carolina, three in Florida, and just recently two more in California. Because you managed the first store, you are Mr. Nervin's first consultant on business issues. In fact, you planned the new stores in San Diego and Santa Barbara. Mr. Nervin is considering sending you to California to manage West Coast operations.

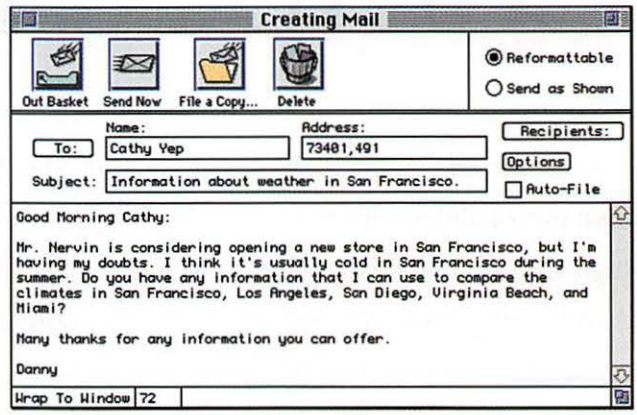
Last Friday, you received a note from your boss about opening a new store in San Francisco. You thought about the idea over the weekend, and you're having doubts. You spent a week in San Francisco two summers ago, and it was cloudy every day. You decide to look at weather patterns there and send Mr. Nervin a report on your findings. You start by turning on your Macintosh.

Goal 1: Find Information

Your first task is to gather some information about weather patterns in San Francisco. You might be able to find what you need on CompuServe, an information service to which you subscribe. Your computer contacts CompuServe through the telephone lines, using a device called a modem and a communications program. You start the communications program and, presto!, you have access to all the information in CompuServe.

CompuServe is just one of the information-rich services a personal computer can reach—an enormous library right on your desktop.

You know you can get up-to-the-minute weather forecasts within CompuServe through the National Weather Service. But that's not what you need. Rather than look for the information yourself, you decide to ask a friend who works at a travel agency. You access CompuServe's electronic mail service and send her the note shown here.



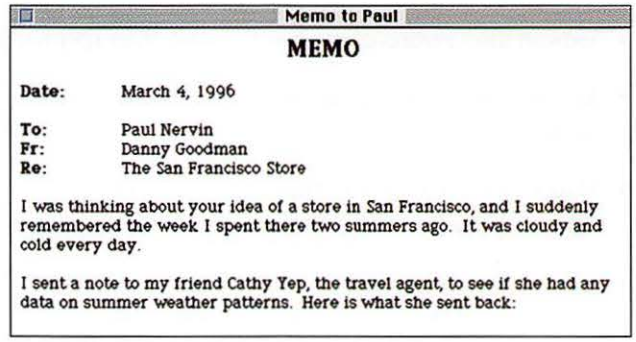
After about 20 minutes, she sends back a note containing the table shown below.

City	Average High Temp. in July
San Diego	82
Santa Barbara	82
San Francisco	71
VA Beach	90
Miami	89

You tell your Mac to save a copy of the table, and you disconnect your computer from CompuServe.

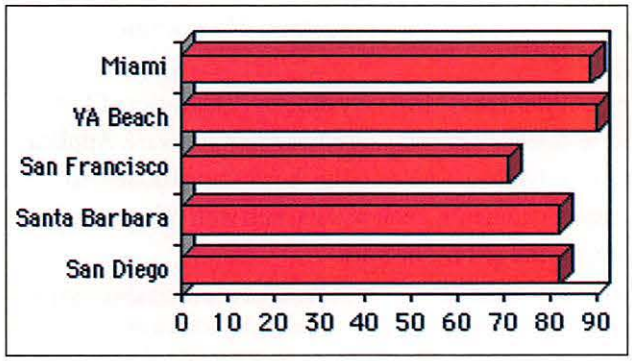
Goal 2: Write a Memo

Now you need to put your findings into a note to your boss, so you start your word processing program, which is called Microsoft Word. You explain to Mr. Nervin your nervousness about the new branch location.



Goal 3: Illustrate Your Findings

Now you want to add the information that Ms. Yep sent in her note. To illustrate the data clearly, you decide to make a bar graph using a spreadsheet program called Microsoft Excel. You start Excel, copy the information from the note into the spreadsheet, then tell Excel to make a bar graph.



You copy the table of information and the bar graph, switch back to Microsoft Word, and paste the information and graph into your memo. You print the result to inspect your work. So far, so good.

Goal 4: Send the Memo to Your Boss

The last task is to send the memo to Mr. Nervin. He just left on a business trip to Los Angeles, but you know the hotel where he is staying. You call the hotel and ask for its fax number. Then you use the fax modem in your computer to send the memo. He'll get the memo as soon as he checks into the hotel.

You've just done more on a personal computer than you could with a huge corporate computer. Personal computers are made for everyday folks, yet their powers are far-reaching.

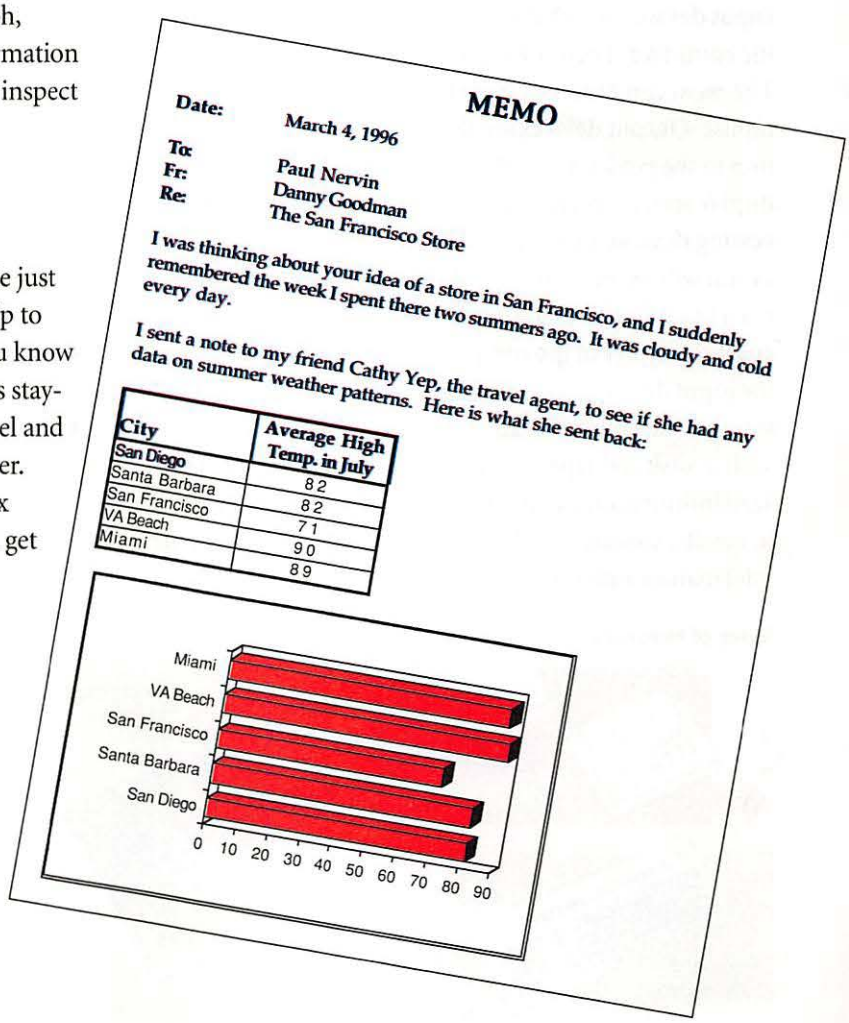
The Possibilities Are Limitless . . .

The scenario you just read illustrated only a few of the thousands of ways you can use a personal computer. In general, you can use computers to do the following:

- Collect information
- Organize and process information
- Communicate ideas

You just witnessed examples of all three uses. In the scenario, you used CompuServe, the communications program, and a modem to collect information about the weather. You used a spreadsheet to process information about the weather into a bar graph. Then you used a word processor and a fax modem to communicate your ideas to your boss.

The possibilities really are limitless. The trick is to know how the computer can make your life easier—then to take advantage of that capability whenever you can.



The Four Parts of a Computer System

When you think about computer technology, it's important to know the difference between two terms: *computer* and *computer system*. A **computer** is a piece of machinery that accepts, processes, and presents data. You should always remember, however, that the computer is just a tool—it doesn't do any good on its own. For a computer to be of any real value, it must be part of a **computer system**, which includes hardware, software, people, and data.

Hardware: The Part You Can Touch

When you look at a computer, what you can see and touch is just one part of the computer system: the hardware. The **hardware** is the machinery, so *hardware* and *computer* can sometimes be used synonymously. The various hardware devices are categorized according to one of five functions: input, output, processing, storage, and communications.

Input devices are what you use to get information into the computer. There are lots of different input devices. The most common by far are the keyboard and the mouse. **Output devices** are things that present information to the person using the computer. The monitor, or display screen, and the printer are the main ones. **Processing devices** are the brains of the computer—though, as you will see in Chapter 2, claiming that the computer has a brain is a bit of a stretch. The processing devices are at the center of the computer. They take data from the input devices, organize it and send it to the output, storage, and communication devices. **Storage devices** such as disk and tape drives give the computer a place to keep information when the processing devices don't need it. Finally, **communication devices** let the computer trade information with other computers.

Software: Controlling the Hardware

Software, also called **programs**, goes hand-in-hand with the hardware. Programs are the electronic instructions that tell the hardware what to do. Machines such as a can opener or washing machine are designed to perform a single function. Unlike them, the computer can perform an infinite number of tasks, because software controls what the machine does. In other words, a computer is powerful because it is a programmable machine.

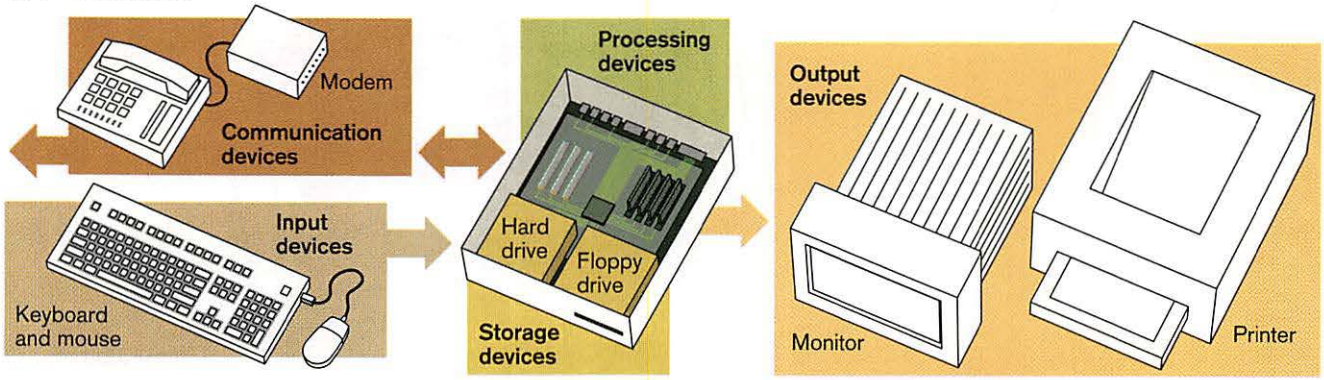
Actually, there are two very different categories of software: application software and system software. **Application software** is what you use to get things done—to create documents, analyze data, talk with other computers, and so on The most common types of application software are word processors, spreadsheet programs, database management programs, graphics programs, desktop publishing programs, and communications programs.

Most of the programs sold in computer stores are application software packages.

System software is the set of basic instructions that runs the computer. It includes several kinds of programs, including the operating system, utility software, and software needed for programming. For most users, the most important piece of system software is the **operating system**, which serves at least three purposes:

- It provides an interface (place of meeting) between the application software and the hardware.
- It tells the processing devices how to interact with the other hardware devices connected to them.
- It provides a way for the user to interact directly with the computer.

Types of Hardware



What Is Data?

Data, the third part of the computer system, is a term used to describe raw facts. Data can be numbers, letters, images, or sounds. Data is the object of everything the computer does—the computer is a machine designed to process data. In the computer, data is usually organized into **files**, which are named sets of data. When you are working with an application, the term **document** is often used instead of *file* to describe a set of data that is being worked on. For example, to edit a letter, you run the word processing program (the application), then use it to load (move from storage into memory) the document or file, which contains the data (the characters that make up the letter).

Surprisingly, the computer represents all data with numbers. What's more, the computer uses the binary numbering system, so the only digits it stores are 0 and 1. (In contrast, people use the decimal, or base 10, numbering system, which has 10 digits.) It's a little strange, but all the data that goes into and out of a computer is represented internally by a series of ones and zeros. This sentence is shown here in binary code. →

```
T 01010100
h 01101000
i 01101001
s 01110011
  00100000
s 01110011
e 01100101
n 01101110
t 01110100
e 01100101
n 01101110
c 01100011
e 01100101
  00100000
i 01101001
s 01110011
  00100000
s 01110011
h 01101000
o 01101111
w 01110111
n 01101110
  00100000
h 01101000
e 01100101
r 01110010
e 01100101
  00100000
i 01101001
n 01101110
  00100000
b 01100010
i 01101001
n 01101110
a 01100001
r 01110010
y 01111001
  00100000
c 01100011
o 01101111
d 01100100
e 01100101
. 00101110
```

In some books and articles, you will need to watch out for subtle differences in the terms *data* and *information*. Technically speaking, data is raw facts, and **information** is a meaningful set of data. For example, a list of numbers is data, but a well-designed bar graph is information. In this book, I tend to use the term *information* more loosely to include both raw facts and meaningful sets of them.

People: A Collection of Users

In a computer system, the person using the computer is often called, appropriately enough, the **user**. It may seem obvious that the user is part of the computer system, but this idea has only taken hold slowly. Throughout most of the history of computers, the machines were designed with the emphasis on the needs of data, rather than the needs of people. In fact, many in the computer industry credit Apple's Macintosh with reminding the computer world of the user's importance. After all, the Macintosh gave rise to the term *user-friendly*. Today, software designers are constantly trying to make programs easier to use, and hardware manufacturers are making computers that are more comfortable and natural for people to interact with.

Types of PCs and Macs

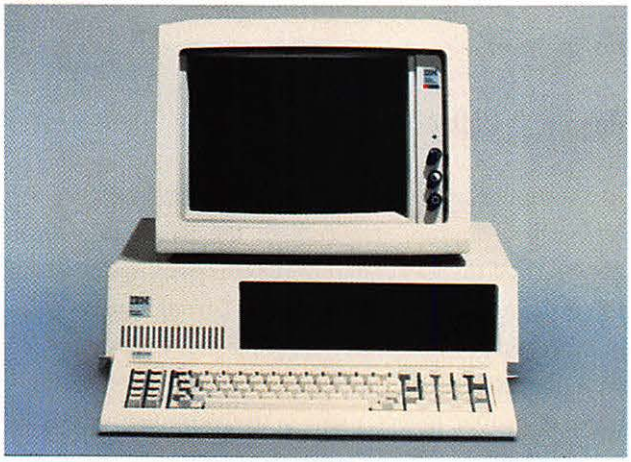
You may have noticed that computers come in many shapes and sizes. Most computers you see today are called microcomputers. A **microcomputer**, also known as a **personal computer**, is a general-purpose computer whose main processing component is contained on a single silicon chip, called a microprocessor. Most microcomputers are designed to be used by one person at a time. (You'll learn about exceptions to this rule in the networking chapter, Chapter 5.)

In their 20-year history, microcomputers have changed a great deal, and a lot of new models and terms have come along. Today there are notebooks, compact models, desktop models, and tower models. All of them can perform similar computing tasks. On these two pages, I'll show you what these terms mean.

Why a Mac Is Not Always a PC

The term *PC*, as you may know, stands for personal computer. People tend to differentiate, however, between PCs and Macs, so you might wonder, "Isn't a Mac a type of PC?" The answer: yes and no, usually no.

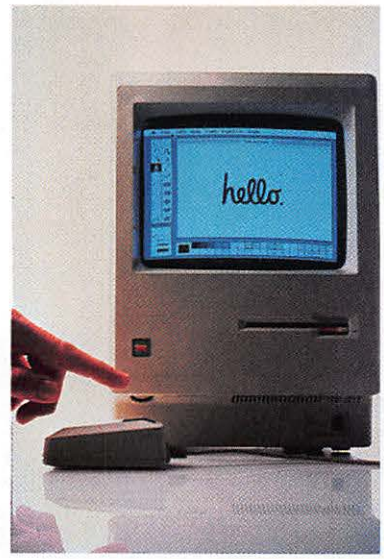
The problem is, when IBM Corporation released its first microcomputer in 1981 (shown below), the company named it the IBM Personal Computer. People soon called it the "PC" for short. It was an immediate success and



quickly became a business standard. For marketing reasons, IBM allowed other companies to copy the PC design. As a result, scores of companies began making **IBM-compatibles** or **clones** that worked with all the same software as the IBM PC. All of these computers, both IBMs and clones, are known as **PCs**.

Three years after IBM released the PC, Apple Computer came out with the Macintosh. It could do many of the same types of things as a PC, but it was radically different in design. The biggest difference between the Mac and the PC was the way the screen looked and the fact that you used the Mac with the help of a pointing device called a mouse. The Mac needed different software than IBM's machines (in other words, it *wasn't* "compatible"). So there came to be a distinction between the terms *Mac* and *PC*, even though the Mac *is* a personal computer. This photo shows the original Mac design.

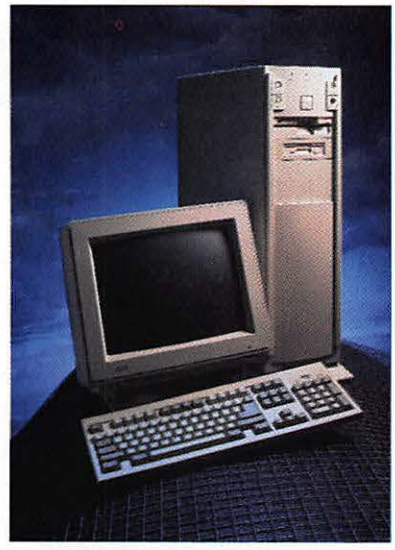
In 1984, Apple introduced the Macintosh as the personal computer "for the rest of us" in a boast of superiority over its more complicated cousins.



Describing PCs

At first, most of the PCs (IBMs and compatibles) on the market looked fairly similar. The main cabinet, known as the **system unit**, lay flat on the desk. The monitor usually sat on top of it. As computer designs evolved, the original configuration (or grouping of parts) became known as the **desktop model**.

One simple modification that has become popular is to turn the system unit up on end and call the computer a **tower model**. Tower models, like the one shown here, are meant to be put on the floor to free up valuable desk space.



A more important change in design has been the steady move toward smaller computers that people can take with them wherever they go. Today the term *portable* is rarely used, because people associate it with the first portables: briefcase-sized machines that weighed as much as 30 pounds. The more current terms are **laptop**, **notebook**, and **subnotebook**. The notebook is the most common type. It gets its name because it's about the size of an $8^1/_2$ x 11" piece of paper.

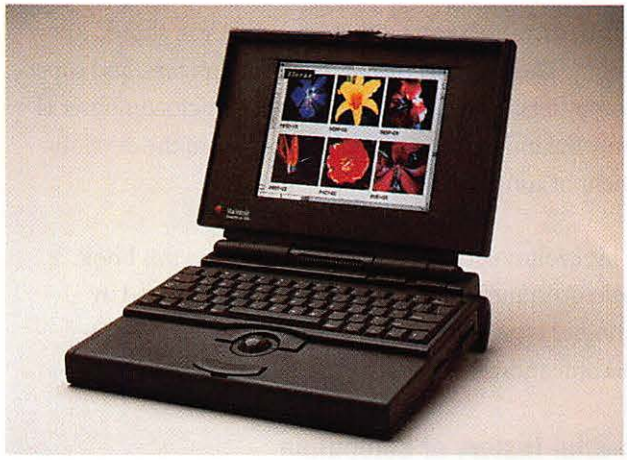
Some people like to include a class of computers that are even smaller than notebooks: the palmtops, sometimes called Personal Digital Assistants, or PDAs. Here, the definition of a personal computer is stretched. PDAs are valuable for keeping addresses, maintaining datebooks, and running other simple applications. But they can't run all the types of software that are used on other kinds of personal computers.

The Macintosh Family

In 1984, there was only one model of Macintosh. Since then, however, Apple has diversified the line and created a family of Macintosh computers. When the Mac line expanded, the original design became known as the **compact Macintosh**, because it had a small 9" monitor that was built into the main cabinet.

Unlike the compact models, most of the Macs sold today are desktop or tower models that look similar to the desktop and tower PCs. These Mac models are sometimes called **modular Macintoshes**, because the monitor and the system unit are separate. The modular Macs include Performa and Quadra lines, and the top-of-the-line power Macs. The Quadra 610 and 650 are shown below.

Apple has also developed a popular line of notebook computers, called **PowerBooks.**



Finally, Apple has a subnotebook line, the PowerBook Duos, which can be used as a notebook computer when you are away from your desk. When you come back, you can slide the Duo back into its docking station, the Duo Dock, which looks like a desktop model computer, except for the slot in the front where the Duo fits.

The Duo gives you the best of both worlds—a fully-powered portable Mac with even more storage and better video at your desk.

The Evolution of the Computer

You have seen several different types of computers on the last few pages, all of them microcomputers. Although this book focuses on microcomputers (especially the Macintosh), there are several other types that you should know about. These are mainframes, minicomputers, and supercomputers. As you will see below, the microcomputer is only the most recent evolutionary stage in the development of computers.

This evolution continues even as you read this book. Microcomputers are not actually being replaced by another type. Rather, they continue to change as they become more powerful.

A Brief History of Computing

The first electronic digital computer came to life in 1946. It was called the ENIAC, which stood for Electronic Numerical Integrator And Calculator. It was developed for the U.S. Army by John Eckert and John Mauchly. It contained 18,000 vacuum tubes and occupied 1,800 square feet. In other words, it was the size of a house. Despite its size, however, the ENIAC had far less processing power than a typical Macintosh today.

Unlike modern electronic chips, vacuum tubes burn out over time. The sole job of some ENIAC technicians was to locate and replace burnt-out tubes.

It was during the 1950s and 1960s that the computer revolution took hold in this country. Businesses began buying mainframe computers to support their need to process data, especially financial data. A **mainframe** is a large computer capable of serving the needs of hundreds or even thousands of users at one time. People normally use the mainframes with the help of **terminals**, which consist of a monitor and a keyboard.

The first alternative to mainframes were minicomputers. The so-called mini gained widespread use in 1965, when DEC released the PDP-8. A **minicomputer** is a relatively small computer, usually about the size of a refrigerator, that can serve the needs of from one to several hundred users at the same time.

The next big advance in computing technology occurred in 1971 when Ted Hoff at Intel Corporation invented the first microprocessor, the 4004. A **microprocessor** is a single piece of silicon that contains the main processing components of the computer. This invention led to the development of the microcomputer, the first of which was released in 1975. The most important developments since then are listed on the timeline at the bottom of these two pages.

One more type of computer has emerged during roughly the same period as the micro, the **supercomputer**, the most powerful computer made. Unlike mainframes, supercomputers are not usually intended for more than one user. Rather, they tend to be used for complex mathematical processing in such fields as physics, meteorology, and astronomy. A Cray supercomputer is shown here.

1975 MITS releases the Altair 8800.
Gates and Allen found Microsoft, licensing Microsoft BASIC to run on the Altair.

1976 Wozniak and Jobs build the first Apple, then found Apple Computer.

1977 Apple introduces the Apple II.
Commodore and Tandy Corporations begin making microcomputers.

1978 Bricklin and Frankston demonstrate VisiCalc on the Apple II.

1979 Intel releases the 8088 processor.
Space Invaders and Pac Man jump start the video game industry.
Hayes introduces the first modem for microcomputers.

1980 WordPerfect is introduced.

1981 IBM releases the IBM Personal Computer, with 64K RAM.
Microsoft creates DOS for the PC.

1982 The first PC clone is sold. Lotus introduces 1-2-3 for the PC; Visicalc is quickly eclipsed.

1983 IBM makes the PC XT, which comes with a 10 MB hard disk.

1984 Apple's profits soar with the introduction of the Macintosh.
IBM creates the PC AT.
Hewlett Packard unveils the LaserJet, the first popular laser printer.

Fundamental Changes of the Microcomputer Revolution

Over the past 15 years, the computer industry has virtually exploded. The mainframe that was so common in the 1950s, 1960s, and 1970s, has been overshadowed by the ever-present micro.

One interesting development over the past few years has been the birth of the microcomputer workstation. Engineers, architects, and scientific researchers often need computers that are more powerful than those needed by home and business users. Many of their needs can now be served by microcomputers. As a result, several companies specialize in making **workstations**, which are really just powerful microcomputers designed for certain fields, like science and engineering. The most popular workstations are made by Sun Microsystems, Silicon Graphics, and Hewlett-Packard. Here is a Silicon Graphics Indigo workstation:

As they get more powerful, microcomputers are also becoming more convenient. Pen-based computers, for example, offer a radical change from the keyboard and mouse that most of us are used to. A **pen-based computer** lets you interact with the machine in the same way that you interact with a piece of paper. If you don't know how to type, you'll probably agree that using a pen is a lot more natural than using a keyboard. Besides, pen-based computers are small and lightweight, so you can take them with you wherever you go. The computer shown here is Apple's Newton.

Where Are We Going?

What's ahead, of course, is anybody's guess, but some trends are clear. Obviously, computer hardware will continue to cram more power into smaller packages. Already, the computing power of today's microcomputer is equal to or better than that of the mainframes of only 20 years ago. We're also likely to see greater convenience. Pen-based computing is one way this may occur. **Voice recognition**—the ability to dictate commands and text to the computer—is another possibility.

Another trend is the increasing importance of connecting computers to form networks, so users can cooperate and share data. One result of the networking trend is that the computer industry and the communications industry (phone, cellular, and cable TV companies) are becoming more interdependent as they prepare for a nationwide network, the data superhighway.

1985 Intel introduces the 80386 chip.
Microsoft releases the Windows user interface for the PC.
Aldus begins selling PageMaker for the Mac.

1986 Motorola introduces the 68030 chip.

1987 IBM comes out with the PS/2 which uses a 386 chip and the new OS/2 operating system.
Apple releases the Mac II and SE.
Microsoft announces Excel for Windows.

1988 Steve Jobs, after leaving Apple, unveils his NeXT workstation.
Apple sues Microsoft for copying the Mac "look and feel" in Windows.

1989 Apple releases the Mac SE/30.

1990 Windows takes off with the upgrade to 3.0.

1991 Apple releases System 7 for the Mac.
DOS is upgraded to version 5.0.

1992 IBM comes out with a 32 bit operating system for PCs, OS/2 2.0.
Sales of PCs based on Intel's 486 skyrocket.

1993 Microsoft releases Windows NT.

1994 Apple introduces the first computers based on Motorola's new Power PC chip.

Computers at Work

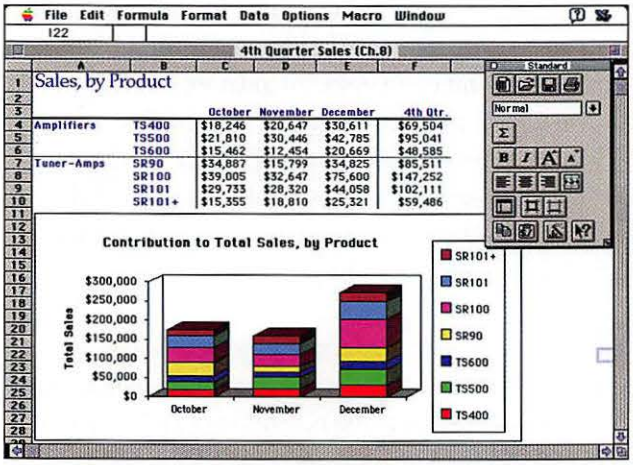
The very first microcomputers were bought mainly by hobbyists. But it didn't take long for the business world to take an interest in these powerful little machines.

VisiCalc was such a productivity breakthrough that businesspeople with access to mainframe terminals often spent their own money on Apple II computers just so that they could have spreadsheet power.

Soon after Dan Bricklin programmed the first spreadsheet, VisiCalc, in 1978, businesses began buying personal computers by the millions.

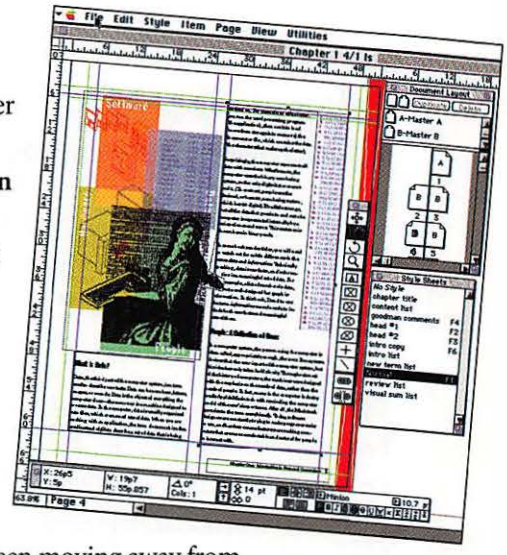
Application Software for Business

By the mid-1980s, three kinds of application software had become popular on microcomputers. The **spreadsheet**, a software tool for creating budgets, tracking expenses, developing business projections, and so on, gained widespread use with the introduction of Lotus 1-2-3. A screen from Excel, the best-selling spreadsheet for the Mac, is shown below.



Software for **word processing** was another obvious choice, considering the number of written documents produced in the workplace. Finally, businesspeople began creating and using **databases**—organized collections of related information—on their microcomputers.

More recently, many other types of programs have become popular. **Graphics software** allows users to create and edit pictures on the computer. **Desktop publishing (DTP) software** lets you create professional-quality page layouts, like those you see in books and magazines. In the upper right corner, a page from this book is being formatted in a DTP program called QuarkXPress. **Communication software** allows people to keep in touch electronically, no matter where they are. And **computer-aided design (CAD) software** has brought architects and engineers into the microcomputer community.



The Need for Connectivity

Businesspeople have been moving away from mainframes and toward microcomputers, because the smaller machines can perform most daily business tasks. What's more, microcomputers are far less expensive and easier to customize for specific needs.

The corporate mainframe does have one advantage, though. With everyone connected to the same big computer, it's easy to share programs and data. With microcomputers, each person tends to keep separate copies of the programs used, and data is often duplicated.

The answer to this potential disadvantage of microcomputers is the **network**, a group of computers connected through wire, cable, or radio transmitters. Many networks are small, connecting just a few computers. Others connect thousands of computers to create huge information webs that can span the whole country, or even the globe.

Networks give users the freedom and flexibility of a microcomputer, as well as the advantage of shared resources, including programs, files, and expensive hardware devices. To provide widespread access to critical business data, such as customer information, networks are vital. Networks also allow businesspeople to communicate better. Today the fastest growing form of communication is electronic mail, or E-mail. With E-mail, users have a kind of electronic postal service that delivers messages through a network. You can type a message, tell the network where it should go, then have your message delivered immediately, without ever leaving your desk.

These days, it's rare to find a desktop computer—even in a small office—that isn't connected to some kind of a network.

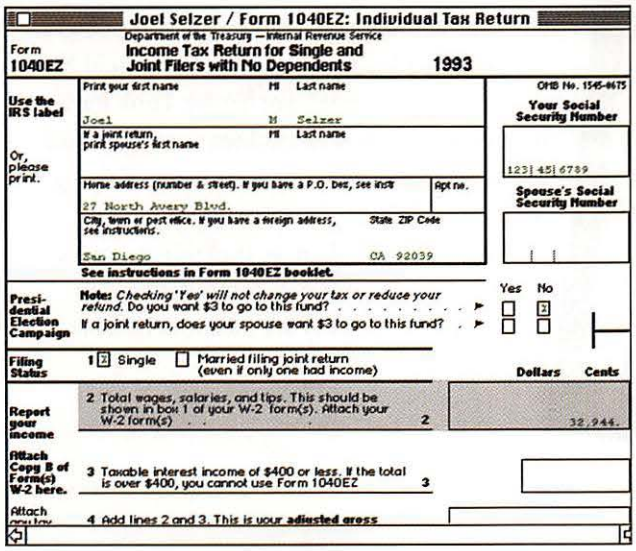
Computers at Home

The term *personal computer* originally came from the notion that microcomputers would be used by individuals, both at work and away from work. Computers were seen to be the ultimate appliance for information: faster than a speedy typewriter, more powerful than a programmable calculator, able to do your taxes in the blink of an eye. Indeed, the personal computer has evolved to meet the needs of users at home, but rarely in the ways that everyone expected. There are programs to help you save time at home, and there are others to help you have fun. In some cases, the computer is being used to control the house itself by opening windows, turning on lights, and controlling the temperature.

Running a household seems to be more and more like running a small business. So a computer fits in nicely at home.

Application Software for the Home

Naturally, a lot of the same software that you use at work can be used for similar purposes at home. Word processors are the most popular household tool, followed by spreadsheet programs, which can help you maintain a budget or analyze your investments. Database software is used to make inventories for insurance purposes and to keep track of addresses and music collections. Special graphics software is great for making party invitations and banners. Other kinds of application software, such as tax preparation programs (shown below), electronic reference guides, and money management software, have been created especially for the home market.



Joel Selzer / Form 1040EZ: Individual Tax Return

Department of the Treasury — Internal Revenue Service
Form 1040EZ — Income Tax Return for Single and Joint Filers with No Dependents — 1993

OMB No. 1545-0675

Use the IRS label. Or, please print.

Print your first name: Joel — MI: M — Last name: Selzer
Your Social Security Number: 123 45 6789
If a joint return, print spouse's first name — MI — Last name
Home address (number & street). If you have a P.O. box, see instr. — Apt no.: 27 North Avery Blvd.
Spouse's Social Security Number
City, town or post office. If you have a foreign address, see instructions. — State: CA — ZIP Code: 92039
San Diego
See instructions in Form 1040EZ booklet.

Presidential Election Campaign — Yes / No
Note: Checking 'Yes' will not change your tax or reduce your refund. Do you want $3 to go to this fund? ▶ ☐ ☒
If a joint return, does your spouse want $3 to go to this fund? ▶ ☐ ☐

Filing Status: 1 ☒ Single ☐ Married filing joint return (even if only one had income)

Dollars — Cents

Report your income:
2 Total wages, salaries, and tips. This should be shown in box 1 of your W-2 form(s). Attach your W-2 form(s) . . . 2 — 32,944.

Attach Copy B of Form(s) W-2 here.
3 Taxable interest income of $400 or less. If the total is over $400, you cannot use Form 1040EZ . . . 3

Attach
4 Add lines 2 and 3. This is your **adjusted gross**

The Computer as a Diversion

Some uses for computers around the house aren't as productive, yet they can be a lot of fun. Most teenagers have played with—or at least seen—a video game system, such as Nintendo or Sega Genesis. Of course, these systems are microcomputers, though they are very specialized ones that use the television as an output device. Similar games are abundant on PCs and Macs, especially on home computers.

A wide selection of strategy and action games can appeal to everyone in the family. Not every game involves kickboxing or space combat.

Computers Built into the House

For years, architects and entrepreneurs have been exploring the possibilities of controlling things like heating, lighting, and water heating with the help of built-in computers. At least two experimental houses, one in Japan and the other in the Netherlands, have all kinds of computer-controlled conveniences built into their design. In the United States, companies such as BSR and Smart House are already marketing some of these ideas. With a Smart House electrical system, you can program your house to be warm when you come home from work in the winter, and cool in the summer. The system can also switch your lights on and off every evening when you are on vacation, or turn on your coffeepot at 6 A.M. each morning.

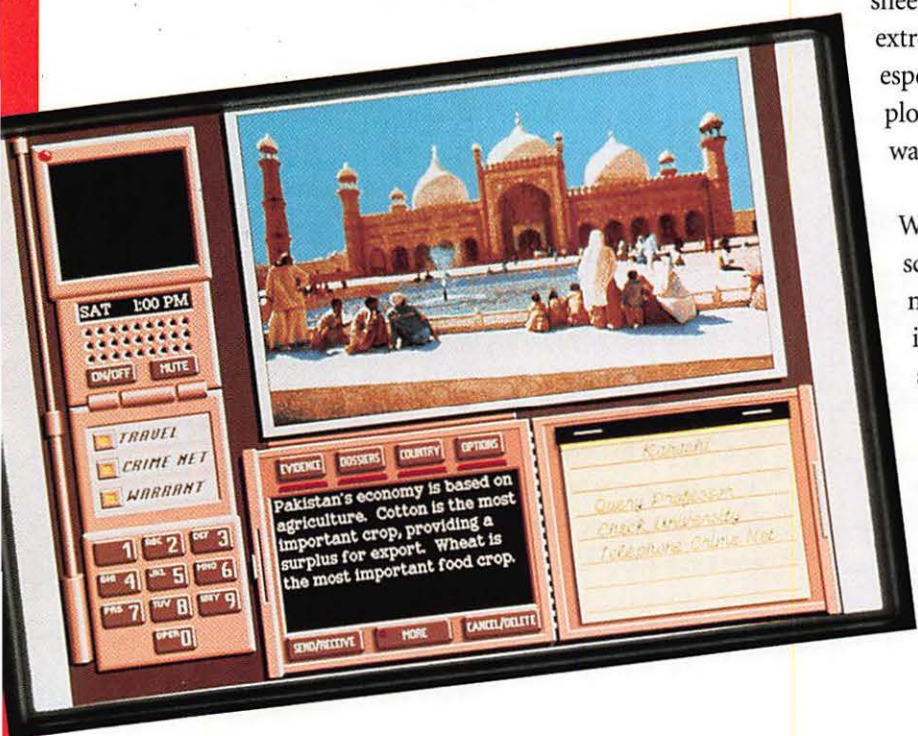
I dream of the day when my handheld computer can dial into my house control system, turn on some lights, set my VCR, and look around the yard with a video camera. Now that's home computing!

Computers in Education

More and more, computers are vital tools in homes and businesses. They have also had an important impact on our schools in at least two different ways. First, the business applications mentioned earlier are used by students to do their assignments better and more quickly. Second, with the help of educational software, computers are actually used to teach certain subjects.

Educational Software

Many children see computers for the first time in school. At the primary school level, computers are used to help teach almost every possible subject, from math to foreign languages. The three most important types of educational software are tutorials, games, and simulations. All three make up the field of *c*omputer-*a*ided *i*nstruction (CAI). A **tutorial** is like an electronic teacher, instructing the student and testing him or her as the lesson progresses. **Educational games** are similar to tutorials, but disguise the subject matter in a more enjoyable form. The best game software challenges the students' knowledge and encourages investigation, problem-solving, and critical thinking. The screen shown below is from Where in the World is Carmen Sandiego, one of the most popular educational games.



A third type of educational software, **simulation software**, uses the computer to re-create situations or phenomena that are impossible or too expensive to set up in the classroom, such as a spaceshuttle mission.

Simulations let students perform dangerous experiments on a computer. Better to blow up a simulated laboratory than the chemistry classroom.

To help students who are having trouble, computers offer teachers a way to give extra help without ignoring the rest of the class. Frustrated students often respond extremely well to computers because they are less judgmental than a teacher and a roomful of students. Advanced students have just as much to gain: If some students move ahead of the class, good computer software can offer supplemental instruction and a greater intellectual challenge.

Software to Help with Your Studies

In middle schools, secondary schools, and colleges and universities, computers are used much in the same way that they are used in business: as tools to help get work done. Word processing software is undoubtedly the most common tool, since writing a paper is a frequent assignment. Spreadsheets can also be extremely helpful, especially when students need to analyze numbers or plot graphs. A spreadsheet can actually be a great way to learn about math.

No fair copying selections from the online encyclopedia into your essay! But a spell-checked, nicely printed term paper can't hurt the ol' grade point average.

When considering how you can use computers at school, remember that the computer should be making your life easier, not harder. Look for ways in which computers can lighten your workload and let you do a better job. Try to avoid doing things on the computer that you could do better or faster with more traditional means. In other words, don't let computers add to your workload. They are meant to be *tools*, not hurdles.

Computers Where You Least Expect Them

So far, you have read about and seen pictures of many different types of computers. They all have one thing in common, though: they are general-purpose machines that can be used for many different tasks. By loading different software, you can turn a general-purpose computer into a specialist on a certain type of problem.

There are, however, many **special-purpose computers** in the world. These are computers designed for just one kind of task. The invention of the microprocessor—also called the computer chip—has led to special-purpose computers in almost every imaginable type of device. If it uses electricity, there is a good chance that it has a computer chip in it. Although these chips aren't as powerful as the ones that run Macintoshes, they can add functionality to all kinds of equipment.

Household Appliances

Today a high percentage of the electrical devices that you use around the house have computers in them. Dishwashers, microwave ovens, refrigerators, washers, dryers, and televisions can all have computer chips in them. The purpose of computerizing an everyday appliance varies. Computer chips in televisions automatically adjust color to keep the picture looking realistic. Stereo components include tiny computers that allow you to create "surround sound," which can make your living room sound like a concert hall. Automobiles can have dozens of chips in them to monitor and control fuel usage, detect maintenance problems, or adjust the air-conditioning or heat.

Until recently, an amazing fact was how many electric motors there were hidden in your house (clocks, refrigerator, heater fan, record player). Today, hidden computers are outnumbering the motors.

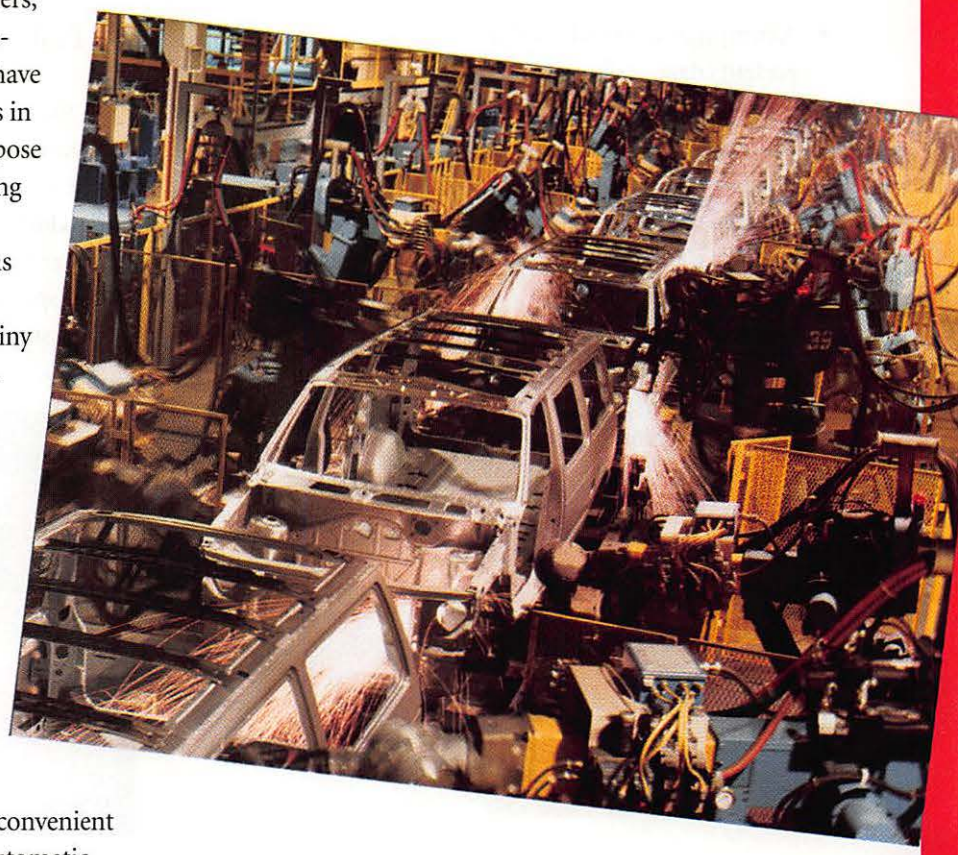
Automatic Teller Machines

Of all the technology that appeared in the 1980s, perhaps the most convenient has been the *a*utomatic *t*eller *m*achine, or **ATM**, a computerized device for accessing your bank account. An ATM is actually a lot like a general-purpose computer. It has input devices (the magnetic strip reader and the keypad), output devices (the computer screen, the receipt printer, and the cash slot), and a computer chip for processing. It also has a communication device, which it uses to access your account information.

The ATM is a good example of the pervasive nature of computers and how much we rely on them. When the one you need to use is out of order, it can ruin your whole day.

Robots

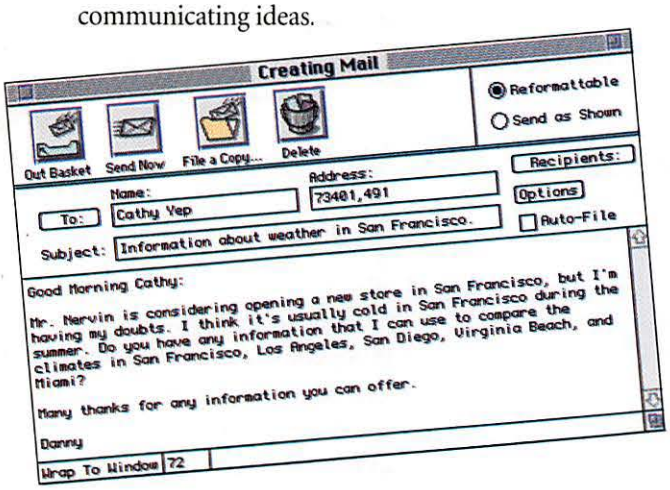
Although science has not yet caught up to science fiction to create Star Trek–like androids, robots are already abundant in industry. A **robot** is really only a computer that processes data to create physical output. The simplest types are called numerical control devices, such as automated drills, lathes, and so on. More advanced robots carry out more complex tasks, such as painting cars or welding sheet metal, by making use of arms, grippers, and video eyes. The robots shown here are working on an automobile assembly line.



Visual Summary

What's It Like to Use a Computer?

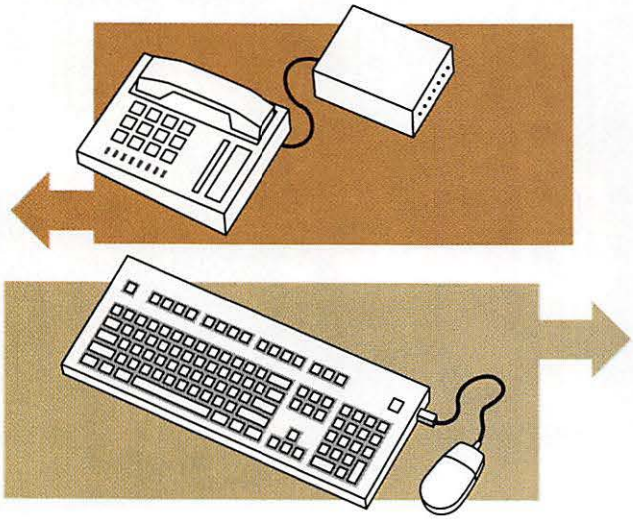
- Computers are useful for collecting information, organizing and processing information, and communicating ideas.



CompuServe's electronic mail service, page 2

The Four Parts of a Computer System

- A computer is a machine that accepts, processes, and presents data.
- A computer system includes hardware, software, data, and people.
- The five functions of hardware are input, output, processing, storage, and communication.
- The two types of software are system software and application software.



Types of hardware devices, page 4

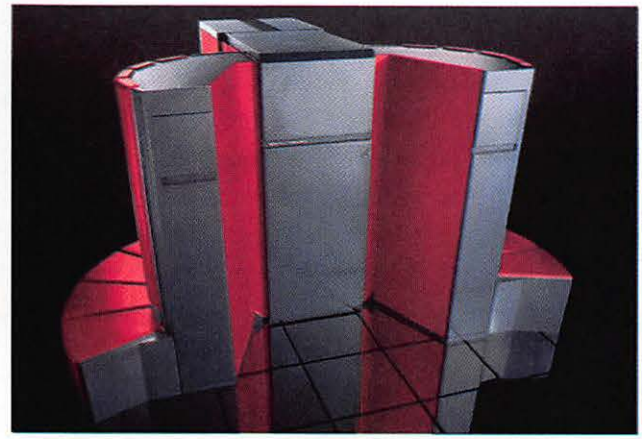
Types of PCs and Macs

- A microcomputer, or personal computer, uses a microprocessor as its central processing device.
- The term *PC* includes IBMs and compatibles. Macs use different software, so they are not always considered PCs, although they are personal computers.
- Full-sized PCs are either desktop or tower models. Portable models are called laptops, notebooks, or subnotebooks.
- The first Macs were compact models. Today's most popular designs are desktop and tower models, plus the Mac notebooks, called PowerBooks.

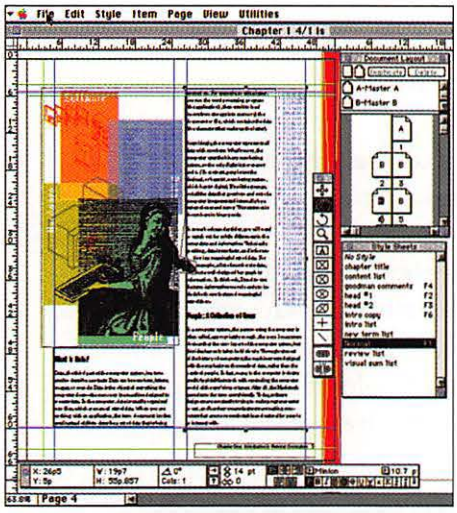
Types of Macs, page 6

The Evolution of the Computer

- In the 1950s, 1960s, and 1970s, most computers were mainframes or minicomputers.
- The invention of the microprocessor led to the development of the microcomputer.
- Other types of computers include supercomputers and specialized types of microcomputers, such as workstations and pen-based computers.



Supercomputers, page 8



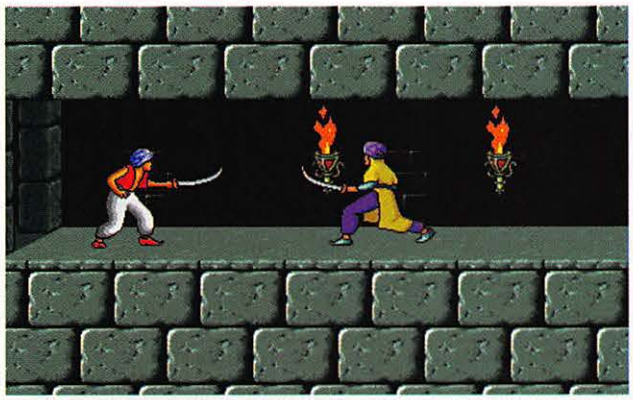
Desktop publishing, page 10

Computers at Work

- The most common business applications are spreadsheets, word processors, database programs, graphics software, desktop publishing (DTP) software, communication software, and computer-aided design (CAD) software.
- Microcomputers in business are often linked to form networks.

Computers at Home

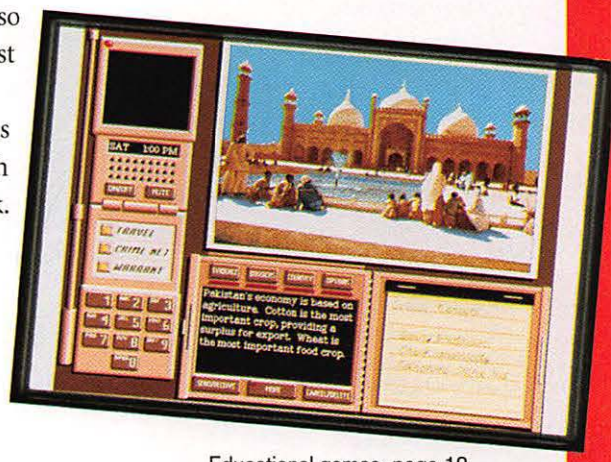
- Owners of home computers use many of the same applications as businesspeople, and many also use computer games.
- Computers can also be used to control lights, windows, and heating in a home.



Video game systems, page 11

Computers in Education

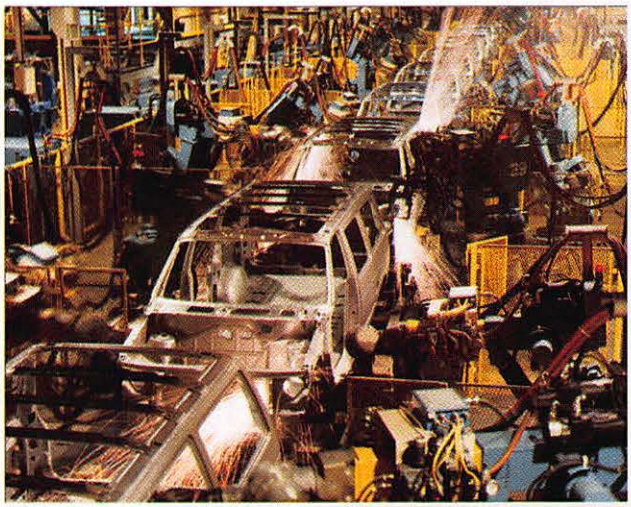
- Computers in the schools have led to the development of software for tutorials, educational games, and simulations.
- Students also use the most common applications to help with schoolwork.



Educational games, page 12

Computers Where You Least Expect Them

- Special-purpose computers are used in such items as household appliances, cars, ATMs, and industrial robots.



Robots, page 13

New Terms

After completing Chapter 1, you should understand the following terms. They appear in bold in this chapter and are listed in the Glossary.

application software
ATM
clone
communication device
communication software
compact Macintosh
computer
computer-aided design (CAD) software
computer system
data
database
desktop model
desktop publishing (DTP) software
document
educational game
file
graphics software
hardware
IBM-compatible
information
input device
laptop
mainframe
microcomputer
microprocessor
minicomputer
modular Macintosh
network
notebook
operating system
output device
PC
pen-based computer
personal computer
PowerBook
processing device
program
robot
simulation software
software
special-purpose computer
spreadsheet
storage device
subnotebook
supercomputer
system software
system unit
terminal
tower model
tutorial
user
voice recognition
word processing
workstation

Chapter Exercises

Review Questions

1. What part of the computer system is often synonymous with the word *computer*?
2. Name the five functions of computer hardware.
3. Briefly describe the difference between system software and application software.
4. List at least five kinds of application software.
5. Briefly explain why a "compatible" is always considered a "PC," but a Mac sometimes isn't.
6. List three modern terms used to describe portable computers.
7. What 1971 invention led to the development of the microcomputer?
8. Name the three kinds of application software that were widely used in business microcomputers by the mid-1980s.
9. Describe each of the three types of educational software.
10. Why is a robot referred to as a special-purpose computer?

Use Your Imagination

1. Based on what you know about computers, describe three ways in which you might use one at school.
2. Describe a job you would like to have and tell how it might take advantage of microcomputer technology.
3. List five different ways that people communicate. Then describe how a computer could be used to help in each method.
4. Think of yourself as a computer. List your input, output, processing, storage, and communication devices.
5. Study the timeline in this chapter, then write a paragraph about how computers might change during the next 20 years.

Beyond the Book

1. In these Beyond the Book activities, you will often be asked to look in magazines and newspapers for information. To familiarize yourself with some of the publications, find out where your library keeps current issues of periodicals, such as *MacWorld*, *MacUser*, *Byte*, *PCWorld*, *PC Magazine*, and *Infoworld*. List the location of each periodical in the terms used by your library's reference system.
2. Find out if your school's library, or the local public library, has a computer system for locating books. In one paragraph, describe how the system is used.
3. What kinds of computers are in the computer lab that you will use for this course? What make are they, and what model?
4. What other computer facilities are available on campus? Is there a different lab of PCs? Is there a lab of mainframe terminals?

THE BASICS OF MICROCOMPUTER

Hardware

2

TO MAKE GOOD USE OF A MACINTOSH—or any other computer—you need to understand a bit about how the machine works. As you learned in Chapter 1, all the parts of the machine are collectively known as hardware. Each piece of hardware is referred to as a *device*. In this chapter, I'll introduce you to the most important hardware devices, from the mouse to the hard disk. I'll explain how they work, individually and together. By the end of the chapter, you should have a much better idea of how data moves through the computer, from input devices to processing devices, and from processing devices to output and storage devices.

You may notice that I listed five types of hardware in the last chapter, but I discuss four in this chapter. I have omitted the fifth type, communication devices. I'll address this topic in Chapter 5. It's important to know what a standalone computer (one that isn't part of a network) can do before you are shown the reasons for linking multiple computers.

Objectives

When you have finished this chapter, you'll be able to do the following:

- Name and describe common input and output devices.
- Describe how data is represented by a computer.
- Explain how the CPU and RAM work together to process data.
- List common types of storage devices and describe how each works.
- Explain the function of the bus and describe types of ports.
- Outline the important features of an ergonomic workstation.

Contents

18 Getting Data into the Computer

22 Getting Information out of the Computer

26 How the Computer Processes Data

30 Storing Programs and Files

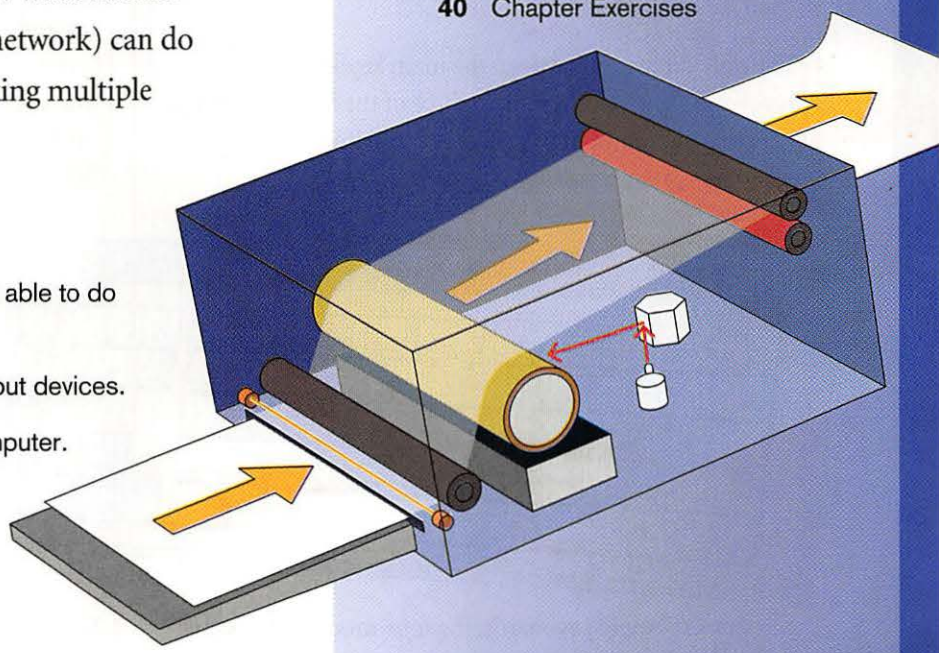
34 Connecting Peripherals

36 Ergonomics

37 Protecting Your Hardware

38 Visual Summary

40 Chapter Exercises



Getting Data into the Computer

Computing is often introduced to students as a three-step process: input, processing, and output. For example, to perform a simple calculation on a computer, you enter numbers and mathematical operators (input), the computer figures the result (processing), and then it displays the result on a screen (output). The process always begins with you—the user—entering data with an input device. You'll see the most common ones in this section.

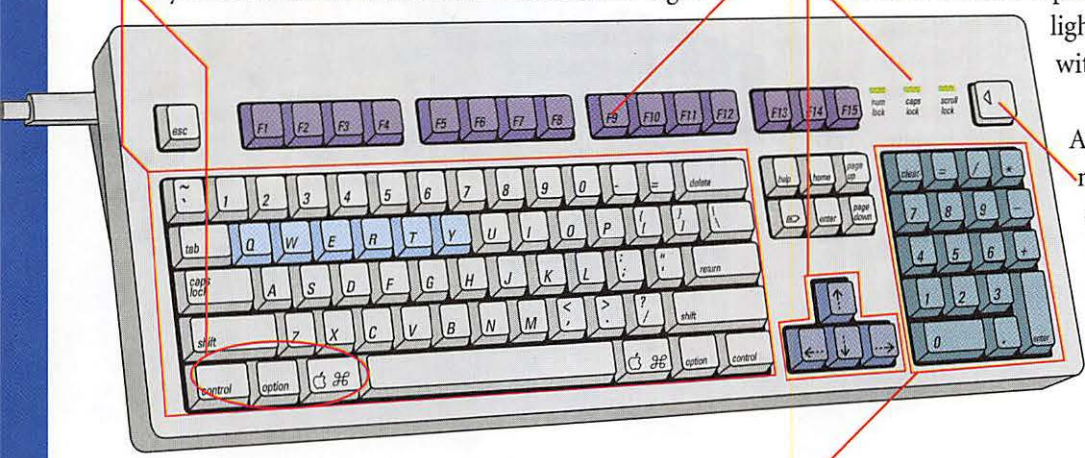
There's a famous rule about input, processing, and output: "garbage in, garbage out."

The Keyboard

For most computer users, the primary input device is the **keyboard**, because the computer is most often used for processing letters and numbers. The most common type of computer keyboard has five parts: the main keyboard, the function keys, the cursor movement keys, the numeric keypad, and the indicator lights. The Apple Extended Keyboard (shown here) and the IBM 101 Keyboard both have all five parts. If you are using a Mac, you may have the Apple Standard keyboard, which doesn't have function keys. Some older Mac keyboards also don't have numeric keypads.

The main keyboard is the part that looks like a typewriter—the part that has the letters on it.

The only difference between the main keyboard and a typewriter keyboard occurs in three of the four modifier keys that are found in the lower-left and lower-right corners. On Apple keyboards, the four **modifier keys** are the Shift, Control, Option, and Command (⌘) keys. They are called modifier keys because they modify or change the meaning of the other keys. You use them by holding one or more modifier keys down and then pressing another letter, number, or symbol key. Modifier keys are often used to send program commands to the computer. For example, to save a document on the Mac, you can usually press ⌘-S. In other words, you hold down the Command (⌘) key and then press S. The Shift key, which you will recognize if you have ever used a typewriter, is also used to create capital letters.



The **function keys**, which are labeled F1 through F12 or F15, aren't often used on the Macintosh, and they are becoming less necessary in many PC programs as well. However, they once served a vital role for the PC, because they provided an easy way to enter program commands. You might also use them if you run PC software on a Mac, but it is more common to enter commands with the mouse or the modifier keys.

The cursor movement keys are also used more with a PC than with a Mac. The **cursor** is the point on the screen where text or numbers are being entered. The cursor in a word processing program shows where the next letter you type will go. It is usually displayed as a blinking vertical line. The **cursor movement keys** let you move the cursor around the screen. Mac users may not bother with them because you can move the cursor easily with the mouse.

The **indicator lights** give you information about the keyboard's current settings. The Caps Lock light tells you whether the Caps Lock key is on. If it is, all letters will be entered as capitals. The Num Lock and Scroll Lock lights relate to controlling the cursor with the keyboard.

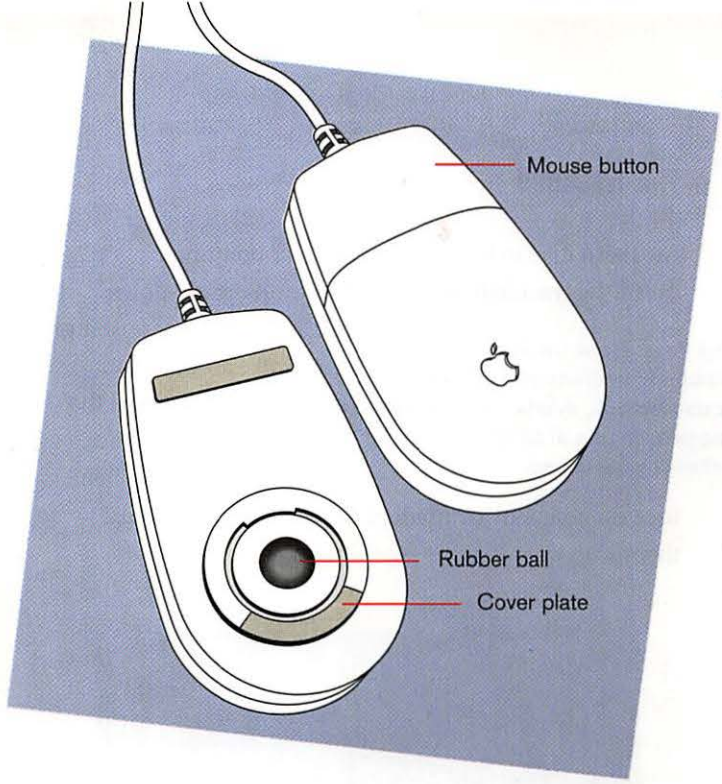
At the top center or top right, most Mac keyboards have an extra key that PC keyboards don't have. The key with the left-facing arrow is used to turn on some modular Macs. Once the Mac is on, this key doesn't do anything.

The **numeric keypad** is just a convenience, because the same characters are available on the main keyboard. If you are entering numbers, the numeric keypad is easier to use.

The Mouse

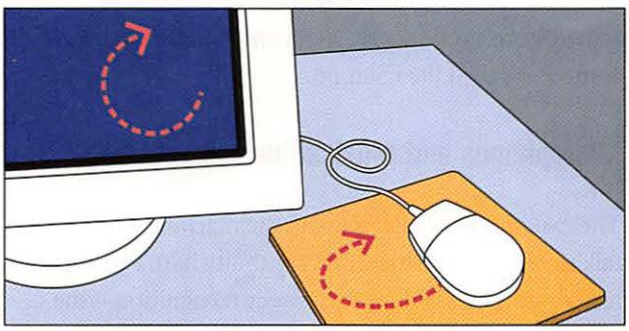
Compared to the keyboard, the mouse offers an easier way to interact with the computer. The **mouse** controls an on-screen pointer, which you can use to perform all kinds of tasks, from entering commands to drawing pictures. The mouse pointer can have many different shapes, depending on what you are doing with it.

A mouse is a fairly simple device. On the bottom there is a ball (as shown in the drawing on the right), which rolls when you move the mouse across a flat surface, such as a desktop or a mouse pad. There are two rollers touching the ball that sense which way the ball is rolling. You use the mouse by pushing it around and pressing the button. There are four basic techniques that you will use with the mouse: pointing, clicking, double-clicking, and dragging.



Doug Englebart invented the mouse in the mid-1960s. The Mac was the first successful microcomputer to include a mouse as standard equipment.

Pointing is the only mouse action that doesn't involve the mouse button. To point to something on the screen, you simply move the mouse on the mouse pad or desktop. Move the mouse left to make the pointer move left, move the mouse forward to make the pointer go up, and so on.



Clicking is a combination of pointing and then pressing the mouse button once. It is often done to select a command or object, or to position the cursor. For example, when you are using a word processing program and you want to edit a word, you begin by clicking to put the cursor within the word.

Double-clicking is just like clicking, except that you press the mouse button twice in *rapid* order. You'll hear a quick "click-click" when you do so. Double-clicking is often a shortcut for selecting an item and then initiating a command. It is often possible to start a program by pointing to the application icon and double-clicking on it.

The fourth mouse technique is **dragging**. This is done by holding down the mouse button while you move the mouse. This technique is often used to select items from a menu, move objects on the screen, and select areas of text or graphics. For example, if you want to underline a sentence in a letter that you have written, you start by dragging the mouse pointer from the beginning to the end of the sentence. When you do, the sentence becomes highlighted.

This is a sample of highlighted text.

Cleaning the Mouse

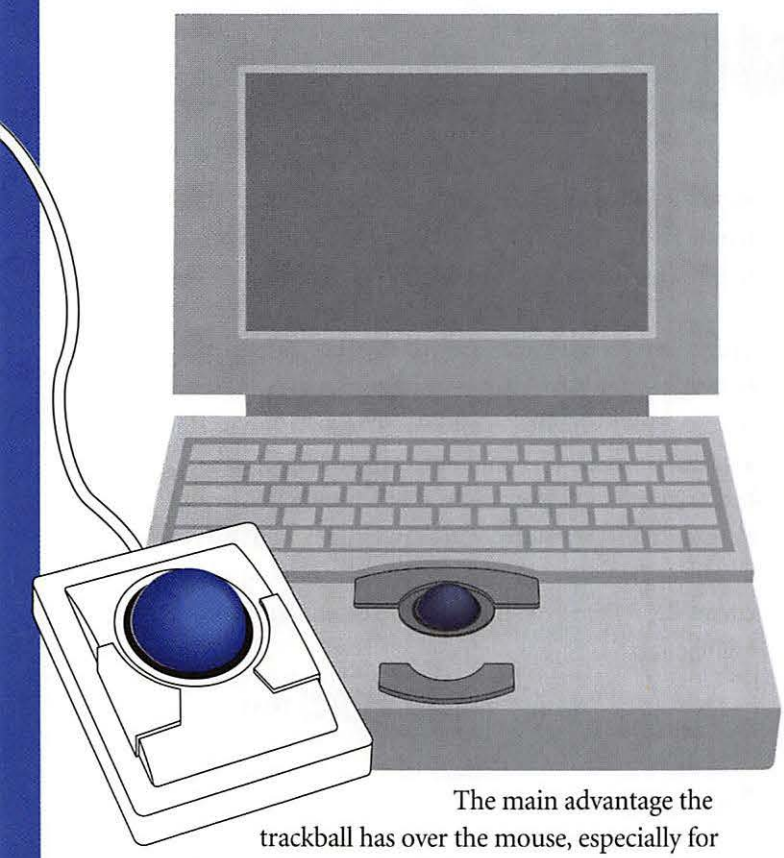
Over time, the rubber ball in the mouse picks up dust, which usually collects on the rollers. If your mouse isn't working quite right—if it rolls as if it has a flat tire—it's time to clean it. Take off the plate that holds in the rubber ball, and remove the ball. Use your fingernails to scrape the dust off the rollers, and blow into the hole to get rid of any other dust. You can use a cotton swab and rubbing alcohol to clean the rollers. When you are through, put the ball back in, replace the plate, and you should be rolling again.

Watch out for pets. Their hair can gum up the innards of a mouse, requiring tweezers to perform a "hair-ectomy" from the rollers.

The Trackball

An alternative to the mouse is another pointing device called the **trackball**, which looks like an upside-down mouse. Instead of pushing the device around, you move just the ball and the device stays in one place. Trackballs are most often used on notebook computers, though some people use them with their desktop machines as well.

The PowerBook trackball designers watched hundreds of people trying to use laptops, everybody from airline passengers at 35,000 feet to writers typing in bed.



The main advantage the trackball has over the mouse, especially for portable machines, is that it doesn't require as much space. If you are using your notebook on a train or an airplane, this is a big help. Also, the trackball can be built into the computer's keyboard, while the mouse is a separate device that has to be plugged in.

Touch Screens

The popularity of the mouse as a pointing device has revolutionized the computer industry, because it allows users to interact with the machine in ways that are much more intuitive or natural than what the keyboard allows. Still, controlling the action on a screen with a device that sits on your desk isn't ideal.

A more intuitive device is the **touch screen**, an output device that also acts as an input device. You give the computer commands by pressing buttons that appear on the screen. These devices are quickly gaining popularity in retail environments, such as record stores (as shown in this photo), supermarkets, and department stores. At some

record stores, you can preview compact discs using a computer called the i.Station.

Microphones and Musical Instruments

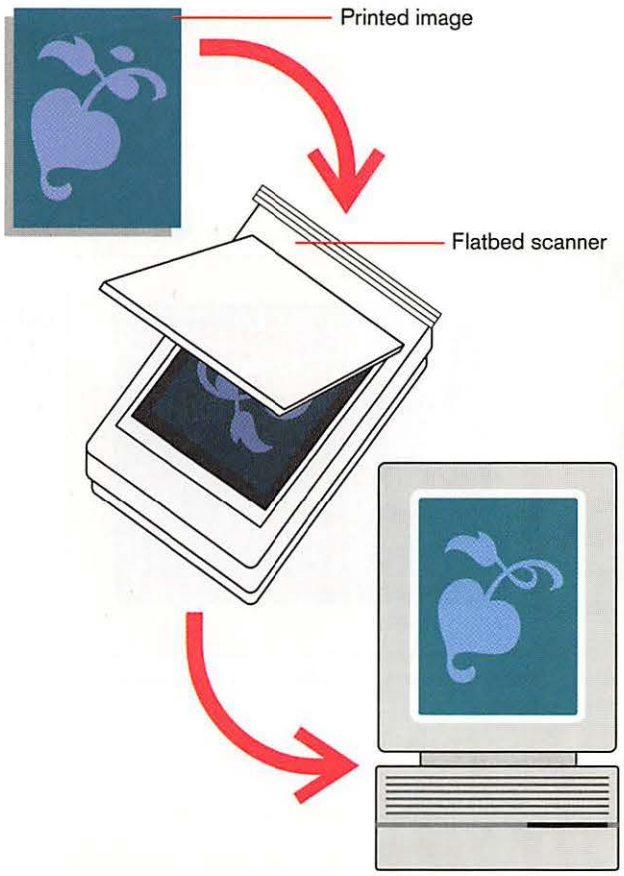
The easiest way to interact with the machine would be to talk to it. Unfortunately, that capability hasn't been perfected, although rudimentary voice recognition—the computer's ability to understand human speech—comes on high-powered Macs, providing a glimpse of the future.

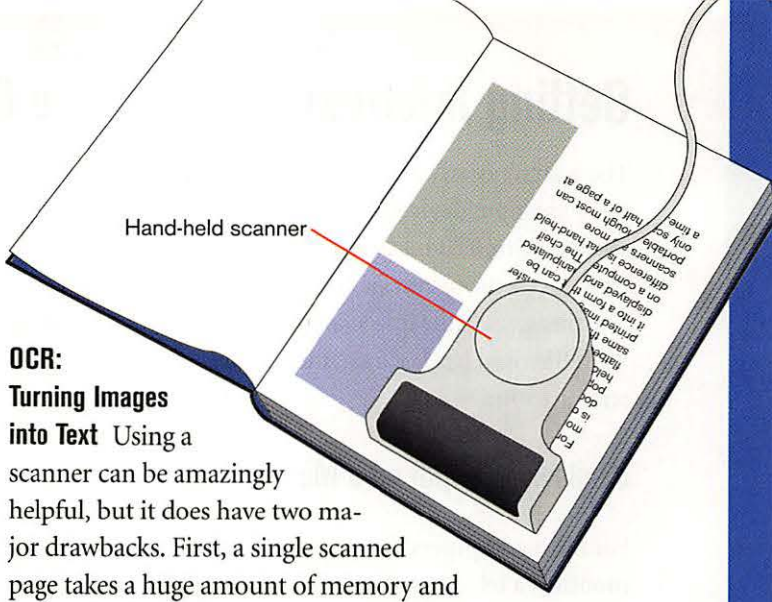
Nevertheless, the microphone is now a common input device, simply because the computer has become a popular means of manipulating sound, especially music. Many electronic musical instruments can act as input devices. An electronic keyboard that transmits MIDI (Musical Instrument Digital Interface) code can be hooked up to a computer to store and manipulate the code. With the right software, personal computers let people set up home recording studios, creating polished audio output.

Reading Printed Images with a Scanner

The most common input device after the keyboard and mouse isn't a trackball or a microphone, it's an image scanner, usually known simply as a scanner. In general, a **scanner** is any device that can read a printed image. The best-known type of scanner is the barcode reader, which you see in supermarkets, department stores, and libraries. Barcode readers scan the identification number of a product, then the cash register looks up the price in a database.

For most of us, however, a more useful type of scanner is one that can scan documents. There are two popular kinds, the hand-held scanner and the flatbed scanner. Both do the same thing: they read a printed image and transfer it into a form that can be displayed and manipulated on a computer. The chief difference is that hand-held scanners are more portable, though most can only scan half of a page at a time. A flatbed scanner is more like a photocopier: you put the printed page on the scanner and it creates the whole image in one pass.





OCR: Turning Images into Text Using a scanner can be amazingly helpful, but it does have two major drawbacks. First, a single scanned page takes a huge amount of memory and storage in the computer. Second, the computer stores the page as a picture, not as a series of words, making it very difficult to edit text that has been scanned.

What you really need is software that can perform **OCR**, or *o*ptical *c*haracter *r*ecognition. With OCR software, you can convert a scanned page of text back into a format that the computer recognizes as letters and numbers. Text takes up far less space in memory and storage than images do, and you can edit text with a word processor. With a scanner and OCR software, you can, for example, scan a magazine article into your computer, then cut and paste quotations from the article into a report you are writing with your word processor.

You will, of course, credit the source, won't you? Instructors frown upon cut-and-paste term papers.

The Impact of Document Imaging The ability to scan printed material is revolutionizing many industries, such as insurance, law, medicine, and library services, all of which rely heavily on printed forms. For example, every insurance policy requires a stack of forms, and every claim against that policy requires another stack. With a **document imaging** system, all of the forms can be stored electronically, rather than on paper. The advantages for, say, an insurance company are tremendous:

- An employee can retrieve a scanned image of a form without ever leaving his or her desk.
- Documents can be retrieved in seconds. If a customer calls with a question, the insurance agent can often answer the question immediately.
- Many insurance company employees can access the same document at the same time. Forms don't need to be passed around the office, and photocopying is greatly reduced.

Getting Information out of the Computer

There aren't nearly as many types of output devices as there are input devices. Only three are widely used: the monitor, printer, and speaker. The monitor creates soft copy, an electronic image of electronically stored data. The printer sets the image on paper—it creates hard copy. With the right kind of data, the speaker is capable of generating sound.

Displaying Output on a Monitor

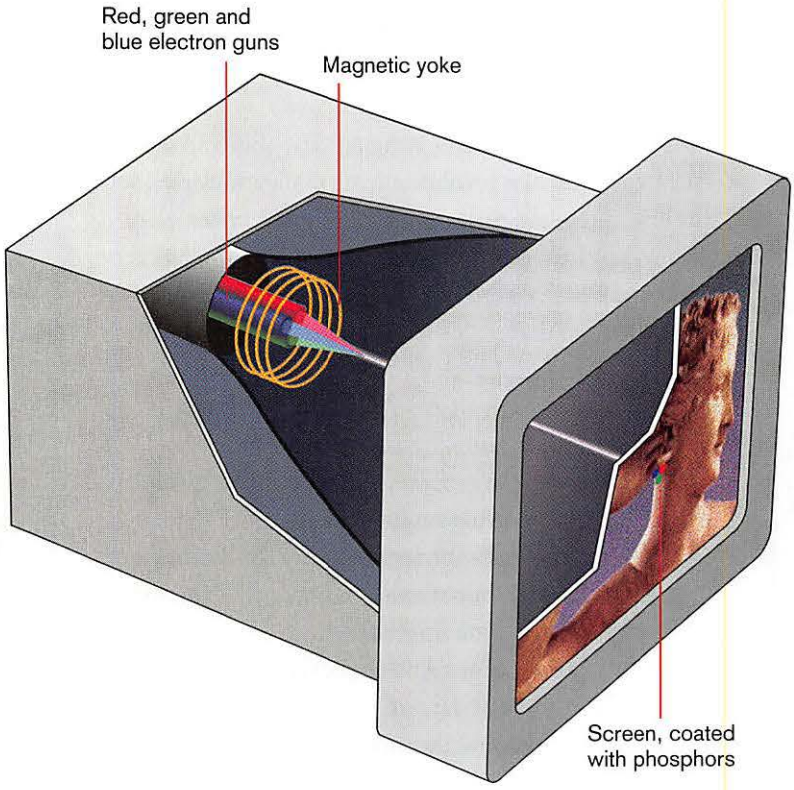
For most computers, the primary output device is the **monitor**, a television-like screen that displays text and graphics. There are two main types of monitors: the **CRT**, or *c*athode *r*ay *t*ube, **monitor** (which looks a lot like a TV), and the **flat-panel monitor** (which can be less than an inch thick). With either type, images can be color, monochrome, or gray-scale. **Color monitors** are often referred to as RGB monitors, because they create images by combining red, green, and blue. **Monochrome monitors** only display one color: either black against a white background, or one color (such as green, amber, or white) against a black background. **Gray-scale monitors** are like monochrome monitors—they can display only one color—but they can display that color in various levels of intensity.

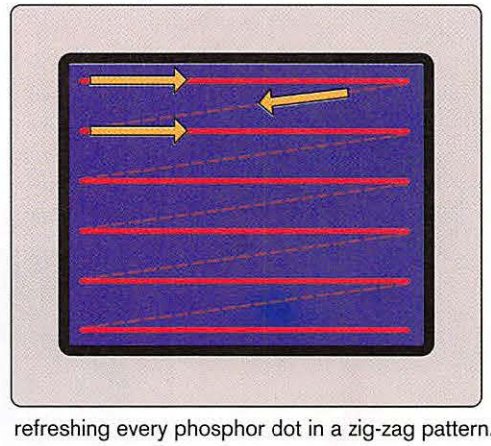
How Images Are Created on a CRT Monitor Almost every nonportable computer uses a CRT monitor. Not only does a CRT monitor look like a television, it also works like one. The drawing at the bottom of the page shows a cutaway of a color CRT monitor.

At the back of the monitor are three electron guns, one for each of the three colors (red, green, and blue). Monochrome and gray-scale monitors only need one electron gun.

The beam of electrons that are shot from the electron guns passes through a magnetic yoke that focuses and directs the beam.

The front of the monitor is the screen that you look at. The inside of the screen is coated with thousands, or even millions, of phosphor dots. These dots glow for a very short time after the electron beam hits them. On a color monitor, the phosphor dots are grouped in threes: one red, one green, and one blue. Together, these three dots make up one **pixel** (the term is a contraction for *pic*ture *el*ement). The color of each pixel is set by the brightnesses of the three phosphor dots, which are, in turn, controlled by the intensity of the three electron beams.





One way that monitors are compared is by their **refresh rate**, which is the number of times each second that the electron gun hits each pixel. Refresh rates are measured in hertz (Hz), which means cycles per second. Good monitors have refresh rates of at least 70 Hz.

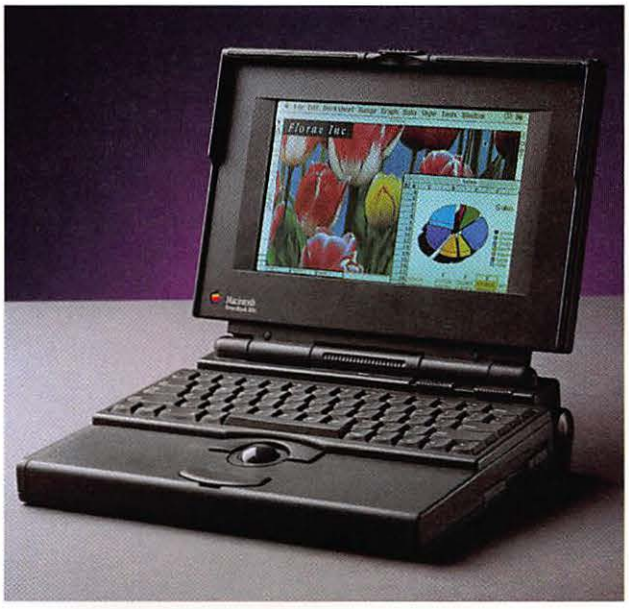
Have you ever noticed the horizontal lines on computer screens shown on television? The monitor refresh rate is interfering with the television camera refresh rate.

Another measurement used to compare monitors is how close the pixels are together. The pixel density is called **resolution** and is measured in dots per inch, or dpi. The Macintosh standard for monitors is 72 dpi.

A third measurement, the number of pixels on the screen, is measured with two numbers: the number of pixels in each row and the number in each column. Compact Macs have screens that are 512 x 342 pixels. 13-inch monitors, which are standard for modular Macs, and VGA monitors, which are a popular standard for PCs, display 640 x 480 pixels (or more). As monitor technology improves, and as many users opt for bigger monitors, even more pixels are being packed on the screen.

Most people confuse the pixel count with resolution. Resolution is a measure of dots per inch, not the number of dots on the screen.

Flat-Panel Monitors There are two major drawbacks to CRT monitors: they're bulky and they draw a lot of power. As a result, they are not practical for notebook computers, which must be small, lightweight, and able to run off batteries. So notebook computers use the second major type of display, the flat-panel monitor (see photo). There are several different kinds of flat-panel monitors, but the most common by far is the **LCD**, or *l*iquid *c*rystal *d*isplay, **monitor**. The screen of an LCD monitor looks similar to that of a CRT monitor, but the technology behind it is completely different.



Liquid crystal displays first showed up on digital watches and pocket calculators. The technology is based on the liquid crystal, which is transparent in its normal state, but becomes opaque (blocks light) when a current is run through it. Creating an LCD monitor requires a fine grid of LCD pixels with transparent wires running through each of them. Creating a color LCD monitor is far more complicated, requiring extra layers of polarizing filters and color filters.

An LCD screen needs a backlight to make the screen visible in a dimly lit room.

You can expect LCD and other flat-panel monitors to show up more and more for desktop computers as well. One reason is that they reduce or eliminate electromagnetic radiation, long exposure to which may be a health hazard, according to some experts.

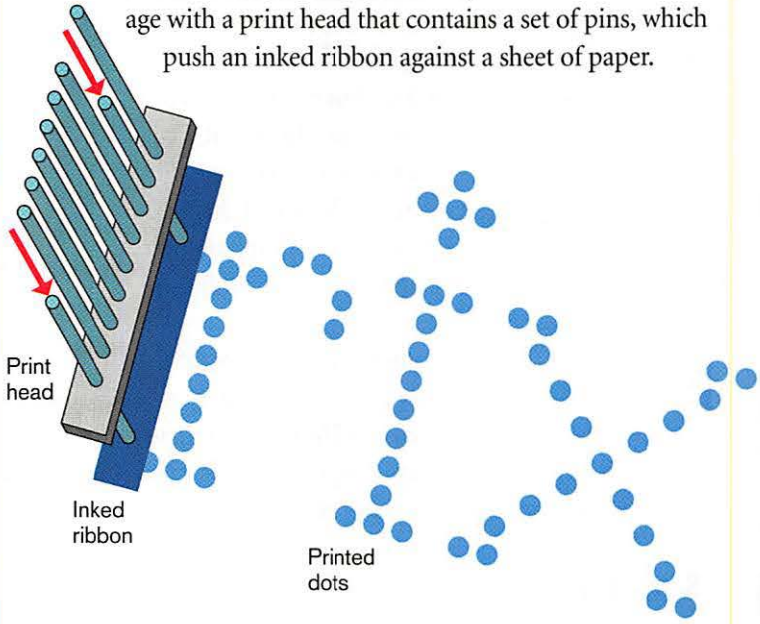
Sound Output

Macs have always had built-in speakers. At first these speakers were used to create beeps and squeaks for user feedback. Over time, however, the speaker has grown into an important output device with a huge variety of uses. Today more and more users are fitting their computers with separate speakers to create multimedia systems. **Multimedia** is the use of text, graphs, animation, sound, and full-motion video to present information. Multimedia was first used on computers to create engaging video games. Today it is used to enhance or animate educational software, put together business slide shows, and record or edit music.

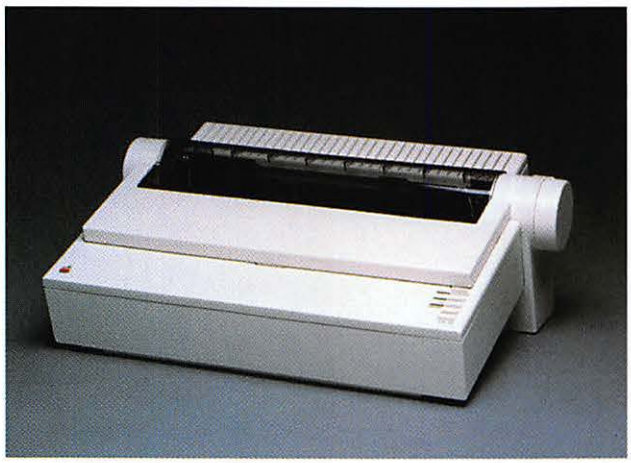
Generating Printed Output

Most of the time you spend in front of a computer, you are looking at the monitor. In many cases, though, your final product is a paper document. The **printer** is therefore the other vital output device. Although many kinds of printers have been made, most fall into one of three categories: dot-matrix, inkjet, and laser printers.

Dot-Matrix Printers A **dot-matrix printer** creates an image with a print head that contains a set of pins, which push an inked ribbon against a sheet of paper.

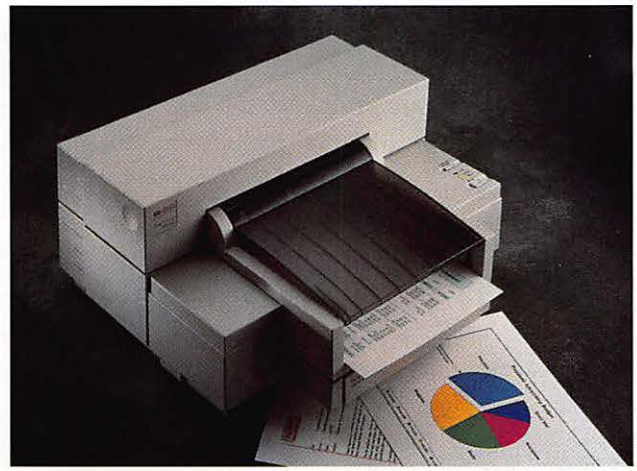


The speed of the printer is measured by how many characters the printer can produce each second. The quality of print is determined by the number of pins in the print head. Most dot-matrix printers have either 9 or 24 pins. Apple's dot-matrix printer for the Macintosh, called the ImageWriter II, is shown here.

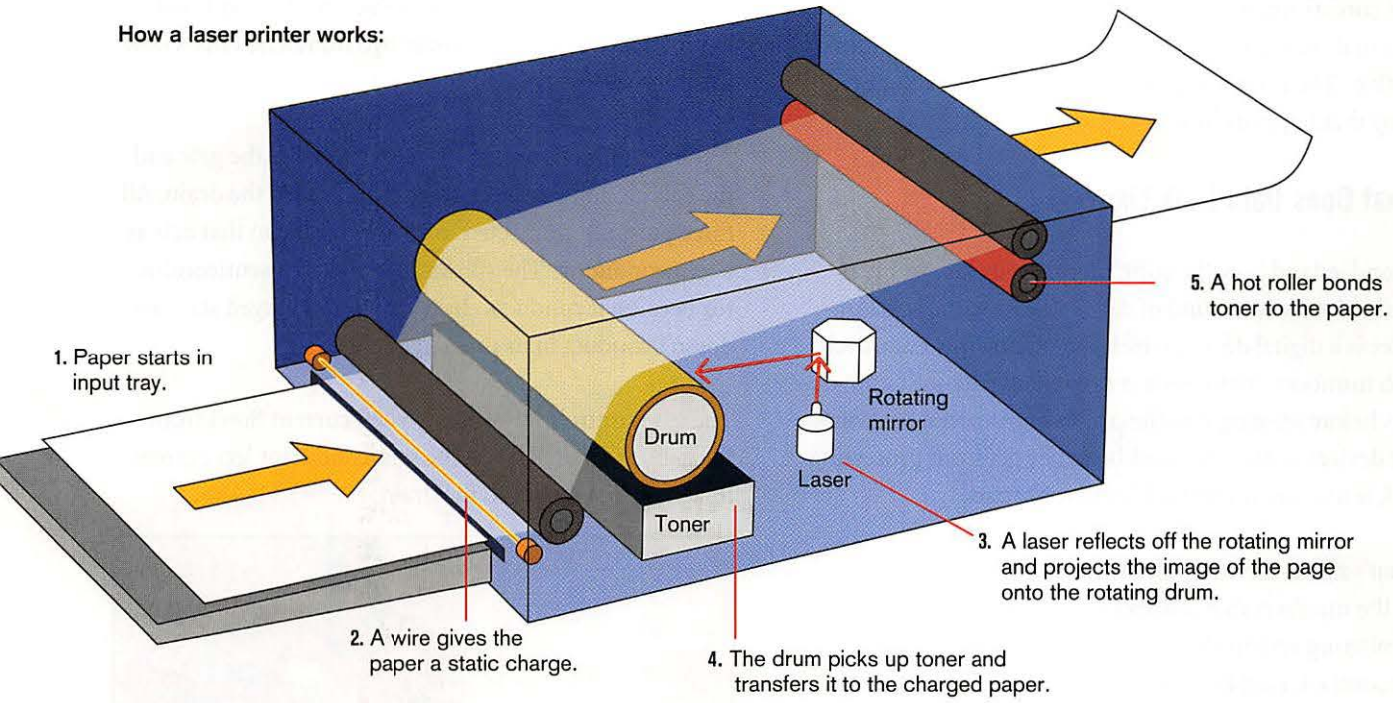


Dot-matrix printers are not the fastest kind, nor do they provide the highest-quality output, but they do have two advantages. First, of course, is price. Apple's ImageWriter II currently costs a little over $400, but there are lower-cost dot-matrix printers available. Another advantage is that dot-matrix printers actually strike the paper, so they are the only popular type that work with multicopy forms.

Inkjet Printers If you need higher-quality output than a dot-matrix printer can provide but you are on a tight budget, the answer may be an inkjet printer, such as the Hewlett Packard DeskWriter shown here.



Inkjet printers work with the help of tiny jets that shoot fine drops of ink at the paper. The quality of inkjet output is measured in dots per inch (dpi), just like a monitor, but the resolution is much higher. Some inkjet printers can spray more than 300 dots per inch. Apple's Style-Writer, which sells for a little over $300, prints at 360 dpi. Even inkjet printers that work at lower resolution still produce visibly better output than a dot-matrix printer. They also print much more quickly.

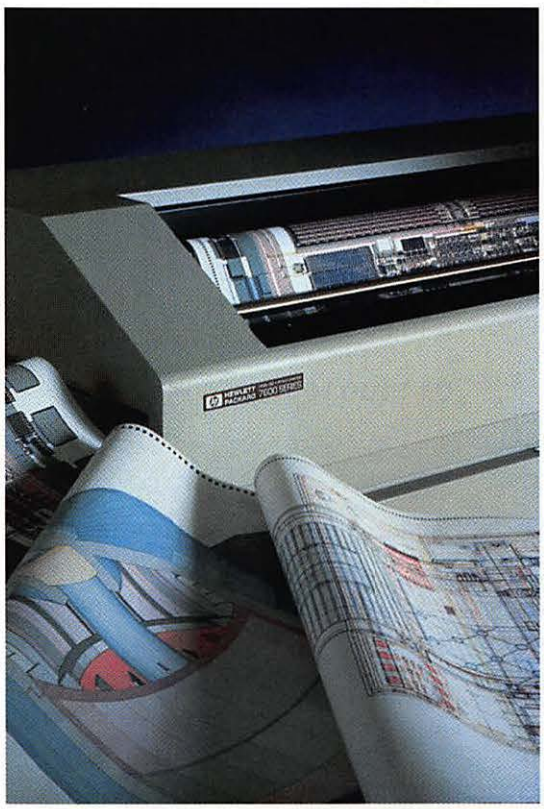


Laser Printers For fast, high-quality printing, the best choice is a laser printer. A **laser printer** works a lot like a photocopier. A laser draws the image on a magnetic drum, which picks up toner (black powder) and then transfers the toner to the paper. The toner is bonded to the paper with heat.

I've always felt that the introduction of the LaserWriter in 1985 was as big a boost to personal computing as the introduction of the Mac in 1984.

As with the inkjet printer, quality of output is measured in dots per inch. But while 360 dpi is the high end for inkjet printers, 300 dpi is the low end for laser printers. Many laser printers are sold now that produce 600 or even 1200 dpi. Printing speed on a laser printer is also much faster. While a good inkjet printer like the StyleWriter can print about two pages per minute, most laser printers can generate at least four pages per minute, and some are more than twice that fast.

Printers for Architects and Engineers The fields of architecture and engineering have spawned a few very interesting output devices that are rarely seen by the rest of us. The best known is the **plotter**, a specialized printer that draws an image with pens. Because architects and engineers need to create renderings and working drawings, most plotters can print on large pieces of paper, up to two or three feet wide. The plotter shown here is made by Hewlett Packard.



How the Computer Processes Data

The core of any computer is the processing hardware, the part that manipulates data and turns it into useful information. The processing hardware is also the hub of everything that happens in your computer.

What Does Data Look Like?

To understand how the computer does its job, you first need to know what kind of data it works with. The computer is a digital device, which means it works exclusively with numbers. Input devices convert all data into numbers before sending it to the processing devices. And output devices convert the numbers they get from processing back into more useful and familiar formats.

What's more, the computer is a binary digital device. All the numbers that it works with are in base two, a numbering system that uses just two characters, 0 and 1. (In contrast, people usually use the decimal numbering system, which has ten characters, 0 through 9.) For example, when you type the word "Computer" at the keyboard, the processing devices see the word as

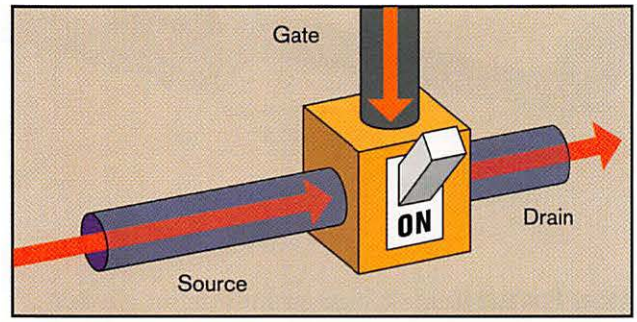
01000011	C
01101111	o
01101101	m
01110000	p
01110101	u
01110100	t
01100101	e
01110010	r

Why does the computer have to represent data in this bizarre format? The reason lies in the most basic computing device, the transistor. The **transistor** is really just a switch that can be either on or off. Since there are only two possible states for the transistor, the data that the transistor processes must be represented in binary form, which has only two numbers. Here's how the transistor works.

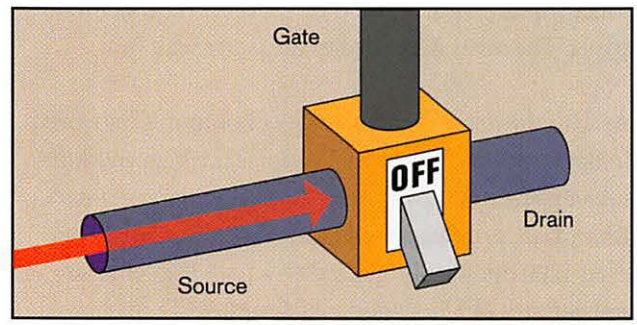
Before transistors, switching was done by vacuum tubes—one tube per switch. Small wonder that early computers no more powerful than modern pocket calculators were room-sized!

A transistor has two electrical inputs, called the gate and the source, and one electrical output, called the drain. All three parts are connected to an area of silicon that acts as a semiconductor. The silicon is known as a **semiconductor** because it conducts electricity in its charged state and doesn't conduct in its uncharged state.

The gate controls the switch. When current flows from the gate, the switch is on: the semiconductor lets current flow from the source to the drain.

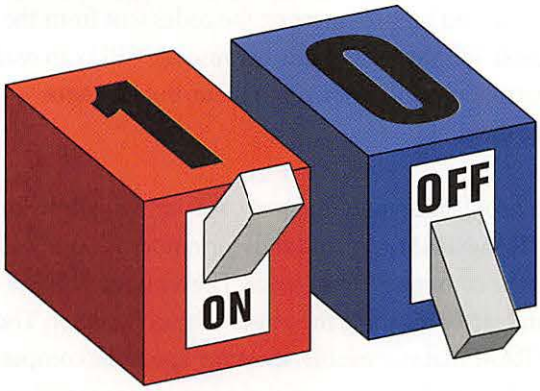


When there is no current from the gate, no current can pass from the source to the drain.



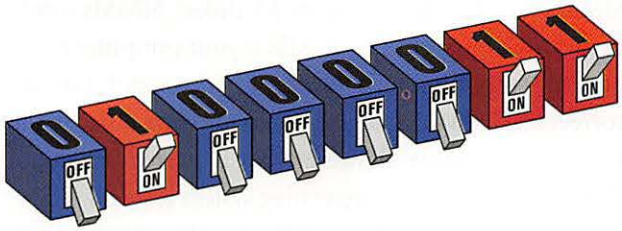
Useful Groups of Data

Because data is represented internally as electrical switches, a single unit of data is one switch. If the switch is off, it is represented by a 0; if it is on, by a 1.



A single unit of data is called a **bit**, which is a contraction of the term *bi*nary digi*t*.

By itself, a single bit of data isn't very useful, so they are grouped together in sets of eight. Eight bits make a **byte**.



There are 256 possible combinations of 1s and 0s in one byte. In other words, with eight binary digits, you can count from 0 to 255.

Representing Text with ASCII A byte is an important unit of data because there are enough unique bytes to assign one to each text character, including the numbers from 0 to 9, all the letters (both upper- and lowercase, A-Z and a-z) and all the punctuation marks and symbols that you find on the standard keyboard. The most popular code for translating between text and bytes of data is called **ASCII**. ASCII (pronounced "as-key") stands for the American Standard Code for Information Interchange. This table (upper right) shows part of the code.

For pictographic languages like Chinese, the Mac uses "double-byte" characters, which allow for 65,536 possibilities.

Measuring Large Amounts of Data One byte, which can represent a single letter, number, symbol, or space, still isn't very much data. After all, a single program can consist of thousands or even millions of characters. To talk about larger collections of data, the computer industry came up with the terms kilobyte, megabyte, gigabyte, and terabyte.

ASCII Table

!	00100001	A	01000001	a	01100001
"	00100010	B	01000010	b	01100010
#	00100011	C	01000011	c	01100011
$	00100100	D	01000100	d	01100100
%	00100101	E	01000101	e	01100101
&	00100110	F	01000110	f	01100110
'	00100111	G	01000111	g	01100111
(	00101000	H	01001000	h	01101000
)	00101001	I	01001001	i	01101001
*	00101010	J	01001010	j	01101010
+	00101011	K	01001011	k	01101011
´	00101100	L	01001100	l	01101100
-	00101101	M	01001101	m	01101101
.	00101110	N	01001110	n	01101110
/	00101111	O	01001111	o	01101111
0	00110000	P	01010000	p	01110000
1	00110001	Q	01010001	q	01110001
2	00110010	R	01010010	r	01110010
3	00110011	S	01010011	s	01110011
4	00110100	T	01010100	t	01110100
5	00110101	U	01010101	u	01110101
6	00110110	V	01010110	v	01110110
7	00110111	W	01010111	w	01110111
8	00111000	X	01011000	x	01111000
9	00111001	Y	01011001	y	01111001
:	00111010	Z	01011010	z	01111010

A **kilobyte** equals 2^{10}, or 1,024, bytes and is abbreviated 1KB. The prefix kilo means thousand, and you can think of a kilobyte as roughly 1,000 bytes. A **megabyte** equals 2^{20}, or about one million bytes and is abbreviated 1MB. A **gigabyte** (GB) is about one billion bytes, and a **terabyte** (TB) is about one trillion bytes.

Kilobyte	1,024 bytes	1KB
Megabyte	1,000,000 bytes (roughly)	1MB
Gigabyte	1,000,000,000 bytes	1GB
Terabyte	1,000,000,000,000 bytes	1TB

The CPU and Memory

Processing hardware is divided into two main components: the central processing unit, or CPU, and the memory.

The Core of the Computer: The CPU The **central processing unit**, or **CPU**, is the part of the computer that does the actual computing. It is also the part that manages everything else that happens in the computer. In a microcomputer, the CPU consists of millions of electrical pathways that are etched onto a silicon chip, which is about the size of your smallest fingernail (see photo). As I explained in Chapter 1, this "computer on a chip" is called a microprocessor.

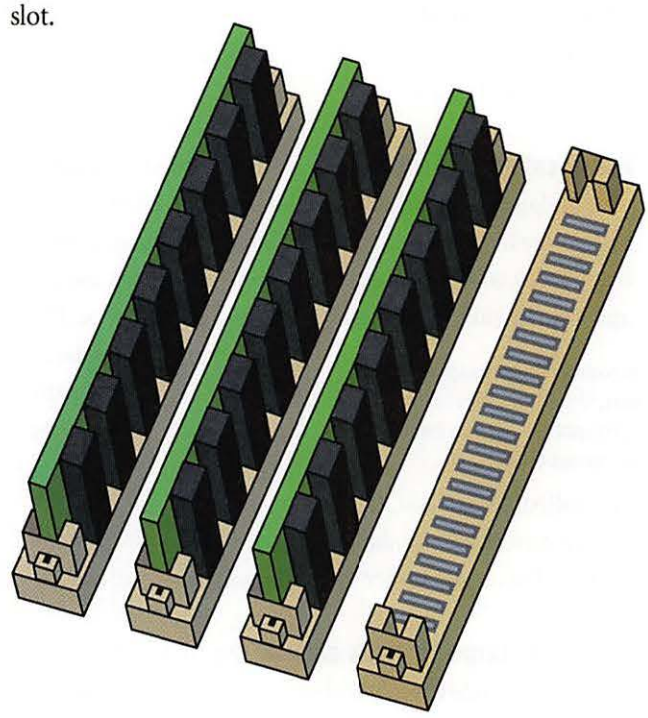
The CPU is so important that some computers, especially PCs, are referred to by the type of CPU they use. For example, if someone tells you "I have a 486," they mean that they have a PC with an 80486 CPU designed by the Intel Corporation. **Intel** is the world's largest producer of microprocessors. The CPUs used in most Macintosh computers are made by Motorola, Inc. **Motorola** chips are numbered 68000, 68010, 68020, 68030, and 68040. The higher the number, the more powerful the chip is. However, the most recent chips for the Macintosh are the PowerPC chips, a new generation of powerful CPUs, made by Motorola and based on an entirely different design than that of the 68000 series.

Memory The function of **memory** is to provide an electronic storage space for programs and data that the CPU needs to access quickly. When you load a program, such as a word processor, it goes from storage into memory. When you load a data file, it goes into memory.

There are two types of memory, ROM and RAM. **ROM** (pronounced "rahm"), which stands for *r*ead-*o*nly *m*emory, contains instructions that relate to the computer's most basic functions. For example, instructions in ROM tell the computer what to do when the power is first turned on and how to interpret the codes sent from the keyboard. ROM gets its name because the CPU can read the instructions that are written there, but it cannot change them.

When people talk about memory, they are usually talking about RAM. **RAM**, which stands for *r*andom *a*ccess *m*emory, is the computer's workspace. The amount of RAM is a vital factor affecting the power of the computer. The more RAM that is available, the more space the computer has for loading large, powerful programs (or more than one program at the same time) and large data files. Most computers sold today have between 2 and 16 MB (megabytes) of RAM.

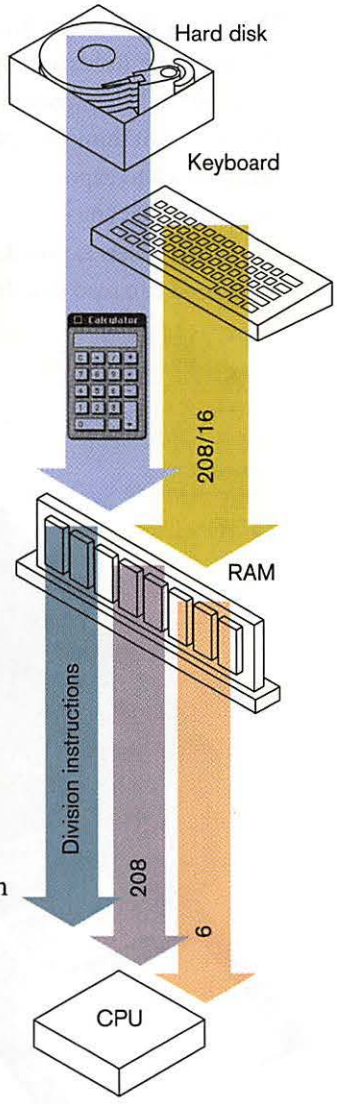
A computer's memory can often be increased by adding SIMMs (Single In-line Memory Modules). SIMMs come in various sizes, from 1 to 16 MB. If your computer is built to accept additional SIMMs, you can simply buy the correct sized SIMM and plug it into the correct slot in the system unit. You may, however, have to make some minor changes in the way your operating system is set up. The drawing below shows three SIMM boards and one empty slot.



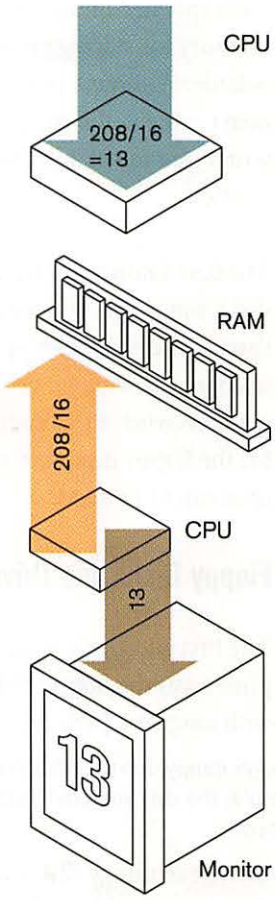
One important feature of RAM is that, unlike ROM, it loses its contents as soon as the computer is turned off. For this reason, RAM is often described as *volatile*. ROM, on the other hand, is nonvolatile. Because RAM is volatile, the computer needs another place to put data and programs when the computer is turned off. This is the function of storage devices, such as floppy disks and hard disks.

Most laptop computers have a "sleep" mode that uses just enough power to preserve the contents of RAM. Energy-efficient desktop computers are now adopting this feature.

An Example of Processing Now that you know all the processing terms, I'll show you a simple example of how it all works. Say you are using your Mac to type up a lab report for a chemistry class. In doing so, you need to divide 208 by 16. To get the answer, you use the calculator that is built into your Mac. Here's what happens:



1. When you start the Calculator program, the program's instructions are loaded into RAM.
2. You type 208/16 at your keyboard. As you do, the CPU accepts the numbers and the mathematical operator (the slash, or division symbol) and puts them in RAM.
3. When you enter the = (equals sign), the CPU looks in memory for the instructions about how to carry out a division problem.
4. The first instruction tells the CPU to load the first number into one of its own internal memory slots.
5. The second instruction loads the second number into a second slot.
6. The third instruction tells the CPU how to divide the first number by the second. The result is placed in a third memory slot in the CPU.
7. A fourth instruction sends the result from the third slot back to RAM.
8. A final instruction sends the result, 13, to the monitor, where it is displayed.



Other Factors Affecting Processing Power

When it comes to processing, power means speed, and there are many factors affecting the processing speed of a computer. First, not all CPUs are created equal. Over the years, vast improvements have been made in CPU design, speeding up processing dramatically.

Memory chips aren't all created equal either. The contents of some RAM chips can be accessed more quickly than others. This access speed is measured in nanoseconds, or billionths of a second.

Another important factor affecting speed is the computer's **system clock**. Every computer has a system clock that it uses to synchronize processing steps. These clocks generate millions of "ticks" every second; the more ticks they generate, the faster the computer can run. A single tick is called a **clock cycle**. The speed of the clock is measured in megahertz, abbreviated MHz, which means millions of cycles per second. Over the years, the clock speeds of Macs have ranged from about 4 MHz to about 50 MHz.

Storing Programs and Files

As I explained in the last section, it is not enough to have memory for storing programs and files, because RAM is volatile. Without a place to put information when you aren't using it, the computer is little better than a typewriter or a calculator. This is why computers have storage devices.

The best-known storage devices are hard disks and floppy disks, but as you will see after you turn the next page, there are several other options. They all have one thing in common, though: unlike RAM, they do not lose their contents when the computer's power is shut off. Except for the floppy disk, they can also store a lot more data than can fit in RAM.

Floppy Disks and Drives

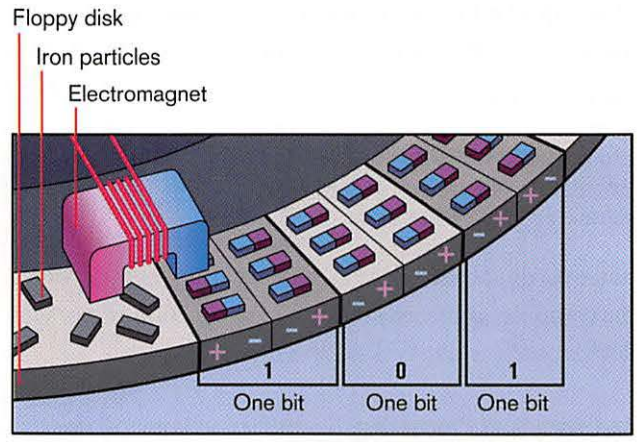
The first effective storage medium used with microcomputers was the **floppy disk**. This is a plastic disk, coated with magnetic particles, inside a plastic envelope or shell. Other common names for floppy disks are *floppies* or *diskettes*. The most popular type of floppy disk today is the 3½" disk—the kind that you use with the Mac. Another type that is still common (though it is becoming less so) is the 5¼" floppy that is used with some PCs. Early PCs all used the 5¼" type, but the 3½" type gained popularity because it is smaller, more durable, and capable of storing more data.

Although floppy disks for the Mac look rigid, the disk material inside is floppy.

5¼ inch floppy disk

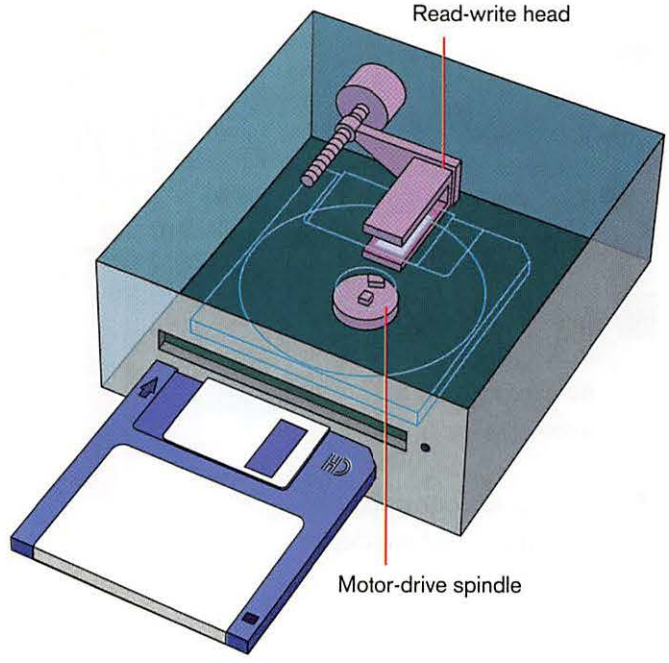
3½ inch floppy disk

The floppy disk is called a magnetic storage medium because it stores data as magnetic charges. The surface of the disk is coated with iron oxide particles, which can be polarized by an electromagnet. The electromagnet is part of the **read-write head**, which works a lot like the heads in a cassette tape player.



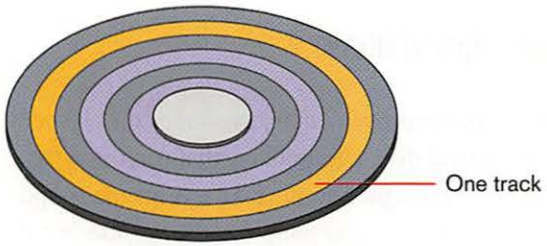
Once the particles are polarized, they can retain their charge for years. If the data needs to be changed, the same recording process can alter the polarity of the iron particles. When the data stored on the disk is needed by the computer, it can be read by another electromagnet.

The Floppy Disk Drive To access the data on a floppy disk, the computer needs a **floppy disk drive**, also known as a *floppy drive*. When you first slide a 3½" floppy disk into the drive, two things happen: the drive moves the metal shutter back to expose the disk, and a motor with a shaft connected to it engages the hub of the disk. Once the surface of the disk is exposed, the electromagnet in the read-write head can read data from, or write data to, the disk.

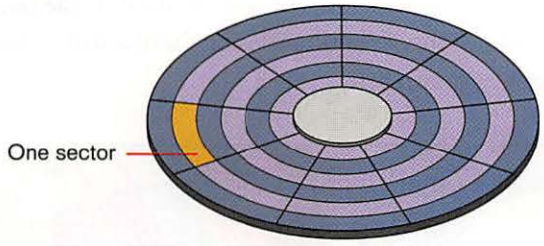


Initializing Disks When you buy a new floppy disk, it is just a piece of plastic with tiny iron particles on it. Before the disk can be used, the disk drive must initialize the disk. **Initializing** is the process of mapping the disk's surface into an organized, logical arrangement of tracks and sectors. First, the drive creates concentric magnetic circles on the disk called tracks. Then it creates radial lines that divide the tracks into sectors. PC users describe this process as **formatting** the disk.

You may also see preformatted floppies for sale, but these are probably for DOS computers.



1. The disk drive lays down tracks.

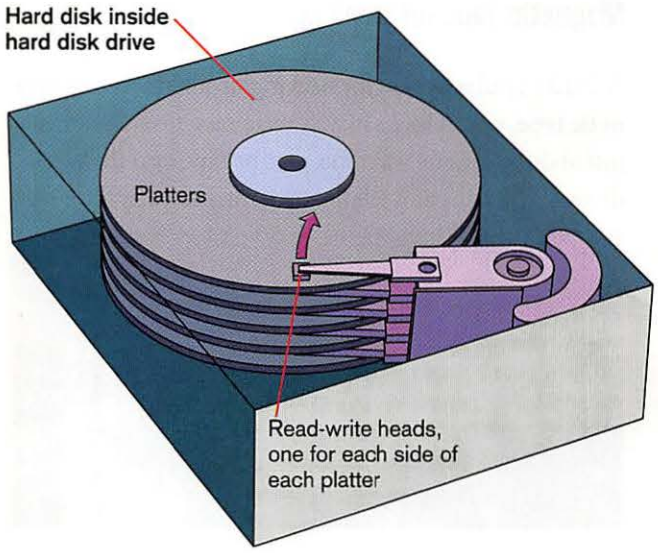


2. The tracks are divided into sectors.

Hard Disks

Although floppy disks can solve the storage needs of a computer, they do have a limitation: capacity. Most 3½" floppies for the Mac can store either 800KB or 1.44MB of data (you can tell by the number of square holes in the corners of the disk: a disk with one hole can hold 800K; a disk with two holes can hold 1.44MB). These capacities are a big improvement over the earliest floppies, but they are not nearly enough for today's programs and data files. When you buy Microsoft Excel for the Macintosh, for example, the program comes on several floppy disks. Having all these floppies on hand every time you wanted to use the program would be a nightmare.

To solve the problem, the computer industry began using hard disks. A **hard disk** works like a floppy disk, except that it consists of one or more metal platters that are permanently encased in the hard disk drive (see drawing above). The platters move in unison, and there is a read-write head for each side of each platter. Hard disks can store from 20MB to 600MB of data, or even more. With this much capacity, you can keep all of your programs and data in one built-in unit. For those of us who used Macs and PCs before hard disks were added, the hard disk was a dream come true.



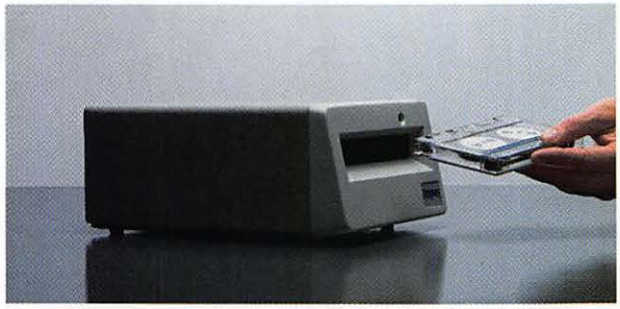
Naturally, hard disks also have their pitfalls, mainly because it is dangerous to keep all of your program and data files in one place. If your hard disk goes bad, you can lose everything. And hard disks *do* go bad. The problem is that the read-write heads in the hard disk are extremely close to the disk platters. A particle of smoke is big enough to bridge the gap between the head and the platter. If the sealed chamber that holds the hard disk breaks and lets foreign material in, if the drive is bumped or dropped, or if the read-write head becomes misaligned, the head will touch the disk and data will be destroyed in a **disk crash**.

Don't forget Goodman's Corollary to Murphy's Law: The closer you are to a project deadline, the more likely the computer will go haywire.

Because there is no sure way to prevent a disk crash, you should create backup copies of the data on your hard disk. A **backup** is just a second copy of your data that you keep as insurance. The most common way to make a backup is to copy data onto floppies, but the process can require a lot of floppies and a lot of time. Another method is to have a second hard disk to copy data to. As you will see on the next two pages, there are now several other options.

Magnetic Tape for Backing Up Data

A third popular option for backing up a hard disk is **magnetic tape**, which looks like a music cassette and works just about the same way. You put the tape into the tape drive (see photo) and tell the computer to copy the



contents of the hard drive to the tape. The advantage is that some magnetic tapes can store enough data to back up an entire hard disk. Once you are done backing up your data, you can remove the tape and store it in a safe place. Magnetic tape is also convenient because you can set your system to back up your data when you aren't around.

The drawback of magnetic tape is that it is useful only as a backup device. No matter how much data your tape can store, you can't retrieve it very quickly. Retrieving data from a magnetic tape is like trying to find a song on a music cassette. You might have to fast forward or reverse through a lot of tape before you get to the spot you need.

Removable Hard Disks

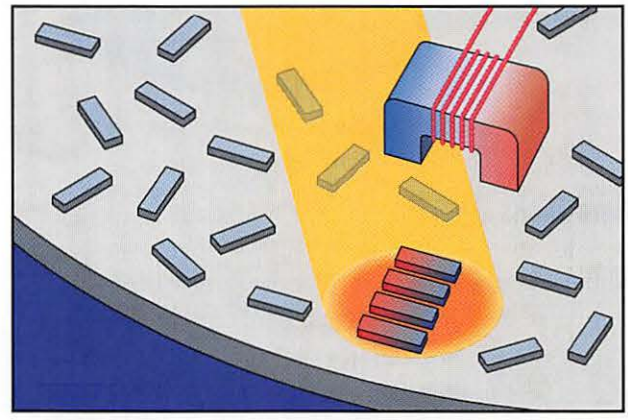
Another method for backing up data is the removable hard disk, often called the hard disk cartridge (see photo).

With a **removable hard disk**, the disk is separate from the drive, so it can be pulled out of the computer and transported. Removable hard disks aren't quite as fast as traditional hard disks, but they're just as convenient, and they offer unlimited storage space. When you need more storage, just buy more cartridges. It can actually be more useful to have your storage divided up into, say, four 88MB cartridges than to have a single 350MB drive.

The two most common removable-disk technologies are called Bernoulli and Syquest. Both of these types come in many different brand names.

Magneto-Optical Disks

One promising improvement on the floppy disk is the **magneto-optical disk**, a technology that combines the use of lasers and magnets to store data. A magneto-optical disk looks like a regular floppy on the outside, but the disk surface is coated with a crystalline metal alloy under a layer of clear plastic. To write data to the disk, the laser melts a tiny spot of plastic, exposing the disk surface to a magnet, as shown here.

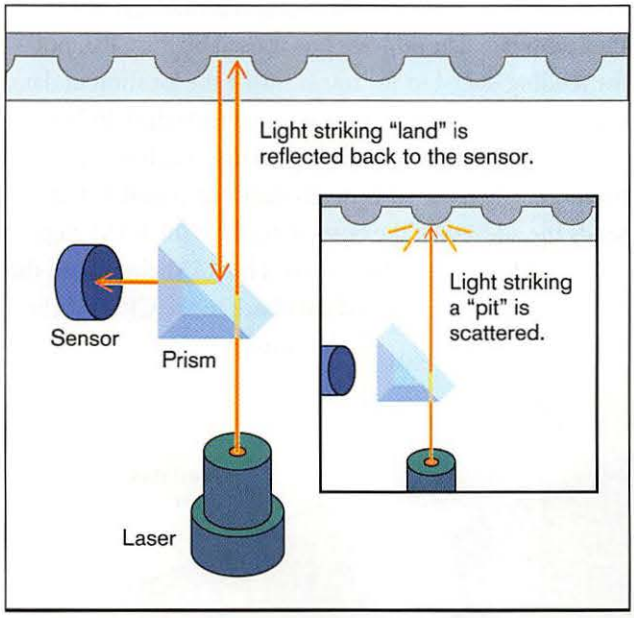


The big advantage of the magneto-optical disk, also known as a *read-write optical* or *erasable optical disk*, is that up to 300MB can be stored on a single side of a disk. The disk can also be removed and transported as easily as any floppy disk. The disadvantages are that the medium is not as fast as today's hard disks, and the technology is still very expensive. As with other computer devices, however, you can expect the performance to improve and the price to drop during the next few years.

Some people call these disks "flopticals."

CD-ROM

Today, the best-known storage device outside of the hard disk and the floppy disk is the **CD-ROM**, which stands for *c*ompact *d*isc–*r*ead-*o*nly *m*emory. CD-ROMs work just like the compact discs that are used to store music. Data is recorded on a textured piece of foil that is sandwiched in a plastic disk. The disk spins and the laser reads the data off the foil, as shown here.



The laser technology allows data to be packed together very tightly: a single CD-ROM, which stores data on only one side, can store up to 550MB of data.

The CD-ROM has one major flaw. As its name implies, it is a read-only device. It takes a special, expensive device to write data to a CD-ROM. Most CD-ROM drives are just disc players, like the CD player that you attach to a stereo. Because they are read-only, CD-ROMs are most useful for data that doesn't need to be changed. The most common use for CD-ROMs is to store games and other multimedia programs that use animated graphics and sound, both of which take a lot of storage space. CD-ROMs are also useful for storing reference data, such as maps, almanacs, indexes, or encyclopedias. Finally, as the cost of recording CDs has dropped, some companies have begun using them to back up data.

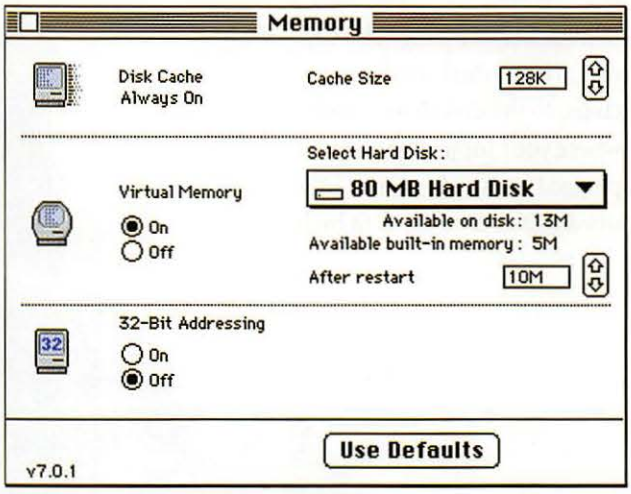
CD-ROMs are now popular for distributing publications like catalogs and reference manuals. At less than $1 per disk to press, they're very cost-effective.

Making Storage Act Like Memory and Vice Versa

In a microcomputer, RAM and the hard disk serve somewhat similar purposes—both are used to hold data. One major difference is that RAM is purely electronic, and the hard disk is electromechanical, which means that RAM is much faster. Yet, there are times when you want to use your hard disk to supplement RAM, or to use part of RAM to act like a very fast disk.

Using part of your hard disk to act like RAM is called **virtual memory**. The practice is common, because System 7 on the Mac and Windows on the PC let you keep multiple applications active—and that takes a lot of memory. The middle part of the Mac screen shown here lets you control how much hard disk space is used for virtual memory.

Virtual memory can be frustratingly slow compared to RAM performance. I don't use it unless a job requires more memory than my Mac has.



Another, less-common practice is to set up part of RAM to act like a storage device. RAM that is set up in this way is called a **RAM disk**. It's not often done, as most people don't have RAM to spare. However, a RAM disk can be useful on notebook computers with a lot of RAM, because RAM uses less battery power than the hard disk.

Remember to save RAM disk documents to your hard disk before shutting down.

Connecting Peripherals

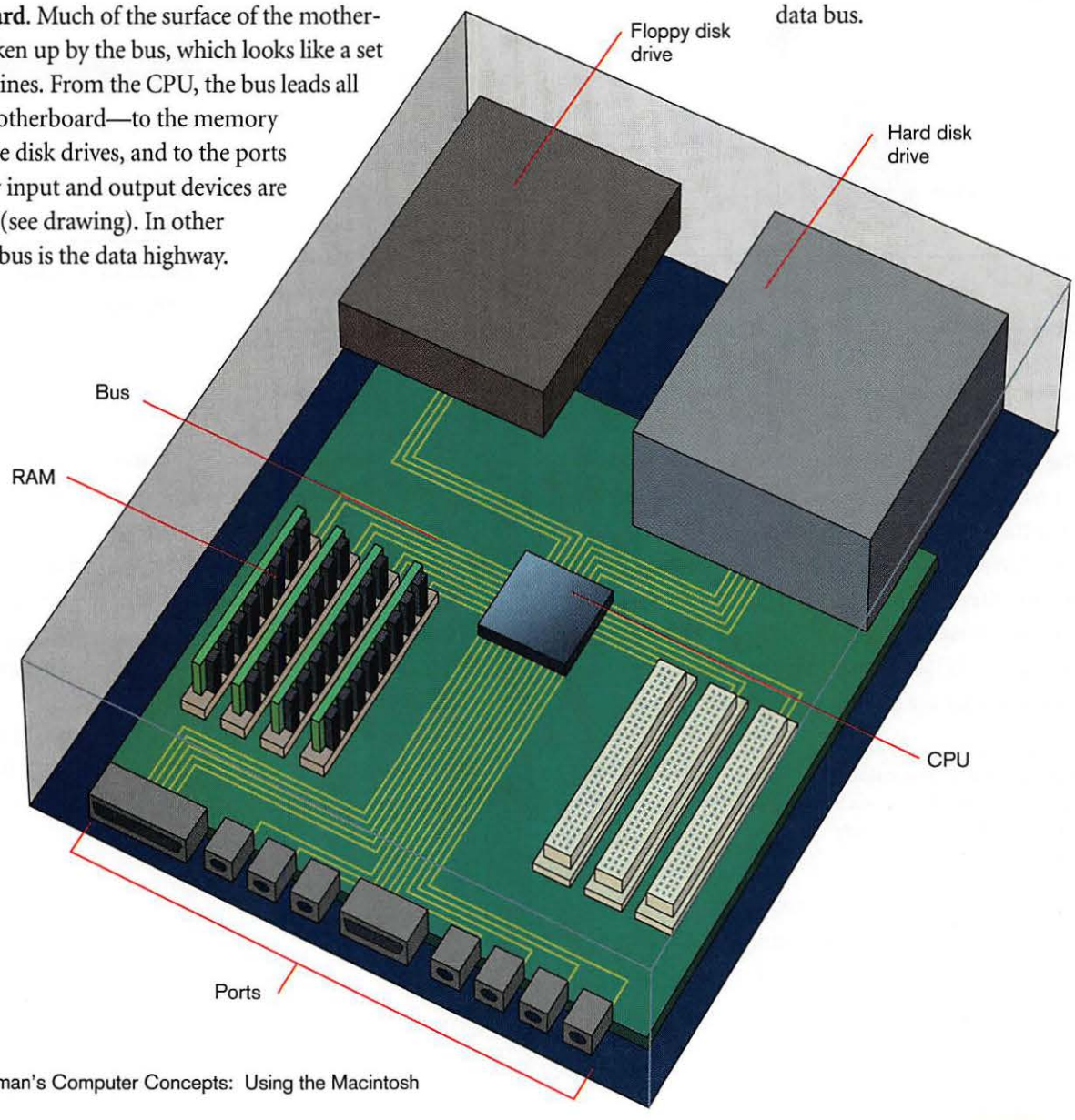
All of the hardware devices outside the system unit are referred to as peripherals (things on the periphery, or outer margins). If you take a close look at a personal computer, you will notice that all of the peripherals are connected directly to the system unit. Actually, all of the peripherals are connected to the CPU (within the system unit), because the CPU is the traffic cop for all data. The electronic paths that connect the CPU to everything else are called the **bus**, and the places where the peripherals plug into the system unit are called **ports**. When it comes time to connect peripherals to your system unit, you need to know a few things about the bus and the ports.

Data Takes the Bus

If you opened up a personal computer, you would see that the CPU and the memory chips are soldered onto a large plastic board, sometimes called the **motherboard** or **system board**. Much of the surface of the motherboard is taken up by the bus, which looks like a set of parallel lines. From the CPU, the bus leads all over the motherboard—to the memory chips, to the disk drives, and to the ports where your input and output devices are plugged in (see drawing). In other words, the bus is the data highway.

Just as the number of lanes in a highway affect the flow of traffic, the number of lines in the bus affect how fast data can move through the computer. Over the years, microcomputers have gradually increased their bus sizes, from 8 bits, to 16 bits, to 32 bits. The size of the bus tells you how many bits of data can be sent at one time.

There is actually more than one kind of bus. The term *bus* usually means the data bus, which is the one that I have just described. However, there is also an address bus in the computer. The **address bus** is used by the CPU, not for sending data, but for transmitting the location of data. One vital part of the address bus connects the CPU to RAM. Every byte of memory space in RAM has a specific location. When the CPU needs data that is in RAM, it sends the address of the bytes it needs to the RAM chips through the address bus. The RAM chips send the requested data back to the CPU via the data bus.



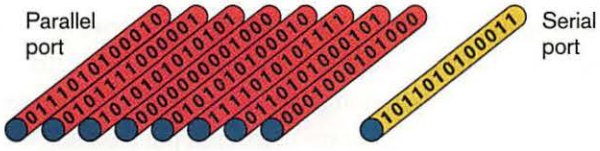
Connecting Peripherals to Ports

A computer needs several different kinds of ports. Looking at the back of a Mac, you'll see that they come in many different shapes and sizes. To show you where to plug in peripherals, Apple has put icons (small graphic images) next to many of the ports. The port for the modem, for example, has a telephone icon next to it, and the port for the monitor is labeled with a monitor icon.

PC ports are different than Mac ports. The only functionally-specific port on most PCs is the one designed for the keyboard. The other built-in ports on a PC are generic, and they fall into one of two categories: serial ports and parallel ports. **Serial ports** transmit data serially, that is, one bit at a time, in sequence. A serial port is like a one-lane road (see drawing below). Devices that are commonly attached to serial ports are mice and modems.

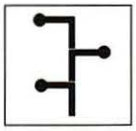
Macs don't have parallel ports, but have something even better, as you'll see in a minute.

Parallel ports can transmit a set of bits in parallel, in much the same way that data is transmitted on the bus.



Naturally, data can go through a parallel port—like cars on a four-lane freeway—more quickly than through a serial port. Devices connected to parallel ports include external hard disks, scanners, and laser printers.

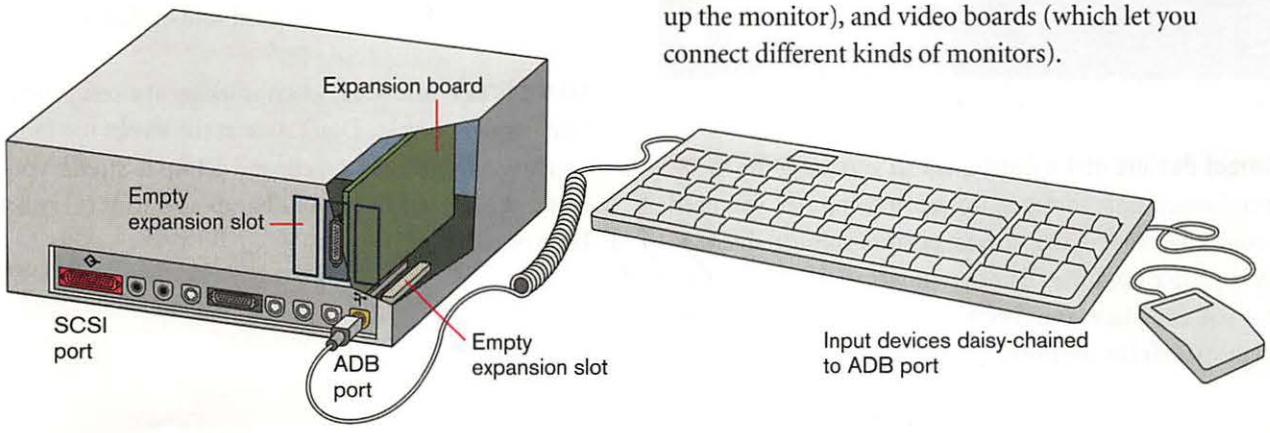
The ADB Port In addition to one or two serial ports, the mac has another connector, called the ADB port, which is marked with the icon shown here.



ADB stands for Apple Desktop Bus. The ADB port is used to connect input devices, such as the keyboard, mouse, and trackball, leaving the Mac serial ports open for other jobs. The difference between an ADB port and a PC's serial port is that the Mac only needs one ADB port, because multiple devices can be connected in sequence. For example, the usual way to connect the keyboard and the mouse is to plug the keyboard into the ADB port and plug the mouse into the keyboard, as shown in the drawing at the bottom of the page. Linking devices in this way is known as **daisy-chaining** peripherals.

The SCSI Port The Mac's equivalent of the parallel port is known as the **SCSI** (pronounced "scuzzy") **port**. The icon to the right is the SCSI icon. SCSI stands for Small Computer System Interface. High speed peripherals, such as disk drives and scanners, connect to the Mac via the SCSI port. As with the ADB port, devices can be daisy-chained to a SCSI port.

Expansion Boards In most cases, the Mac's built-in ports are all you need, because you can daisy-chain peripherals. But most PC ports do not allow daisy-chaining, and most PCs have only one parallel port and two serial ports built in. So PCs rely heavily on expansion boards that plug into expansion slots on the motherboard. An **expansion board** is a printed circuit board that extends the bus to a specific type of device. The port for the device is part of the expansion board. PCs, especially clones (non-IBM machines), usually need expansion boards to connect even such ordinary peripherals as the monitor and the printer. Most PCs have from four to eight expansion slots. Modular Macintoshes also have expansion slots, though there aren't usually as many and they are not as commonly used. The most typical uses for Mac expansion boards are for internal modems, accelerator boards (which speed up the monitor), and video boards (which let you connect different kinds of monitors).



Ergonomics

As with any piece of equipment, a computer poses certain risks to your health, especially if you spend a great deal of time sitting at a desk, typing, or staring at a screen. Most of the health risks related to computers fall into the field of **ergonomics**, a fancy word for the study of the physical relationships between people and machines.

Maintaining a Healthy Relationship with Your Computer

Many of the health problems that have been linked to computer use can be avoided by setting up your workspace right. The most important factors to consider are having a good chair, a desk that is the right height, and proper lighting. You also need to consider your own work habits.

Correct Posture and a Good Chair If you are going to spend much time sitting in front of a computer, you need a good chair that makes correct posture comfortable. Most people opt for a chair that moves up and down so that you can place your feet flat on the ground with your thighs parallel to the floor.

Monitor Height and Glare The computer's monitor can hurt both your neck and your eyes. The most comfortable viewing height, for most people, is a monitor that is at, or just below, the level of the eyes. This lets you keep your neck in a relatively neutral position and maintain good posture. However, if you have bifocal or trifocal glasses, you may need to adjust your monitor height differently.

Computer monitors can be especially bad for your eyes. If the monitor's refresh rate is not high enough, the flicker of the screen will tire your eyes. Light reflecting off the screen will also cause fatigue. When setting up your computer station, make sure to take the source of light in the room into account. If you have a window, it's best for the light to be shining in a direction parallel to the surface of the screen, rather than at your screen, where it will cause glare, or at your face, where it may be brighter than your screen. If the source of glare is impossible to avoid, you might consider an antiglare screen that clips onto the front of your monitor.

Proper Keyboard Height The right keyboard height is also important. For comfortable typing, your forearms should be roughly horizontal. Unfortunately, most desks are too high. The solution is either to have a special computer desk, which is lower than the traditional desk, or to have a low keyboard shelf. (Some users even put their keyboard on their lap now and then, for variety.) The alternative to proper keyboard height is to risk **Carpal Tunnel Syndrome** (CTS), a painful type of repetitive-stress injury that results from holding the wrist in a flexed or extended position for long periods of time.

CTS affects many people in a variety of jobs. You can spot some sufferers by their wrist braces.

Besides proper keyboard height, another way to guard against CTS is to buy a special ergonomic keyboard, such as the two-piece hinged keyboard sold by Apple.

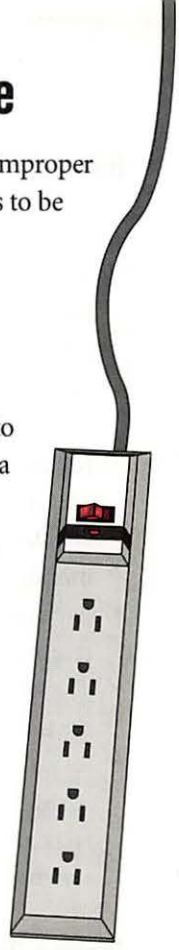
Take a Break Above all, when working at a computer, take frequent breaks. Don't stare at the screen too long, don't type too long at a spell, and get up to stretch your legs and back and shake your hands and arms every half hour or so.

Protecting Your Hardware

It isn't just your health that is in danger from improper use of your machine. The computer also needs to be taken care of.

The First Line of Protection: The Surge Suppressor

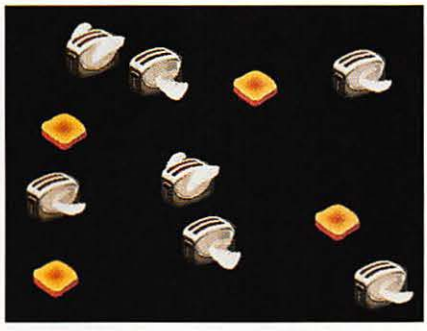
The most catastrophic event that can happen to your computer is an electronic surge or spike, a jolt of power that can occasionally occur in any electrical system. A surge or spike can run straight through your computer's power supply to the motherboard and turn your whole system into an expensive piece of junk. Fortunately, protecting your system from electrical ruination is simple: buy a surge suppressor. A **surge suppressor** (shown here) is a strip of electrical outlets with a circuit breaker built in. The circuit breaker cuts the power to your computer if a surge or spike comes through the wire.



Of course, the surge suppressor protects your hardware at the expense of any data that may be in memory. Data in RAM disappears as soon as the power is cut. Any power outage poses the same threat. Many businesses address this danger by attaching the main network computer to an **uninterruptible power supply**. This device has a built-in battery. If the power goes off, it keeps the computer running long enough to let you copy any data from memory to storage.

Protecting Your Monitor

To protect their monitors, many users buy screen saver programs. The danger in this case is burn-in, which can occur when the same image is displayed for a long period of time (say, while you're at lunch), causing the pixels that make up the image to fade faster than the rest. A **screen saver** program automatically pops up when no change has occurred on the screen for a specified amount of time. Some screen savers turn the screen black, but most display moving images like the one shown in the lower left corner. When you touch the keyboard or move the mouse, the screen redisplays what was on it before the screen saver began.



Screen savers have become a form of high art, from squadrons of flying toasters to the bridge of the starship Enterprise.

Burn-in isn't the problem that it used to be, but screen savers are still popular because they're entertaining. If a password is necessary to reactivate the screen, they can also be used to keep prying eyes from seeing the contents of your screen when you leave your desk.

Turning Your Computer On and Off the Right Way

Electronic devices tend to be sensitive to sudden changes in electrical current, so you have to start up and shut down carefully. You can't just pull the plug out of the wall, like you might do to the vacuum cleaner.

A computer should be turned on with the power switch that is on the computer itself. On most compact Macs, the power switch is on the back of the system unit. On most modular Macs, the on switch is the left-facing arrow on the keyboard. With modular Macs, you should turn on peripherals *before* you start the computer.

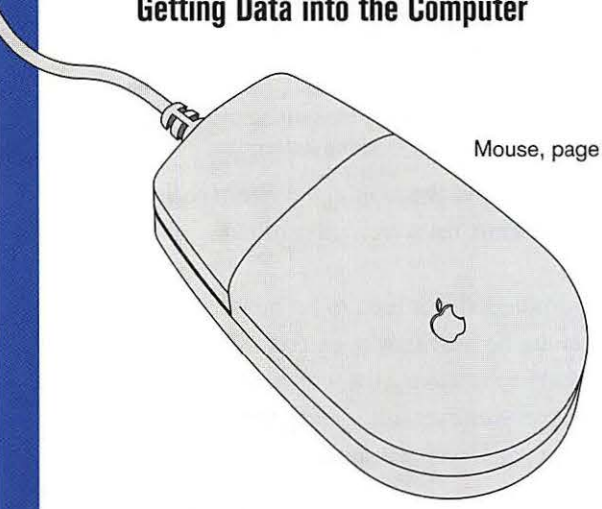
Sometimes you need to restart a computer even after it is already on. You will need to do so when (not if—for it will happen!) your software freezes up or when you have finished installing a new piece of software. On the Mac, you restart by dragging the mouse pointer to the Restart option in the Special menu.

Turning the computer off is dangerous for software and data, as well as hardware. To avoid damaging files, you need to make sure that the computer is not trying to process any instructions when you try to shut it down. The only proper way to shut down a Mac is to choose Shut Down from the Special menu, as shown here.

Shutting down via the Special menu ensures that you'll have a chance to save changes to open documents.

Visual Summary

Getting Data into the Computer

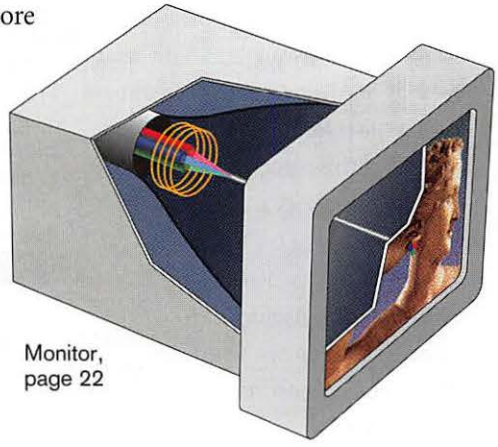


Mouse, page 19

- The primary input device is the keyboard. It includes the main keyboard, the function keys, the cursor movement keys, the numeric keypad, and the indicator lights.
- The mouse lets you work more directly with output displayed on the monitor.
- The four principal mouse techniques are pointing, clicking, double-clicking, and dragging.
- Other input devices include the trackball, touch screen, light pen, microphone, and scanner.

Getting Information out of the Computer

- CRT monitors display images on a screen using electron guns, a magnetic yoke, and a grid of pixels made of phosphor dots.
- Most flat-panel monitors create images with a grid of liquid crystal pixels.
- The three most common types of printers are the dot-matrix, inkjet, and laser printer.
- The audio speaker is becoming more popular as a computer output device.

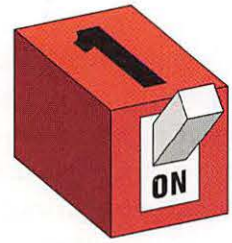


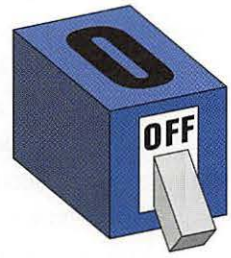
Monitor, page 22

How the Computer Processes Data

- Because the computer uses transistors to process data, the data must be represented as binary digital information—as ones and zeros.
- A single binary digit is called a bit. Eight bits make a byte, roughly 1,000 bytes make a kilobyte (KB), and about 1,000,000 bytes make a megabyte (MB).
- Each character of text is represented by one byte of data.
- The main processing devices are the CPU and memory.
- As well as the CPU and RAM, another factor that affects processing power is the system clock speed.

Binary switches, page 27

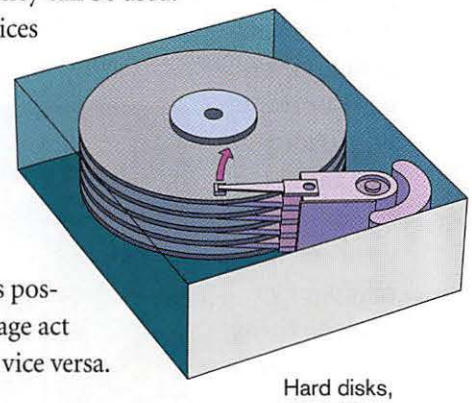




Storing Programs and Files

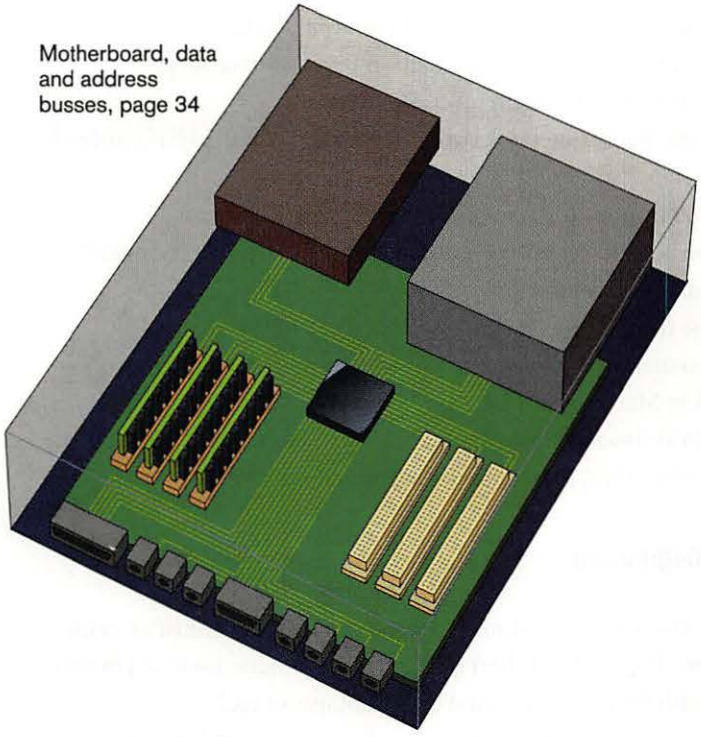
Floppy disks, page 30

- The most common storage devices are floppy disks and hard disks.
- Both are magnetic devices and both must be initialized before they can be used.
- Other storage devices include magnetic tape, removable hard disks, magneto-optical disks, and CD-ROMs.
- In some cases, it is possible to make storage act like memory, and vice versa.



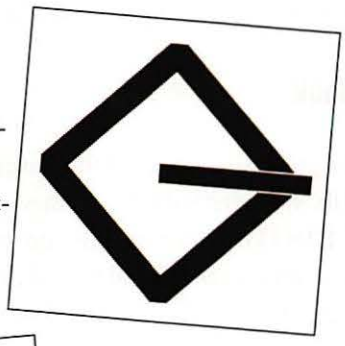
Hard disks, page 31

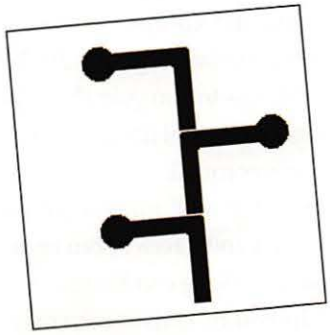
Connecting Peripherals



Motherboard, data and address busses, page 34

- All peripherals are connected to the CPU through ports and the bus, which acts as the data highway.
- In addition to the data bus, the computer also has an address bus that is used by the CPU to mark the location of data.
- In PCs, most ports are either serial or parallel ports. The Mac equivalents are the ADB and SCSI ports.
- Both Macs and PCs can be upgraded with expansion boards, though this option is more often necessary for PCs.

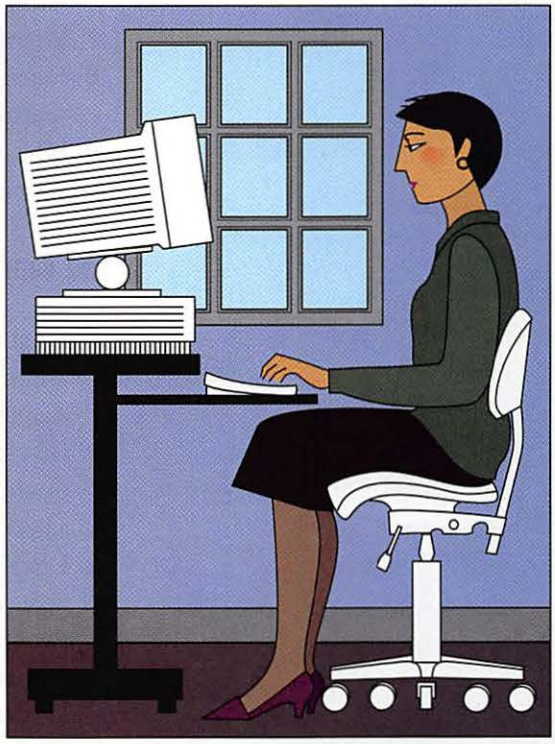




ADB and SCSI ports, page 35

Ergonomics

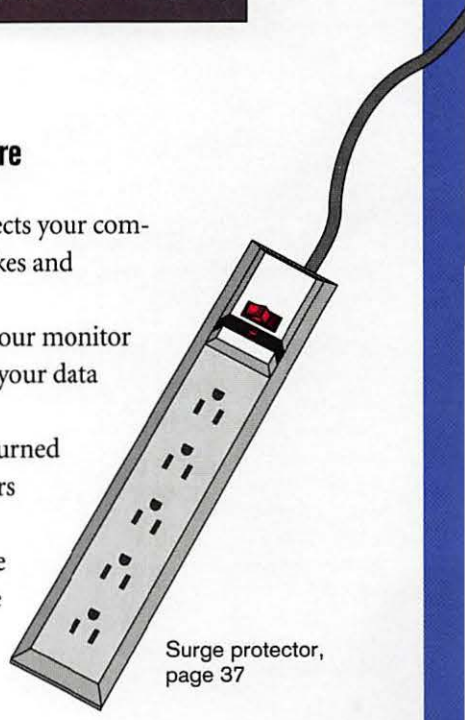
- Ergonomics is the study of the physical relationships between people and machines.
- An ergonomic computing workstation includes a good chair, proper heights for the keyboard and the monitor, and suitable lighting.
- Staying comfortable while working at a computer also requires taking frequent rests.



Ergonomics, page 36

Protecting Your Hardware

- A surge suppressor protects your computer from electrical spikes and surges.
- A screen saver protects your monitor from burn-in and hides your data from prying eyes.
- Macs and PCs must be turned on and off properly. Users must make sure that no program instructions are being executed when the power is turned off.



Surge protector, page 37

New Terms

After completing Chapter 2, you should understand these terms. They appear in bold in this chapter and are listed in the Glossary.

address bus
ASCII
backup
bit
bus
byte, gigabyte (GB), kilobyte (KB), megabyte (MB), terabyte (TB)
carpal tunnel syndrome (CTS)
CD-ROM
central processing unit (CPU)
clicking
clock cycle
cursor, cursor movement keys
daisy-chaining
disk crash
document imaging
double-clicking
dragging
ergonomics
expansion board
floppy disk, floppy disk drive
formatting
function keys
hard disk
indicator lights
initializing
Intel
keyboard
magnetic tape
magneto-optical disk
memory
modifier keys
monitors: color, CRT, flat-panel, gray-scale, LCD, monochrome, touch screen
motherboard
Motorola
mouse
multimedia
numeric keypad
OCR
pixel
pointing
ports: ADB, parallel, SCSI, serial
printer: dot-matrix, inkjet, laser, plotter
RAM, RAM disk, ROM
read-write head
refresh rate
removable hard disk
resolution
scanner
screen saver
semiconductor
surge suppressor
system board
system clock
trackball
transistor
uninterruptible power supply
virtual memory

Chapter Exercises

Review Questions

1. List the three most common input and output devices.
2. Why does the mouse make the function keys less necessary?
3. Name each of the four main mouse techniques.
4. Explain why many notebook computers come with trackballs instead of mice.
5. Why are color monitors sometimes called RGB monitors?
6. Name two advantages and one disadvantage of buying a laser printer rather than an inkjet printer.
7. Why must computer data consist of ones and zeros?
8. Name two makers of microprocessors. Who makes the microprocessors used in Macintoshes?
9. Why is RAM described as volatile?
10. Why is it important to have to use a surge suppressor?

Use Your Imagination

1. What are the qualities that make a good storage device? List as many as you can. Then make a chart of the storage devices discussed in this chapter with the advantages and disadvantages of each.
2. Give an example of an occupation in which a dot-matrix printer would be adequate, then describe an occupation that would require a laser printer.
3. Describe a job for which having a color monitor would be absolutely necessary.
4. Describe an input device that could eliminate the need for a keyboard.
5. A pocket calculator has no storage device, and yet it uses program instructions, such as "add," "divide," and "square root," to compute results. Where might those instructions be stored?

Beyond the Book

1. Describe the processing power of the computers in your school's computer lab. What type of CPU do they have? What are their clock speeds, in MHz? How much memory do they have?
2. Use a major computer periodical to find the processing power of the average PC advertised today. Then find the processing power of the average Mac being advertised. In one paragraph, compare the two.
3. Look into the cost of adding a storage device to back up your 300MB hard disk. Use computer magazines or catalogs to compare the cost of buying a magnetic tape system, a magneto-optical drive, and a removable hard disk system. Report on prices for all.
4. Using whatever sources are available, find three additional ergonomic devices that are designed for computer users and haven't been mentioned in this book. How do they improve working conditions?
5. Report on the cost of SIMMs. What is the cost of 1MB of memory?

SYSTEM 7 AND OTHER

Operating Systems

3

Contents

42 What Is an Operating System

44 Five Operating Systems for Microcomputers

46 The Macintosh Desktop

48 File Management with Windows and Folders

50 Extending the GUI with Menus and Dialog Boxes

52 The File and Apple Menus

54 Multimedia and QuickTime

56 Utility Software

58 Visual Summary

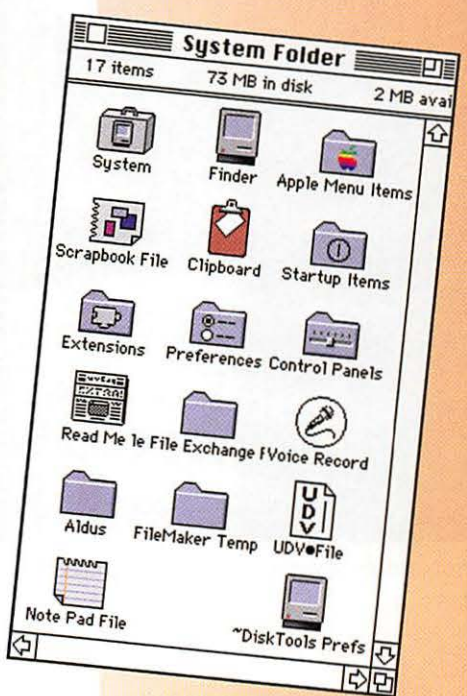
60 Chapter Exercises

AT THE HEART OF THE COMPUTER SYSTEM is the operating system. To learn how to use any computer productively, you must first learn to use its operating system. Fortunately, the Macintosh was designed around its operating system—Apple went to great lengths to make the Mac as easy to use as possible. I'll lead you through the most important features of the Mac's operating system later in the chapter. But first, you need to know what the Mac's operating system does, and who its major competitors are.

Objectives

When you have finished this chapter, you will be able to do the following:

- Name the three functions of an operating system.
- Name and describe the five operating systems commonly used on microcomputers.
- Name the features of the Macintosh Desktop.
- Describe the characteristics of a hierarchical file system.
- Use all the features found in Macintosh dialog boxes.
- Explain the purpose of the options in the Apple and File menus.
- Name and explain the most common control panels.
- Describe the capabilities of QuickTime and tell how to play QuickTime movies.
- Describe the most common types of utility software.



What Is an Operating System?

The computer's operating system serves three main functions. It provides interfaces between the user and the hardware, between the application software and the hardware, and between the processing hardware and the peripherals (see the drawing at the top of the next page).

The User Interface

The first function is the one you notice the most. The operating system sets up the **user interface**—the set of screen elements that let the user control what the computer is doing. You can think of the user interface as the computer's personality. There are basically two different types of user interfaces, command line interfaces and graphical user interfaces.

Command Line Interfaces The best-known command line interface is **DOS**, the most common operating system used on PCs. In a **command line interface**, the user controls the computer by typing commands at the keyboard. For example, to find out what files are stored on a floppy disk using DOS, you type **DIR**. Here's an example of what you might see on the screen.

DIR is the command to list the files in a directory.
A: is the designation for the first floppy drive.

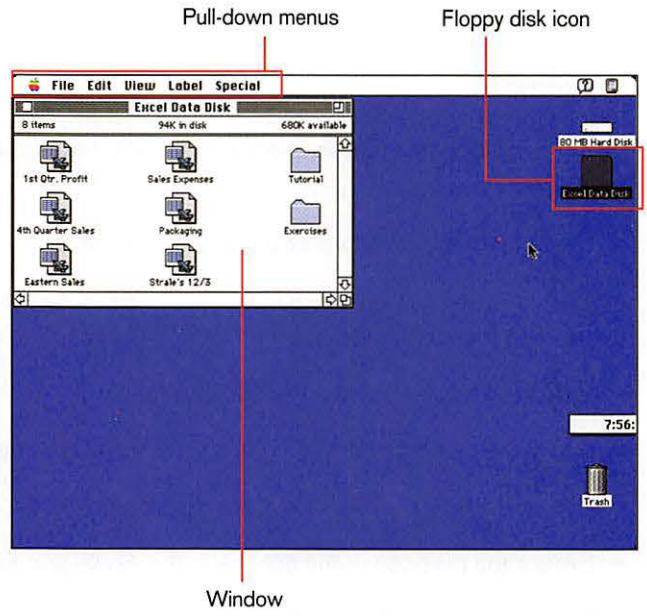
```
A:\>dir

 Volume in drive A is ACTIVITY
 Directory of A:\

DOSFILES     <DIR>      12-01-93   3:00p
NDWFILES     <DIR>      12-01-93   3:00p
WINFILES     <DIR>      12-01-93   3:00p
DAILYRPT TXT      200 08-18-93   8:57a
EASTERNS XLS     4174 08-19-93  11:36a
EFF-HIST TXT    30884 08-19-93   9:44a
EFF_PLCY DOC    12133 08-19-93  11:39a
FOUNDING TXT     4627 08-19-93   9:45a
INTOUCH  TXT     1690 08-21-93   1:05p
MEMO3-12 DOC     3762 08-23-93   9:57a
OUTLINE  DOC     2846 08-19-93   9:32a
PACKAGIN XLS     4630 08-19-93  10:11a
SALE_FIN XLS     5211 08-19-93  10:12a
SYSTEM   TIF    19157 08-16-93  10:29p
      14 file(s)      89314 bytes
                     133120 bytes free

A:\>
```

A:\> is the operating system prompting the user for a command.

After the user types the command and presses the Enter key, DOS responds with the directory listing, then displays the A:\> again.

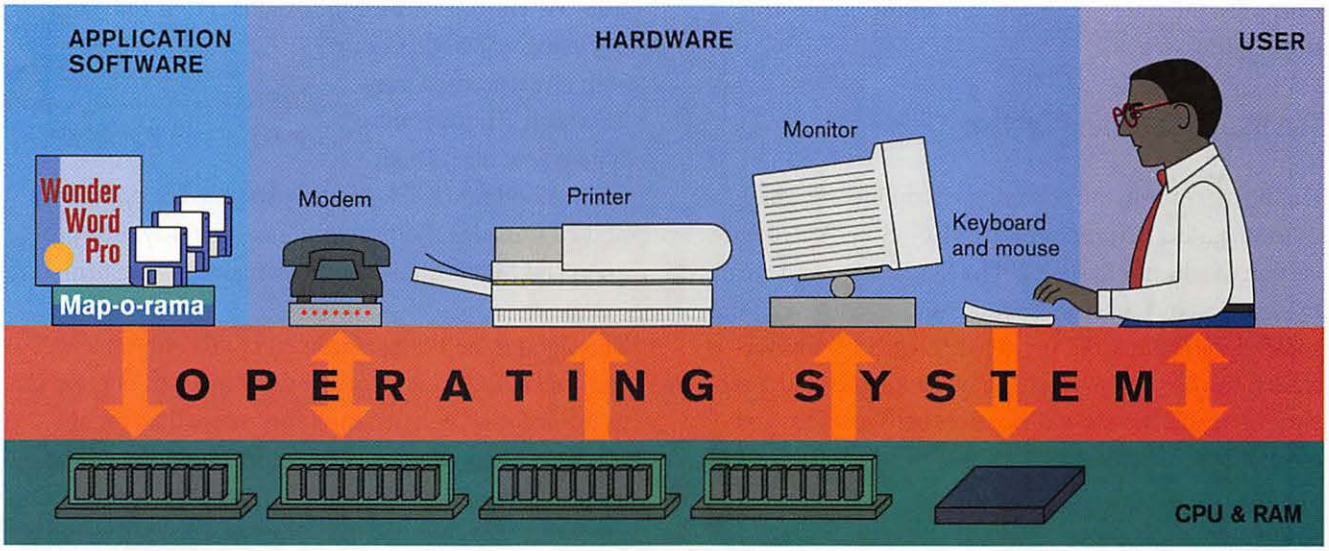
Graphical User Interfaces The Macintosh was the first commercially successful computer to employ a **graphical user interface**, or **GUI** (pronounced "gooey"). In this type of interface the user controls the system by manipulating graphical objects. Graphic objects can include things like **icons**, which are small pictures that represent files or programs, and pull-down menus, which are lists of commands that are displayed when you point to the menu name and hold down the mouse button. For example, to display the contents of a floppy disk on the Mac, the user double-clicks on the icon representing the disk. The Mac's operating system, a combination of components called the System and the Finder, responds by opening a graphic window that lists the contents of the disk.

Microsoft Windows 3.1 puts a GUI face on top of DOS. Future versions of Windows will combine the functions of DOS and the GUI into a single operating system.



The Application Interface

The second function of the operating system, the application interface, is what makes choosing an operating system such a big decision. Most programs work with only one application interface. So when you decide on an operating system, you are committing yourself to the



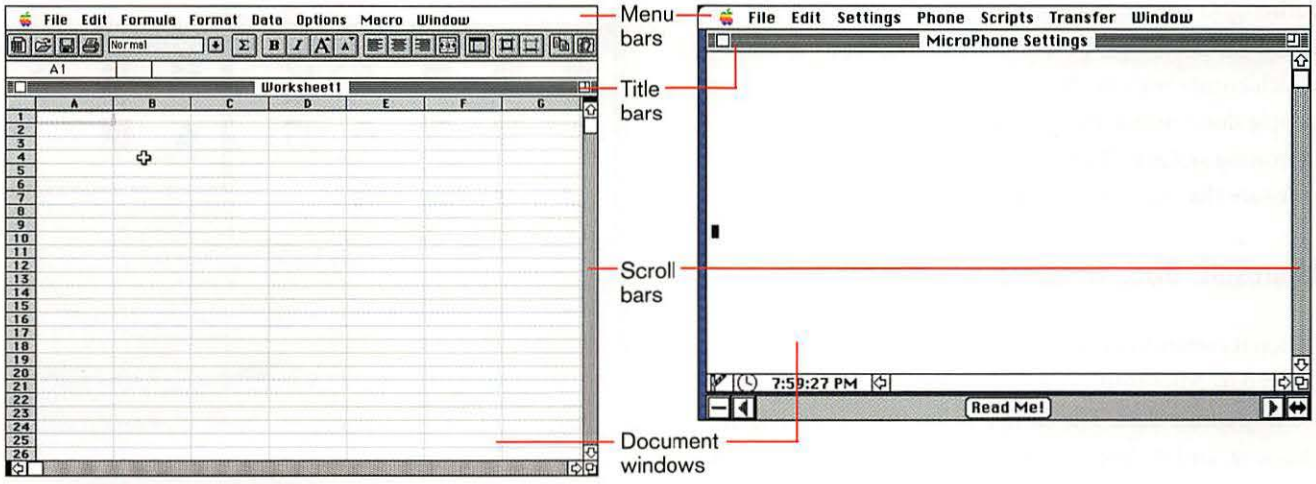
programs that work with it. In other words, when you buy a Mac, you must buy application software that is designed for the Mac.

Application interfaces differ dramatically between operating systems. Applications that work with DOS, for example, can look and feel very different from each other. This aspect of DOS can be a blessing or a curse. The software developer has a great deal of freedom in creating the application. The user, however, has more difficulty learning new programs, because the user interface for each one is entirely new.

The Macintosh application interface, in contrast, is much more uniform. Every application conforms to the Mac's personality. Each has the required menus across the top and the window elements that you will learn about later in the chapter. For example, compare the opening screens from Excel (below left) and MicroPhone II (below right). These programs are used for completely different reasons—one is for making spreadsheets and the other for using a modem. But they still look similar and have many similar commands. The advantage of this uniform application interface is that once you learn one program, it's easier to learn others.

The Hardware Interface

Finally, the operating system tells the CPU how to interact with the other hardware devices connected to it. As a user, you don't need to worry much about the hardware interface—just as you don't need to understand internal combustion to drive a car. A good operating system is designed to shield you from issues related to hardware management.



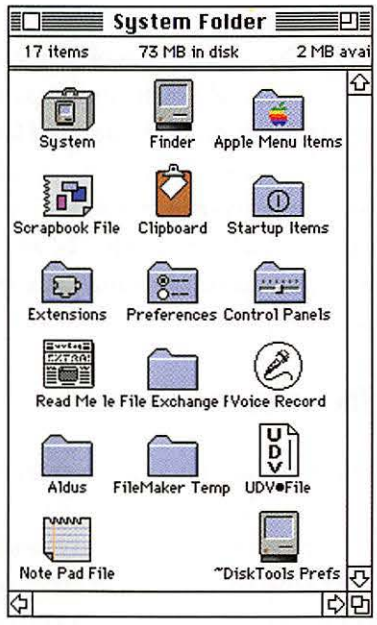
Five Operating Systems for Microcomputers

Currently, there are five major competitors in the field of operating systems.

The Mac's Operating System

On the Macintosh, the operating system is commonly called the MacOS (pronounced "Mac-oh-ess"), a recent version of which is **System 7**. The Mac screens you see in this book were made using a Mac running System 7. And some of the features discussed here are new to this version. If the Macs at your school are running an older version, there will be minor differences between what you see in this book and what you see on-screen in the computer lab.

Except for a few instructions that are stored on ROM chips, the operating system is located in the **System Folder**, the contents of which are shown at right. The two most important files in the System Folder are the ones in the upper left corner, the **System File** and the **Finder**. The System File is the core of the operating system, and the Finder controls the user interface.



Although a few people use another operating system, called Unix, on high-powered Macs, most use the MacOS, which comes with the Mac when you buy it. In fact, many people don't differentiate between the machine and the operating system. "The Mac" can mean the machine, the software that runs it, or both.

Microsoft: DOS, Windows, and Windows NT

When it comes to operating systems for PCs, those created by Microsoft Corporation are far and away the leading contenders. The company has three products in this area, and it's important to distinguish between them.

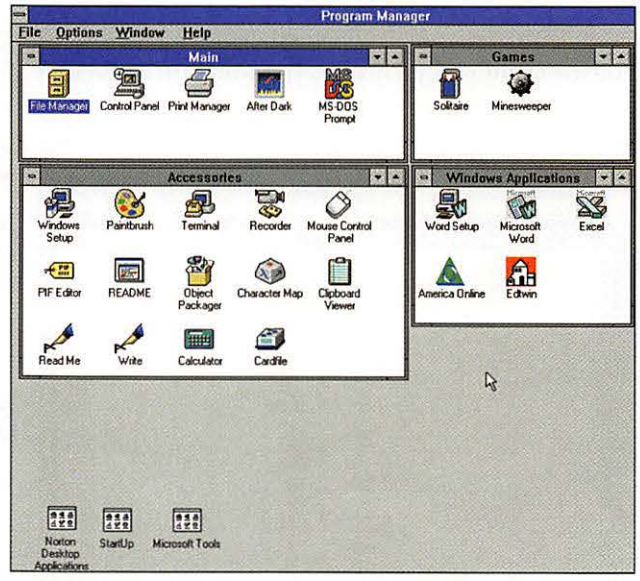
DOS When IBM released the original PC in 1981, the operating system that came with it was licensed from Microsoft. The operating system was called DOS, which stood for Disk Operating System. The popularity of the PC made DOS the world's most widely used program and Microsoft the world's largest software firm.

DOS is also known as MS-DOS, which distinguishes Microsoft's version from IBM's version.

Throughout the 1980s, almost every PC sold came with a copy of DOS. As a result, there are thousands of programs available for DOS-based machines, more than for any other operating system. The wealth of programs is seen as the biggest advantage of DOS. It is such a strong selling point that the other PC operating systems build in the capability of running DOS-based software.

Windows Recognizing the appeal of the Mac's GUI and the consistent look of Mac programs, Microsoft released Windows in 1987. As of version 3.1, **Windows** is not an operating system. It is merely a graphical user interface for DOS. (However, Windows will become a full-fledged operating system in future versions.) Windows adds important functions to the machine, and it brings a consistent graphical environment to DOS-based PCs. The Windows user interface is shown here.

Microsoft wanted to convert DOS users to Windows, so Windows lets you operate DOS programs, in addition to those specifically designed for Windows—not a trivial technical feat.



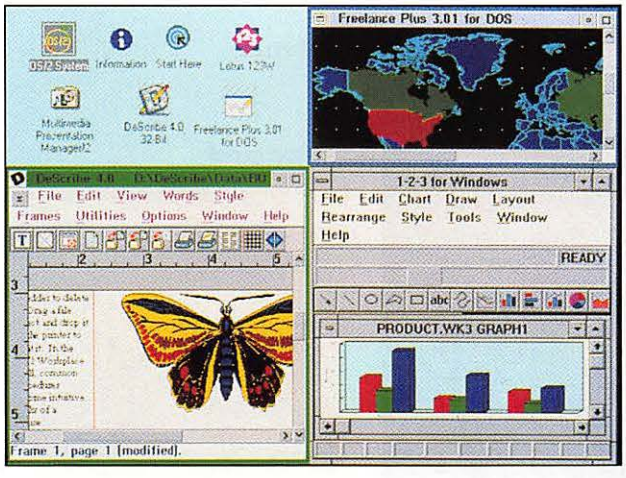
One of the valuable functions that Windows adds to the PC is the ability to keep more than one program running at once, a capability known as **multitasking**. System 7 lets the Macintosh perform this same type of multitasking. Windows also makes it easy to move data between applications.

Windows NT There are certain capabilities that Microsoft can never add to Windows, simply because (as of version 3.1) Windows still requires DOS, and DOS has basic limitations. In 1993, Microsoft finally released the successor to DOS, a powerful operating system called Windows NT (NT stands for New Technology). Windows NT looks a lot like Windows (DOS-based Windows, that is), but it doesn't require DOS and doesn't suffer from DOS's limitations. In other words, Windows NT is an operating system, though Windows is not.

Windows NT is mostly for large business installations that depend on networked PCs. Few individual users need its power.

IBM's Operating System: OS/2

Today, IBM's PCs can still run DOS, but many are sold with IBM's own operating system, called **OS/2**. The user interface for OS/2, called the Workplace Shell, is shown here.



OS/2 was first released in 1987, but it gained little support, largely because of its hardware requirements. With OS/2 version 2.1, released in 1993, however, IBM is again challenging Microsoft's dominance of the PC operating system market. In terms of capabilities, OS/2 is comparable to Windows NT.

Unix

The last major operating system, Unix, is actually the first, because it has been around since 1969. **Unix** was originally developed by AT&T's Bell Laboratories for one of its minicomputers, but the program has been modified to work on almost every type of computer, from micros to mainframes. One class of computers, the workstations, use Unix almost exclusively.

For years, Unix users have been saying it is the operating system of the future. Unix allows an advanced type of multitasking, and it lets a single computer be used by more than one person at a time. Unix also has powerful networking capabilities built into the operating system.

Still, Unix has never caught on among the mass of microcomputer users, mostly because it has a reputation for being hard to use and also because it requires a relatively powerful machine. Both of these drawbacks are disappearing, however. New versions of Unix have powerful GUIs (like the one shown below) and can now be run on machines with less RAM than it takes to run Windows NT or OS/2 version 2.1, Unix's main competitors.

Recognizing the importance of Unix, Apple developed software that allows a Mac to behave like a Unix workstation on a network. Called A/UX (Apple Unix), it also lets users run regular Mac software.

The Macintosh Desktop

Up to this point, I have been discussing operating systems in general, explaining their three functions and the major competitors. To get a complete sense of what an operating system does and how you use it, though, you need to explore one in depth. For the rest of this chapter, I'll show you the important features of System 7.

Objects on the Desktop

A graphical user interface lends itself to certain understandable metaphors (or figures of speech) that relate software features to objects in a typical office. The Finder's central metaphor is the **Desktop**, your electronic workspace. Learning to use the Finder begins with learning about the Desktop.

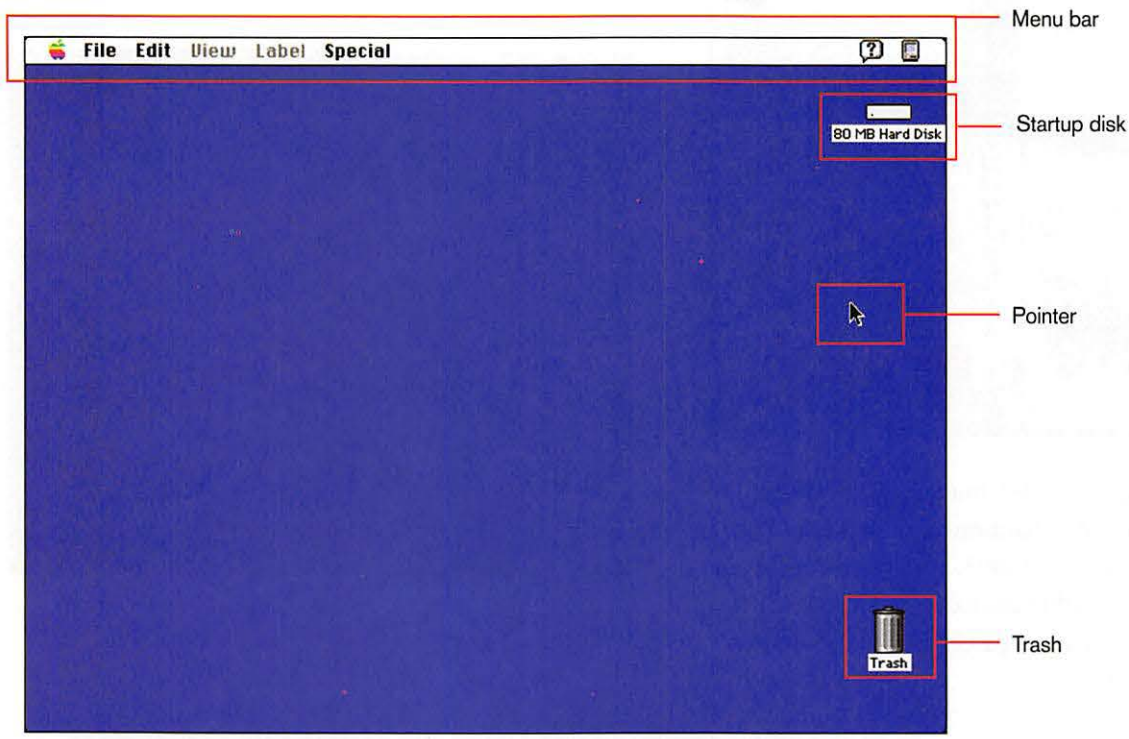
I like to imagine the Mac Desktop as if it were the top surface of a real desk. It's where I spread out my work.

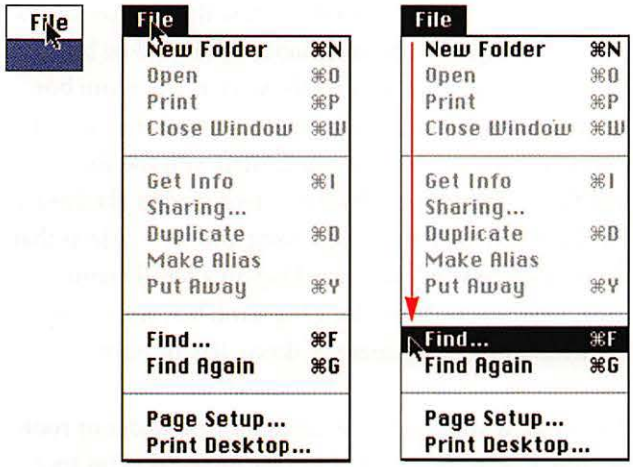
When you first turn on the Mac, the CPU reads the part of the operating system that is stored on ROM chips. Next, it loads the System File and the Finder into RAM. When it is done loading the Finder, you see the Macintosh Desktop, shown below.

The Pointer Your main tool for interacting with the Desktop is the mouse, which you use to control the pointer. Metaphorically, the pointer is an extension of your hand—you use it to point to papers on your desk and shuffle them around. You use the mouse and the pointer to select objects on the screen, choose commands, and move files. In the screen here, the pointer is displayed as an arrow, but it isn't always shown that way. When the Mac is executing a command, the pointer may turn into a watch. While the watch is visible, you aren't able to do anything else. The watch is the Mac's way of saying, "Wait a minute while I work on your command." As you use application software on the Mac, you'll see several other pointer shapes.

The Menu Bar The menu bar runs along the top of the Desktop. Each of the words and icons in it is a heading for a pull-down menu. When you point to a heading with the mouse and press the mouse button, the pull-down menu appears, listing options that start Finder commands. To choose a menu option, you point to the menu bar, hold down the mouse button, and drag the pointer to the desired option, as shown at the top of the next page.

The menu at the far-left edge of the menu bar is known as the Apple menu. It contains a set of helpful Desktop tools. You will learn more about the Apple menu later in the chapter.

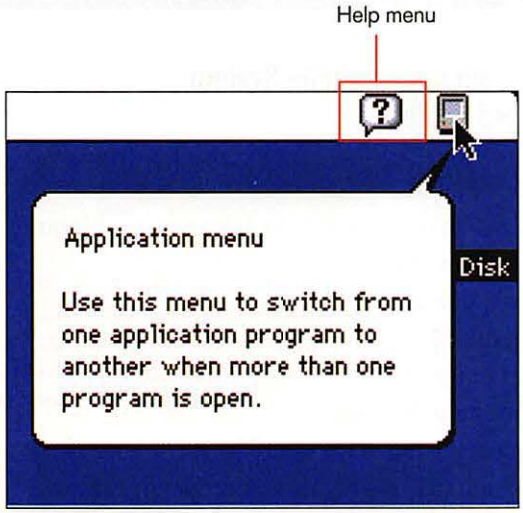




Point with the pointer, hold the button down to see the menu, and drag the pointer to the option you want.

At the far-right edge is the Application menu, which you can use to switch between programs that are currently running. When you are using the Finder (in other words, when the Desktop is displayed), the heading for the Application menu is an icon that looks like a compact Mac. When you are using an application, the heading is the icon for that program.

The Help menu is just to the left of the Application menu. You can use the Help menu to get information on specific topics or to turn on a System 7 feature called Balloon Help. With Balloon Help turned on, the Mac displays text in bubbles (like those shown in comic strips) that give you information about items you point to with the cursor. For example, if you point to the Application menu heading, Balloon Help displays the following bubble:



The Startup Disk When a Mac is first turned on, it must have access to a disk that contains the System software. This disk is called the **startup disk**. It can be a floppy disk, a hard disk, or the main computer in a network. The hard disk is the most common startup disk.

An icon representing the startup disk is always displayed in the upper-right corner of the screen, just below the Application and Help menus. If you start the Mac from the hard disk, then insert a floppy disk, the floppy disk icon appears below the startup disk.

The Trash In the bottom-right corner of the screen is another icon that is always visible when you start the Mac. The **Trash** can is where you throw away files when you don't want them anymore. You just drag the file's icon to the Trash, and it disappears. And, just as with a real trash can, the contents of the Trash icon aren't actually gone until you select the Empty Trash option from the Special menu. (In System 6 and earlier, however, the Trash is emptied whenever you turn off the Mac.)

Apple prides itself on accommodating different countries. In the United Kingdom, Trash is labeled more civilly as Wastebasket.

The Trash can has one other function. When you want to eject a floppy disk from its drive, you drag the disk's icon into the Trash, as shown in the screen to the right. Don't worry: Dragging the disk to the Trash doesn't erase the disk. It just ejects the disk. There are other ways to eject a floppy disk from its drive, but this way is the easiest and best.

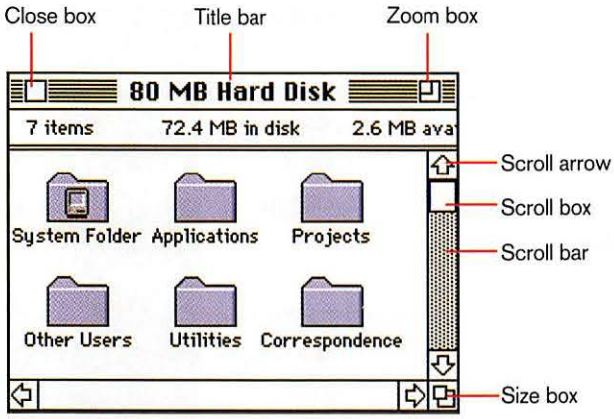
The floppy disk icon appears as an outline when it is being dragged around the Desktop

File Management with Windows and Folders

When you work at a computer every day, it doesn't take long to have hundreds, or even thousands, of files on your computer's hard disk. Organizing your work then becomes a major concern. Fortunately, the Finder gives you the power to create electronic file cabinets to organize your documents and programs. When you work on a Macintosh, you can think of each disk as a separate file cabinet. Within each disk, you are free to create as many folders as you need to organize your data and software. When you want to see what is in a folder, you double-click on it and it turns into a window on the Desktop.

Using Windows on the Desktop

Say you have just started your Mac and you are looking at the empty Desktop that was shown in the last section. If you double-click on the hard disk icon, a window—similar to the one shown here—appears on the Desktop.

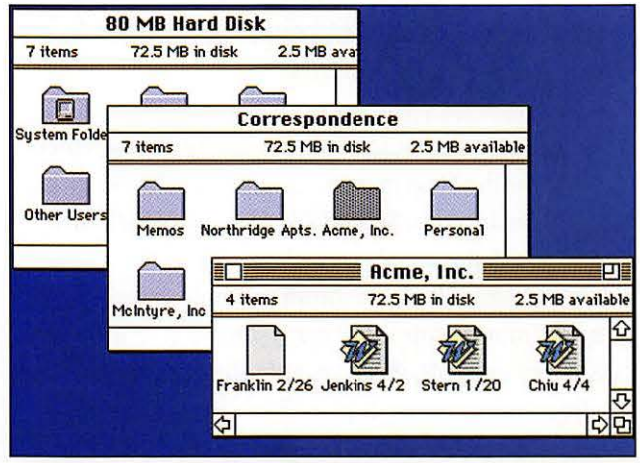


A **window** is the Mac's way of letting you view the contents of a disk, folder, or document. When you are working with the Finder, windows show you the contents of disks and folders. When you work with applications, windows show you the contents of documents.

You can think of each window as a piece of paper on a real desktop. You can arrange them neatly, overlap them haphazardly, and even bury a smaller one beneath a larger one.

Every Macintosh window shares certain features, including a title bar, close box, zoom box, and size box. Some also have scroll bars. The **title bar** tells you the name of the disk, folder, or document you are looking at. It also lets you move the window. If you drag a title bar, the whole window moves. The **close box** does exactly what its name implies: when you click on it, the window closes. You can change the size and shape of the window by dragging the **size box** around the screen. The **zoom box** lets you jump back and forth between two different window sizes: the last size that you created with the size box, and the optimum size, which is determined by the Finder. Finally, the **scroll bars** let you bring into view objects that don't fit in the window. By clicking on a **scroll arrow** or dragging the **scroll box** along the scroll bar, you can move the window's viewing area up, down, left, or right.

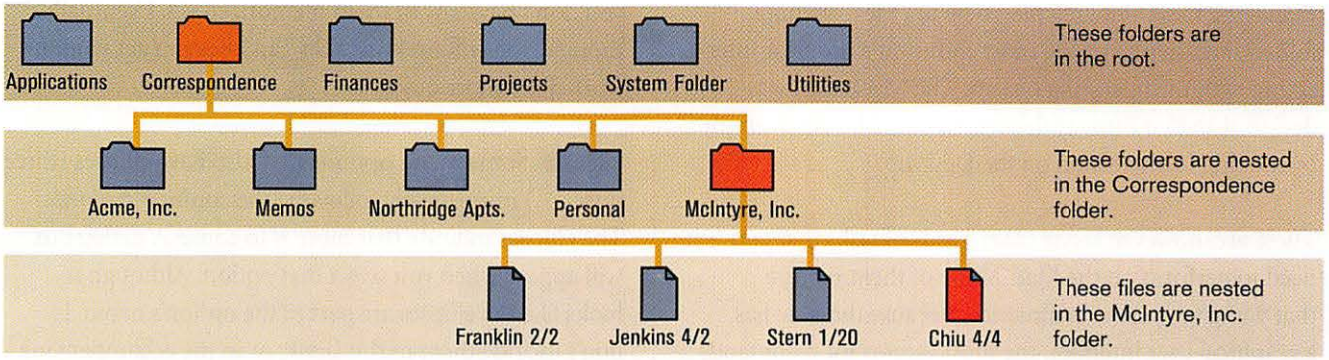
The window you just saw is called the disk folder or **root**, because it is the first level of storage on a disk. This root has six folders visible in it. A **folder** is a collection of files and other folders, much like a file folder in a file cabinet. If you double-click on a folder icon, such as the Correspondence folder, it opens into another window. The Correspondence folder contains still more folders. If you double-click on one of these, such as the folder for Acme, another window opens.



Creating a Hierarchical File System with Nested Folders

A folder inside another folder is said to be **nested**. An organized system of nested folders is known as a **hierarchical file system**. If you diagram the folders that are open in this figure, you can see part of the hierarchy on this hard disk (see the diagram at the top of the next page). The goal of managing your files is to organize your files in a logical way that lets you find any file quickly.

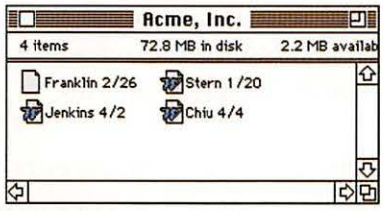
While nested folders can get cumbersome in a real filing cabinet, Mac folders are far more accommodating—you can create more levels than you'll ever need.



Other Ways to Look at a Hierarchical File System

The Finder offers other ways to look at files and folders. The folders shown in the last two screens were displayed in By Icon view, meaning that each file and folder is shown as an icon, with its name underneath it. There are two other views available. (Still others are available with earlier versions of the System.)

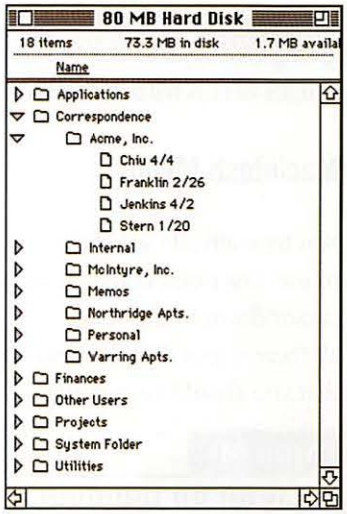
The second is called the By Small Icon view. It works much like the By Icon view, except that the icons are smaller, so more of them can fit into a window.



A third option is the By Name view. With System 7, the By Name option offers a very different way to view folders, because it lets you view the contents of multiple folders in the same window. For example, here is the root of the 80MB hard disk, displayed By Name.

Some users refer to this kind of text listing as an outline view, sorted by name.

There is an arrowhead to the left of each folder in the window. If you wish to see the contents of that folder, you can click on the arrowhead. It then turns to point down, and the contents of the folder are displayed. For example, clicking on the Correspondence folder in this screen displays the six folders inside it, one of which is the Acme folder. Click on the arrow to the left of the Acme folder, and its contents are displayed. Notice that nested files and folders are aligned to the right of the folder in which they reside. With the By Name view, you can do most of your file management with only one window open on the Desktop.



A Proven Strategy for File Management

There are many ways to organize the files on a hard disk. Ask five different users, and you'll hear five different methods. There is, however, one loosely defined model that is widely used, especially by Macintosh users.

There is one folder that all Macs share: the System Folder. It resides in the root of the startup disk, and its contents are determined by the operating system. Another folder that you can find on many Mac systems is an Applications folder. It contains one folder for each application that has been loaded onto the startup disk.

The rest of the folders on the hard disk are for your data files. There are two common ways to organize data files. The first is by project, with one folder for each project you are working on. The second is by function, with one folder for, say, correspondence, one for budgets, one for brochures, and so on. In general, you should not have any files—only folders—in the root of your startup disk.

Extending the GUI with Menus and Dialog Boxes

Managing files—moving files, deleting files, opening folders, and so on—is the most common reason for interacting with the operating system. The Macintosh was designed so that most of these tasks could be done simply by moving icons around on the Desktop.

There are, however, many other kinds of tasks that you need to perform on the Mac. Many of them require that you give specific commands. Because the Mac has a graphical user interface, the most important commands in every program are available through a system of menus. When the operating system, or any other program, needs you to clarify a command, the Mac prompts you for details with dialog boxes.

Macintosh Menus

You have already seen how easy Macintosh menus can be to use: Just point at the menu heading, click, and drag the cursor down to the option you want. In many cases, that's all there is to it. But there are some other menu features that you should be aware of.

Keyboard Shortcuts Along the right edge of many menus, you sometimes see sets of symbols. Most of them begin with the command symbol (⌘). These symbols are **keyboard shortcuts** that tell you how to give the same command from the keyboard, without using the mouse and the pull-down menu. For example, you can create a new folder by selecting New from the File menu, but it's faster to hold down the command key (⌘), and press the letter N.

While the characters in the menus are uppercase, you don't hold the Shift key down, too—just the ⌘ key and the letter key.

You don't need to bother with the shortcuts when you are first getting comfortable with the Macintosh—besides, you don't have any of them memorized yet. Eventually, though, you will find that they can help you get your work done more quickly.

Ellipses Some menu options may also have ellipses (three dots: . . .) immediately following the command name. The ellipses indicate that more is to come: A dialog box will appear when you select that option. Although it looks like the ellipses are part of the option's name, I don't include them in this book, or in the accompanying tutorials. For instance, I will instruct you to "Select Erase Disk from the Special menu" rather than "Select Erase Disk . . . from the Special menu."

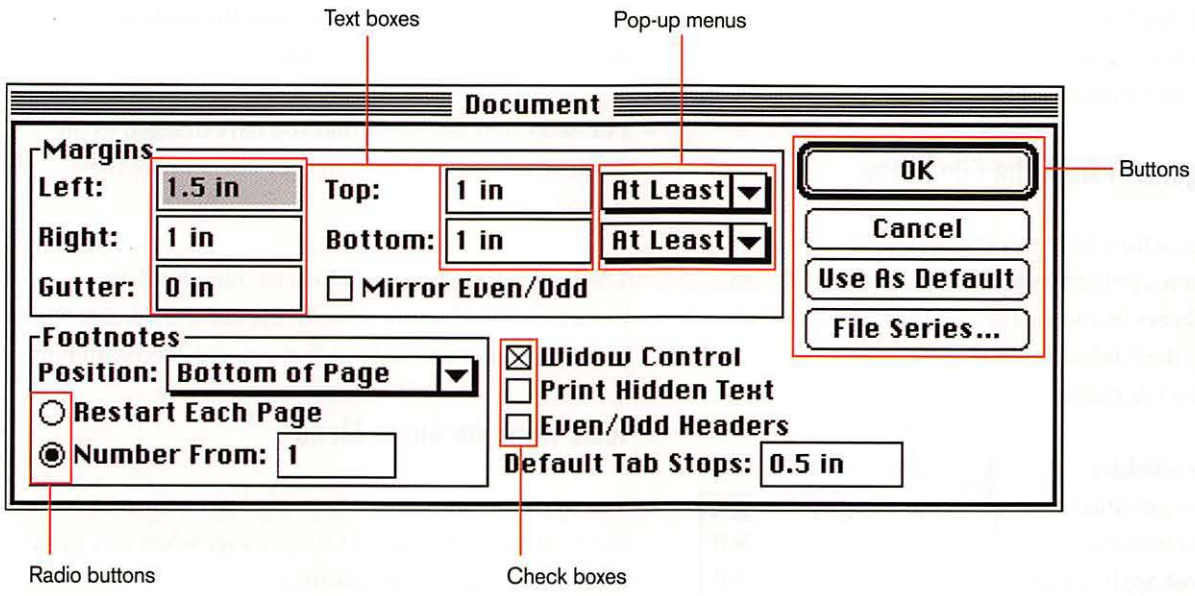
Using Dialog Boxes

Dialog boxes are the Mac's way of getting more information from you when you issue a command. There are as many different dialog boxes as there are commands that use them, but they all use a few common elements. The Format Document dialog box (shown at the top of the next page), which comes from Microsoft Word, uses most of the possible elements.

Buttons are one feature that every dialog box has. Buttons initiate actions when you click on them. Since dialog boxes are usually for completing commands, there is always a Cancel button that lets you change your mind and kill the command, and there's usually an OK button that you click when you are done with the dialog box. The button with heavy lines around it is the **default button**. Pressing the Return key on the keyboard does the same thing as clicking on the default button.

Text boxes are completed by typing information at the keyboard. The ones shown here are very short—other dialog boxes have text boxes where you type whole words or even sentences. If you wanted to change the size of the margin in one of these text boxes, you would double-click in the box to select its contents and then type a number to specify a new margin size. You can also use the Tab key to move from one text box to the next.

Pop-up menus let you select from a set of options. You click on the down-facing arrow, and drag down to the option you want, the same way you use a pull-down menu. The currently selected option is displayed at the

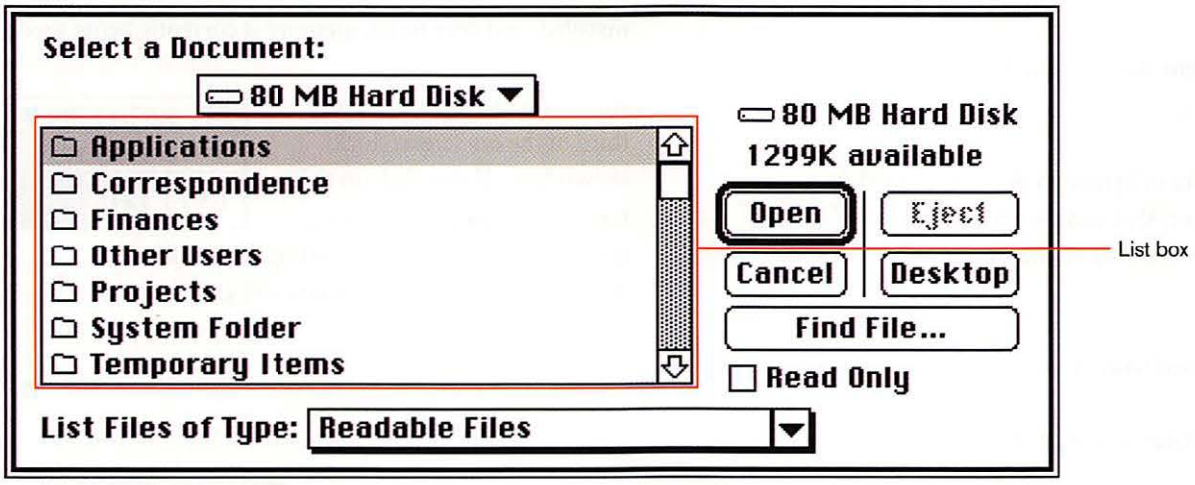


top of the menu. These pop-up menu indicate that the top and bottom margins will be at least one inch.

Radio buttons are another way to select from a set of options. When you click on a radio button, it appears black, and the other buttons in the set turn white.

Check boxes work like radio buttons, but more than one of them can be selected at a time. When you click on them, an X appears in the box. Click again and the X disappears.

List boxes are one dialog box element that does not appear in the Format Document dialog box. A list box is similar to a pop-up or pull-down menu—you use it to select from a list of options. But the contents of the list can change. If there are more options than fit in the list, the box will have a scroll bar along the right edge. The list box shown here comes from the Open dialog box in Microsoft Word.



The File and Apple Menus

The File and Apple menus deserve special attention, because they let you tap into the power and convenience of the Mac's operating system.

File Management from the File Menu

The contents of the File menu change slightly as you move from one application to the next, but several commands are always included. The one shown here is the File menu in the Finder. You will find several of these items in every File menu.

Selecting New Folder displays a new, untitled folder in the currently active folder. In most applications, this option creates a new document.

Open does the same thing as double-clicking on a document in the Finder.

Most File menus contain at least one Print option. **Print** prints a selected document. **Page Setup** lets you set the paper size and tell the printer to print sideways on the paper, if you prefer. **Print Window** is useful for printing the contents of a folder or file system.

Close Window does the same thing as clicking on the close box.

Get Info gives information about a selected document: the application that was used to create it, the file size, when the file was first created, and when it was last modified.

Sharing is used with networked Macs to share files.

Duplicate makes a copy of the selected item.

Make Alias, a new feature for System 7, lets you create an icon that is linked to another document or application. When you double-click on the alias, the original document or program is opened.

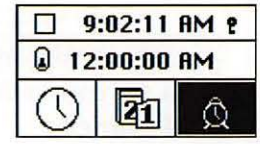
Put Away puts any items that you have dragged to the Trash or the Desktop back in the folders where they started.

The **Find** option helps you look for files. **Find Again** looks for more documents with the same attributes (such as file type or creation date) that you specified with Find.

Tools from the Apple Menu

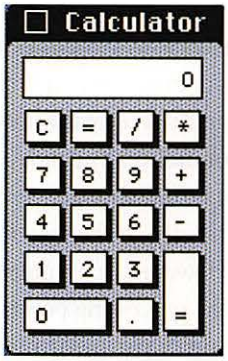
The Apple menu contains a set of useful on-screen tools. The contents of the menu rarely change when you move from one application to another.

About This Macintosh displays information about what model Mac you are using, which version of the System is installed, and how much memory is currently being used.



Alarm Clock displays the top third of the on-screen clock shown here. If you click on the flag in the upper-right corner, the rest of the box appears, letting you set the time, the date, and the time the alarm will go off.

Calculator displays this calculator, which you can use just like a hand-held calculator.



The **Chooser** lets you connect to different parts of a network or switch between different printers.

The **Control Panels** option opens the Control Panels window, where you customize many aspects of the operating system. The section at the bottom of these two pages explains what you can do with the control panels.

There are many unusual symbols that you can type by using the modifier keys, especially the Option key. With **Key Caps**, you can find out what symbols are available and what key combinations you type to enter them.

The **Note Pad** is a place to jot notes or reminders to yourself.

The **Puzzle** is just a diversion. Try it when you need a break.

The **Scrapbook** is a good place to store pieces of information, such as your address, that you frequently need to copy into documents.

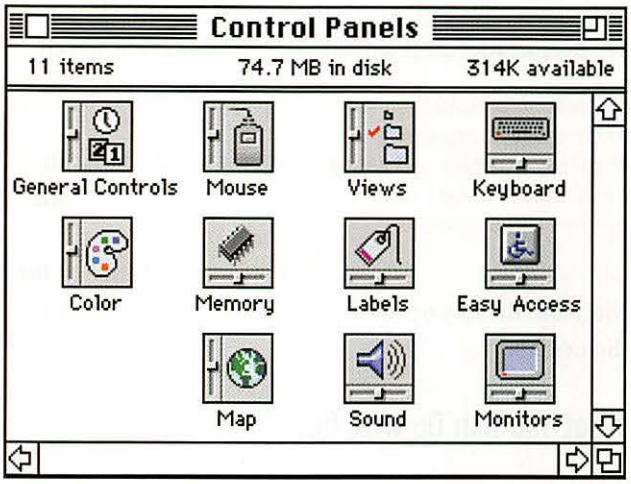
The Control Panels

The fastest way to customize the Mac to suit your needs and tastes is to explore the **control panels**, the dialog boxes that control certain system parameters. All of the panels are accessed by double-clicking on icons in the Control Panels window, which you open using the Apple menu. The icons shown here are the most common. You may have others on your machine.

By keeping your Mac's internal clock set to the correct date and time, you're assured of accurate time stamps on your saved documents.

The most important reason to access the General Controls control panel is to correct the time and date.

The **Mouse** control panel sets the mouse's tracking and double-click speed. Both adjustments can help beginning mouse users.



The **Views** control panel sets the size and arrangement of the icons in the Finder and the kinds of information that are displayed in list views.

In the **Keyboard** panel, you can change how fast the keys repeat when you hold one down, and how long it takes before they begin to repeat.

If you have a color monitor, you can use the **Color** panel to change both the color that is used to highlight text and the second color used to highlight the window controls.

In the **Memory** control panel for System 7, you can optimize processing speed. Don't bother with any of these settings until you are an experienced user.

You can use the Labels control panel to help you organize and color-code your files.

With **Easy Access**, users with physical disabilities can make the mouse and keyboard easier to use. The **Map** control panel lets you measure distances and time differences between two selected locations on a world map.

The **Sound** control panel lets you adjust the volume of the sounds coming from your Mac and choose different warning beeps.

If you have a color or gray-scale monitor, the **Monitors** control panel lets you set how many colors or shades of gray can be displayed.

Multimedia and QuickTime

Beginning with System 7.1, the Macintosh operating system includes an extension called **QuickTime**, which lets any color Mac play video clips, animated graphics, and sound. In other words, QuickTime makes multimedia a standard capability on the Mac, and thereby opens doors to a whole new range of digital data.

Multimedia is a hot buzzword for combinations of any of the following: text, graphics, animation, video, and sound. Good multimedia software makes information come alive.

What You Can Do with QuickTime

By adding moving video and sound to your other data, QuickTime movies can turn a simple presentation of information into a truly stunning display that will delight, entertain, and enlighten your audience.

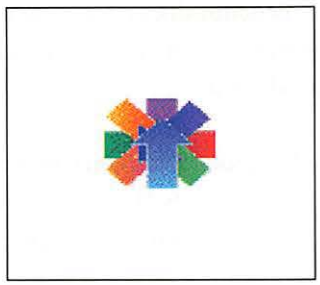
Imagine, for example, a complex spreadsheet that illustrates your sales projections for the next business quarter. You are submitting the spreadsheet to your boss, but it requires a lot of explanation to make it clear. With QuickTime movies pasted in, you could add a video narration and animate your graphs.

Think of the possibilities of adding QuickTime movies to letters you write with a word processor. Say you are sending a letter on disk to your mother about the first steps your daughter has just taken. If you get the image on film using a video camera, you could add the movie to the letter (as long as your mom has a color Mac). When she sees the picture pasted in the document, she double-clicks on it and her granddaughter comes to life.

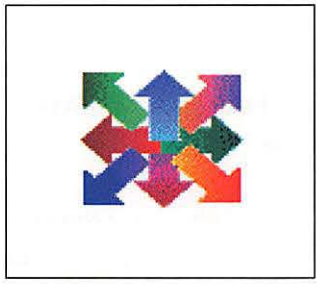
Perhaps the most exciting use of QuickTime movies is in instructional material. Imagine a tutorial program that teaches about the fall of the Berlin Wall. With movies in the tutorial, you could read about the events, then click on a newscaster image and see a short video clip of Dan Rather covering the story, then click on another image to watch the first East Germans climb through the holes in the wall.

An Astounding Technical Feat

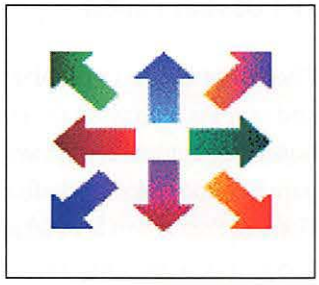
For the most part, computer operating systems are designed to generate static images—things that don't move. Certain programs, such as video games and presentation graphics programs, create the illusion of motion by displaying a series of images very rapidly on the screen. However, a computer with the processing power of your typical Macintosh just isn't capable of displaying full-motion, full-color video with high-fidelity sound—like you see and hear on a television.

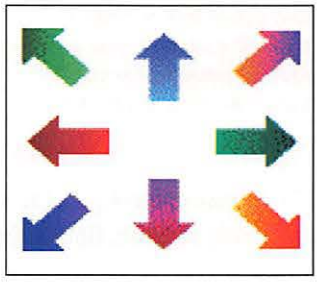


Nevertheless, Apple's QuickTime system extension does allow a Mac to display full-motion video with sound. For now, QuickTime movies are usually small, ordinarily not larger than one-quarter of the screen. And they don't always run at the standard 30 frames per second.



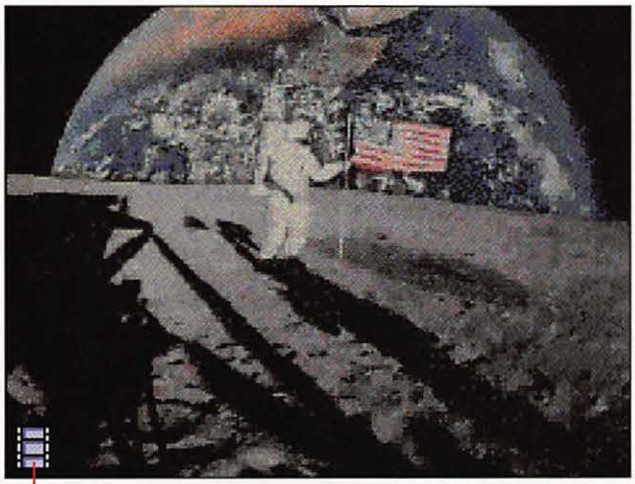
The images shown on the right are a simple example of a QuickTime movie. When they are flashed on the screen at intervals of 1/30th of a second, they create a short clip that looks like arrows exploding out from the center of the picture.





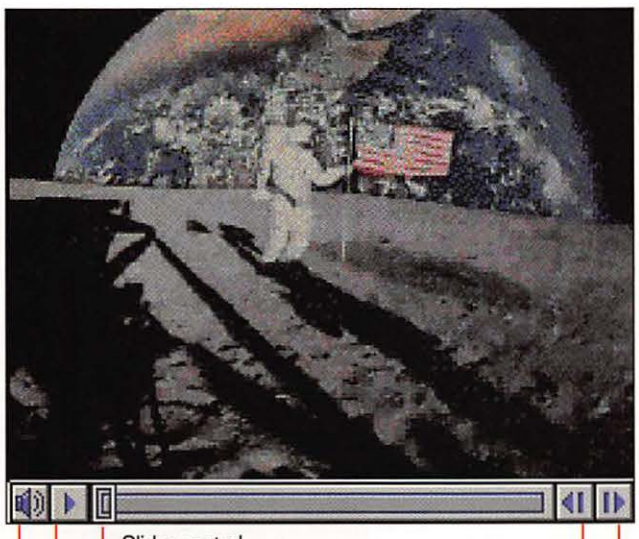
Using QuickTime

QuickTime uses a special file format called **MooV** to store animated graphics, full-motion video, and sound—data that changes over time. There are two ways to play back a file stored as a MooV. The simpler method is used for movies that are identified by a film badge in the lower-left corner of a still image. When you double-click on the image, the movie plays. Clicking on the movie again stops it.



QuickTime badge. Clicking here plays the movie.

Instead of a badge, some images are displayed with a set of controls that look like standard VCR or cassette tape buttons. With this second method (shown below), you have additional control over playing the movie, including stepping through it frame by frame and adjusting the sound level.



QuickTime's user interface lets you play movies, but QuickTime alone doesn't let you create them. To make your own movies, you need more hardware and software. Remember: QuickTime is part of the operating system; it isn't an application. To record video, you need a camcorder or a VCR and a video capture card to create digital images from the video. To create animated graphics, you need animation software. And recording and playing quality audio requires a sound card. To edit QuickTime movies, you need a special video editing program.

A number of software products offer libraries of QuickTime video clips and other elements to help regular folks put together professional-looking multimedia presentations.

Utility Software

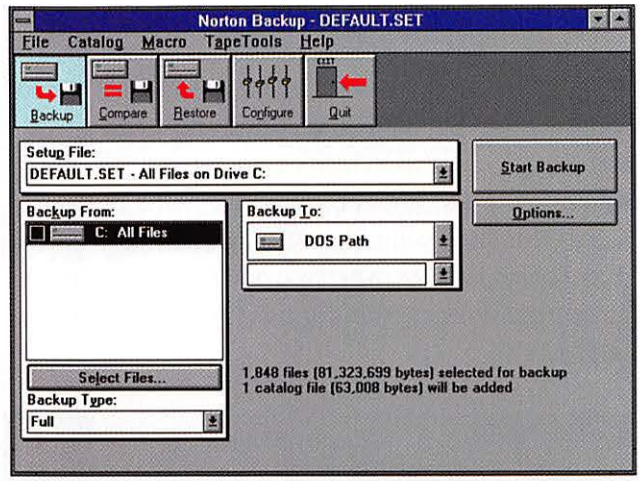
There is a class of software that lies somewhere between the operating system and applications, called utility software, or just utilities. **Utility software**, which is usually considered a type of system software, enhances the operating system by adding extra features that are not included in the operating system. Utilities for the Mac are often created by people or companies other than Apple, and they are often free or inexpensive.

As operating systems have matured, some programs that were once sold only as utility software are now incorporated into the operating system. This is especially true in the PC arena, where DOS, Windows NT, and OS/2 now include programs for backing up data, compressing stored files, and protecting against viruses. Apple Computer, however, seems to prefer to leave the development of utilities programs to outside developers. The following are a few of the most common types of utilities.

Backup Utilities

Although a hard disk is a very convenient place to keep all of your program and data files, there are certain dangers in keeping that much valuable information in one place. If your hard disk crashes, some or all of the data on that disk will be damaged. Even if you never experience a disk crash, other mishaps, such as theft or a fire, can cause data to be lost.

As insurance against such disasters, you should make periodic backups of your hard disk. As you learned in Chapter 2, you can back up to floppies, magnetic tape, or some other storage medium. But no matter what you use, the process can take some time. **Backup utilities** are designed to streamline the process, so that the backup takes less time, occupies less storage space, and requires as little attention as possible. With a good backup utility, you simply identify the files that you want backed up and tell where they should be copied to, and the program takes care of the rest. The backup program shown at the top of the next column is Norton Backup, a utility that runs under Windows on a PC.



The dialog box shown here is a typical interface for a backup utility. If you are backing up to floppies, you will still need to sit by your computer to move the floppies in and out of the drive. If you have a device that can store everything you need to back up, however, you may be able to set up the software so that it performs the backup while you aren't around.

Some Macintosh models—especially the Performas—have a simple backup utility preloaded on the hard disk when you buy the computer. One of your first tasks should be to run the utility to back up the system software onto floppy disks—you'll need that backup if anything goes wrong with your Mac.

Here's one final word of caution: It's best to keep your backup data as far away from the original as possible—ideally, in a different building. If anything truly disastrous happens, such as a fire or an earthquake, you may still have your data when your computer is destroyed.

File Compression Utilities

An interesting truism that all computer users learn sooner or later is that you can never have too much storage space. No matter how big your hard disk seems when you buy your computer, eventually it won't be enough. One partial solution to this problem is a **file compression utility**, which uses mathematical algorithms to condense data before it is stored on a disk. When the data is loaded back into memory, the compression utility decompresses it to its original form. Good file compression software, such as Disk Doubler or Stuff-It can work unobtrusively, without the

Hard disks are amazing. At first, you think they're much larger than you'll ever need. Before you know it, you're using compression utilities to give you more space.

user's even knowing that the file is being compressed. Yet it can effectively double the amount of data that will fit on a hard disk.

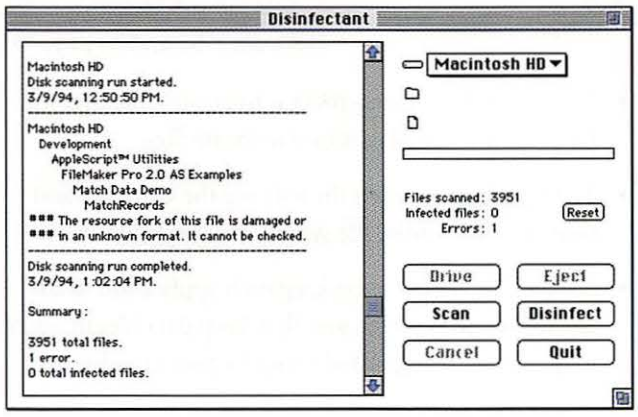
Besides adding extra space to your hard drive, file compression utilities can be very handy in data communications. When you need to send large files over the modem, file compression software can save you a lot of time—and money, if the call is long distance or if you're paying an electronic service by the time used. Modem manufacturers have realized the advantage, however, so some newer modems do their own file compression.

Antivirus Utilities

A computer virus is a nasty small program that reproduces itself in other programs or on other disks. Once a virus has infected your hard disk, it can destroy valuable data.

The best way to guard against computer viruses is to use an antivirus utility, which can scan files and disks and recognize the computer code that is used in making viruses. When the program recognizes a virus, it issues a warning and attempts to disinfect the infected area. The screen shown here is from Disinfectant, a popular Mac antivirus utility.

Use a virus-checking program to scan any floppy you receive from someone else. Practice safe disk!



Font Managers

Software developers use the term **font** to refer to the typefaces that the computer displays and prints. Several of the most common fonts are shown here.

Helvetica: Several of the most common fonts are shown here.
Courier: Several of the most common fonts are shown here.
Times: Several of the most common fonts are shown here.
Palatino: Several of the most common fonts are shown here.

Each font that is available to the computer requires special codes that translate simple text into the letters and numbers that you see on the screen or on a printed page. Normally, an operating system with a graphical user interface comes with a set of fonts that the user can choose from. But if you need to create professional-looking documents, you may need lots of different fonts. To help you organize a large font collection, you can buy a font manager, a utility that loads only the fonts you need for a specific project.

Disk Defragmentation Utilities

When you first save a file on a disk, the disk drive puts the file in a set of adjacent sectors on the disk. As you continue to store files on your disk, the computer packs them together as tightly as possible. Eventually, all the spaces next to that first file are taken up by other files. If you then go back and add data to the first file, the disk drive has a problem. It could move the whole file to a new location on the disk, but shuffling files around on a disk takes a lot of time. Instead, the drive writes the new data on a non-adjacent sector (perhaps one quite far away) and adds a pointer in the first part of the file so that it remembers where the second part is.

This solution works fine for a while. But eventually, a large percentage of your data files become fragmented—scattered around the disk in several locations. Every time you load one of these files, your disk drive has to collect the file from all the places where the different parts of the file are stored. Since moving around the disk takes time, fragmented files slow down your hard drive. A disk defragmentation utility, however, can reorganize the files on your hard disk, putting all the parts back together. It can take an hour for the utility to perform this operation, but the result makes a valuable difference in the performance of the drive.

Be sure that you have a complete, up-to-date backup of your hard disk before using utilities that perform tasks like these.

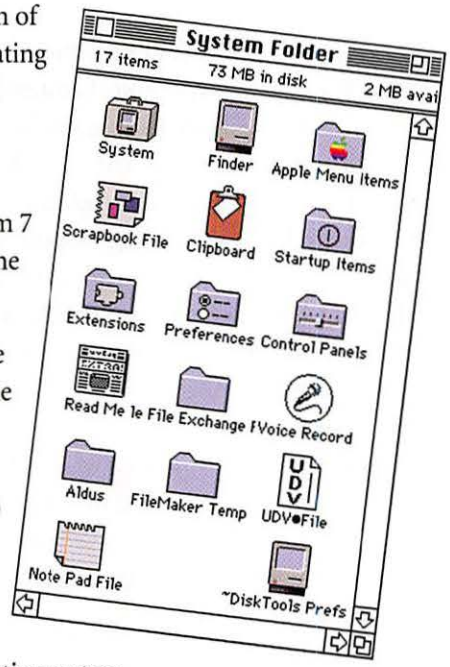
Visual Summary

What Is an Operating System?

- An operating system provides interfaces between the user and the hardware, between the application software and the hardware, and between the processing hardware and the peripherals.
- There are two types of user interfaces: the command line interface (which is typified by DOS) and the graphical user interface, or GUI (which is typified by the Macintosh operating system).
- Most programs can only work with one operating system.
- The Macintosh application interface ensures that all programs conform to the Mac personality.

Five Operating Systems for Microcomputers

- A recent version of the Mac's operating system is called System 7.
- The files that compose System 7 are located in the System Folder.
- The System File is the core of the operating system. The Finder controls the user interface.

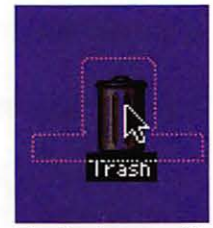


Mac's operating system, page 44

- The most common operating system used on PCs is DOS.
- Windows is a GUI that makes a DOS-based PC act more like a Mac.
- Windows NT is Microsoft's successor to DOS, a powerful operating system for powerful PCs.
- IBM's entry into the operating system market is OS/2, a competitor of Windows NT.
- Unix, which has been touted as the operating system of the future, was originally developed by AT&T for one of its minicomputers.

The Macintosh Desktop

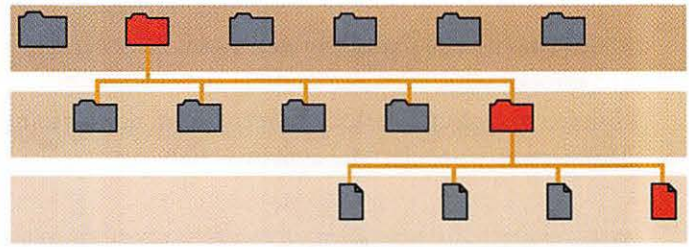
- The user's main tool for interacting with the Desktop is the mouse, which controls an on-screen pointer.
- The menu bar provides access to a set of commands listed in pull-down menus.
- The disk that stores the System file is called the startup disk.
- Files can be deleted and floppies can be ejected by dragging them to the Trash.



The Trash, page 47

File Management with Windows and Folders

- In the Finder, windows show the user the contents of disks and folders.

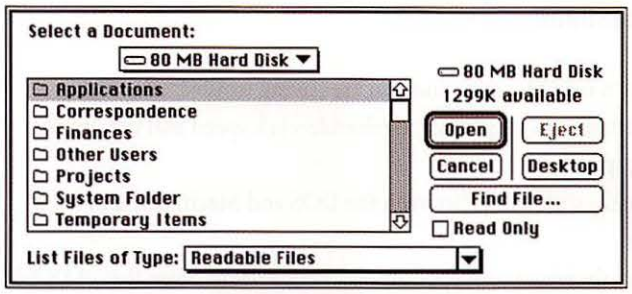


Hierarchical file system, page 49

- The goal of file management is to create a hierarchical file system that makes it easy to locate files.
- The By Name view lets the user see the structure and contents of an entire file system in a single window.
- On the Mac, many users keep each application inside an Applications folder, and they keep data files in other folders that are organized either by project or by function.

Extending the GUI with Menus and Dialog Boxes

- Many menu options have keyboard shortcuts, usually consisting of key combinations that include the Command key (⌘).

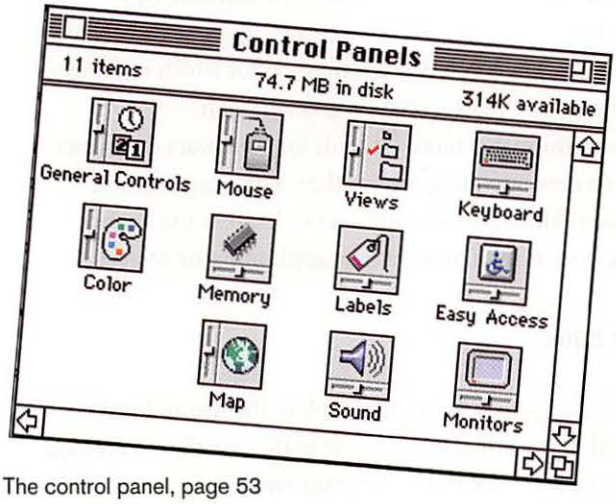


Dialog boxes, page 51

- Menu options with ellipses (. . .) cause dialog boxes to open.
- The features of dialog boxes include buttons, radio buttons, text boxes, pop-up menus, check boxes, and list boxes.

The File and Apple Menus

- Every application has a File menu whose contents are similar to the File menu in the Finder.
- The options in the File menu let the user perform file management tasks.
- The Apple menu includes a set of handy Desktop tools.



The control panel, page 53

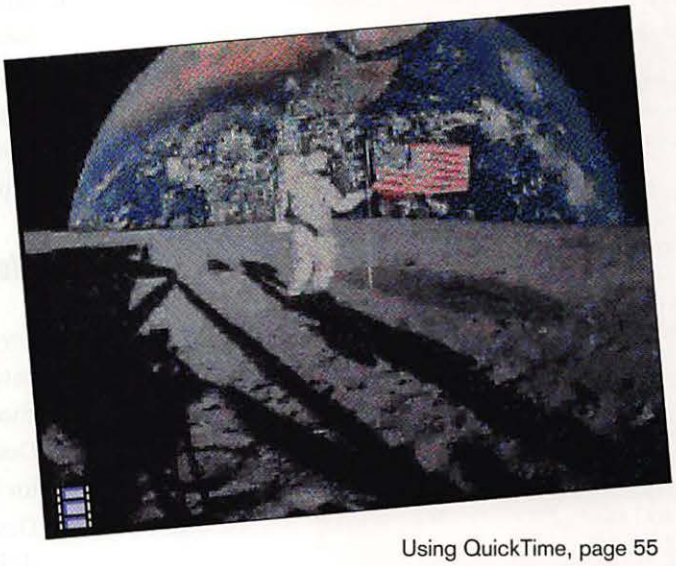
- Many system-level settings can be adjusted with the control panels.

Multimedia and QuickTime

- QuickTime is a system extension that lets the user play back time-based data, such as video, animated graphics, and sound.
- The QuickTime user interface lets the user play movies by double-clicking on a static image or by using VCR-like controls.

QuickTime, page 54

- To record video, animation, or sound, the user needs additional hardware and application software—since QuickTime is a system extension, not an application.



Using QuickTime, page 55

Utility Software

- Utility software adds extra features that are not included in the operating system.
- Backup utilities streamline the process of backing up a hard disk.
- File compression utilities compact data, giving more room on the hard disk or allowing for faster file transfer with a modem.
- Virus protection utilities scan files for known viruses, thus protecting against data loss.
- Font management utilities let the user organize large font collections.
- Disk defragmentation utilities keep a hard drive running quickly by making sure that all the parts of each file are stored near each other.

New Terms

After completing Chapter 3, you should understand the following terms. They appear in bold in this chapter and are listed in the Glossary.

antivirus utility
backup utility
button
check box
close box
command line interface
control panel
default button
Desktop
dialog box
disk defragmentation utility
DOS
file compression utility
Finder
folder
font
graphical user interface (GUI)
hierarchical file system
icon
keyboard shortcut
list box
menu bar
MooV
multitasking
nested
OS/2
pop-up menu
pull-down menu
QuickTime
radio button
root
scroll arrow
scroll bar
scroll box
size box
startup disk
System 7
System File
System Folder
text box
title bar
Trash
Unix
user interface
utility software
virus
window
Windows
Windows NT
zoom box

Chapter Exercises

Review Questions

1. If you are a new Mac user and you are having trouble using the mouse, where can you adjust the double-click speed and the mouse tracking speed?
2. Describe the differences between the DOS and Macintosh user interfaces.
3. How does the Macintosh application interface differ from that of DOS?
4. What is the primary difference between Windows and Windows NT?
5. Name the five most common operating systems used on microcomputers.
6. What does the ⌘-E next to the Eject Disk command in the Special menu tell you?
7. What do ellipses (. . .) next to a menu option mean?
8. What is the goal of file management?
9. How do you make the current time appear on the Desktop?
10. Explain the importance of backup software.

Use Your Imagination

1. Say you are going to buy a computer and are trying to decide between a Macintosh and a DOS-based PC. Which would you choose and why? Give at least three reasons for your decision.
2. Describe a document (different than the examples in the book) for which a QuickTime movie would be a valuable addition.
3. Describe a job for which you should back up your entire hard disk every day. Then describe another job for which making a full backup once a week would be good enough.
4. Why do you think it is more difficult for a software developer to market a new operating system than a new application?
5. Why do you think it is more difficult to learn to use a new operating system than to use a new application or utility?

Beyond the Book

1. Using a Mac in your school's lab, explore the hierarchical file system and make a map of it similar to the one shown on page 49. How might the file system be improved?
2. What is the latest version of the Mac's System software? What features and capabilities have been added since version 7.0?
3. Using the computer periodicals in your library, find recent reports on the sales performance of Windows NT. How is it selling? What reasons are given for its performance?
4. Find at least three Mac users and three PC users who own their computers. What reasons do they give for deciding on one type of computer rather than the other? What generalizations can you make from their reasons?

HOW COMPUTERS ARE USED

4 Application Software

WHEN YOU ARE USING A COMPUTER, your application software is your primary set of tools. Application software—also simply called *applications*—are the programs that you use to do productive work. In contrast, the hardware and the operating system are the **platform** that allows you to run different applications. In this chapter, you will learn about the most widely used applications: word processing, spreadsheets, databases, graphics, and desktop publishing. By the end of the chapter, you should have a much broader understanding, not only of what these programs can do, but also of what people do with computers.

Objectives

When you have finished this chapter, you will be able to do the following:

- Explain where to look and what to look out for when buying software.
- Describe three different kinds of software support.
- Define software piracy.
- Describe the basic steps of loading a program, opening existing documents, saving documents, closing documents, and quitting a program.
- Name the important features of word processing, spreadsheet, database, graphics, and desktop publishing software, and explain how each of these applications is used.
- Explain two ways in which data from two or more applications can be combined in a single document using a Macintosh.

Contents

62 Buying and Installing Software

64 Using Software

66 Word Processing

68 Spreadsheets

70 Database Software

72 Graphics Software

74 Desktop Publishing

76 Other Applications

78 Combining Applications

80 Visual Summary

82 Chapter Exercises

Buying and Installing Software

The first steps in using any program are, of course, buying it and installing it on your computer. Like shopping for anything, buying good software is a skill. Practice and experience will make you better at it, but there are some valuable tips that can help. Installing software is a simple process—most of the time. When things go wrong, you need to know where to go for help. Finally, using and buying software have important legal and ethical considerations that affect you, the consumer, as well as the software vendor.

Shopping for Software

Buying software is a tricky business, so here are a couple of tips. First, get reports on the software from friends, colleagues, and computer periodicals. Get people's opinions about how the software performs, and read about its features. If possible, try it before you buy it: take a class, use a demo copy at a software store, or try out a friend's copy.

The best advice was offered years ago on an entirely different kind of product: "Ask the person who owns one."

Next, check the program's **hardware requirements**: the computer equipment required to run the program. Every program should tell you—usually on the outside of the box (as shown in the photo below)—which **platform** it is made for (Mac, PC, or other, and the version of the operating system that's needed) and how much memory and storage it requires. If your computer is already

pushed to the limit in RAM or hard disk space, you might not be able to use a large program. Also, some software requires special hardware. You don't want to get home and find that you need a $300 CD-ROM drive to run it.

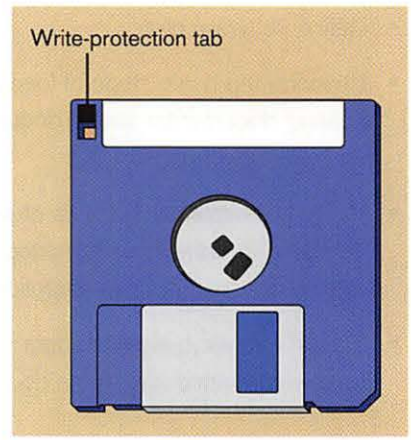
Installing Software

Once you buy the program, the next step is to **install** it, which means to copy the program files onto your computer's hard disk and decompress them, if necessary. When you buy a major application, such as a spreadsheet, word processor, or graphics package, the program comes in a box with several floppy disks (though some new programs are being shipped on CD-ROM) and one or more books. The books should include a software manual and an installation guide. These books are collectively referred to as the **documentation**.

Before you try to install the program, read the installation guide, then follow the steps carefully. One other common part of the documentation is a file, usually called Read Me (or something similar), which is normally found on the first program disk. This file contains additional information that was not available when the other documentation was sent to the printer. You should read the Read Me file before you begin installation. On the Mac, you can usually read the file simply by double-clicking on it.

Before you install the program, you should also make a backup copy of the floppy disks that the software came on. Installation guides usually tell you to do this, but if they don't, do it anyway. Floppy disks can get damaged. If you ever need to reinstall the program from the original disks, a damaged floppy will keep you from getting back to work.

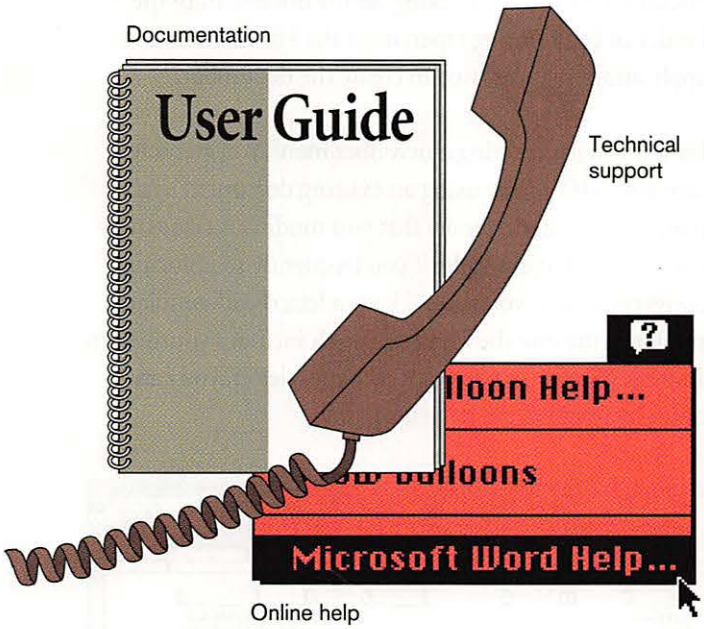
To be safe, you should **write-protect** the original floppies before making the backup. The computer can read a write-protected disk, but it can't change any of the data on it. To write-protect a 3 1/2" floppy, turn the disk over so you're looking at the back of it, with the sliding shutter towards you. Slide the plastic tab in the upper-left corner so that a hole shows through the disk shell, as shown here.



After making the backup copy, you are ready to follow the installation steps. If anything goes wrong, the documentation should include a telephone number for **technical support**. You can call it to get professional help straight from the software developer.

Many programs come with an Installer program that copies the files to your hard disk. All you do is insert floppy disks when asked.

Besides the documentation and technical support, most good software has a third kind of support: built-in help features. If you have completed the Basic Mac Skills section at the back of this book, you have seen the help features that are built into System 7. The simplest type of help feature is a text document in which you can look up the topic that you need information about. A more powerful type is called **context-sensitive help**, which automatically gives information related to the task you are trying to perform when you issue the help command. The drawing below reviews the three main types of software support.



Protecting the Software Vendor

When a company sells you a copy of its software, it is really selling a **software license**. In most cases, the license allows the buyer to install the program on one computer. Large companies and organizations that use the same program on many machines can usually buy **site licenses** or **network versions** that permit use of the program on a specified number of computers.

Any breach of the license—whether by loading the program onto more machines, or by giving or receiving an unlicensed copy of the program—is considered **software piracy**. In other words, it is theft.

Every year, software piracy costs the software industry—and software customers—billions of dollars. Over the years, the software vendors have tried various ways to protect themselves. At one time, they tried building copy protection into the programs to make it impossible, or very difficult, to duplicate the program after the initial installation. But copy protection caused more headaches than it solved. Today, most vendors simply rely on the honesty and integrity of their customers and on the long arm of the **Software Publishers Association**, or **SPA**, which investigates and prosecutes software pirates.

A Few Words About Program Upgrades

Most of the big-name software packages are in a constant state of evolution. The companies that develop these products—Claris, Microsoft, Lotus, WordPerfect, Borland, Symantec, and so on—are forever making improvements, adding features, and tightening performance. Each time a program is improved, the software developer releases an **upgrade**, the next version of the software.

Register your software so that you'll get notices of upcoming upgrades. This isn't like registering a toaster warranty—you will hear from the software company.

The version number is usually part of the software package's name. For example, version 7 of the MacOS is called System 7. Minor improvements in the software are often designated with decimal numbers, and major improvements deserve a jump to the next integer. So, when Microsoft added some features to Word, the version changed from Word 5 to Word 5.1. But when Apple overhauled its system software, it moved from System 6.0.8 to System 7.

You should think of upgrades in the same way that you think about buying software. Most of the time, upgrades cost money, and they always require an investment of time. Look at what the upgrade offers you, find out what it will cost, and factor in how long it will take to reinstall the software and learn the new features. Then decide whether you really need it.

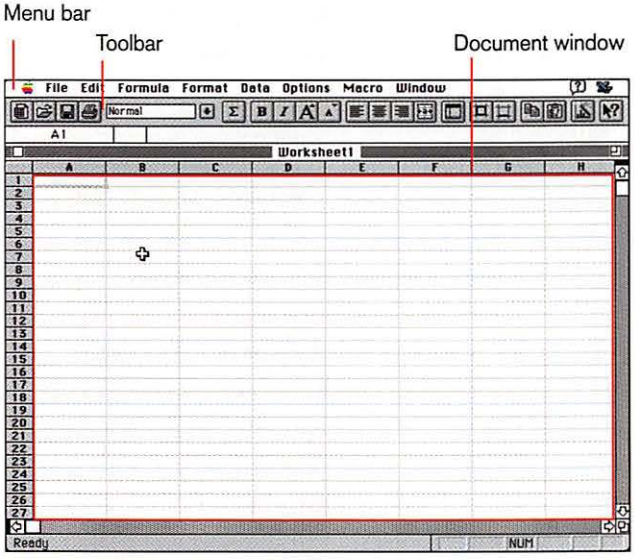
Using Software

The basic steps for using any application program are the same. To use the program, you first load it into memory. You can then create new documents or open existing ones and edit them. To preserve your work, you must save it using the program's save features. Finally, you can close the document and begin work on another, or you can quit the program, clearing it from memory.

Starting the Program

With a program successfully installed, you are ready to begin work. First off, you need to start the program, also known as launching or loading the program. **Loading** the program is the more accurate term, because the program must be loaded from storage into memory to be used.

Once loaded, many programs present you with a blank document, expecting that you are going to build something from scratch. For example, when you load Microsoft Excel, you see a blank worksheet.

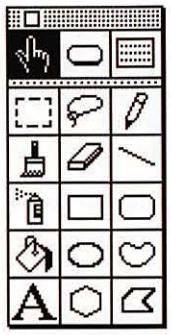


On the Mac, the new document is displayed in a window, as you can see from its title bar, scroll bars, and so on. This type of window is called a **document window**. It works just like a window on the Desktop.

Another way to tell that an application has been loaded is to look at the menu bar. For each application it's a little different, but at least a couple of the menus are the same as in the Finder.

The Application menu also shows what applications are loaded.

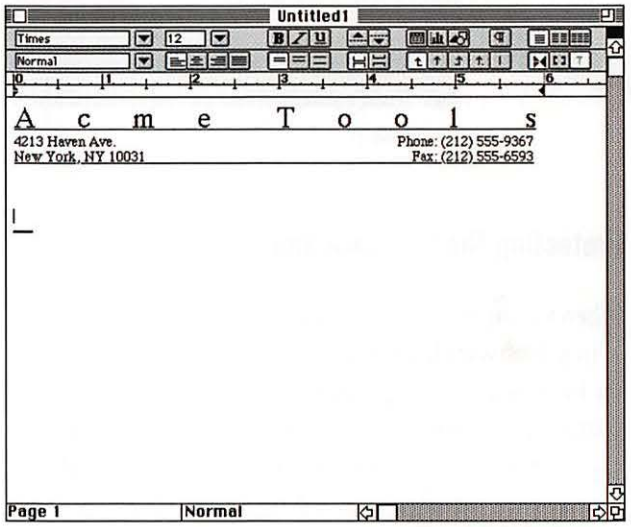
There can also be features that are not in the Finder. Across the top of the screen, for example, Excel includes a **toolbar**, which gives you quick access to the most commonly used commands. Many graphics programs include a **palette**, which is like a toolbar that can be moved around on the screen. The palette shown here is from HyperCard.



Opening Existing Documents

If you want to create a document from scratch, then you are ready to begin as soon as the program is loaded into memory. Many times, though, you will want to edit a document that you created in an earlier session. When using software, **editing** simply means changing an existing document—it doesn't necessarily imply making corrections to text. On the Mac, you can open an existing document by double-clicking on the document in the Finder or by choosing Open from the File menu in the application that was used to create the document.

Even if you are creating a new document, you can often save yourself time by using an existing document as a **template**, a generic model that you modify to create new documents. For example, if you frequently send formal correspondence, you should keep a letterhead template, similar to the one shown here, which includes your return address. Whenever you want to write a letter, you can begin by opening the letterhead file.

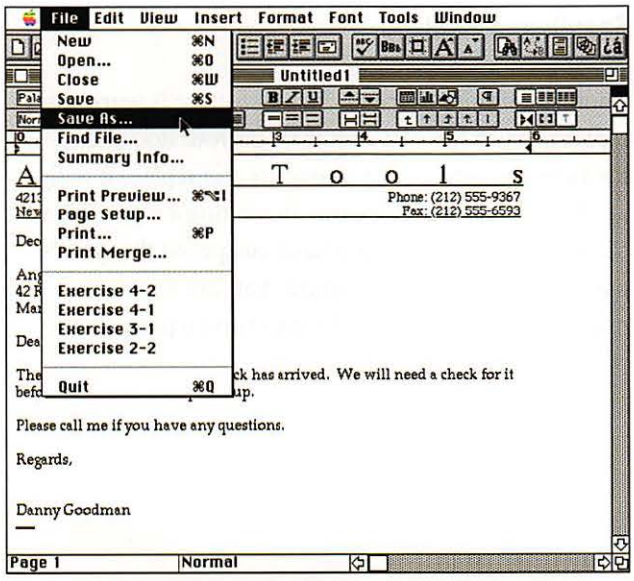


In many Macintosh programs, it is possible to have more than one document window open at one time. This can be especially useful for copying data between documents. However, only one document is active at any given time. Usually, inactive documents are hidden behind the active one. If it is ever unclear which document is active, look at the title bar. Nothing is visible on the title bar of an inactive document except the title itself, which appears in gray rather than black. To switch between open documents, you can usually select the document you want to make active in the application's Window menu. Or, if you can see part of the document window for the document you want to make active, you can simply click on that window.

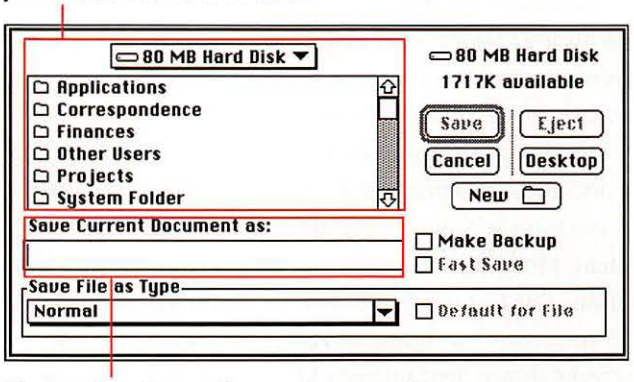
If your Desktop is getting really messy—but you want to keep all those programs and documents open—choose Hide Others from the Application menu. Only the active application remains visible.

Saving Your Work

When you are working in an application, your document is in RAM. To preserve it, you must **save** your document. In other words, you must copy the file from RAM to a disk. There are two commands that you use to save files, and it is vital that you understand the difference between them. The **Save** option in the File menu saves your file under the name that is displayed on the title bar. No dialog box appears when you choose Save, because the Mac has all the information it needs. On the other hand, when you choose **Save As** (as shown here), the application displays a dialog box like the one shown above, where you can choose a new location for the file and give it a new name. The exception to this rule happens when you choose Save with a new document displayed, which has a generic, default name in the title bar. In this case, choosing Save displays the Save As dialog box.



You use the pop-up menu and list box to indicate where you want the new file to be stored.



Then you type the new file name here and click on the Save button.

Get used to typing ⌘-S frequently to save your work. A power outage or software malfunction could lose everything since the last save.

Most of the time, you choose Save to copy your work to disk. But if you open an existing document and use it as a template, you need to choose Save As to give the new document a name different than the template name. Otherwise, your template will be altered.

Closing Documents and Quitting the Program

When you are done working with a document and have saved it to a disk, you have two options. If you want to stop working on the current document but continue working with the same software, you can **close** the currently active document, clearing it from memory. The fastest way to close a document is to click on the close box in the document window. You can then choose Open to load the next document. If, on the other hand, you are through using the application, you should choose Quit from the File menu. When you **quit** a program, the Mac clears it from memory.

Word Processing

The first application that most people learn to use on a computer is word processing. Creating written documents is a major part of many jobs, as well as school, and word processing software is a revolutionary improvement over its predecessor, the typewriter. Unlike using a typewriter, word processing separates the processes of creating a document and printing it. This allows the user to make corrections without having to retype the entire document. Modern word processing programs also have a host of valuable features that can save you countless hours and let you create handsome and effective documents. The screens shown here are from Microsoft Word, the most popular word processing program for the Macintosh.

Word Wrap

The first great feature of word processing software is one that everybody can now take for granted: word wrap. **Word wrap** means that you don't have to (and shouldn't) press the Return or Enter key at the end of each line. The program uses the margins and the type size to figure out where to begin the next line. With word wrap, you can add or delete text or change the page setup, and the program automatically refigures where to end the lines.

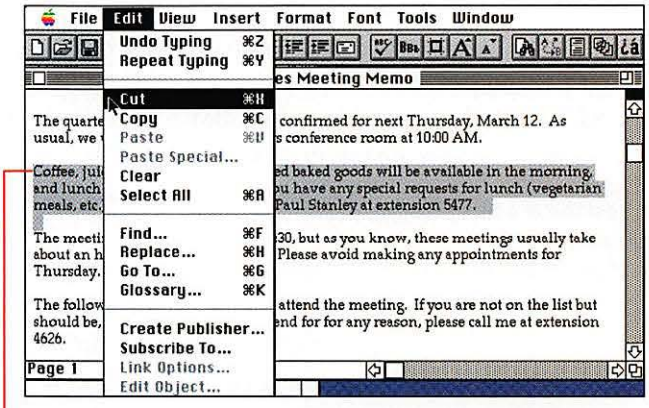
Cut, Copy, and Paste

A second valuable feature of every decent word processing program is the ability to move blocks of text around on the page. The Macintosh accomplishes this with the help of the **Clipboard**, an electronic storage space that holds just one block of data at a time.

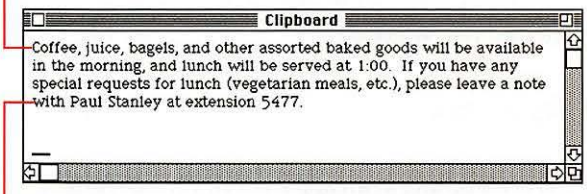
If you want to move a paragraph from one place in a Microsoft Word document to another, you start by highlighting the paragraph. Then you choose Cut from the Edit menu to remove the paragraph from the document and place it in the Clipboard. Finally, you click to position the cursor where you want the paragraph to go, then choose Paste from the Edit menu. The Copy command does the same thing as Cut, except that the block is not removed from its original location.

The keyboard shortcuts for cut, copy, and paste—⌘-X, ⌘-C, ⌘-V—are conveniently located so that they can be typed with the left hand, while the right hand uses the mouse to select data and set the insertion point.

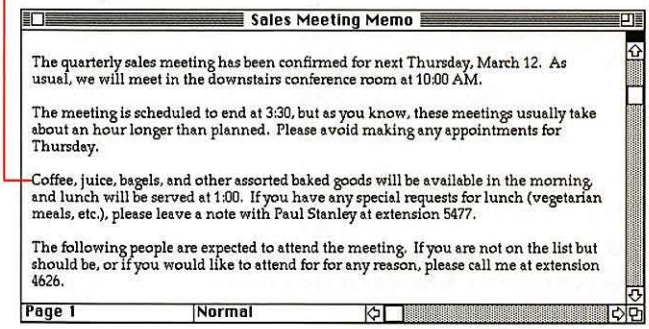
The three screens shown here illustrate the cut and paste operation.



The text is cut to the Clipboard . . .



. . . then pasted into the new location.



Search and Replace

Another common word processing feature is **search and replace**, which lets you look through your document for a specific sequence of characters and replace it with another. For example, say you are writing a report for a client and discover that you have misspelled the client's name throughout the document. You can search for misspelled occurrences of the name and replace them with the correct spelling.

Formatting Text

Today's word processing software let you assign all kinds of different attributes to the text in your documents. You can use different fonts, change the size of fonts, and make characters appear in bold, italic, or underlined text.

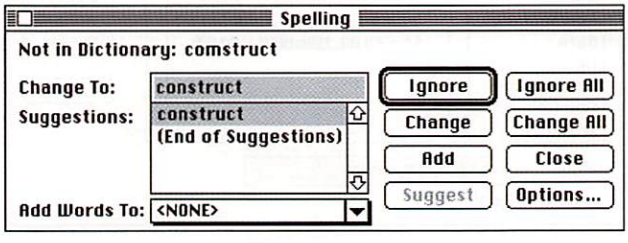
Don't get carried away with fonts. Too many on a page, and your paper looks like a ransom note.

Formatting Documents

Word processors also give you a great deal of control over the arrangement of the text on the page. You can adjust the margins, control the spacing between lines, create more than one column on a single page, and arrange text in tables. You can also add special features to longer documents, such as running headings across the top of every page, and automatically numbered footnotes and page numbers.

The Spelling Checker, Thesaurus, and Grammar Checker

A welcome addition for many users was the introduction of spelling checkers to word processing programs. With a **spelling checker**, you can compare every word in your document with the words listed in the program's dictionary. When the program finds a word that isn't in its dictionary, it alerts you and asks if the word is correct, as shown here.



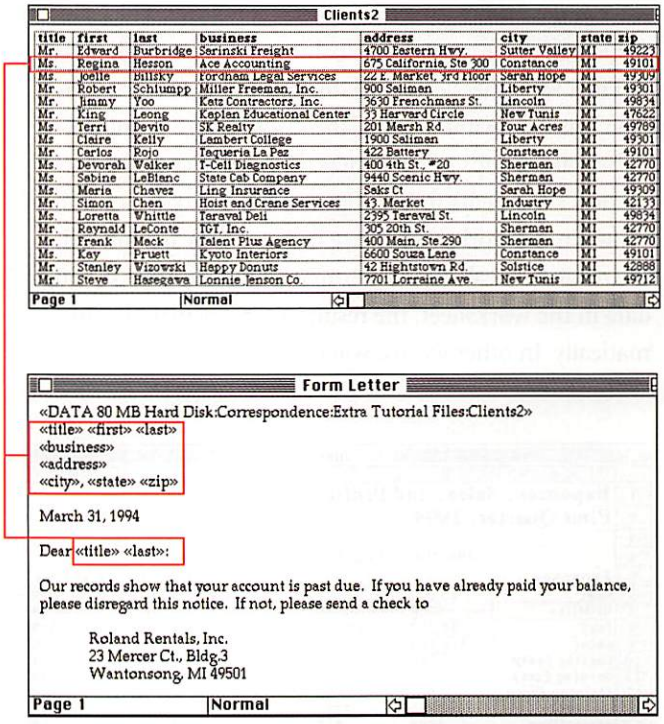
Of course, you still need to proofread your documents, since a spell checker won't find many personal names or words that are spelled correctly but used incorrectly.

More recent additions to word processors include the thesaurus and grammar checker. A **thesaurus** lets you enter words and find synonyms (words of similar meaning) or antonyms (words of opposite meaning)—a valuable tool for any writer. A **grammar checker** examines your work for nonstandard syntax or incorrect grammar, then alerts you to any problems.

Mail Merges

One of the most common—and potentially labor-intensive—tasks required of office workers is sending out form letters to a large group of recipients. For example, say your company is moving and you want to send your new address to all your regular clients. You wouldn't compose a different letter for each client. Instead, you would compose a standard letter and change the recipient's name and address for each one.

Most word processors let you perform **mail merges**, which automate this process. First you create an address file (see the first figure below), containing all the people to whom you normally send correspondence. Then you compose the letter (the second figure shown below), setting up special fields in the letter where the name, address, city, state, and zip code go. Finally, you identify which addresses are to be merged with the letter, then let the program do the rest of the work.



Each address in the Clients 2 file is copied into the Form Letter, and then the letter is printed.

Spreadsheets

In days of old (back in the 1970s), financial calculations, such as budgets and payroll, were figured with a pencil, an adding machine, and a large piece of paper with gridlines on it called a ledger. But in 1978, Dan Bricklin and Bob Frankston invented VisiCalc, the visible calculator. The original version of the program ran on the Apple II. VisiCalc was the first spreadsheet program, which allowed users to enter numbers into an electronic ledger. Spreadsheets also let users enter formulas, which compute results based on the contents of other numbers in the spreadsheet. Formulas are the wonderful part of spreadsheets, because they automatically perform most of the arithmetic—so you don't have to.

Spreadsheet programs caught on early because they let you play the "what if?" game. By plugging in trial values, you instantly see their effect on the final figures. What used to take hours by hand can be accomplished in seconds.

Spreadsheet Terminology

Spreadsheets have a unique set of terminology. Here's a rundown of the basics. The term *spreadsheet* can refer to either the program or the data file. Often, the data file is known as a **worksheet**. The worksheet is organized into rows and columns (see the worksheet below). The intersection of one row with one column is called a **cell**. Each cell in a worksheet can hold one of three different kinds of data: values, formulas, and labels. **Values** are numbers. **Labels** are groups of characters. **Formulas** are mathematical statements that compute numbers based on other values in the worksheet. Once the formulas are entered, the results are calculated automatically. And if you change data in the worksheet, the results are recalculated automatically. In other words, you don't have to do the arithmetic.

1st Quarter Profit

	A	B	C	D	E	F
1	**Expenses, Sales, and Profit**					
2	**First Quarter, 1994**					
3						
4		Jan-94	Feb-94	Mar-94	1st Qtr. Totals	
5	Expenses					% of Total
6	Rent	$3,000	+ $3,000	+ $3,000	= $9,000	9%
7	Utilities	$350	$311	$330	$991	1%
8	Food	$8,250	$9,003	$12,494	$29,747	31%
9	Labor	$16,800	$16,590	$16,700	$50,000	52%
10	Cooking Equip	$0	$994	$0	$994	1%
11	Serving Equip	$340	$0	$56	$396	0%
12	Cleaning Equip	$25	$102	$59	$186	0%
13	Insurance	$252	$252	$252	$756	1%
14	Advertising	$588	$13	$420	$1,021	1%
15	Loan Paymt.	$1,231	$1,231	$1,231	$3,693	4%
16	Total	$30,836	$31,406	$34,542	$96,784	
17						
18						Average
19	Sales	$35,690	$31,558	$40,101	$107,349	$35,783
20						
21	Profit	$4,854	$152	$5,559	$10,565	$3,522

Cell

This cell contains a formula that adds up the three cells to the left.

Label

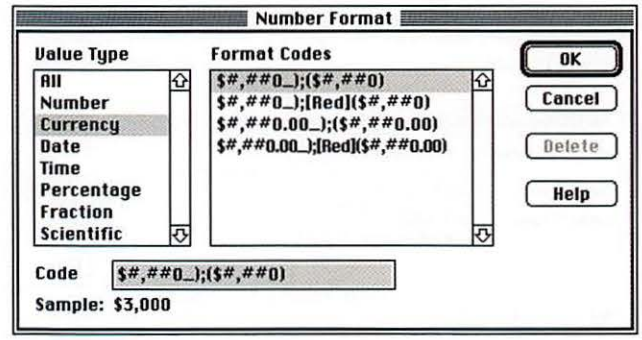
Value

Formatting Cells

A good spreadsheet program offers a lot of control over how text and numbers appear in the worksheet. The user has many of the same options that are available in a word processing program. You can control the size of text, use different fonts, and make characters bold, italicized, underlined, or even appear in red (if you have a color monitor). Many spreadsheet programs also include a spelling checker to catch misspelled words.

A spreadsheet program, however, needs another set of formatting options that relate specifically to numbers. Some numbers are dollar amounts, some are percentages, some are simple integers. Dates and times are stored as numbers so that they can be used in calculations, but they still need to look like dates and times. For each of these types of numbers, the program needs to know how you want the number to look. Do you want dollar amounts to include cents, or just whole dollars? To how many decimal places should numbers be rounded off? Should a date appear in a long format, such as "January 14, 1995," or should it be abbreviated as "1/14/95"?

To let you control how numbers are displayed, spreadsheet programs include lists of number formats. For example, this is Excel's Number Format dialog box.

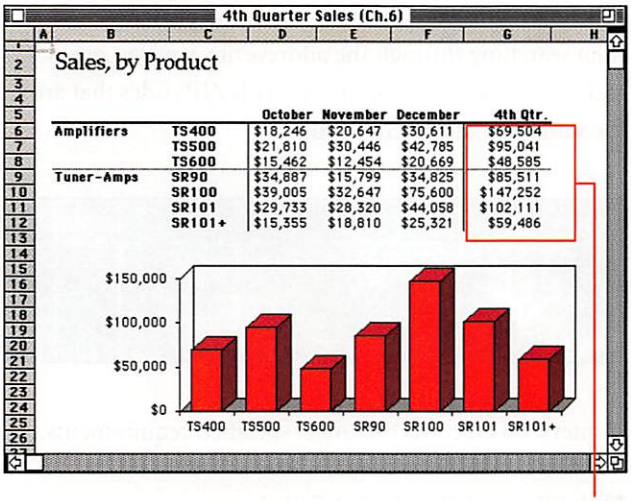


The formats in the right column are the four options available for formatting currency. Each of the options in the left column has a different set of available formats. At the bottom of the dialog box, the Sample field shows how this code formats the number 3000.

Adding Analytic Graphics

All of the well-known spreadsheet packages can generate charts based on the numbers in a worksheet. The charts are called **analytic graphics** because they help the person looking at the spreadsheet analyze the numbers quickly.

The most common analytic graphics are pie charts, line graphs, and bar graphs, but today's spreadsheet packages can add a lot of spice to these three simple types. Three-dimensional effects can be added, as you can see here.



The bar graph illustrates the numbers in the fourth column.

Bar and line graphs can also be combined to show two or more different types of information on the same set of axes.

All of these effects are used with the goal of making the information more engaging and easier to understand. They are not so much for the benefit of the person creating the worksheet as for the intended audience. They are especially useful for businesspeople who need to make presentations to their superiors or to clients.

Ways to Use a Spreadsheet

Many people who don't use spreadsheets think of them as tools for accountants: Spreadsheets, they think, are for preparing budgets, payroll, and other aspects of a company's general ledger. But spreadsheet programs are surprisingly easy, and people have found hundreds of ways to use them.

Some people even find too many uses for them, using spreadsheets to do jobs better handled by other types of software, such as database programs. I know some early spreadsheet users who wrote their correspondence in a spreadsheet, because they were afraid to learn a word processor!

First of all, accounting isn't what it used to be. Spreadsheets have made it possible (or palatable) for most businesspeople to get more involved with the accounting process. Once they learn to use a spreadsheet program, many people find it valuable to keep track of their personal accounts on their computer.

Spreadsheets can also be immensely valuable in almost any applied science, since they are perfect for collecting, organizing, and analyzing numeric data. Most spreadsheets have many statistical functions built in, so the process of, say, figuring the standard deviation for a set of data can be accomplished in seconds.

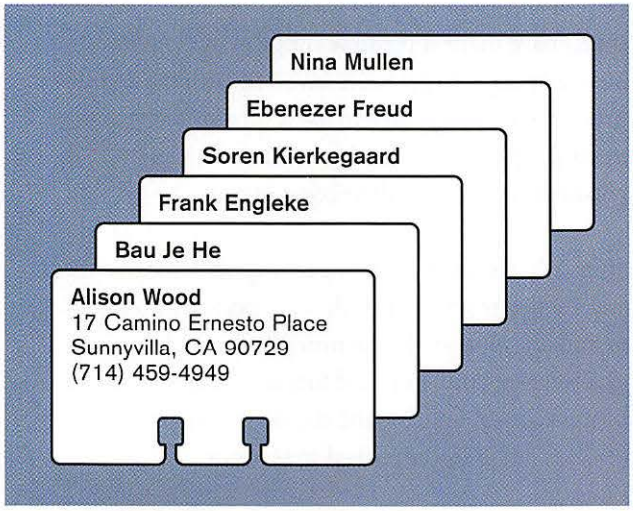
Finally, spreadsheets offer an exceptionally easy way to create tables and charts for organizing data. In fact, most of the major spreadsheet programs offer at least a few database capabilities.

Database Software

Businesses always need to organize large amounts of data—data about clients, sales transactions, employees, and so on. When the data is numerical, the spreadsheet is the logical tool. But when businesspeople need to keep track of a mix of data types—numbers, text, and even images or sounds—**database software** is what they turn to.

What Is a Database?

A database is an organized collection of facts that are stored electronically. The simplest example of a database is an address file. For example, this stack of address cards can be considered a database.



In database terminology, each address in the file is referred to as a record. A **record** is a set of related data about a specific thing or event. In this case, the thing or event is a person or business, and the data all relates to the location of the person or business.

Each record in a database is made up of a group of fields, and every record in a simple database, such as an address file, has the same set of fields. In the address file, the fields are Name, Street Address, City, State, Zip Code, Telephone Number, and so on. So a **field** is a specific type of data that relates to every record in a database.

The easiest way to think about a database is as a collection of forms, each one with different kinds of information in the blanks. In fact, most forms you fill out get transferred to a database program somewhere along the line.

Sorting and Querying

A database program, also known as a **database management system (DBMS)**, is a program that lets you create and manipulate databases. The real power of the software is its ability to sort and query the information stored in a database. To **sort** a database means to reorder its records according to the content of a specific field. For example, an address file would normally be sorted by the name of each person or business. But you could just as easily tell the database software to sort the records according to city or zip code. You can even tell the program to sort according to more than one field. So it could sort the records by city and list the clients in a single city alphabetically.

Now imagine you are taking a trip to New York City to visit a certain client, Acme Tools. You don't want to be driving all over town, but you would like to drop in on other clients in the same neighborhood as Acme. Rather than searching through the address file, you can query (ask) the database for addresses with ZIP codes that are the same as that of Acme Tools.

NAME	STREET	CITY	STATE	ZIP
[redacted]				
Ginza Sushi Co	839 Bronx River P.W.	New York	NY	10467
Sanford Press	2384 Williamsridge	New York	NY	10467
Computhings	1139 E 222nd St.	New York	NY	10467
Acme Tools	205 Bronxwood Av.	New York	NY	10467

A **query** lists records that meet specified requirements.

Flat-File and Relational Databases

Most database programs create either flat-file or relational databases. The example you have seen so far is a **flat-file database**, which means that the database is composed of a single file, and all of the records in the file have the same set of fields. A flat-file database can be displayed as a table, with one field for each column and one record in each row, as shown at the top of the next page.

As you can see from the screen at the top of the next page, a flat-file database looks a lot like a spreadsheet. Not surprisingly, most spreadsheet programs include flat-file database capabilities. The database managers built into integrated packages, such as Microsoft Works and ClarisWorks, are also limited to flat-file databases. So is

NAME	STREET	CITY	STATE	ZIP
Acme Tools	205 Bronxwood Av.	New York	NY	10467
Gizmos Inc	10 Pine Wood Ave	Fairfax	CA	94930
Computhings	1139 E 222nd St.	New York	NY	10467
Quartet & Co	12 Fish Mongers St.	Dust Pit	IL	56491
Clamps Grips	32 Big Tree Ln.	Hillsbloom	CA	41569
Food Stuff Inc	9 Marsh Wood Dr.	Rosewood	WA	90591
C.P.M.	68040 Chip St.	Oakland	CA	94967
Fredies of LA	63 Slip St.	LA	CA	67516
Ginza Sushi Co	839 Bronx River P.W.	New York	NY	10467
Heptite Guild	67 Crystal St.	Ballybran	MA	31678
East America	13 S East St.	Midtown	TX	98735
Sanford Press	2384 Williamsridge	New York	NY	10467
Skokie & Snarf	21 Mountian Hights	Any Town	NJ	97681
Art Log Inc	515 Dead End Rd.	Bogsvill	VA	10769
A.P.F.S.D.S.	56 Now What Drv.	Someplace	NC	58761
Data-Tech	29 Canal St.	Yorksburg	SC	78534
JCN Computers	113 Vole St.	Dirtsburg	NC	98761

the most widely used database program for the Macintosh, FileMaker Pro. For many users, this is all the database power they ever need.

Other programs that are specifically designed as database managers, such as FoxBase and 4th Dimension for the Mac, plus FoxPro, Access, dBASE, and Paradox for the PC, are known as **relational databases**. In a relational database, each file still consists of records and fields, but multiple files can be related to each other, as long as each file shares one field with at least one other file in the database.

Say you are running an office supply store. You have one database file called Clients, which lists the names and addresses of all your regular customers. You have another called Inventory, which lists the names and prices for each of the items that you stock in your inventory. When customers call in their orders, your salespeople add records to a third file, called Orders. The Orders file is related to the Clients file because they both contain fields that show the name and address of a client. The Orders file is also related to the Inventory file because they both contain fields that show the names of items and prices.

The real power of a relational database is evident when your salespeople fill out orders in the Orders file. As soon as a salesperson types the name of a client into an Order record, the database manager picks up the client's address from the related Client file and enters it in the proper field in the Order record, as shown below.

Many people have made careers of creating customized databases for business, education, and government. The need for these kinds of services will only increase in the years ahead.

When the salesperson enters the name of an item you keep in stock, its price is entered automatically, because the database manager can look up the price in the Inventory database. The relational database does most of the work of looking up and entering data, so the salespeople can take orders in far less time.

NAME	STREET	CITY	STATE	ZIP
Acme Tools	205 Bronxwood Av.	New York	NY	10467
Gizmos Inc	10 Pine Wood Ave	Fairfax	CA	94930
Computhings	1139 E 222nd St.	New York	NY	10467
Quartet & Co	12 Fish Mongers St.	Dust Pit	IL	56491
Clamps Grips	32 Big Tree Ln.	Hillsbloom	CA	41569
Food Stuff Inc	9 Marsh Wood Dr.	Rosewood	WA	90591

ITEM	STOCK_NUM	AMOUNT	PRICE	NOTES
Paper Clips_	15632	100	1.50	100 clips per box
Stapler	50981	55	3.49	Uses #2 staples.
#2 Staples	50982	150	1.24	200 staples per b
Flow tip pen	67891	50	2.89	Red.
Flow tip pen	67892	49	2.89	Black.
Post it notes	73561	30	0.75	Yello, 50 to a pa
Ink pad	15637	5	1.75	Black.

NAME Acme Tools
STREET Bronxwood Ave CITY New York
STATE NY ZIP 10467 PHONE 1-212-555-4321

ITEM:	SIN:	PRICE:		TOTAL COST:
Paper Clips	15632	1.50$	x 2	3.00$
Ink Pad	15637	1.75$	x 1	1.75$
Rubber Bands	67142	2.35$	x 3	7.05$

11.80$
+ 3.93$
15.73$

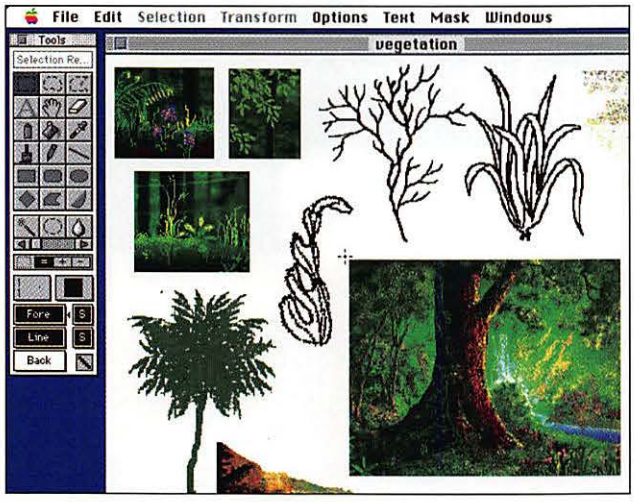
Graphics Software

Graphics software, which lets you create and edit illustrations on a computer, has gained widespread use during the last ten years. Part of its popularity is due to the development of the laser printer and PostScript, a language for controlling printers. But the Macintosh, with its graphical interface, has also been a major factor in attracting artists and illustrators to computers and in making graphics software an important computer application.

When the first Macintosh was released in 1984, it came with two applications: a word processor, called MacWrite, and a paint program, called MacPaint. Clearly, Apple Computer saw the ability to create graphic images on the Mac as a major selling point.

Paint Programs

MacPaint was one of the first **paint programs**, which allow electronic painting using a palette of software tools and a mouse. Other paint programs include SuperPaint and PC Paintbrush. A screen from a paint program, along with its tool palette and some images created using the program, is shown here.



How a Paint Program Works The tool palette in a paint program lets you draw lines, curves, and freehand shapes. It also lets you color or shade areas of the screen. As you add lines and colors to the image, the program stores the file as a map of the screen, called a **bitmap**. As you may remember from the hardware chapter, Chapter 2, the images that appear on the computer's screen consist of tiny dots called pixels. A bitmap is essentially a file that lists information about every pixel.

There are two disadvantages of bitmaps (also known as raster graphics). The first is that they require huge amounts of memory and storage. The other problem is that it is difficult to manipulate specific parts of the picture once it has been created, because the software has stored the image, not as a set of objects with different attributes, but as thousands of dots. If you have painted an image of a tree on a grassy hill, the software doesn't recognize the image of the tree as separate from the image of the hill, so you can't easily move the tree.

Think about the math of a color image. To know which of 256 possible colors a pixel is, the computer needs one byte of information. A 640 x 480 pixel screen has 307,200 pixels. Therefore, 307KB of storage are required for an uncompressed bitmap that fills the screen. For even more colors, the number jumps to megabytes per image.

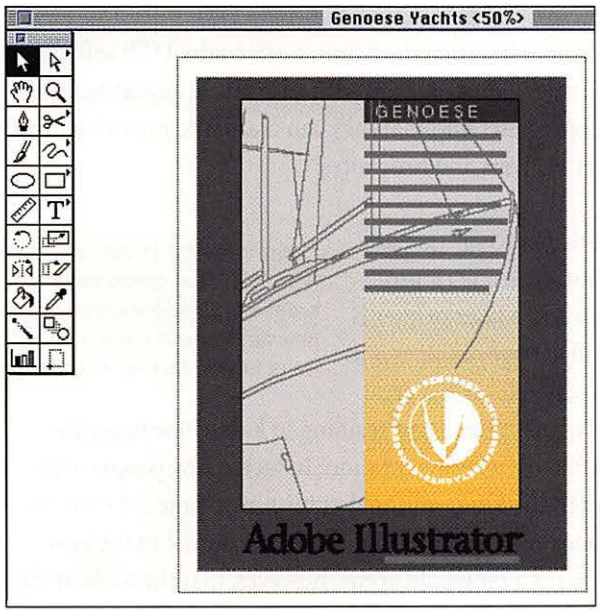
Image Editing Software The advantages of bitmap graphics are best demonstrated by a special class of programs known as **image editing software**, of which Adobe Photoshop is the most famous example. Programs like Photoshop aren't really designed for creating images so much as for editing them. Specifically, they let you enhance images by adding realistic textures, colors, and a wide variety of photographic and artistic effects. The screen shown here is from Photoshop.

Once you see how image editing programs can manipulate photographs, you'll never again believe anything you see in print.

Draw Programs

Among graphics packages, the alternative to a paint program is a draw program. This class of software includes such well-known programs as Aldus Freehand,

CorelDRAW, and Adobe Illustrator, which was used to create the screen below. Creating images in these programs is similar to using paint programs. Usually, they have menus of commands and a palette of tools.



The Power of Object Graphics The real difference between draw programs and paint programs is in how the software stores the image. In both types, you create objects and place them on the screen. However, the **draw program** stores the object, not as a collection of dots, but as a mathematically designed shape. For example, a line is stored as a straight object with two defined end points. A square is defined as a collection of four lines. Even free-hand curves are stored mathematically. Images that are composed in this way are known as **object graphics** or **vector graphics**.

The advantage of creating images with object graphics is that you can manipulate individual objects in the image. Any individual object can be moved, rotated, enlarged, shrunk, or distorted in certain mathematically definable ways. These capabilities give the user real freedom in creating and editing drawings.

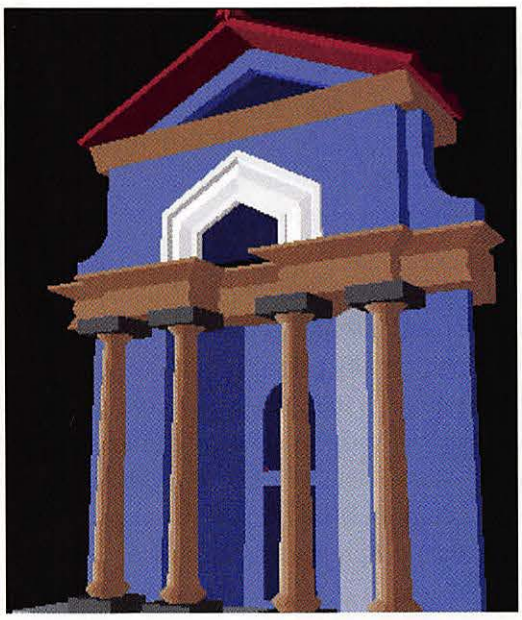
Object graphics also appear much smoother than bitmaps when printed on laser and laser-quality printers. Bitmaps sometimes reveal their jagged edges in the printout.

Presentation Graphics One special niche within the family of draw programs is occupied by **presentation graphics** programs, which focus on capabilities for creating visual presentations. Businesspeople often need to create images that really grab the audience's attention, so presentation graphics programs include features for adding 3-D effects, stringing images together into slide-show presentations, and adding pieces of clip art. **Clip art** means small, ready-made images that users can select from a library of images and paste into their own documents.

Computer-Assisted Design The draw programs also include a special kind of software, known as computer-aided design, or CAD software, which specializes in the kinds of drawing tools required by architects and engineers. In the microcomputer market, the biggest-selling CAD program is AutoCAD, from Autodesk.

CAD software is designed for creating precise electronic models, often in three dimensions, as shown in the screen below.

These capabilities make CAD software a powerful tool for many different professions. Architects can design a house and take clients on a visual tour of it before it is built.



Engineers can design mechanical parts and test them before building prototypes. With precise maps loaded into a CAD database, geologists, urban planners, or disaster relief workers can study the effects of both human and natural forces, from traffic flow to hurricanes.

Desktop Publishing

One of the many industries that have been revolutionized by the microcomputer is publishing. Much of the work of designing and laying out complex documents—such as this book—can now be performed with a relatively inexpensive computer, a laser printer, and desktop publishing (DTP) software, which emulates (imitates) much of the publishing process on a computer.

Once again, the Macintosh was instrumental in the rapid development of this revolution. With the introduction of Aldus PageMaker, millions of Macintosh users found that with practice they were able to create high-quality, professional-looking documents. As programs, such as PageMaker, Ventura Publisher, and QuarkXPress, have become more sophisticated, the desktop publishing industry has exploded.

The Mac made DTP famous, and vice versa. In the early days of the Mac, the only reason some PC-dominant companies bought Macs was for DTP. It took years for the same abilities to migrate to PCs.

DTP Features

DTP software shares many features with the powerhouse word processing programs, such as WordPerfect, Word, and MacWrite Pro. Over the years these word processing programs have added DTP features so that, without using more than one program, most users can produce documents that look highly professional. Still, there is a big difference between these two classes of software.

For one thing, DTP programs are not often used for entering large amounts of text. In other words, most people don't type a long document using a DTP package (although the latest versions of QuarkXPress and PageMaker are making it much easier to do so). More often, you enter text with word processing software, then load the word processing document into the DTP program for advanced formatting.

Once the text is in, the DTP package offers powerful features in four specialized areas: page layout, typesetting, styles, and graphics. The screen shown on the right shows a page from this book being edited in Quark XPress. On the next page, the four primary DTP features are illustrated.

People Who Use Desktop Publishing

Now that publishing has become computerized, it has spread far beyond the traditional print media of books, magazines, and newspapers. Businesspeople compose attractive company newsletters with DTP software. Educators find that the features offered by DTP software can make their classroom materials more engaging. And entrepreneurs find that they can create their own highly effective flyers and brochures.

The good news is that you can buy templates that guide you in the creation of professional-looking newsletters and reports, even if you don't have a flair for page design.

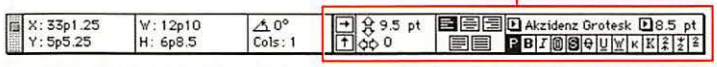
This is not to say that any person with a DTP program and a laser printer is a skilled page designer and typesetter. It takes a great deal of experience and training to know how to create an effective text presentation. In fact, many people who were trained in traditional publishing blame DTP for the explosion of poorly designed print material in the past few years. Few would argue, however, that the tools of the trade have not improved.

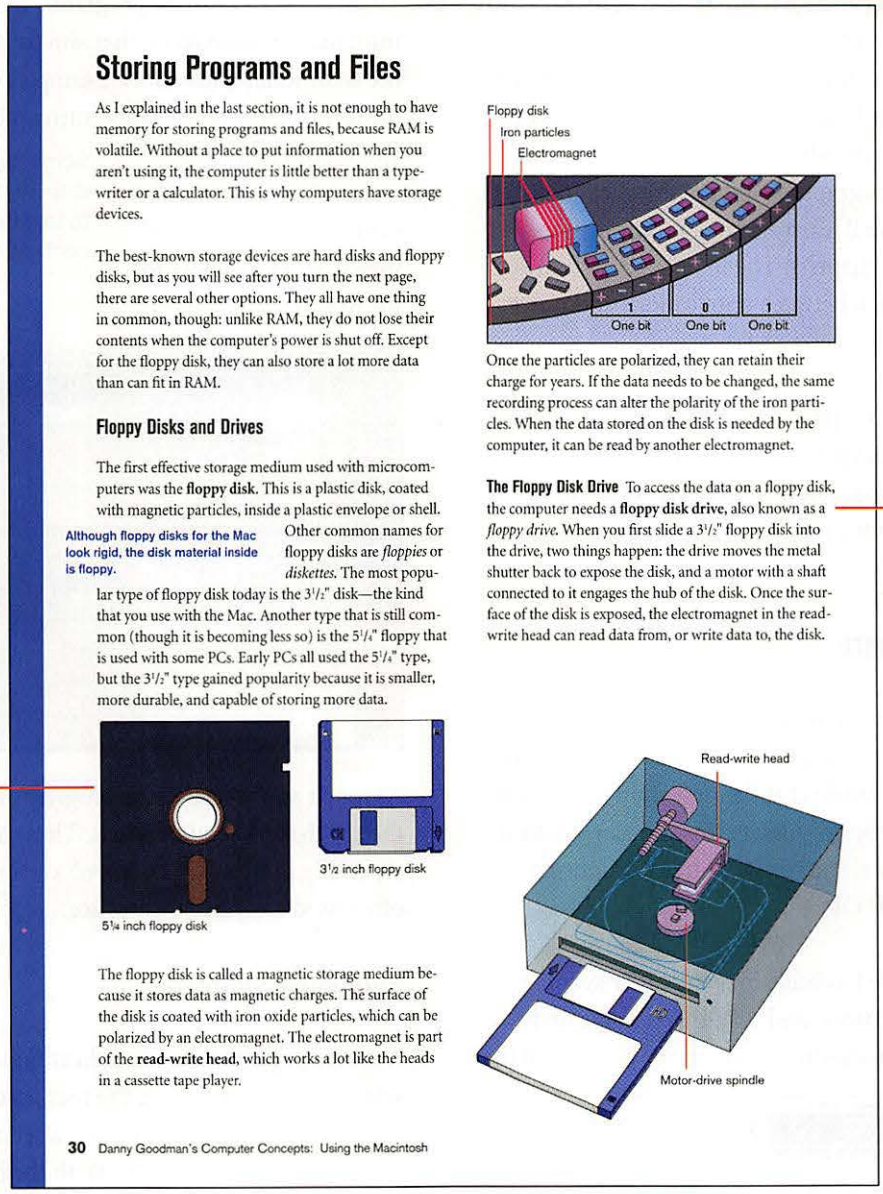
Page Layout

DTP packages specialize in giving you maximum flexibility in how text is arranged on a page. You can control the page size, the margins, and the number of columns. You can set up two different styles for different pages. You can also add ruling lines—the horizontal and vertical lines that are used to create visual divisions of text on a page.

Typesetting

In addition to the control over font and type size that you find in word processing, DTP software adds many advanced features, including the ability to rotate text, control the exact spacing between lines, and even tighten the spacing between characters.





Storing Programs and Files

As I explained in the last section, it is not enough to have memory for storing programs and files, because RAM is volatile. Without a place to put information when you aren't using it, the computer is little better than a typewriter or a calculator. This is why computers have storage devices.

The best-known storage devices are hard disks and floppy disks, but as you will see after you turn the next page, there are several other options. They all have one thing in common, though: unlike RAM, they do not lose their contents when the computer's power is shut off. Except for the floppy disk, they can also store a lot more data than can fit in RAM.

Floppy Disks and Drives

The first effective storage medium used with microcomputers was the **floppy disk**. This is a plastic disk, coated with magnetic particles, inside a plastic envelope or shell.

Although floppy disks for the Mac look rigid, the disk material inside is floppy.

Other common names for floppy disks are *floppies* or *diskettes*. The most popular type of floppy disk today is the 3½" disk—the kind that you use with the Mac. Another type that is still common (though it is becoming less so) is the 5¼" floppy that is used with some PCs. Early PCs all used the 5¼" type, but the 3½" type gained popularity because it is smaller, more durable, and capable of storing more data.

5¼ inch floppy disk

3½ inch floppy disk

The floppy disk is called a magnetic storage medium because it stores data as magnetic charges. The surface of the disk is coated with iron oxide particles, which can be polarized by an electromagnet. The electromagnet is part of the **read-write head**, which works a lot like the heads in a cassette tape player.

Floppy disk
Iron particles
Electromagnet
1
0
1
One bit
One bit
One bit

Once the particles are polarized, they can retain their charge for years. If the data needs to be changed, the same recording process can alter the polarity of the iron particles. When the data stored on the disk is needed by the computer, it can be read by another electromagnet.

The Floppy Disk Drive To access the data on a floppy disk, the computer needs a **floppy disk drive**, also known as a *floppy drive*. When you first slide a 3½" floppy disk into the drive, two things happen: the drive moves the metal shutter back to expose the disk, and a motor with a shaft connected to it engages the hub of the disk. Once the surface of the disk is exposed, the electromagnet in the read-write head can read data from, or write data to, the disk.

Read-write head
Motor-drive spindle

Style Sheets
No Style
caption
chapter title
content list
goodman comments F4
head #1 F2
head #2 F3
head #3
intro copy F6
intro list
new term list
Normal F1
review list
visual sum list

30 Danny Goodman's Computer Concepts: Using the Macintosh

Adding Graphics

Perhaps the biggest difference between word processing and desktop publishing is their control over the placement of graphics on a page. DTP programs let you import all kinds of graphics, including both bitmap and object graphics. Once a graphic has been placed on a page, you can control the size of the frame, the size of the image within the frame, and the way that the text is wrapped around the frame.

Creating Styles

To help save time, DTP packages let you give names to the type styles that you use repeatedly in a document. For example, if many of the paragraphs in your document are single-spaced with a blank line between paragraphs, you could name this style Normal. Whenever you wanted to apply that style, you could choose Normal from a customized menu of styles.

Other Applications

Although the five types of programs mentioned above represent the largest markets for application software, there are many others. Here are just a few of the types that are gaining popularity with microcomputer users.

Integrated Software

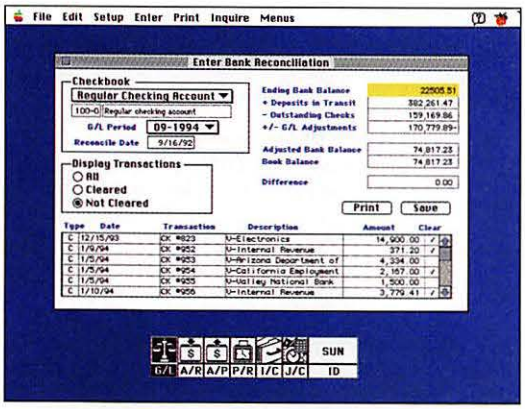
One popular type of product is **integrated software**, such as Microsoft Works and ClarisWorks, which combine several applications within a single user interface. When you load an integrated program, you usually have access to word processing, spreadsheet, and database applications, and sometimes graphics and communication software as well. (You'll learn about communication software in the next chapter.) The integrated software makes it easy to switch between applications and move data between them.

Integrated software is especially popular with beginning users, because it is inexpensive and is generally easy to use. However, it does not offer all the features of individual programs for word processing, spreadsheets, databases, and graphics.

Accounting Software

Spreadsheet programs have simplified many accounting tasks. But setting up a complete, computerized, accounting system using spreadsheet software—even for a small business—is a complicated task. A much easier solution is accounting software, such as Peachtree Accounting (shown below) or MYOB.

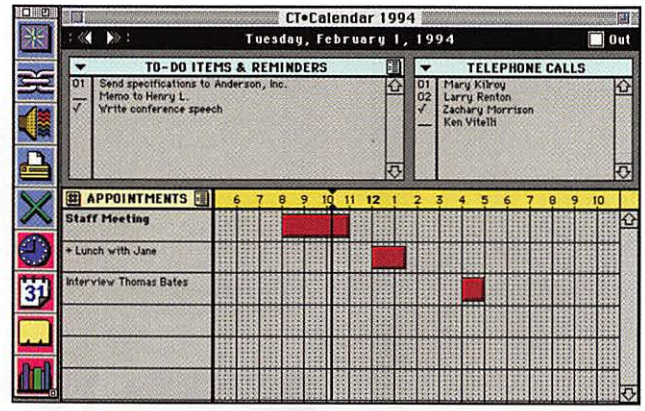
Accounting software has built-in features for keeping track of payroll, inventory, and accounts payable and receivable—all the traditional accounting systems. All the user has to do is customize the features by adding data. Microcomputer accounting software brings sophisticated accounting power within reach of even the smallest business or self-employed individual.



Personal Information Managers

There is a class of small programs, called **personal information managers**, that aim to emulate some of the traditional office tools. Examples of these programs include address books, appointment books, calendars, and memo pads. The screen shown here is from Connections, a personal information manager for the Mac.

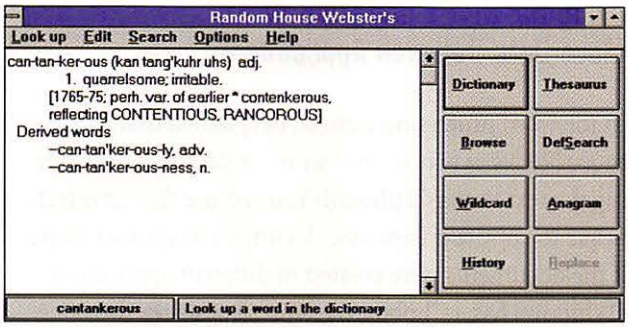
Some calendar programs let you dial into the network at the office to update your calendar from a centralized group calendar.



As much as possible, these programs are used just like their real-world counterparts. These applications are especially popular on notebook computers, which are often used away from the office.

Reference Software

Another popular type of application is **reference software**, programs that give the user access to an entire dictionary, an almanac, or even a set of encyclopedias that is stored electronically. With the increasing popularity of CD-ROM drives, more users have access to CD-ROM disks, which can store hundreds of megabytes of information—enough to put the entire *Oxford English Dictionary* on a single disk. The software that accesses this data can actually be a relatively small program that you keep on your hard disk or load from the CD-ROM disk whenever you need it. The screen shown at the top of the next page is a Windows version of Webster's dictionary.



Tax Preparation

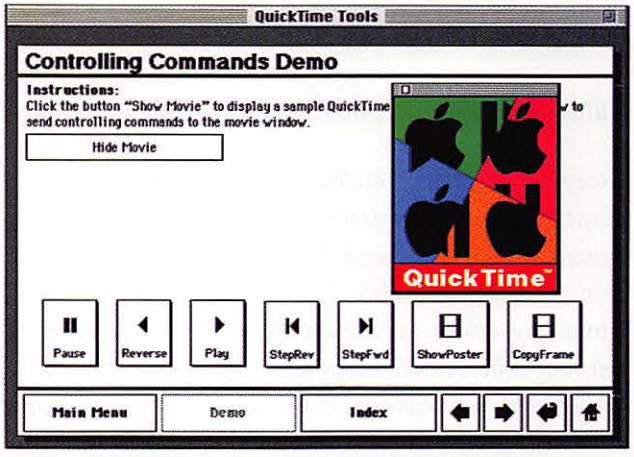
One special type of program that gets popular every spring is **tax preparation software**. Programs such as MacInTax and its competitors aim to relieve the confusion caused by filling out long forms and additional schedules.

With good tax preparation software, the program first asks you a number of questions to create a financial profile. When the profile is complete, the software knows exactly which parts of which forms you need to complete, so it prompts you for only the information that relates to your situation. Some programs also send you an update every spring that includes the current year's forms for both federal and local taxes. The program can then print the tax form, completely filled out (except for the signature). Or, you can file electronically, using a modem (which you'll learn about in the next chapter).

The HyperCard Player

Besides graphics and desktop publishing software, the Macintosh also popularized hypermedia software through the HyperCard program. **Hypermedia** refers to programs that can create cross-references between all types of data. HyperCard is called an application, but it could just as easily be called a programming language—actually, it is both. It is closely related to database software, though it doesn't look like a DBMS.

The **HyperCard Player** is the part of HyperCard that works like an application, letting you look at **stacks**. There are HyperCard documents composed of **cards** that can contain text, graphics, or even sound. Some of the stacks that people create are like interactive documents that let you jump around within a body of written information. For example, many computer books are published as HyperCard stacks. Each card in the stack is like a page in a book, except that you can click on a button on the card to jump to various other cards in the stack. This is a card from a typical HyperCard stack:



Other stacks are more like applications themselves, because they allow you to enter your own data. For example, it is relatively easy to create an address book stack in HyperCard. A user with the HyperCard Player can add names and numbers to this stack to create a customized phone book. You will learn more about HyperCard when you get to Chapter 6.

Expert Systems

One type of application that has received a lot of attention in the past few years is the expert system. **Expert systems** are *a*rtificial *i*ntelligence (AI) programs that can simulate human expertise and decision-making in a specific subject area.

Expert systems have been created in a variety of professional areas, from medicine to air traffic control. For example, a medical expert system called MYCIN makes diagnoses based on patient data. Expert systems are one of the cutting edges in application development. They are difficult to create, but can save users immense amounts of time once they are in place.

Combining Applications

From the descriptions I have given you thus far of the Macintosh and how it is used, you might expect that the things people do with a computer are neatly defined according to the applications that they use. Of course, this isn't really the case. Many users keep multiple applications running on their machines at all times, and many combine their work from different programs into mixed documents.

Running Several Applications at the Same Time

Except for DOS (without Windows running), most of today's operating systems allow multitasking. With System 7 and (DOS-based) Windows, this is called cooperative multitasking. Unix, Windows NT, and OS/2 allow a more powerful kind, called preemptive multitasking, but cooperative multitasking is enough for most users. It allows you to hold more than one program in memory and switch back and forth between them quickly. You can even perform certain tasks, such as receiving files on a modem or sending files to the printer, while you work in another application.

By letting you keep all of your favorite tools running on your computer, multitasking lets you work more naturally, focusing your attention on wherever it's needed at the moment. If you are working on a memo to a client and one of your coworkers asks for some sales figures, you can quickly switch to your spreadsheet software to find the information. On the Mac (with System 7), all you have to do is select your spreadsheet program in the Application menu, as shown here.

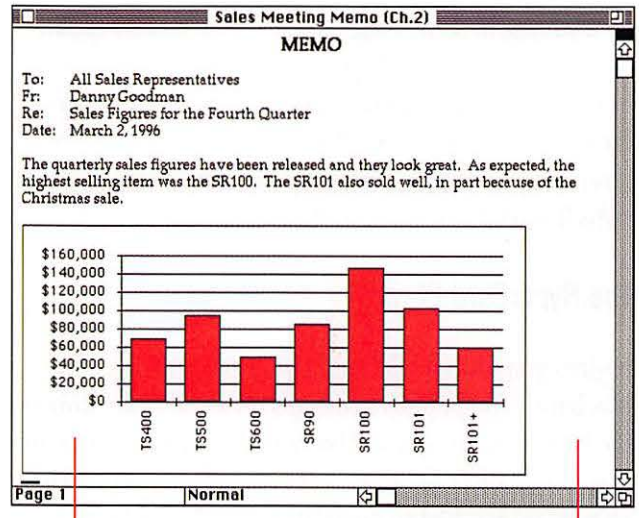
You can then switch back to the word processor without losing more than a few seconds on the request.

Using the Mac's Clipboard to Move Data Between Applications

In the word processing section, I explained that you can move blocks of text around within a document by copying the text to the Clipboard. You can use the same technique to copy text from one document to another, even if the documents were created in different applications. (Windows has a Clipboard feature that works the same way.)

The Clipboard is a storage space shared by every application that has an Edit menu (which is to say, almost every application). This means that any application that can understand the format of the data in the Clipboard can accept that data in its own documents. In other words, if you create a bar graph in a spreadsheet program and copy it to the Clipboard, you can paste it into a report you are writing, as long as your word processor is designed to accept graphic files. Here you can see a bar graph that has been pasted into a memo.

The Clipboard can actually store a wide variety of data—even a QuickTime movie.



Bar graph created in Excel

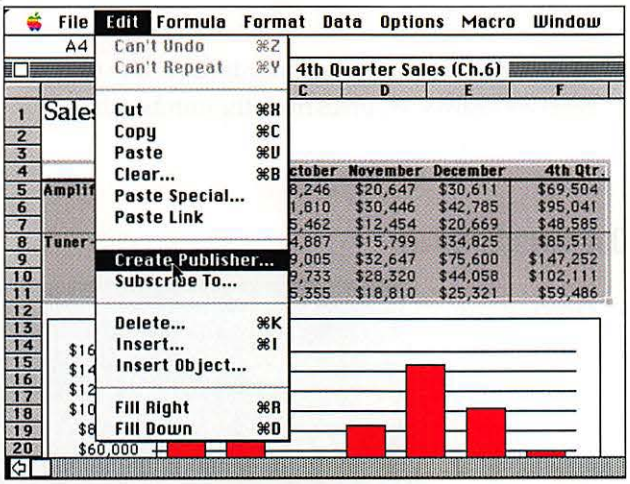
Memo created in Word

Apple encourages software developers to use a few standard formats for data, such as TEXT for alphanumeric data and PICT for graphic files. Many applications are programmed to accept these standard formats from the Clipboard, so data that is copied there tends to be highly versatile. The Clipboard is limited, however, in being able to store only one piece of information at a time. For storing multiple items on the Mac, you can use the Scrapbook.

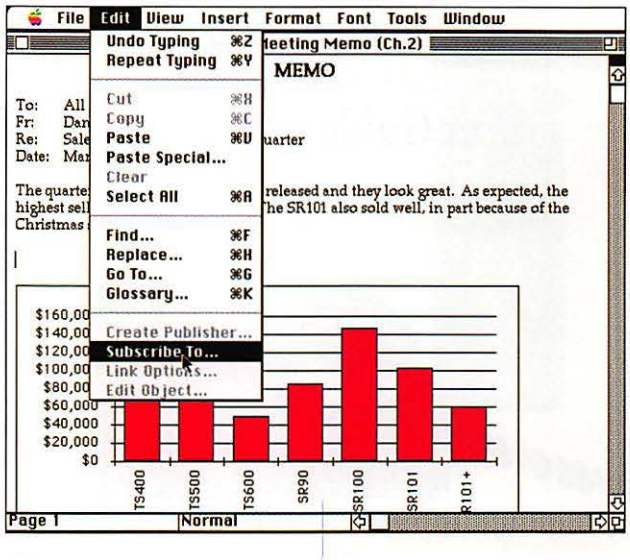
Using Publish and Subscribe to Link Documents

The Clipboard gives you an ideal way to move data between documents in many cases. But what if you periodically send your boss a standard written report that must include up-to-the-minute accounting information? To keep the report accurate, you would need to copy the same part of the spreadsheet into your report template every time you wanted to send it to your boss. This kind of repetitive work is very inefficient.

There are two ways around the problem. First, System 7 offers a feature called **publish and subscribe** that lets you maintain active links between documents. When you select a set of data and choose Create Publisher from the Edit menu of an application, you create an **edition**, an intermediate file that is linked to a source file. Here, a set of sales data is being set up as an edition.



You can then choose Subscribe To from the Edit menu to paste the edition into a second document, as shown below.



From then on, the second document automatically includes the current version of the data from the first document.

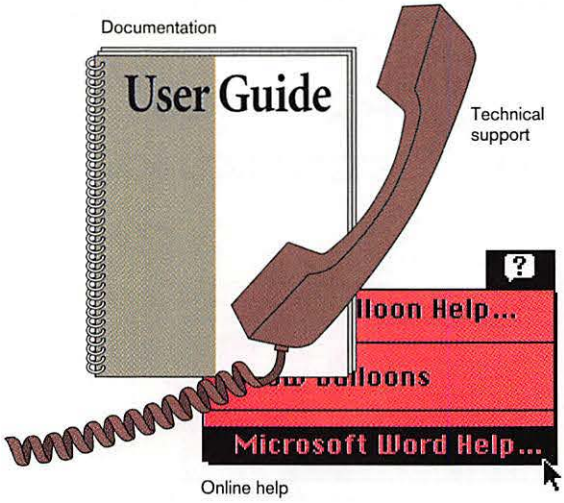
The publish and subscribe feature is not special to the Macintosh. The Windows environment calls a similar feature **object linking and embedding**, or **OLE**.

The other way to solve the problem is to use AppleScript, a powerful programming language capable of automating system-level processing and using data from multiple applications. You'll learn more about AppleScript in Chapter 6.

Visual Summary

Buying and Installing Software

- When shopping for software, get reports from friends, colleagues, and computer periodicals.



Types of software support, page 63

- Before you buy a program, check its hardware requirements.
- Software should be supported by documentation, technical support, and help features.
- Make a backup copy of the program disks before installing a program onto your hard disk.
- Any breach of a software license—by loading the program onto more than one machine (or the specified number of machines) or receiving an unlicensed copy of the program—is considered software piracy.
- An upgrade is a new version of a program, usually with additional features or capabilities.

Using Software

- Starting a program is the process of loading it into memory.
- Most programs assume that you want to create a new document when you start them, but you can also edit an existing document.

Palettes, page 64

- Before you quit, you should save your work. Use Save to preserve the work under the existing name, or Save As to give the document a new name.
- To finish working on one document and clear it from memory, you close it.
- When you are done working with a program, you choose Quit to clear it from memory.

Word Processing

- The fundamental advantage of word processing over using a typewriter is that the computer separates the process of creating and printing the document. This speeds up the revision process.
- The most important word processing features include word wrap, cut and paste, search and replace, text and document formatting, spell checking, and performing mail merges.

Spreadsheets

- Spreadsheets are useful whenever large sets of numbers need to be organized and mathematically manipulated.
- In a worksheet, a cell can contain a value, a formula, or a label.
- Cells can be formatted with a variety of text and number formats.
- Most spreadsheet packages include the ability to generate analytic graphics from the numbers in the worksheet.

Database Software

- Database software lets you create, sort, and query organized collections of facts.

NAME	STREET	CITY	STATE	ZIP
Acme Tools	285 Bronxwood Av.	New York	NY	10467
Gizmos Inc	10 Pine Wood Ave	Fairfax	CA	94930
Computhings	1139 E 222nd St.	New York	NY	10467
Quartet & Co	12 Fish Mongers St.	Dust Pit	IL	56491
Clamps Grips	32 Big Tree Ln.	Hillsbloom	CA	41569
Food Stuff Inc	9 Marsh Wood Dr.	Rosewood	WA	98591
C.P.M.	68040 Chip St.	Oakland	CA	94967
Fredies of LA	63 Slip St.	LA	CA	67516
Ginza Sushi Co	839 Bronx River P.W.	New York	NY	10467
Heptite Guild	67 Crystal St.	Ballybran	MA	31678
East America	13 S East St.	Midtown	TX	98735
Sanford Press	2384 Williamsridge	New York	NY	10467
Skokie & Snarf	21 Mountian Hights	Any Town	NJ	97681
Art Log Inc	515 Dead End Rd.	Bogsvill	VA	10769
A.P.F.S.D.S.	56 Now What Drv.	Someplace	NC	58761
Data-Tech	29 Canal St.	Yorksburg	SC	78534
JCN Computers	113 Vole St.	Dirtsburg	NC	98761

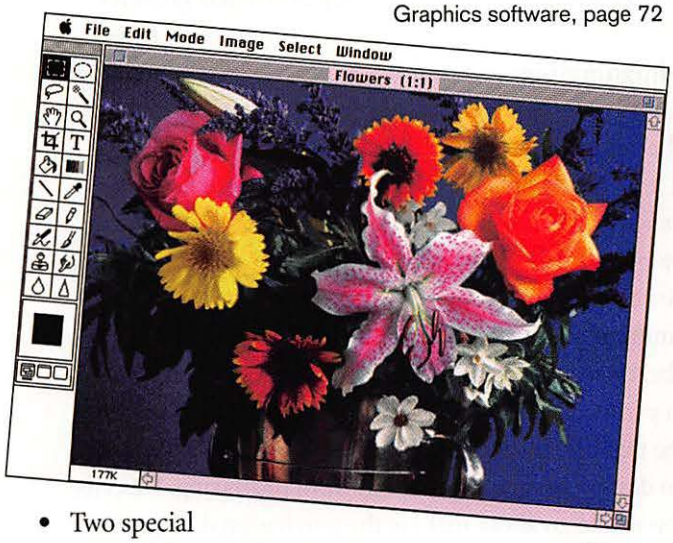
Database software, page 70

- A database file is a collection of records, each of which has the same set of fields.
- A flat-file database is composed of a single file, the data in which can be organized as a table.
- A relational database lets you make logical connections between files that share at least one field, so that the data in one is available to the other.

Graphics Software

- Graphics software lets you create and edit images on a computer.
- Paint programs, which store images as bitmaps, are good at creating realistic coloring and shading.
- Draw programs store images as collections of mathematically defined objects.

Graphics software, page 72



- Two special types of draw applications are presentation graphics programs, which help the user create business presentations, and CAD programs, which help engineers and architects create accurate electronic models.

Desktop Publishing

- DTP software shares many features with word processing software, but it is specifically designed for advanced page layouts, typesetting, and integration of graphics and text.
- Normally, users import text and graphic files into a DTP package rather than enter them directly.
- The capabilities of DTP software have created a revolution in the publishing industry. A wide variety of people can now create what appear to be professionally published documents.

Other Applications

- Integrated software combines several applications under one interface.
- Accounting software helps businesses set up computerized accounting systems, such as payroll and inventory.
- Personal information managers emulate the tools of the traditional office.
- Reference software offers an on-line interface to dictionaries, encyclopedias, and other reference works.
- Tax software streamlines the process of preparing federal and state tax forms.
- The HyperCard Player gives Mac users access to HyperCard stacks that have been created by other users or companies.
- Expert systems imitate the human decision-making process in a specific subject area.

Combining Applications

- Except for DOS (without Windows), most operating systems allow multitasking.
- The most common benefit of multitasking is the ability to switch quickly between two or more applications.
- The Macintosh Clipboard makes it possible to copy data from one application and paste it into another.
- With the publish and subscribe feature, you can set up a link between documents so that a change in the source document is reflected in a file that is using the same data.
- With AppleScript, you can automate the process of combining data from different applications.

New Terms

After completing Chapter 4, you should understand the following terms. They appear in bold in this chapter and are listed in the Glossary.

accounting software
analytic graphics
bitmap
card
cell
clip art
Clipboard
close
context-sensitive help
database management system (DBMS)
database software
document window
documentation
draw program, paint program
editing
edition
expert system
field
flat-file database
grammar checker
hardware requirements
HyperCard Player
hypermedia
image editing software
install
integrated software
label, value, formula
loading
mail merge
object graphics, vector graphics
object linking and embedding (OLE)
palette
personal information managers
platform
presentation graphics
publish and subscribe
query
quit
record
reference software
relational database
Save, Save As
search and replace
site license, network version
Software Publishers Association (SPA)
software license
software piracy
sort
spelling checker
stack
tax preparation software
technical support
template
thesaurus
toolbar
upgrade
word wrap
worksheet
write-protect

Chapter Exercises

Review Questions

1. Why is it wise to make a backup copy of program disks when you first purchase the program?
2. Name three different kinds of software support.
3. Define software piracy.
4. What Mac command should you issue to save a document under a different name than is displayed in the title bar?
5. In your own words, explain how a template can save you time.
6. What is the difference between using the Mac's Clipboard to copy data between applications and using the publish and subscribe feature?
7. Name and describe the word processing feature that streamlines the process of creating a batch of form letters.
8. Why are analytic graphic features built into spreadsheet programs?
9. What type of database can you create with a spreadsheet program?
10. Describe the difference between bitmap and object graphics.

Use Your Imagination

1. Describe a new and useful kind of application software.
2. Would it be worthwhile for a software company to develop a comprehensive program with advanced word processing, desktop publishing, and graphics capabilities? Why or why not?
3. Describe a way in which a spreadsheet could save you time in performing a task that you do regularly.
4. Describe a way in which a graphics program could save you time in performing a task that you do regularly.
5. Imagine that you are about to buy a word processing program, but you don't yet know much about word processing. Describe how you would go about making the purchasing decision.

Beyond the Book

1. List the names and version numbers of three applications that are used on the computers in your school's computer lab.
2. Use whatever resources are available to you to find out the cost of purchasing a new copy of both Microsoft Word and Excel.
3. Use computer periodicals to find a comparison of two or more word processing programs. Summarize the findings, and explain which program is better for your needs and why.
4. According to several computer periodicals, what is the most highly rated DTP package? Why is it so highly rated?
5. What are the hardware requirements for the latest version of QuarkXPress?

Connecting Computers

TO EACH OTHER

5

Contents

84 The Evolution of Networking

86 The Advantages of a Network

88 Network Hardware

90 Network Software for the Macintosh

92 Modems and Communication Software

94 Getting Online

96 The Dangers of Connectivity

98 Ever-Increasing Flexibility

100 Visual Summary

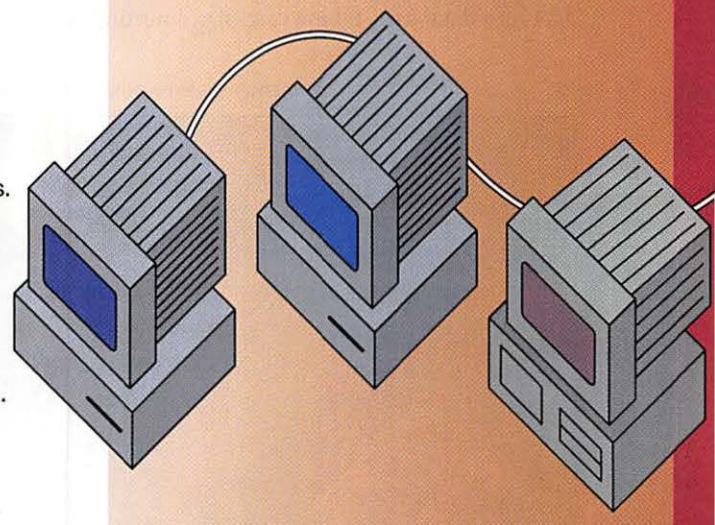
102 Chapter Exercises

IN ADDITION TO THE PROCESSING, input, output, and storage devices that make up computer hardware, there is a fifth category: communication devices. These devices make it possible to share data and programs between microcomputers. When users work together in the same organization, communication devices can be used to create a network, a group of computers that are permanently linked. When users need to set up a temporary communication, they use the phone lines, a device called a modem, and communication software.

Objectives

When you have finished this chapter, you will be able to do the following:

- Explain why microcomputer networks have been replacing mainframes.
- List at least four advantages that networked computers have over stand-alone computers.
- List the most common communication channels used in networks.
- Name and describe three common network topologies.
- Describe how to set up your Mac for use on an AppleTalk network.
- Explain how criminal hackers can endanger a business network.
- Describe two common ways to protect the data on a network.
- Explain how the word modem describes what the device does.
- Name the services most commonly offered by bulletin board services and information services.
- Describe the idea behind the data superhighway.



The Evolution of Networking

To understand how and why microcomputers are linked together to form networks, you need to understand the mainframe legacy. For 30 years, "business computing" implied the use of a mainframe computer, with computer users sitting at terminals.

As microcomputers became popular during the 1980s, however, people found that smaller computers offered less expensive and more flexible ways to meet their information needs. The biggest disadvantage of using microcomputers was the fact that they made it harder to share data and software. To address this problem, organizations began linking their microcomputers together to form networks.

The Mainframe System

Consider the implications of a mainframe system. Think of an office building with a single computer in it, a machine that takes up a whole room. Scattered around the building are terminals, each of which is only a keyboard and a monitor connected by cables to the mainframe (see the drawing at the bottom of the page). With some mainframes, hundreds of terminals can be used at the same time. Through an arrangement known as **time-sharing** (which is similar to multitasking), each user can access programs and data at virtually the same time as other users.

Most of the people who sit at these terminals are entering data into databases, taking care of accounting, and obtaining summarized reports of current inventory and accounts. One group of employees, the **information systems (IS) department**, consists of programmers and other computer professionals who take care of the mainframe and create programs for the benefit of other users.

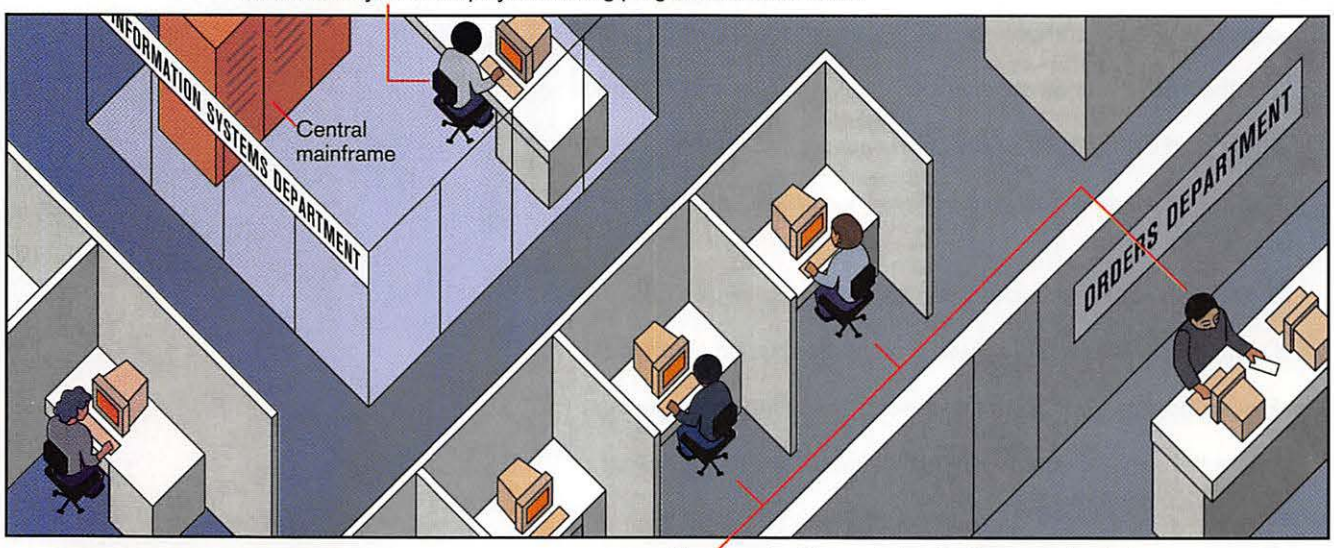
Another popular acronym is MIS, for management information system. Corporate data processing departments are therefore sometimes called MIS departments.

Where It Works In some circumstances, the mainframe system is extremely effective. Large corporate databases can involve many people using the same data at the same time. For example, in a manufacturing plant, one group of people may be entering sales transactions into a database, another group may be monitoring inventory levels and ordering raw materials, and a third may be keeping tabs on the flow of money. All three of these groups share data, and the information systems department creates programs so that each of them can get the information it needs from the shared database.

Many people still work in front of terminals connected to mainframes: reservation agents for airlines, hotels, and car rentals; order takers at toll-free order hotlines; telephone company operators. Mainframes are here to stay.

If you are at a large college or university, you might find a mainframe on campus that is used for such things as generating payroll and coordinating teaching schedules. Mainframes are also very common at large companies with complex billing systems. For example, your phone and power bills are printouts from mainframe databases.

Information systems employee creating programs for other users.



Users work with terminals wired to central mainframe.

The Downside of the Mainframe System But the mainframe system has certain limitations. First, it is frighteningly expensive. A company has to buy or lease a mainframe (which can cost millions of dollars), pay for upkeep, and keep an entire department on staff to create programs that make the computer useful. Mainframe software is also frighteningly expensive.

Equally important, the mainframe system is extremely rigid. The information systems department first attempts to understand how information flows through the organization. Then it creates programs to manage the information flow. The result is a highly centralized and customized system of information.

However, a lot of useful information isn't part of a company's central information system. People keep their own correspondence, their own addresses, and their own budgets and schedules. What's more, everybody takes care of these things a little differently. But an information systems department can't get involved in making programs to suit every employee's business needs.

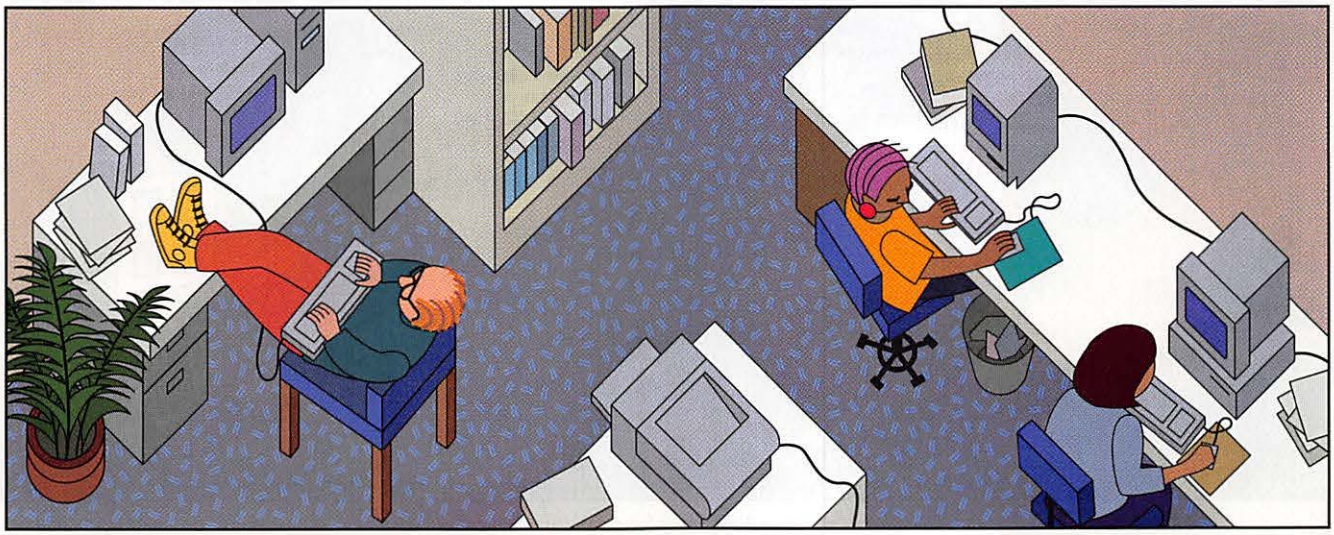
Enter the Microcomputer

In the late 1970s, businesspeople gradually began to see the microcomputer as a valuable tool. Small business owners and managers, who couldn't afford a mainframe or a minicomputer, suddenly had access to a flexible and powerful tool for doing accounting. Word processing software became more powerful, microcomputer database software appeared, the PC clone market matured, and businesspeople began buying microcomputers by the millions. Even employees in large businesses, where mainframe terminals were abundant, were buying Macs and PCs.

During the past ten years, the microcomputer has proven itself as the foremost business tool. With programs that you can buy from any software store, the personal computer can help perform the vast majority of business-related tasks, including many that are rarely done on mainframe computers. For example, the graphics, desktop publishing, and hypermedia applications that you learned about in the last chapter would probably not have been developed for mainframe computers, because they don't fit into a typical centralized business system.

Despite all the advantages offered by microcomputers, however, business users still need to share data, so computers are often linked to form networks. The drawing below shows a small business network.

With a network, users can get the advantages of both kinds of system: the flexibility of working on a microcomputer and the connectivity of a mainframe. The network is what has made the microcomputer the ultimate business solution.



Microcomputers networked together so users can share files, software, and peripherals.

The Advantages of a Network

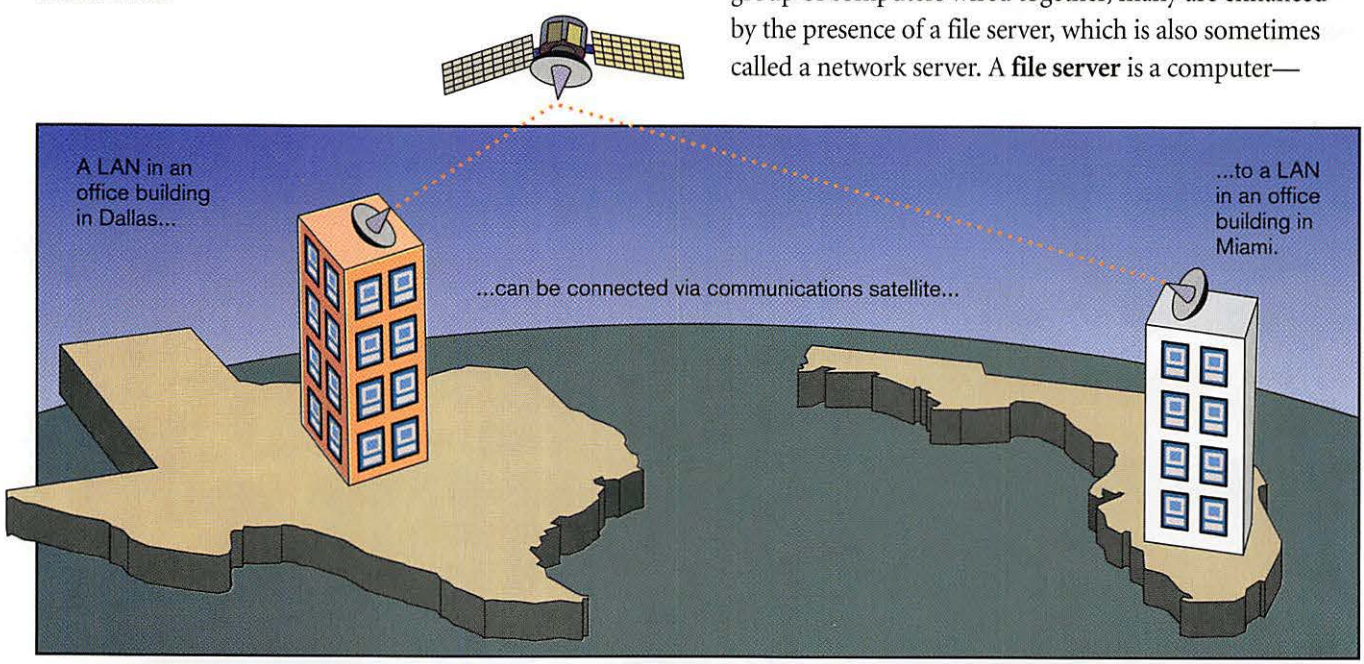
Linking computers to form a network creates a system that is greater than the sum of its parts. Suddenly, each user can cooperate in group projects, communicate with other users, and share equipment that would be too expensive to buy for each computer.

LANs and WANs

One advantage of a network is that its size isn't fixed. You can make a network out of two computers or two thousand computers. You can make it as big as you need or as big as you can afford. You also have a lot of flexibility over the physical area that it covers.

In general, there are two classes of networks. A network that fits in a room, a single building, or even a couple of adjacent buildings is considered a **local area network**, or **LAN** (pronounced "laan"). A LAN is ideal for a company that has all of its offices in a single location.

Many businesses, however, have offices scattered around a city, around the country, or around the world. Such companies might have a LAN at each branch office, but employees still need to share data among the various LANs, so the company connects its LANs. A group of interconnected LANs, scattered over a broad geographical area, is known as a **wide area network**, or **WAN** (pronounced "waan") You can think of a WAN as a network of networks.



Together, they form a WAN.

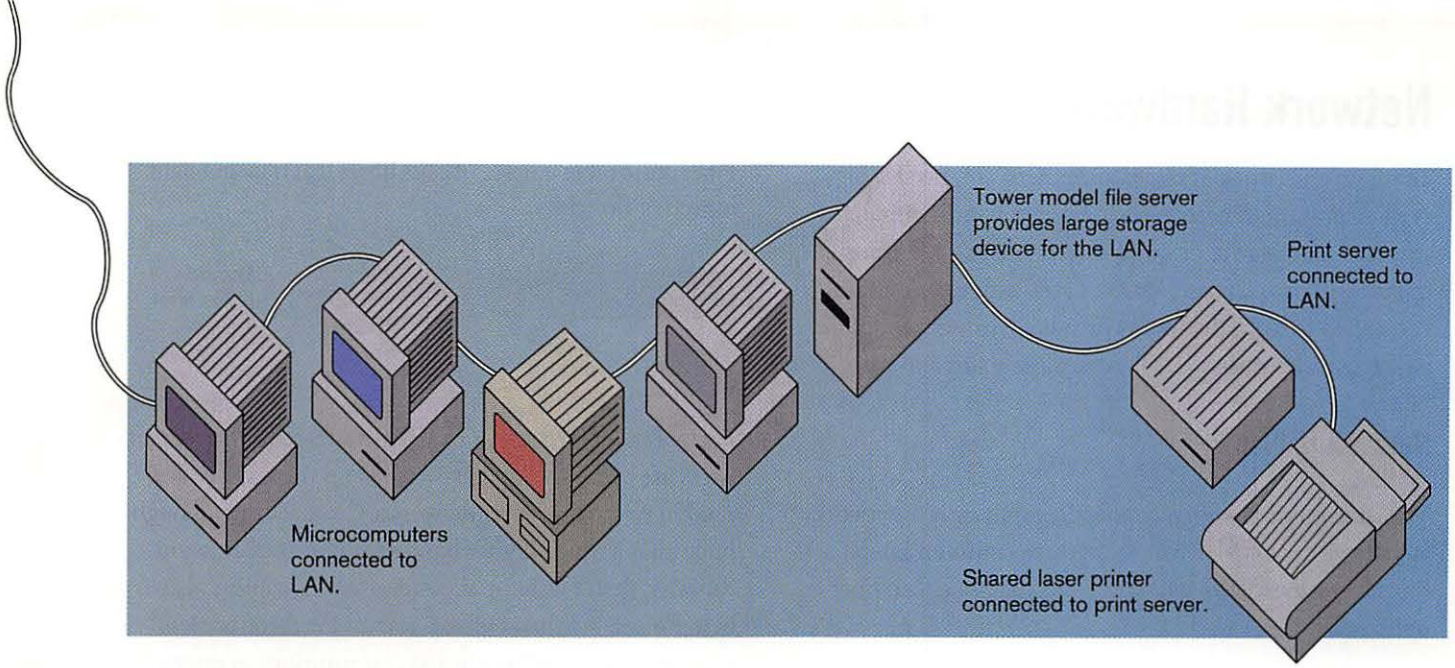
File Transfer: The Benefits of a Simple LAN

Imagine a very simple LAN, such as four Macintoshes in a single room with cable connecting them. The primary advantage of networking the four Macs is the ease with which users can move files from one computer to another. **File transfer** is the process of moving files from one networked computer to another.

File transfer on a simple LAN might not sound like much of an advantage. After all, you could just copy a file to a floppy and hand it to your coworker across the room. But electronic file transfer is, in fact, a major convenience. First of all, moving a file between networked hard disks is faster than copying to a floppy and then from the floppy back to another hard disk. Second, many files are so large that they won't fit on a single floppy disk. In these cases, the time savings with a network can be dramatic. But the biggest advantage is that the network allows a single user to perform the whole transfer, whereas moving a file via floppy requires the users of both computers to be involved. With the network, the user who needs the file can look for it on another hard disk without ever bothering the other user.

The Benefits of a File Server

Although some LANs are simple ones, consisting of a group of computers wired together, many are enhanced by the presence of a file server, which is also sometimes called a network server. A **file server** is a computer—



often a microcomputer—equipped with a large hard disk, which acts as the LAN's central storage device (see drawing above).

The file server can be used to store data, programs, or both. Storing data there is a simple way to share files. Storing programs there lets a company buy network versions and save on software costs. It also prevents one program from taking up space on many different hard disks.

The increasingly popular notion of collaborative computing—several people contributing to a single document—depends on personal computers capable of communicating with each other with a minimum of hassle.

Using a file server in a LAN means that you can save money on the other computers, because they don't need to have large hard disks. In fact, in some cases, it's possible to buy computers that don't have disk drives at all. These computers, known as **diskless workstations**, have input, output, and processing devices, but they rely on the file server for all their storage needs. When you turn on a diskless workstation, the processor looks for the operating system on the file server.

Saving Money with Networked Printers and a Print Server

Most companies can't afford to buy a laser printer for every user. But then, most people don't use a laser printer all day; they just want one for occasional print jobs. By connecting an expensive printer to a local area network, several users can share it.

If there are several shared printers in a network, they are often connected to a **print server**, a device that controls data going to a set of printer ports.

Naturally, printers aren't the only type of expensive peripheral that can be shared on a network. In some organizations, people share scanners, modems, CD-ROM drives, and many other devices.

Electronic Mail

The last major advantage of networking is the communication medium known as electronic mail. **Electronic mail**, usually called **E-mail**, is a messaging system that lets users on a network leave written notes for each other. Each person on the system has a unique E-mail address. When you want to send a message to somebody, you enter their E-mail address, then type the message. The messaging system stores the message in the recipient's electronic mailbox. When the recipient turns on the computer, the E-mail system tells the person there is a message waiting.

Studies show that users reply to E-mail messages more quickly than to paper mail or memos. You get so used to the speed that any other form of mail becomes "snail mail."

E-mail is revolutionary because it combines some of the best features of the telephone and postal systems. It's fast, convenient, and inexpensive. With a good E-mail system, internal company memos are hardly necessary. You can send the same message to a large group of recipients; you can include standard information (such as your telephone number) in every message; you can even attach documents that you created in other applications.

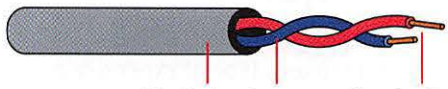
Network Hardware

To set up a network of microcomputers, you need a certain amount of hardware. Connecting the computers usually requires wire or cable, unless you want to transfer data via electromagnetic waves. Each computer that is connected to the network also needs a hardware interface, which usually consists of an expansion board and a port.

Network Cables

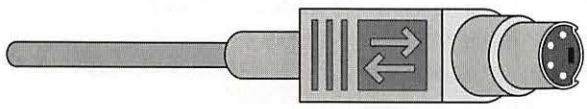
The conventional way to connect computers in a network is with wires or cables. There are three common kinds that are used: twisted-pair wires, coaxial cable, and fiber optic cable.

Twisted-pair wires consist of two insulated wires that are twisted around each other. Common telephone wire—the



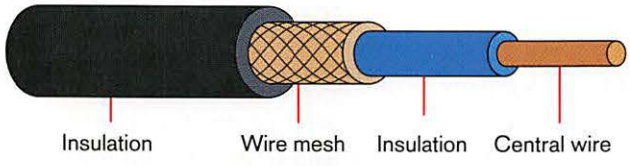
kind that connects the telephone to the wall—is one type of twisted pair, but the type used in networks is usually a little higher quality.

On the Mac, one common type of cable for networks is Apple's own LocalTalk cable, which is a special type of twisted-pair wire. **LocalTalk** is the cabling system that



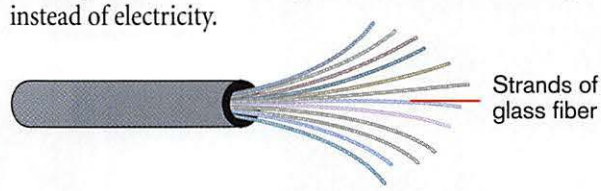
is used in **AppleTalk**, Apple's proprietary networking system, which is built into every Macintosh. Another variation is called PhoneNet, which allows common telephone wiring to be used instead of special cable. AppleTalk is known as a **protocol** because it includes a set of rules for communicating data.

Coaxial cable consists of a central insulated wire, surrounded by a woven wire sleeve. Cable TV used to



be installed with coaxial cable, but many cable companies are switching to fiber optic cable.

Fiber optic cable is made of glass fibers that transmit light instead of electricity.



Each of these three types has its advantages. Twisted-pair wires are by far the least expensive and the most widely used in microcomputer networks. Coaxial cable, though bulky, has a much higher **bandwidth**, or transmission capacity, than twisted-pair wires. Coaxial cable is also better insulated than twisted-pair and is therefore less susceptible to interference and communication errors. Fiber optic cable has a much higher bandwidth than coaxial cable, is immune to interference, and is very small. However, it is expensive and more difficult to install than either of the others.

Wireless Transmission Channels

An alternative to connecting computers with cables is to use **wireless communication**, in which the signal that carries the data is transmitted through the air via electromagnetic waves. Once again, there are several different kinds, which are differentiated by the type of signal that they use. Some systems transmit with microwaves, others with infrared, some with visible light, and some with common radio frequencies. Each of the different bands has somewhat different properties, and the availability of all frequencies is controlled by the Federal Communications Commission. In general, transmission speeds with wireless systems are not as high as with hard-wired systems (systems that use wire or cable).

Although wireless communication is becoming more common in LANs, it is most often used in WANs, where hard-wiring the system would be too costly. Local networks can be bridged together across town with microwave radio dishes on the tops of buildings, or around the globe with communication satellites.

In the future, wireless networks will pervade corporate and campus buildings. You'll be able to bring an electronic notepad to a meeting or class, and be linked to all the files stored on your desktop computer.

The Hardware Interface

In addition to the cabling required to connect computers, each machine in a network needs internal hardware—both circuitry and a port—that provides an interface between itself and the other computers or devices on the network. All Macs have built-in hardware that allows them to connect to an AppleTalk network. The AppleTalk port is the same as the printer port, and it is labeled with a printer icon.

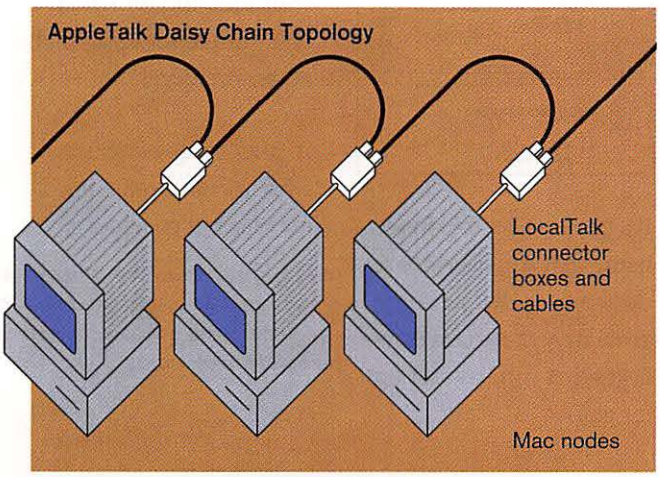
Even the very first Macintosh had AppleTalk built-in—a true breakthrough that took a couple of years to prove its value. It's easier to connect a Macintosh to a network than to install a VCR.

Most PCs require an expansion board to connect to any network. Likewise, some Macs require expansion boards to connect to anything but an AppleTalk network, although an increasing number of models are coming with Ethernet hardware built in. **Ethernet**, a widely used network protocol, was developed by Xerox, Digital, and Intel. **Token Ring**, another common protocol, was developed by IBM. Both Ethernet and Token Ring networks are significantly faster than AppleTalk networks.

Network Topologies

Each network—AppleTalk, Ethernet, and Token Ring, and so on—requires a certain **topology**, or pattern of connections between the computers on the network. The computers are often referred to as **nodes**.

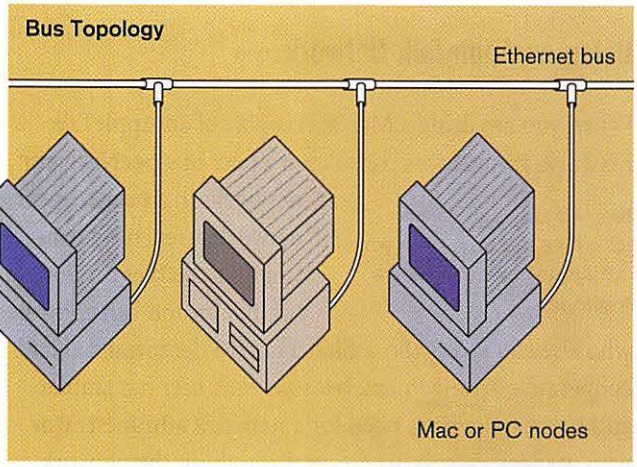
AppleTalk networks use a **daisy-chain topology**, in which each node in the network can be connected to one or two other nodes, as shown here.



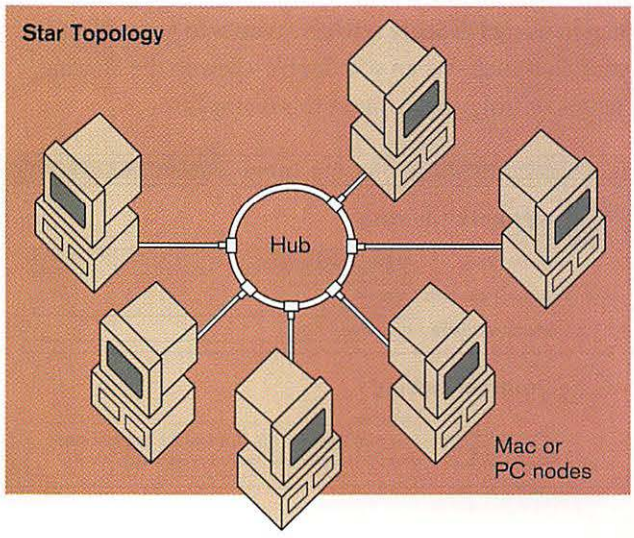
The LocalTalk connector box is what allows each node to connect to the daisy chain. The Apple end of the box plugs into the AppleTalk port on the back of the Mac. The two plugs at the other end of the box can be attached to other nodes in the network.

Ethernet requires a **bus topology**, in which all of the nodes on the network are connected to a single wire that acts as a backbone for the network (see below).

It's often possible to mix and match networks, so (for example) several departmental AppleTalk networks can be linked to a central server via Ethernet.



The third common topology used with microcomputers is the **star topology**, which is used in Token Ring networks. In a star topology, there is a hub or ring at the center of the network, with cables extending to each of the nodes.



Network Software for the Macintosh

Every piece of hardware in the computer requires software to run it. Network hardware is no exception. The programmers at Apple have tried to make using an AppleTalk network as easy as possible by including the necessary software in System 7. The daisy-chain topology and the AppleTalk software make setting up a Mac network exceptionally simple. Apple refers to the easy networking of the Mac as its plug-and-play capability.

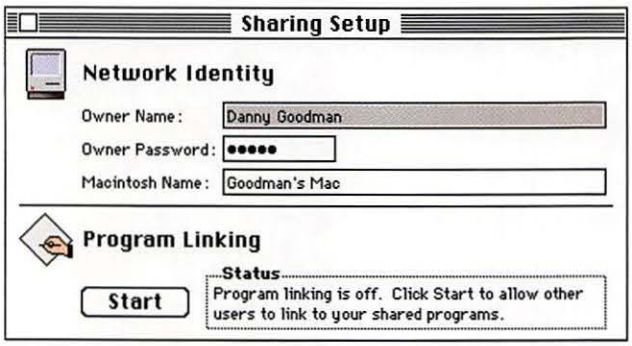
Apple has also included Apple File Exchange with System 7, which lets you write and read files to and from DOS-formatted floppies.

Using an AppleTalk Network

When you are using a Mac that is part of an AppleTalk network, your Mac is considered a peer in a **peer-to-peer network**. In a peer-to-peer network, users have control over the files on their hard disks and can control who else can access those files. This is a decentralized and cooperative arrangement, because each user has similar authority; there is no need for a **network administrator** who manages access privileges throughout the network. This type of arrangement is also known as **workgroup computing**, because it's perfect for users who need to work together on projects.

You can even buy software to connect a Mac at home or in your lap to an AppleTalk network via the telephone.

Setting Up Your Mac for FileShare **FileShare** is the name for the software you use to connect to an AppleTalk network. Once the cables have been hooked up, the first step in using FileShare is to give names to yourself and your computer. When you double-click on the Sharing Setup control panel, you see this dialog box:

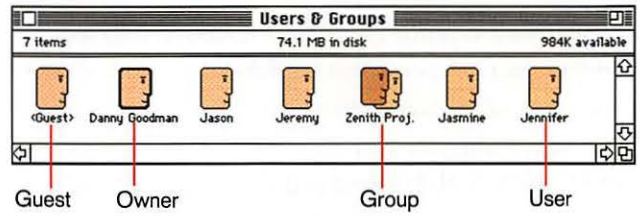


Here you type your name and your password. You use this name and password when you want to access your own Mac from somewhere else on the network. Then you enter a name for your machine. When other users need access to your computer, they select this name in the Chooser.

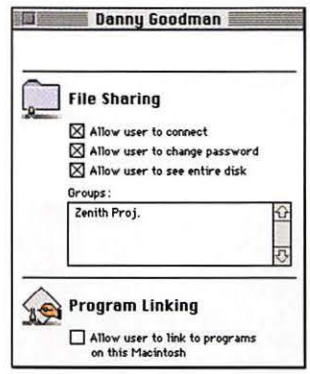
Make sure you give your Mac a name that others will be able to identify readily as being your machine.

Establishing Access Privileges for Other Users After setting up your own name and password, you can use the Users and Groups screen to set up access privileges for other users who will need to have access to your files.

Double-clicking on an icon opens a dialog box, where you can specify access privileges.



Access privileges refer to each user's ability to read and write files from and to a remote computer. As the owner, you should always give yourself maximum access privileges. You establish your access privileges by double-clicking on your icon. The Mac responds by opening this dialog box:



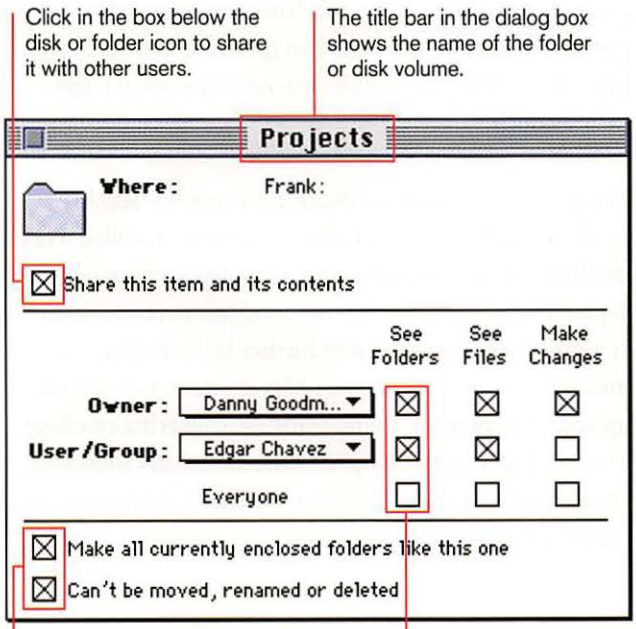
Then you do the same for the users, groups, and guests that you have defined. Users are people who need to connect to your Mac and for whom you want to set up special access privileges.

A guest is a generic user who has not been named. If a person tries to connect to your Mac but provides a name that you have not set up as a user, that person is given only the access privileges that you have set up for guests.

In very small networks, where file privacy isn't an issue, you can allow everyone guest access, instead of managing passwords.

A group is a convenient way to establish access privileges for several previously defined users. For example, you might allow one group of users to access a folder in your hard drive, while another group can access a different folder.

Sharing a Disk or a Folder Once you have set up access privileges for the owner, users, guests, and groups, you can make specific folders or your whole hard disk available for remote access. To share a folder or a disk, you first highlight the folder or disk in the Finder, then choose Sharing from the File menu. This dialog box appears:

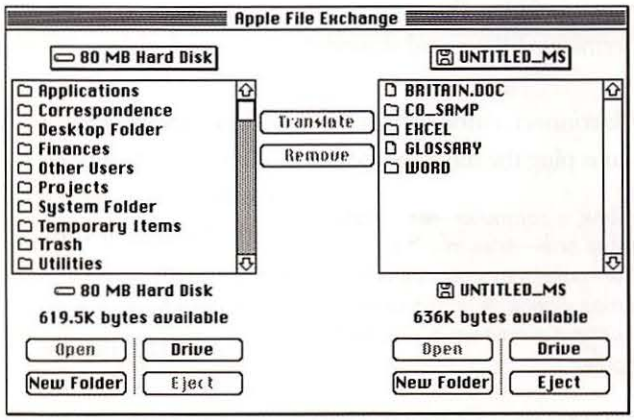


Apple File Exchange

Connecting a group of Macs is easy; setting up a network that includes both Macs and PCs is a lot harder. But with or without a network, it is frequently necessary for Mac and PC users to trade files.

Fortunately, all of the Macs sold today are equipped with a SuperDrive. (If your Mac can use high-density disks, it has a SuperDrive.) With **Apple File Exchange**, your SuperDrive can act like a PC disk drive, writing and reading to and from DOS-formatted diskettes. You can even format a DOS disk.

To work with DOS disks, you must first start Apple File Exchange by double-clicking on its icon in the System Folder. When you do, the following dialog box appears.



The left side lists the contents of the Mac's active disk (usually the hard disk). The right side shows the contents of the DOS-formatted disk. You can use the buttons to translate files from one format to the other.

Apple and others offer additional software that lets your Mac treat a DOS disk as if it were a Mac disk—you just insert the disk and drag files around to your heart's content.

Of course, Apple File Exchange is a somewhat crude solution to the problem. A more elegant solution would be system software that can emulate a PC on a Mac platform (or vice versa). Until such hardware is perfected, though, Apple File Exchange will have to do.

Modems and Communication Software

When organizations need to connect groups of computers around the office or around the globe, they set up networks. But when individual users need to send data to other users or to networks to which they aren't directly connected, they use the telephone system, communication software, and a modem.

What's a Modem?

A **modem** can take a stream of bits from a computer and translate it into an audible signal that can be sent through the telephone lines to another computer. This process is illustrated in the drawing at the bottom of the page.

Changing digital data into a sound wave is called modulating the signal. The computer that receives the data also has a modem, which demodulates the signal back into a stream of bits. The term *modem* is a contraction of the terms *mo*dulator and *dem*odulator.

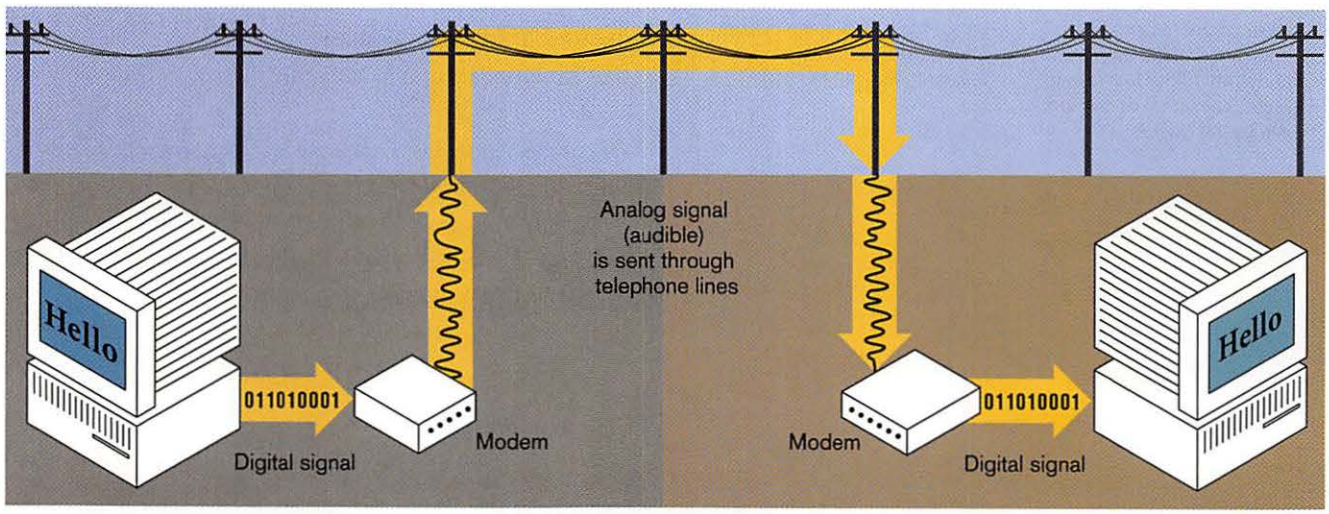
To connect a modem to a Macintosh, all you have to do is plug the modem into the modem port, then plug a standard phone wire into the modem. It's also possible to install an internal modem—an expansion board that fits into one of the computer's internal slots. Some Macs have built-in modems, and all you have to do is connect a standard phone line.

In my view, a computer—especially a portable one—is as much a communications device as it is a computing device. A laptop computer without a modem is only half a computer.

Modems are compared by the speed at which they can transmit and receive data. Modem speeds are measured in baud or bits per second. **Baud** is the more common term, but it isn't exactly accurate, because it measures the number of signal changes per second. Modern modems can pack several bits into every signal change, so **bits per second**, or **bps** (which means just what it says), is the correct unit for measuring transmission speeds. In practice, the two terms are often used interchangeably.

The first modems for microcomputers operated at 300 bps. Today, the slowest modems sold operate at 2400 bps. Faster models can operate at 4800, 9600, 14,400, or 19,200 bps. In addition to packing as many as six bits into every signal change, some modems compress data, so it is possible to achieve transmission speeds as high as 57,600 bps (or roughly four double-spaced typewritten pages each second).

Many of today's modems include fax capabilities. A modem that lets you send and receive faxes is called a **fax modem**. The latest models of fax modems are extremely sophisticated. Not only do they transmit data and faxes at high speeds, they go a step further by including voice mail features. With this type of fax modem, you can set up your computer as a dual-purpose answering machine. The computer can pick up the line, determine what kind of call is coming in, and either record a voice message or receive a fax.



Using Communication Software

To use a modem, you need **communication software.** The most popular programs for the Mac are MicroPhone II and Smartcom II. For the PC, the most popular program is ProComm Plus. Using modem software can be a little tricky, because there are a lot of settings that must be correct before you can transmit data.

The first thing to realize is that, for two computers to communicate via modem, they need to be set up the same way. It's sort of like two people needing to speak the same language. Naturally, the two modems must be operating at the same speed. Fortunately, most modems can automatically detect the speed of another modem and adjust to the speed of the slower one.

The other settings relate to the short strings of bits that the modems send back and forth. Years ago, two users who wanted to set up a communications session needed to agree on all the settings, which are known as **line settings.** But today, most people use a setting called **8-N-1** as a default. Here's what it means:

8 data bits: This means that there are 8 bits in each set of data that the modem sends.

No parity: Parity is an old way to check that there are no errors during communication. It isn't often used anymore.

1 stop bit: This means that there is one bit to signal the end of the string of eight data bits.

Once you have agreed on the line settings, one user initiates the call using the communication software, and the other user's communication software answers the call. As soon as the line is open, the two modems perform a **handshake**, an audible signal that ensures that each modem is set up with the same line settings. After the handshake, regular communication can begin.

Don't be discouraged if your first attempt at connecting to another computer via modem is unsuccessful. Once you get the settings correct on both sides, things should go smoothly—most of the time.

Often, the communication software that receives the call is set for **host mode**, which establishes a user interface for the person who initiated the call. In host mode, the receiving computer can be set up to prompt the caller for a name and a password. Then it presents the user with a menu, as shown at the top of the next column.

One of the advantages of host mode is that you can call into your own computer when you are working somewhere else—as long as you have access to another computer with a modem. That way, you always have access to the files stored on the computer you use most.

```
Please enter your name: Matt
Please enter your password: *****


--------- MINI BBS MAIN MENU -----------

1 - Display directory of files (access restricted)
2 - Send file(s) to the BBS
3 - Receive file(s) from the BBS
4 - Reserved
5 - Change your password
6 - Reserved
7 - Help
8 - Log off

Please enter the number of your selection:
```

When two individuals set up modem communications, the usual reason is to transfer one or more files. File transfer between modems requires both users to use the same communications protocol, a set of rules akin to the line settings but more sophisticated. The protocol dictates how much data is sent in each chunk, and how the modems check for communication errors. The most common protocols are Kermit, Xmodem, Ymodem, and Zmodem. Of these, Zmodem is the fastest and the easiest to use.

Error correction protocols are nice, because the receiving computer checks for data accuracy after each burst of data. If the burst doesn't arrive intact (perhaps there was a crackle on the phone line), it asks the sending computer to try that burst again.

Getting Online

There are three common reasons that people use modems. The first is to exchange files with other users. The second is to connect to a remote network. For instance, many people use their modems to connect to the office LAN through a remote access number. A third reason is to connect to a bulletin board service or an information service, a process known as getting **online**.

Bulletin Board Services

A **bulletin board service**, or **BBS**, lets anyone with a modem participate in electronic roundtable discussions with other users. There are bulletin boards that focus on thousands of different topics, from computer science to sports, politics, religion, and music.

While the BBS started as a computer hobbyist attraction, the concept today extends to corporate and academic use. In a company, a BBS can be a place for employees to air gripes and engage in lively debates.

Many **user groups**, acting like computer clubs, provide a BBS in addition to meetings and newsletters. Users join the discussion to talk about features and to ask and answer questions about using the program or device.

Using a Bulletin Board The first step in using a bulletin board is to logon. **Logon** is the general term for connecting to a network. The process usually includes typing an identification name or number and a password. Once you finish logging on, the BBS knows who you are and can automatically identify your messages for other users. After you logon, you are generally presented with a menu of choices, where you indicate which discussion group you want to join. A **discussion group** is a group of users who are discussing a specific topic. In the bulletin board shown here, each discussion group is called a conference.

```
                    CONFERENCES

 1 - Conferences on Social Responsibility and Politics (1K)
 2 - Media and Communications (1K)
 3 - Magazines, Publications and Zines (1K)
 4 - Business and Livelihood (1K)
 5 - Body, Mind, Health (1K)
 6 - Cultures and Languages (1K)
 7 - Of Place and Places (1K)
 8 - Interactions (1K)
 9 - Arts and Letters (1K)
10 - Recreation (1K)
11 - Entertainment (1K)
12 - Education, Science and Planning (1K)
13 - Grateful Dead (1K)
14 - Computers (1K)
15 - Conferences About The WELL, Itself (1K)
16 - Private Conferences (2K)
17 - Print Out All 200+ Conferences (11K)
```

Once you pick your discussion group (if the BBS has more than one group), you are free to read messages left by others, post your own message, or respond to any of the messages you have read. Normally, the messages in a discussion group are organized into **threads**, which are on-line conversations that relate to a very specific topic. The threads listed below are all part of a discussion group called Great Outdoors.

```
Topic - Number of responses - Header

  1   0 WELLcome to the Great Outdoors!
   <topic is frozen>
  2  70 Backpacking Trips
  3 119 Outdoor Equipment
  4  19 Outdoor Footwear
  5  26 Nordic and X-Country Skiing
  6   7 Paddle and Portage by Canoe
  7  12 Climbing Partner(s) Wanted
  8  55 Whitewater
  9   3 Biking
 10   2 "How does the rope get up there so you can climb up i
 11  17 Peak Bagging
 12 103 Introduce Yourself Here
 13   3 Bridge Swinging
 14   6 User Fees in the Outdoors
 15   4 Hawaii outdoors fun, know of any?
 16  80 Kar Kamping with Kids
   <linked topic>
 17  85 Rock Climbing / Mountaineering
--More--[Hit space to continue or q to stop.]
```

The logical way to read the messages is to follow each thread separately. For example, here are a couple of messages in a thread called Skiing.

```
Topic  30 [outdoors]:  Skiing
#4 of 61: Jacques Leslie (jacques)      Mon Dec 28 '92 (22:29)    10 lines

 Funny that I found this topic a day after returning from a week at Keystone,
 spent with my family of five, everyone of us from 6-year-old Sarah to
 45-year-old me, spending as much time as possible on skis. This sojourn
 merely whetted my appetite, and now that I've heard that Tahoe got 3 feet of
 snow TODAY, I can't wait to get there. Tristan, our 23-year-old, actually
 got off the plane from Colorado yesterday and got to Tahoe by 11 this
 morning. He is, to say the least, enthused about the snow in which he now
 wades.

 Anyone have any ideas for ski rentals in Tahoe?

Topic  30 [outdoors]:  Skiing
#5 of 61: Motorhead (macspac)      Tue Dec 29 '92 (20:18)     8 lines

 North, South or West Shore?

 Most of the time, it makes sense to get demo rentals right at the resort,
 rather than in town. That way, you can trade at lunch and try several other
 models. If you know what you want, and you just need a good price and proper
 setup, try Dave's Ski Shop in Tahoe City, Rainbow Mountain on Ski Run Blvd. i
 South Lake, and the rental shop at Homewood has some of the best Vokls (sp?)
 anywhere.
```

When you are done, you must **logoff** (or logout), which ends your connection to the other computer or network. Some bulletin boards are free, while others charge, either by the month or by the length of time that you stay online. The second type of fee is known as **connect time charges**. BBSs automatically keep track of your connect time charges.

The Value of Bulletin Boards It's difficult to convey just how valuable—and how enjoyable—bulletin boards can

be. With access to the right discussion group, you can learn about things that interest you from people who are experts on the topic. Whether you are doing research, searching for people who share your interests, or just shooting the breeze, bulletin boards are the answer. At the same time, bulletin boards can be a huge waste of time. As you explore different ones, you will find that a high percentage of the messages are either irrelevant, uninteresting, or just plain wrong. Unfortunately, the only way to find gold in a riverbed is to sift through dirt.

The ability to say what you want without eye contact makes some BBS participants behave more boldly online than in real life. Others tend to be shy, and just read the exchanges—the legions of silent "lurkers."

Other Resources on Bulletin Boards In addition to the discussion groups, some services keep data and programs for their subscribers to download. Data files usually contain general information related to a particular discussion group. Program files are software that other users have uploaded onto the bulletin board. If you download shareware and continue to use the program, make sure you send the requested payment to the developer.

Information Services

Bulletin boards are usually small operations, run by individuals, local user groups, or small companies. **Information services**, on the other hand, are much larger. They take the concept of a bulletin board and expand on it to offer a wide range of online services. In this country, the largest information services are CompuServe, America Online, Prodigy, and GEnie.

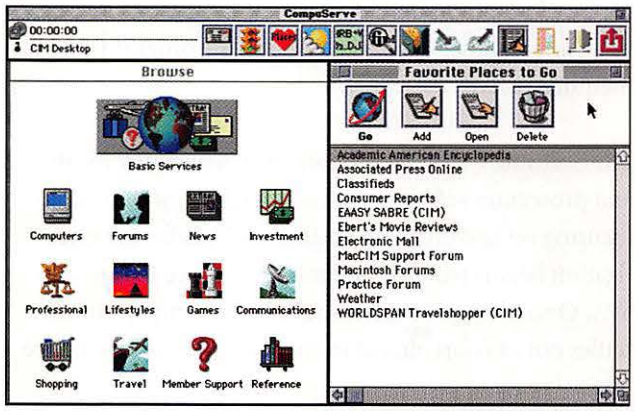
Here's a list of a few of the things you can do with an information service:

- Take part in discussion groups
- Send E-mail to other subscribers
- Set up electronic conferences
- Download shareware and freeware
- Obtain updated versions of applications
- Shop and advertise in the "classifieds"
- Shop for retail goods in electronic "malls"
- Obtain up-to-the-minute stock quotes
- Buy airline tickets and reserve travel accommodations
- Play chess and other interactive games
- Look for information in online encyclopedias and almanacs

Using an Information Service

In general, you subscribe to an information service by paying a monthly rate. You may also be billed for connect time charges for certain services. Once you have subscribed, you can simply use your modem to connect to the service, logon, and access the various services through the user interface, which is usually a menu system. However, some information services have GUIs that make them much easier to use. The interface shown here is called the CompuServe Information Manager.

CompuServe and America Online are popular hangouts for Mac fans. You're likely to meet industry bigwigs in the discussion areas, as well as everyday folks trying to get the most out of their Macs.



The Internet

Similar to an information service, but more like a public WAN, is the Internet, the largest network in the world. The **Internet** (often referred to simply as the Net) is a network of networks that forms a worldwide information web among universities, businesses, and government agencies and research facilities. It was started as a tool to help scientists share information, but it has grown into a huge multipurpose network.

The most popular feature of the Internet is its E-mail system. With an account on the Net, you can send messages to millions of users around the world. Most Internet nodes also have access to USENET, a collection of several thousand discussion groups. Finally, most of the nodes on the Net have public files on them that can contain all kinds of information. There are several tools available to Net users for locating specific types of files.

The Dangers of Connectivity

Data communications—using a network, a modem, or both—offers opportunity, to be sure. But it also poses certain threats. Software manufacturers are made more vulnerable to piracy as connectivity increases. As businesses build LANs and WANs, they jeopardize the very security of the data they store there. And just as individuals can benefit from getting online or using a network at work, they can also be stripped of their privacy through the same systems.

More Problems with Software Piracy

The biggest loss of revenue from software piracy is due, not to home users, but to businesses that buy single-use copies of programs and load them onto network servers or let any number of employees load the programs onto their hard drives.

The Software Publishers Association, which investigates and prosecutes software pirates, spends most of its time focusing on law-breaking businesses. Usually, the investigation begins with a disgruntled employee calling the SPA. Once the investigation begins, the company often settles out of court almost immediately, because software piracy is easy to prove.

The SPA also occasionally investigates BBSs and information services for making copyrighted software available to subscribers. Once again, it is not difficult to catch the culprits, once a report has been made to the SPA.

Corporate Security and the Criminal Hacker

Software developers aren't the only businesses to suffer at the hands of computer criminals. Almost any business can be hurt if sensitive company information gets into the wrong hands. And with LANs, WANs, and remote access numbers for telecommuters and businesspeople on the road, a great deal of company data is available to anyone who can logon to the business's network.

The press frequently uncovers stories of **hackers**, computer experts who use their skills to break into corporate or government computer networks with the help of a modem and a remote access number. To be fair, the original definition of a hacker is a skilled programmer, so it is more accurate to identify the lawbreakers as "criminal hackers."

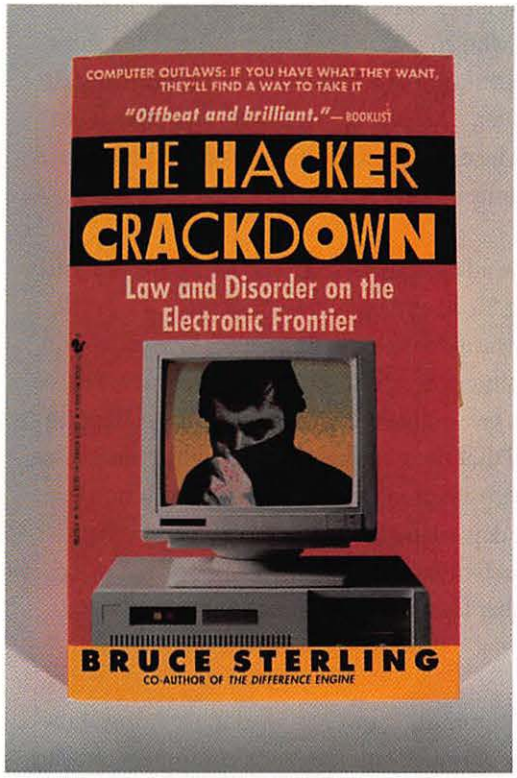
In general, the goal of the criminal hacker is to figure a way through a network security system, usually by finding a password for someone who has broad access privileges or by getting around the password system completely. Once the hacker has broken in, he or she is free to look at files, alter them, or destroy them.

It's amazing how often systems are compromised by user carelessness with passwords. Don't ever give your password to anybody else.

At first it might seem odd that someone would want to break into a corporate computer system. But just consider all the organizations that store their records in computer networks: the federal government, the phone companies, credit card companies, scientific research groups . . . the list goes on and on.

The Hacker Crackdown There are three primary ways that organizations try to deter the criminal hacker. The first is well-designed logon systems and tight control of access privileges. The second is by calling on law enforcement for a crackdown. But the legal issues are sticky, and few law enforcement officials are trained in the highly technical area that they are trying to police. In several cases, hackers have had their rights abused with unjust arrests or confiscation of valuable equipment. Several fascinating

books have been written on the hacker phenomenon and the crackdown. The best known is the one shown here:



In response to the law enforcement crackdown, there is now a nonprofit agency called the Electronic Frontier Foundation (EFF), which gives legal aid to computer users and programmers whom the foundation believes are being unjustly prosecuted. The EFF also develops policies and conducts lobbying efforts on issues related to intellectual property and privacy laws.

Data Encryption A third way to increase security is to use **data encryption**, encoding data that is sent through communication channels or stored on a network. With encrypted data on a network, the only thing a criminal hacker can do is erase files—a pointlessly malicious crime, since the hacker doesn't know what is being erased.

Data encryption works by altering bits according to a mathematical algorithm. The government's approved form of encryption, known as DES (for Data Encryption Standard), uses a seven-character key to encode and decode data. A key this size means that data can be encoded in over 7×10^{16} different ways, making it almost impossible to decode data without an extremely powerful computer and lots of time.

Computerized Threats to Personal Privacy

The power of the computer network can also be used against individuals, including not only employees who use a network at work, but also people who never even touch a computer.

Monitoring the performance of workers through a network is actually a fairly common practice. Employers have been known to use their access privileges to examine employee files, including correspondence and E-mail messages. It is also possible to gauge how fast employees are working. For example, with a sales force that works on the phones, an employer can check to see how many sales calls each salesperson makes per hour. With data entry personnel, employers can see how many keystrokes per minute each worker is making.

Many people are offended by these practices, but in cases where individuals have brought their employers to court, the courts have tended to side with the businesses. After all, there is no explicit constitutional right to privacy at work, and the computers and networks in such cases belong to the businesses.

Many individuals are also bothered by businesses that collect data about people who are not their employees. People leave a trail of data every time they use a credit card, subscribe to a magazine, take out a loan, rent a house, or go to the doctor. Some businesses make their money by collecting this data and selling it back to other businesses. The best known are the credit rating companies, which collect records from creditors to build credit histories on individuals.

Other companies specialize in mailing lists, which other companies use for direct-mail marketing. A mailing list company collects information about the magazines that people subscribe to and the products they buy. It then sells this information to companies that are looking for customers who match a certain profile. For example, if you owned a company that made high-quality tennis balls, it would be very valuable to know the addresses of people who subscribed to tennis magazines. With such a mailing list, you could send brochures directly to the customers who are most likely to purchase balls from you.

Ever-Increasing Flexibility

In the information age, communication is vital. Your ability to tap the full power of your computer is ultimately dependent on your ability to connect and communicate with other users and other computer systems where information is stored. Using a network, a modem, or an information service is just the beginning, but it is an important beginning. These skills allow you to extend the power of your machine beyond your immediate vicinity.

As networks grow together, however, an immense wilderness of information will form. To explore that wilderness effectively, you will need to expand your data communication skills, and keep expanding them throughout your life.

Telecommuting

One of the first benefits that data communications can offer is mobility. Businesses have offices so that employees can gather together, communicate, cooperate, share information, and share office equipment. But if your primary business tool is a computer, and you can stay in touch with the office through your modem, then you should be able to maintain a high level of productivity either at home or on the road.

The past few years have seen massive growth in the number of people who work either part time or full time at home. Many of these people are freelance workers who operate a business out of their homes, often relying on their computer skills. But many others are full-time employees who engage in **telecommuting**: They work at home, but stay in touch with the office with the help of a computer, a telephone, a modem, and often a fax machine. The drawing at the bottom of this page shows a typical home office.

Some of the advantages of telecommuting are extremely compelling. Road congestion and pollution are eased. Time isn't wasted in the car. Employees save money on gas, car maintenance, food, and even insurance. Businesses can save on office space. In many cases, employers have found that their employees' productivity increases, because there are usually fewer distractions at home during the day, and because workers recognize that their productivity is measured in terms of what is accomplished rather than the number of hours spent at the office.

Not all telecommuting involves working at home, however. Businesspeople with notebook computers can stay in touch when they are traveling. And salespeople can communicate with a central office when they are on the road making sales calls.

Massive Connectivity

In the evolution of business computing, one logical step was the formation of LANs to connect the computers in a single office. The next step was for businesses to connect multiple LANs to create WANs. With a large WAN, a business could connect most of its computers nationwide or worldwide. At the same time, individual users have been subscribing to bulletin boards and information services to satisfy their individual information needs.

But connecting all the computers in a single business and subscribing to information services isn't the end of the rainbow for connectivity. In the information age, businesses often need to cooperate in order to compete effectively. Many businesses are now finding that cooperation is easier when they connect their networks and create even larger WANs. And individuals are finding that they want more and more information and services from their information services.

The Data Superhighway Because communication can help businesses compete, the federal government may be able to help business by providing—or promoting—an infrastructure for data communication. This is the idea behind the data superhighway. According to the plan, the **data superhighway** would be a massive web of fiber optic cables that span the country.

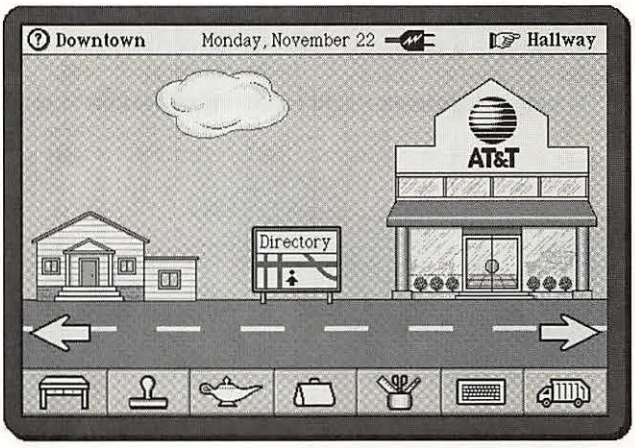
The benefits of the data superhighway could be tremendous, with effects as wide-ranging as those of the interstate highway system. People and businesses could move huge amounts of data across the country instantly. Shopping could become an electronic activity. Vast amounts of information could be available with the push of a button. Audio tapes and video movies and documentaries could be stored digitally and put into libraries, where they could be borrowed, rented, or sold. Truly interactive television would become possible. There's really no telling what will happen.

Knowbots Versus the Infoglut Think of the possibilities: Turn on your TV and have 500 channels at your fingertips. Tap into your favorite information service and choose between tens of thousands of discussion topics, a classified ads section that covers the globe, an E-mail directory that includes everyone who has a computer, databases filled with almost all the facts you ever need to know. With all this information at your fingertips, you have one big problem: How do you find just the information that you care about or need?

The growth of data communications is going to bring us **infoglut**, the overabundance of information. As a computer user, one of your central goals will be battling infoglut. Already, there are some strategies for tackling the problem. One of them involves programs called **information agents**, also known as **knowbots**—programs that are capable of ranging through file systems and databases in search of specific kinds of information.

Active E-mail users already feel the burden of infoglut. Some E-mail systems let users filter out messages that don't match certain criteria—allowing messages from the boss to pass, but automatically deleting general messages addressed to everybody on the network.

Already there are companies that give users access to knowbots. General Magic, for example, makes a program called Magic Cap, in which users navigate around a "Downtown" where several information services are available. The screen below shows the AT&T building, where you can use information agents to obtain many kinds of information. For example, you might want to get the best price on an airline ticket to Paris. You can fill out an electronic form, and the electronic agent monitors the ticket reservation system for you, sending a report when it finds a good deal. With well-designed agents at your service, a worldwide network could be a gold mine rather than just a deep pit of frustration and wasted time.



Visual Summary

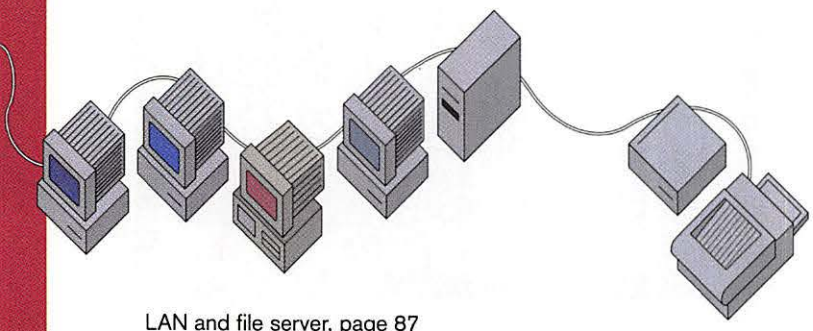
The Evolution of Networking

- Mainframe computer users work at terminals that are connected to a central computer, housed in its own room.
- An information systems department maintains and writes programs for the mainframe.
- A mainframe system tends to create a highly centralized information system.
- Microcomputers, when networked together, offer a more flexible system for meeting the information needs of users.

Networking microcomputers, page 85

The Advantages of a Network

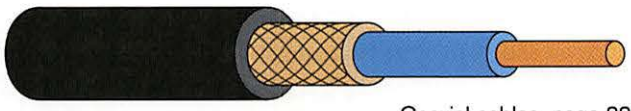
- A local area network, or LAN, connects computers that are close to each other.
- A wide area network, or WAN, is a network or LANs covering a large geographical area.
- A simple LAN makes it easy for users to share files.
- A file server provides a central storage facility for a network.
- A print server controls the flow of data to shared printers on a network.
- Connecting peripherals to a network is a cost-efficient way to give users access to expensive peripherals.
- Networks let users to send written messages via E-mail.



LAN and file server, page 87

Network Hardware

- The most common ways to connect computers in a network are with twisted-pair wires, coaxial cables, or fiber optic cables.
- AppleTalk, Apple's proprietary network protocol, uses LocalTalk cables.

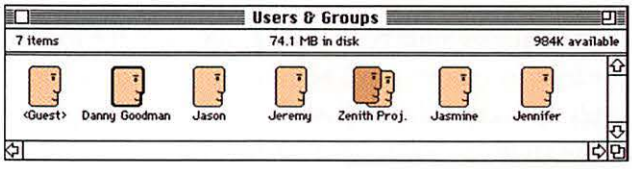


Coaxial cables, page 88

- It is also possible to connect computers, or make bridges between LANs, using wireless communication channels.
- Macs and PCs require an internal hardware interface and a port to connect to a LAN.
- Each network protocol requires a specific topology, usually a daisy-chain, bus, or star topology.

Network Software for the Macintosh

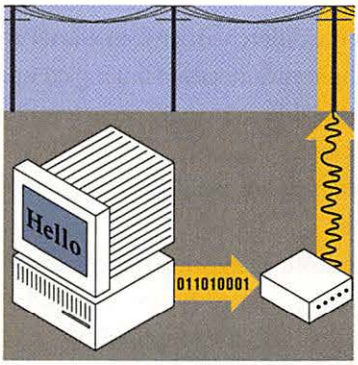
- AppleTalk networks are referred to as "plug-and-play" because it is easy to expand the daisy-chain topology, and System 7 includes the necessary network software.
- An AppleTalk network is described as peer-to-peer and workgroup computing.
- To set up your Mac to be part of an AppleTalk network, you must give yourself and your computer names in the Sharing Setup control panel, then determine the access privileges for the owner, users, guests, and groups.



Users and groups, page 90

- You can determine who has access to what files on your Mac in the File Sharing dialog box.
- Apple File Exchange allows a Mac with a SuperDrive to read from, write to, and format DOS disks.

Modems and Communication Software



- A modem modulates and demodulates sets of data between digital and audible signals.
- Using a modem requires communication software.

Modems, page 92

- To establish communication between two computers, the two modems must be operating at the same speed and using the same line settings.
- The most common line settings are 8-N-1.
- Uploading means sending a file. Downloading means retrieving a file.
- Transferring files requires a protocol, such as Kermit, Xmodem, or Zmodem.

Getting Online

- To get online, you must first logon.
- Bulletin board services let users participate in electronic roundtable discussions.

- BBSs can be valuable for finding information, generating ideas, or sharing your interests with others.
- Information services often include discussion groups. They also offer many other features, such as E-mail, electronic shopping, software libraries, and games.

Information services, page 95

- The Internet is a network of networks connecting universities, businesses, and government agencies and research facilities.

The Dangers of Connectivity

- The most significant threat of software piracy comes from businesses.
- The Software Publishers Association spends most of its time investigating businesses and BBSs.
- The security of business data can be threatened by criminal hackers, who use their computer skills to break into networks, usually through remote access numbers.
- Businesses try to deter criminal hackers with tight network security, the threat of law enforcement, and data encryption.
- Personal privacy can suffer at the hands of computers, when networks are used to monitor employee performance or look at personal files, or when databases are created to track credit histories or purchasing habits.

Ever-Increasing Flexibility

- Data communications can aid the mobility of the user, making telecommuting possible.
- The data superhighway is one step toward massive connectivity and a potential competitive edge for American businesses.
- With huge networks, a central problem is how to find the information you need.
- One strategy for combating infoglut is the creation of knowbots, programs that roam through file systems and databases looking for specific kinds of data.

Home office, page 98

New Terms

After completing Chapter 5, you should understand the following terms. They appear in bold in this chapter and are listed in the Glossary.

8-N-1
access privileges
Apple File Exchange
AppleTalk
bandwidth
baud
bits per second (bps)
bulletin board service (BBS)
bus topology
coaxial cable
communication software
connect time charges
daisy-chain topology
data encryption
data superhighway
discussion group
diskless workstations
electronic mail (E-mail)
Ethernet
fax modem
fiber optic cable
file server
file transfer
FileShare
hacker
handshake
host mode
infoglut
information agent
information service
information systems department
Internet
knowbot
line settings
local area network (LAN)
LocalTalk
logoff
logon
modem
network administrator
node
online
peer-to-peer network
print server
protocol
star topology
telecommuting
thread
time-sharing
Token Ring
topology
twisted-pair wire
user group
wide area network (WAN)
wireless communication
workgroup computing

Chapter Exercises

Review Questions

1. What is the difference between a LAN and a WAN?
2. Name three advantages of linking computers to form a LAN.
3. What is the difference between a terminal and a diskless workstation?
4. List three network topologies and name a protocol that uses each one.
5. Name the four categories of users on an AppleTalk network.
6. What is the purpose of Apple File Exchange?
7. Explain what the line settings 8-N-1 mean.
8. What services do BBSs and information services have in common?
9. Describe two things that corporations do to protect their files from criminal hackers.
10. How can a knowbot address the problem of infoglut?

Use Your Imagination

1. Why do you think the plans for the data superhighway include using fiber optic cables as a communication channel?
2. Imagine a telephone system in which voice communication is transmitted and stored digitally. Describe two advantages that such a system could have over the existing telephone system.
3. Imagine a universal E-mail system to which virtually everyone had access. How might such a system affect our postal system?
4. What would be the advantages of linking the computers in a LAN, using wireless communication channels?
5. Describe three discussion topics that you would like to join on a bulletin board service.

Beyond the Book

1. If the computers in your school's computer lab are connected to form a LAN, what network protocol is being used and what is the topology of the LAN?
2. Find out if your school has an Internet node and how you can get an account to use it.
3. Does the computer lab have a print server? If so, how many printers are connected to it?
4. Write a half-page report on the most recent progress that has been made on the data superhighway project.
5. Research and write a one-page report comparing current transmission speeds in hardwired networks versus wireless networks.

Programming

6

UP TO THIS POINT, you have been learning about software from the user's point of view. Each piece of software that you learn to use gives you added freedom, letting you do new things with your computer. To gain even greater flexibility, however, you need to take the next step: learning to create software. The process of creating software is called **programming**.

Objectives

When you have finished this chapter, you will be able to do the following:

- Describe how programming languages have evolved from machine languages to the fourth-generation languages.
- List five third-generation languages.
- List the five steps in the traditional programming process.
- Describe the most important techniques of structured programming.
- Describe the difference between object-oriented programming and programming with a procedural language.
- Name and describe five types of fourth-generation languages.
- Identify three ways in which HyperCard can be used.
- Define the primary elements of a HyperCard card.
- Explain how AppleScript can be used.

Contents

104 A History of Programming: The First 40 Years

106 Traditional Programming with Third-Generation Languages

107 Object-Oriented Programming

108 Fourth-Generation Languages

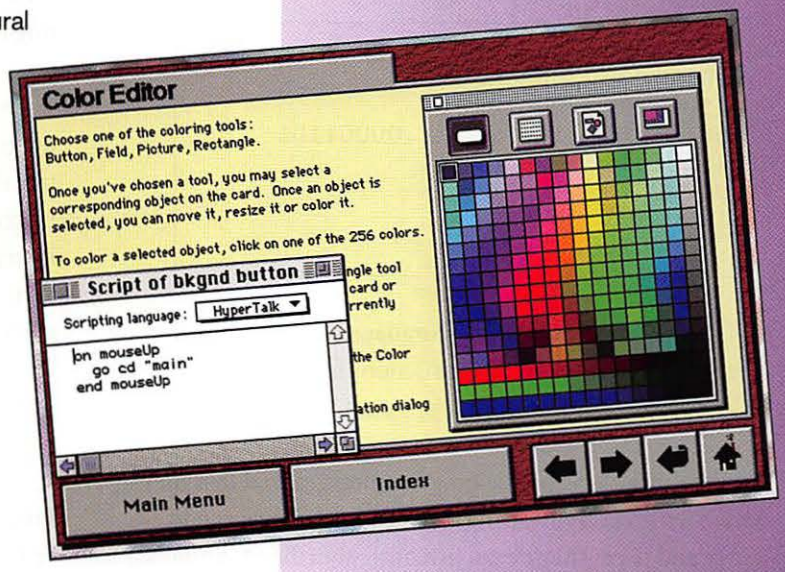
110 The Power of HyperCard

112 AppleScript: System-Level Scripting

113 Freedom

114 Visual Summary

116 Chapter Exercises



A History of Programming: The First 40 Years

Like most computer-related skills, programming isn't what it used to be. It began in the 1940s as an incredibly labor-intensive task that required writing out strings of ones and zeros that nobody outside the field could understand.

Over the years, as programmers built on what was done before, programming became a more intuitive and less mysterious skill. Today, with the latest generation of programming languages, even relatively inexperienced users can begin to learn programming.

The Early Days of Programming: First- and Second-Generation Languages

In the early days of computing—back in the 1940s—using a computer required writing programs, because there simply wasn't any software for sale. And writing programs required writing out the strings of ones and zeros that the computer could understand (see Chapter 2). There is still a small amount of programming that's done this way. It is known as programming in **machine language**, because it involves writing code that the machine understands. This is what machine language looks like:

The earliest microcomputers of the 1970s had to be programmed in machine language. This was also before keyboards and video monitors were available for personal computers. Programming entailed setting eight switches to enter each alphabet character.

```
10111010   00000000
10111000   00000001
11001101   00010101
00111010   11111000   00001101
11101011   00000110
01000010
11001101   00010101
01000010   00001000
```

In general, a **programming language** is any set of words or symbols used to write instructions for a computer. **Code** is just a short word for program instructions.

It didn't take long before programmers realized that they were writing certain strings of machine language code over and over. They began inventing shorthand symbols to represent these strings. The results of their efforts were the first symbolic computer languages, known as **assembly languages**. The assembly languages became known as second-generation languages, and the machine languages as first-generation languages. Assembly languages dominated programming during the 1950s. This is part of a program written in assembly language:

```
; read string
      MOV     DX,0
      MOV     AH,1
      INT     21h
; count characters
WHILE:
      CMP     AL,0DH
      JE      ENDWHILE
      INC     DX
      INT     21h
      JMP     WHILE
; print result
ENDWHILE:
```

Enter the Third-Generation Languages

In 1954, FORTRAN, the first third-generation language, was invented by John Backus. Since then, many others have appeared, including COBOL, BASIC, Pascal, and C.

There are three primary features of third-generation languages. First, they are largely machine-independent. In other words, a program written in a third-generation language is not written for a specific type of processor. If you write a program in BASIC, you can use that program on a Mac, a PC, or a VAX minicomputer—though you might need to make some minor adjustments.

The second feature of third-generation languages is that programs require either an interpreter or a compiler to translate the program into machine language. An **interpreter** is a program that translates the language while the program is running. A **compiler** translates the program before it can be run.

An interpreted language is easier to work with while learning to program, but the language must be loaded into memory for the program to run. Early commercial computers, like the Apple II and original IBM PC, included an interpreted version of BASIC in ROM, so it was always available.

Finally, third-generation languages are known as procedural languages because they force the programmer to develop a structured series of procedures or steps to accomplish the goal.

In general, then, a **third-generation language** is a machine-independent procedural language that requires an interpreter or a compiler.

The Most Popular Third-Generation Languages

Although there are many third-generation languages, a handful have dominated the field. Each was created for a different purpose, so each has certain strengths and weaknesses. Here are explanations of the most commonly used languages and a few lines of code written in each.

FORTRAN Specifically designed for creating applications in mathematics, engineering, and science, **FORTRAN** is still used for these kinds of programs.

```
PRINT *, 'Enter a line of text.'
READ (*,*) LINE
LENGTH = LEN(LINE)
PRINT *, 'No. chars. = ', LENGTH
END
```

COBOL Another early third-generation-language, **COBOL**, is widely used on mainframes and minis for creating business and accounting applications, such as payroll and inventory systems.

```
PROCEDURE DIVISION.
    DISPLAY "Enter a line of text."
    ACCEPT IN-LINE
    INSPECT IN-LINE TALLYING COUNT
     FOR ALL CHARACTERS BEFORE EOL
    DISPLAY "No. chars. = ", COUNT
    STOP RUN.
```

BASIC The Beginners All-purpose Symbolic Instruction Code (**BASIC**) was created by John Kemeny and Thomas Kurtz as a language for teaching programming to their Dartmouth students. It is extremely popular among nonprofessional programmers who need to create relatively small programs.

```
10    REM Character count program
20    PRINT "Enter a line of text."
30    INPUT LINE$
40    PRINT "No. chars. = "; LEN(LINE$)
50    END
```

Pascal A highly structured language, **Pascal**, was also created as a tool for teaching programming and grew to become an important language in its own right.

```
begin
   count := 0;
   writeln ('Enter a line of text.');
   repeat
      count := count +1;
      read (ch);
      if not eoln
         then line[count] := ch
   until eoln;
   writeln ('No. chars. = ',count)
end.
```

C First developed in 1972 at Bell Laboratories by Dennis Ritchie, C was specifically designed to be highly machine-independent. C is the most popular language for creating microcomputer applications.

Most of today's young programmers regard FORTRAN and COBOL as dead languages. They prefer to work in C and Pascal. Occasionally, a program may have parts written in assembly language, which is more difficult to write, but runs faster.

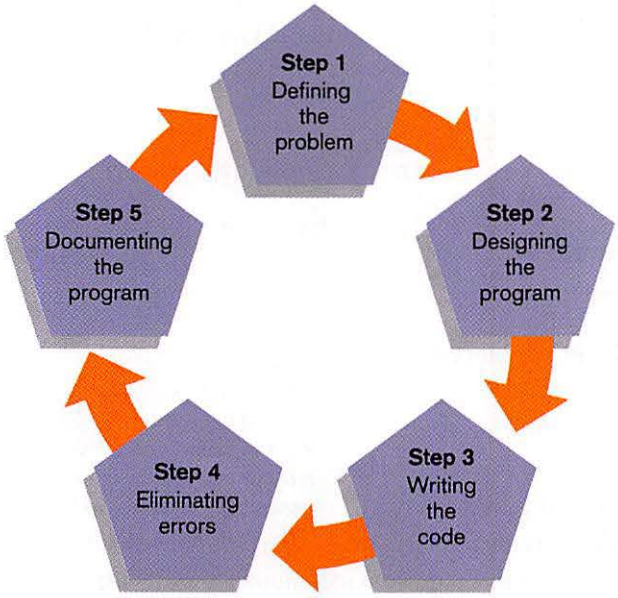
```
main()
{
     puts("Enter a line of text.");
     gets(input);
     length = strlen(input);
     puts("\nNo. chars. = %u.",length);
}
```

Traditional Programming with Third-Generation Languages

Third-generation languages have been around for some 40 years now, and programming with them has become part art and part science. Until the mid-1980s, most successful programmers developed software according to a well-established set of five steps. At the core of the process was the philosophy of structured programming.

The Programming Process

If you have ever studied problem-solving, the five steps that outline the programming process may look familiar.



The five steps form a ring because problems, and the programs that solve them, continually evolve. You see, a program is only a temporary solution. As soon as it's complete, users begin to see the problem more clearly. This process leads to new definitions of the problem, and revisions of the program. The programming cycle is one reason for the constant barrage of software upgrades.

Creating a software program is generally an iterative process, going round and round until the software performs the job it was intended to do.

Principles of Structured Programming

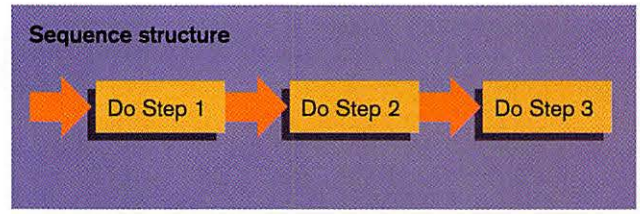
From the programmer's point of view, the heart of the programming process is *Step 2: Designing the Program*. The traditional method of design, which is built into some of the most popular languages, such as C, is called **structured programming**. Structured programming is actually a rather vague term that encompasses several strategies.

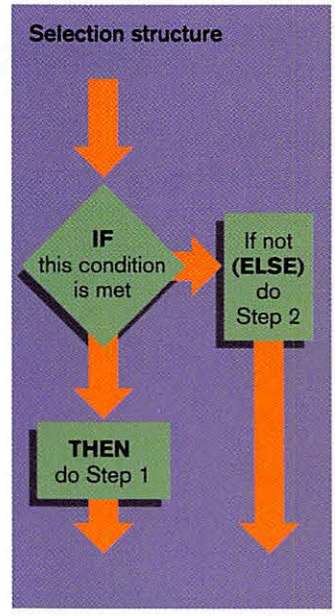
The more time spent on Steps 1 and 2, the faster the rest of the process becomes. Inexperienced programmers are often too quick to jump into programming, and end up discarding lots of code when the lack of planning sends them down blind alleys.

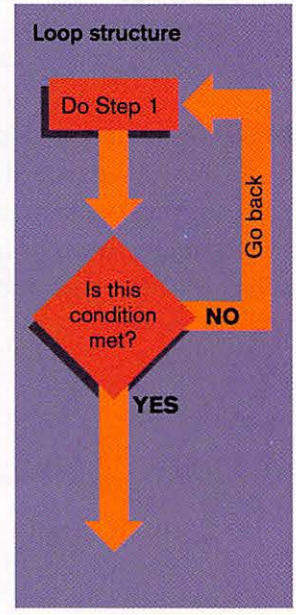
Top-Down Design The most basic strategy of structured programming is top-down design. **Top-down design** means that you start with the central task that needs to be accomplished and break it down into smaller and smaller tasks until every one of them is simple and manageable.

Creating Flowcharts and Pseudocode There are two common tools for creating top-down designs, flowcharts and pseudocode. A **flowchart** is a graphical tool for diagramming the logical structure of the program. Writing **pseudocode** is a bit like sketching out a story line before you worry about writing style, grammar, and spelling.

Using Logic Structures The building blocks of all procedural languages are the **logic structures** that establish the sequence of steps in which the program is executed. Surprisingly, there are only three types of logic structures: the sequence structure, the selection structure, and the loop structure.







Object-Oriented Programming

The biggest trend in the use of third-generation languages is the move toward object-oriented programming. It is so significant, and such a break from the techniques of traditional, structured programming, that many programmers are calling C++ (pronounced "see-plus-plus) and the other object-oriented languages part of the fourth generation.

A New Way of Thinking

Object-oriented programming, or **OOP**, requires thinking about a program's design very differently from the way it's done in procedural programming. Instead of the program consisting of a sequence of instructions, an object-oriented program creates software **objects**—which are often objects that the user sees on the monitor. For example, an on-screen data entry form could be designed as an object. It could contain other objects, such as the fields where the user enters information, or a button the user clicks on to save information to the disk.

With OOP, the programmer's job is to define the characteristics and behavior of each object, and then to establish how the program's objects work with each other. For example, when the user clicks the "Main Menu" button on the HyperCard card shown below, the button object tells the program to display the main menu screen that controls the HyperCard stack, or document.

When you buy an object-oriented language, such as C++, the software package typically comes with libraries of existing objects. Each of these "master" objects is called a **class**, and each has its own behavior. Programmers can create copies of the objects to use in their own programs, making modifications as necessary .

OOP is fun to work with, because it eliminates a lot of drudgery.

OOP and GUI

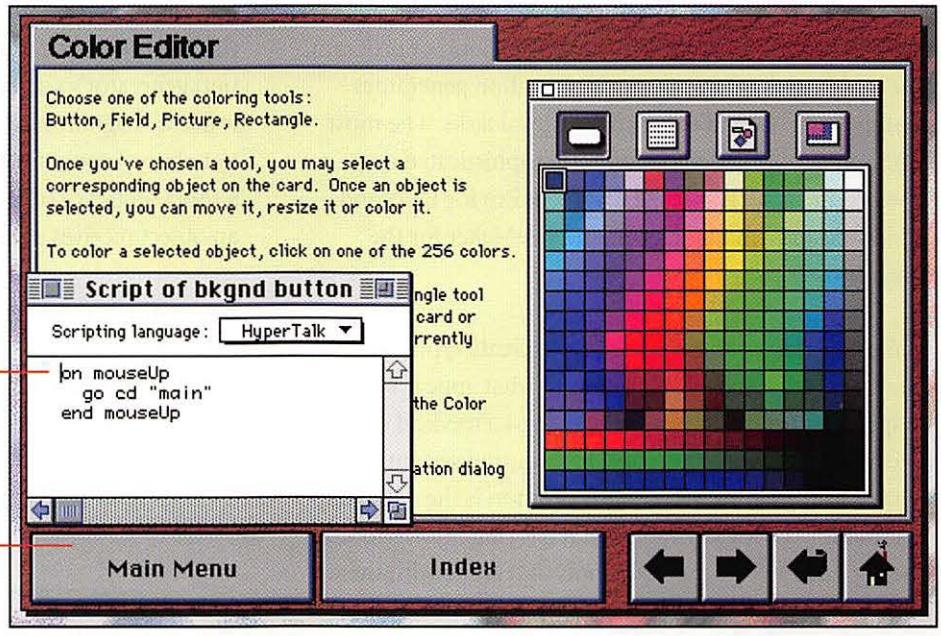
Graphical user interfaces, such as the Macintosh, lend themselves very well to object-oriented programming. When you start a Macintosh application, a lot of the time spent in loading the program is devoted to creating objects in memory, such as windows and buttons. Once the objects are defined in memory, the program waits for the user to do something. Any action, such as clicking a button, choosing a menu item, or typing into a field, sends messages from one object to another.

The job of programming becomes that of defining the objects and deciding how they should respond to user actions. This is not to say that programming a word processor or spreadsheet program is easy. In fact, the constant demands for more features and increased intelligence on the part of the program make programming a tremendous challenge. But with the help of object-oriented languages, the challenges can be met much more quickly.

This HyperCard card tells the user how to use the HyperCard Color Editor. Each button at the bottom of the card is controlled by an OOP object. The code for the object is written in HyperTalk, the OOP language behind HyperCard.

This window shows the object-oriented code that controls the Main Menu button.

Main Menu button



Fourth-Generation Languages

Most large-scale software development is done with third-generation languages (if you include the object-oriented languages in the third-generation). But now newer types of languages, called fourth-generation languages, are making programming easier and easier, so that program development is now possible for the average user.

Ask a few programmers what a fourth-generation language is, and you're not likely to get a very good definition. Everyone seems to have a different idea about it. In general, the products called **fourth-generation languages** are designed for specific areas of program development. These include code generators, application generators, scripting and macro languages, authoring tools, and query languages.

Code Generators

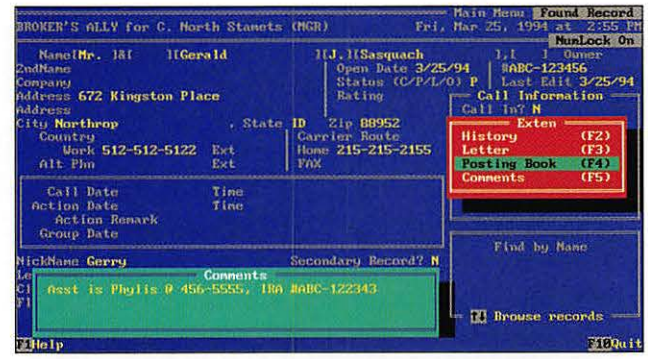
A number of high-level tools are available for serious programmers, who typically write in languages such as C and Pascal. Among these tools are those that let the programmer design some or all of the program by clicking and dragging elements on the screen. These tools automatically create the C or Pascal code for the programmer. This code is then joined with the rest of the code written by the programmer and, together, compiled into the final program.

Application Generators

The term **application generator** might lead you to believe that you can use such a tool to create any kind of program you could think of. In practice, application generators tend to focus on data entry and retrieval tasks. The most common application generators are sophisticated database products, such as dBASE and FoxPro for DOS and Windows, and 4th Dimension and FileMaker for the Macintosh.

While you can use these programs to create typical databases, it is also possible to create what appear to be special-purpose applications, such as a medical office automation system or personal calendaring system. What these applications have in common is the database's facilities for storing, sorting, and retrieving information. The application designer uses tools that come with these databases to design the menus, forms, and buttons that the user sees on the screen. The user may be unaware of the database program that handles the information.

For example, the figure below comes from Broker's Ally, a program that helps stock brokers keep track of their clients ans accounts.



This application software was programmed using a database product named BTrieve, which is a competitor of dBASE. Although some users think of BTrieve and dBASE as applications, they are really much more like programming languages. The languages, however, are more specialized than third-generation languages like C and Pascal, and that's why they are often called application generators.

Scripting Languages and Macro Languages

Much of the work of designing a program with an application generator consists of laying out fields and buttons on the screen with the aid of a mouse. Much of the detail work is performed with the help of the application generator's scripting language. A **scripting language** is like a programming language, although it typically (but not always) consists of plain-language words. A **script** is a short sequence of instructions to be carried out when an object receives a message.

For example, a data entry form might contain a script to insert the current date and time into appropriate fields whenever the user selects the "New" command from a menu. A hypothetical script for this action might look something like this:

```
on newRecord
     put the date into field "Date"
     put the time into field "Time"
end newRecord
```

In some programs, such as Microsoft Excel, the scripting language is also called a macro language. A **macro** automates a series of steps that the user performs frequently. Programs that have macro capability often allow the user to create the macro by recording the steps as the user performs them. The application software converts the process into the macro language code. From then on, the user can give a single command to play back the whole series of steps.

Authoring Tools

More flexible than database-oriented application generators are **authoring tools**, such as HyperCard for the Macintosh, which provide facilities for creating graphic designs, as well as data entry fields and action buttons. These tools are intended for nonprogrammers, so they provide a small set of well-defined objects whose behavior can be modified using dialog boxes that are associated with each object. Authoring tools are commonly used for multimedia presentations and interactive programs. This is because they let authors incorporate text, graphics, animation, video, and digital sound, blending multiple media into a single application. Authoring tools are often employed to provide application solutions when commercial software for the special need does not exist.

Authoring tools greatly simplify the programming tasks. They let everyday folks create professional-looking programs that publish information, train others, and manage information.

Most authoring tools also include their own scripting languages, which allow more experienced users to create their own versions of the buttons, fields, and scripts for truly customized applications. For example, as you saw two pages ago, HyperCard buttons are controlled by a scripting language called HyperTalk. Like many scripting languages, HyperTalk is object-oriented. You can see why many people consider OOP languages part of the fourth generation.

Query Languages

Personal computer users often need access to huge databases stored on mainframes and minicomputers. In the past, such information retrieval had to be performed only by the data processing department of the company.

Today, many large databases can be accessed by a friendlier **query language**. The best known is SQL, which stands for Structured Query Language. This query, for example, is written in SQL. The lines that follow the query are the results.

```
SELECT [First], [Last], [Phone]
FROM Contact.DBF
WHERE (AC="213")

Greg        Brady      555-1284
Vivian      Leigh      555-4993
Keiko       O'Brien    555-7854
James       Kirk       555-3341
Fred        Mertz      555-8882
```

Some personal computer database and spreadsheet programs include SQL capabilities. For example, a spreadsheet may include a script that triggers an SQL query of the mainframe database. The resulting information is inserted into the spreadsheet, where further calculations can be performed.

The Power of HyperCard

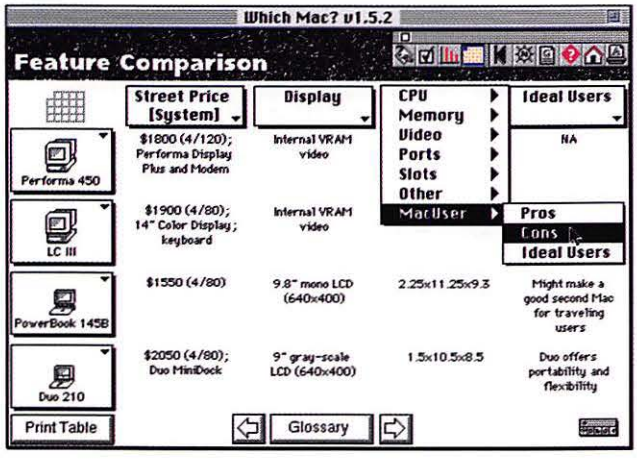
As I explained in Chapter 4, the HyperCard Player can be used as an application, which you use to open, read, and use HyperCard documents, called stacks. But HyperCard —the complete program, of which the Player is just one part—can also be used as a fourth-generation programming language. With it, you can create new stacks, which act like programs. To give you a better sense of what's possible, I'll show you a few examples of what you can do. I'll then explain the basics of how HyperCard applications are created.

What You Can Do with HyperCard

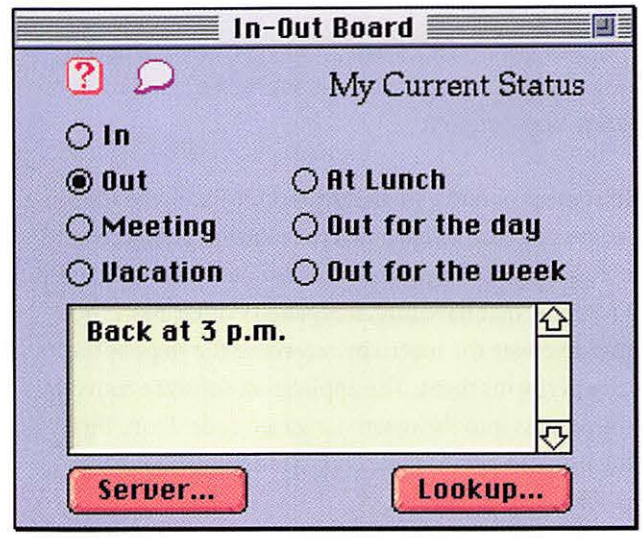
In Chapter 4, I gave two examples of what HyperCard stacks can do: They can act as interactive electronic books or as personal information managers, such as address books. Actually, there are countless ways you can use HyperCard. Users around the world have created millions of valuable HyperCard applications. Many of them are available in the software libraries of bulletin board services and information services. Here are a few examples.

Few authoring environments have sparked the imaginations of would-be programmers as has HyperCard. People with excellent ideas for programs have even found new careers as application and multimedia developers.

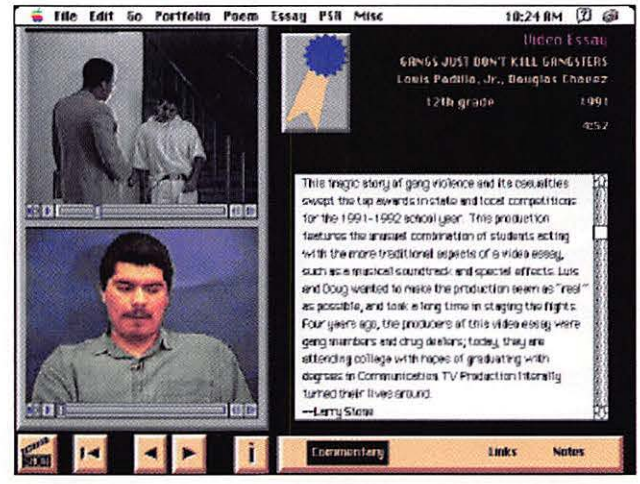
Which Mac Should I Buy? Some Macintosh colleagues and I created this stack, the purpose of which is to lead you through many of the decisions that you need to make when purchasing a Macintosh.



The In-Out Board The In-Out Board lets users on a network keep track of each other. No more will you wander the office looking for the boss who's already out to lunch.



Bell High School Video Portfolios This HyperCard stack, published on CD-ROM, shows videos made by students in a high school video production class. The second QuickTime clip tells about the student who made the video.



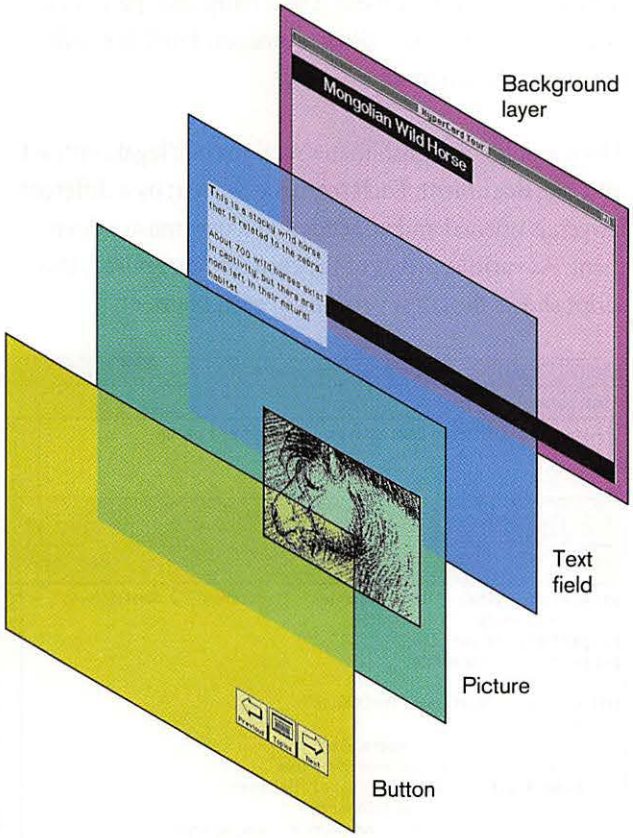
Stack Templates In the interest of helping people create new stacks, Apple distributes a set of templates that you can use to create your own stacks. This is a good place to start exploring the possibilities of HyperCard.

The HyperCard development kit comes with libraries of material you can copy and paste into a stack of your own creation. That's how most HyperCard users get started.

Using HyperCard

Creating HyperCard applications is a matter of building each card in a stack. To understand the process, you need to understand the anatomy of a card and see the main tools that you have to work with.

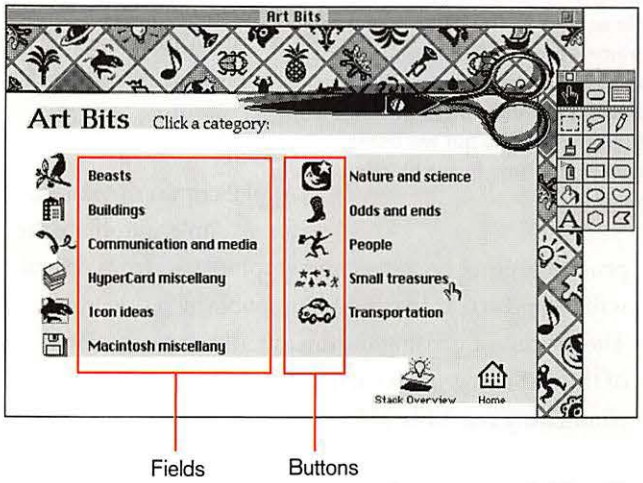
Cards and Backgrounds HyperCard stacks are constructed from different **card layers**, like pages of clear acetate piled on top of each other. Each layer has exactly



one element on it. Elements include pictures, text fields, and buttons. If an element from a higher layer is on top of one from a lower layer, the lower element is hidden from view. When editing stacks, however, you can always change the order of the layers.

There are two groups of layers in each stack. The elements that are common to every card in a stack are the background layers. The **background** acts as the template that you use to make the various cards in the stack. The elements that are specific to a particular card are in the card layer. If you want to make changes to the background, you must first choose Background from the Edit menu.

Fields and Buttons In HyperCard, you construct cards by adding buttons and fields and by painting images on the card or background. A **field** is an area on a card that contains text. In other words, fields contain data. You can create fields, determine what they can contain and how big they are, and set a number of other attributes.



Buttons, on the other hand, contain commands. The ability to add buttons is what qualifies HyperCard as a real programming language. Some buttons establish links between cards to let the user jump from one place to another in the stack. Other buttons can initiate actions, such as telling the computer to dial a telephone number or print a document.

HyperTalk While it is possible to create powerful applications by copying and pasting together fields and buttons from other stacks, you can customize the behavior of fields and buttons by editing or writing scripts in HyperCard's scripting language, called HyperTalk. The vocabulary of HyperTalk is virtually all common English words. And you can assign a script to a particular object, so that you can control exactly what a button does when you click on it, or how a card behaves when you arrive at it. For many HyperCard authors, HyperTalk was their very first computer programming experience. It allowed them to bring expertise in noncomputer fields to the Macintosh, providing colleagues and students with special-purpose programs that would otherwise never have been developed.

HyperTalk is one of the easiest programming languages to learn. But its power makes HyperCard a practical tool for even the most serious business and government applications.

AppleScript: System-Level Scripting

Although most macro and scripting languages work within the confines of individual programs, some also work at the system software level, automating work that involves multiple applications and hard disk management. Macro programs, such as QuicKeys, and system level scripting languages, such as AppleScript, let users customize the way programs work with each other and the way their systems work. An AppleScript script could, for example, automate the process of combining text and graphics files from several writers and artists into a desktop publishing document. The process of revising the document as new versions of the text and graphics arrive could be streamlined, eliminating repetitive DTP work.

AppleScript gives users relatively simple access to the innards of a program—formerly the private domain of the programmer. We'll still need programmers to create the building blocks, but we users will determine how those blocks fit together.

The Birth of AppleScript

For all the advantages of a GUI, such as the Mac's Finder, it does present a challenge for scripting languages. The problem is that "a picture is worth a thousand words." Writing scripts involves describing user actions relative to pictures on the screen. The actions can be described in many ways.

Recognizing the challenge, Apple Computer devised a scripting technology for System 7, called Open Scripting Architecture (OSA). **AppleScript** is a scripting language that lets you use the powers of OSA.

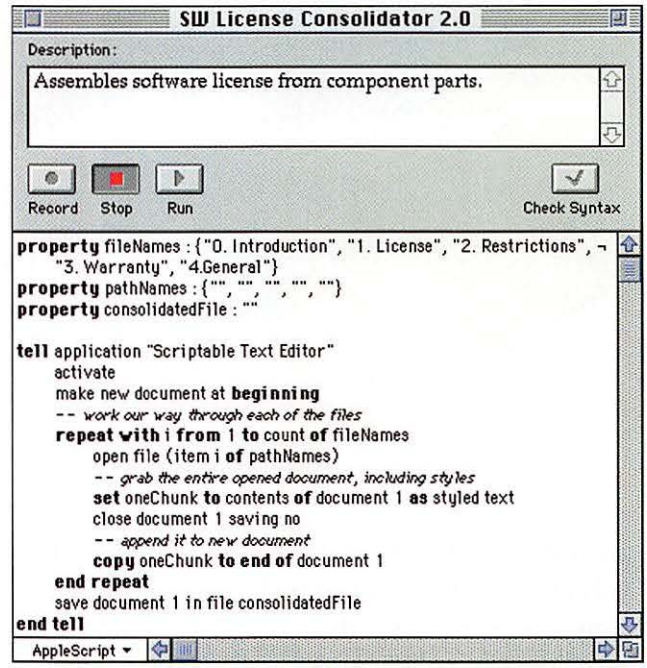
The advantage of system-level scripting is that AppleScript can work to control system software and numerous applications. In the ideal use of this technology, a script can automate the process of integrating data from otherwise incompatible programs. Instead of learning multiple languages, you can use a single language to work with all the scriptable programs.

Objects and Messages

Part of the magic that makes OSA and AppleScript work is the way that software developers have designed their programs to be scriptable by an external language. A key factor is defining the elements of each program's documents as objects. For example, in a word processing document, typical objects are characters, words, and paragraphs; in a spreadsheet, typical objects are cells, columns, and rows.

The importance of thinking about such items as objects becomes clear when you must describe in words the actions you perform on those objects. A script may need to extract data from a specific cell in one spreadsheet, then insert that value into a specific location within a word processing document. Describing each piece of a document as an object allows common English words to refer to the objects.

The script below consolidates sections of a legal contract into one document. Each segment, written by a different lawyer, is opened and appended to a new master document. As various pieces of the contract are revised, this script shows the latest versions of each segment.



Freedom

In the early days of computing, there was no difference between the computer user and the computer programmer. Computers were the domain of scientists who wrote programs to solve complex numerical problems. With the dawn of the corporate mainframe and business computing, the creation of programs became a career for both software developers, who were employed by the makers of mainframes, and information systems professionals, who worked for the company that bought the mainframe. The programmer was the person who knew all about computers, and the user was someone who knew what buttons to push to enter data or generate a report.

A More Sophisticated User

With the widespread use of microcomputers, such as the Mac and the PC, the difference between the user and the programmer is starting to fade into the past, like a chapter in the history of computing. There are two reasons for this evolution.

First, computer users are no longer just button-pushers. Having your own computer (whether you own it or your employer does) forces you to learn a lot about the machine and the software that runs on it. Take a look at the Glossary at the end of this book. By reading this book, you have been exposed to hundreds of new terms. The typical computer user of 20 years ago didn't know a tenth of them (though, to be fair, many of the terms didn't exist). The level of sophistication that you, as a computer user, have attained, brings computer programming within your intellectual grasp.

More Sophisticated Programming Languages

At the same time that users have been getting more sophisticated, so have programming languages. And more sophisticated languages, like sophisticated applications and operating systems, are ordinarily easier to use than their predecessors. HyperTalk is a perfect example. Here is a programming language that even a computer novice can begin to use. And the other fourth-generation languages offer similar examples. They all attempt to bring programming power to the computer user, blurring the lines between user and programmer.

For computers to become easier to use, programs must do more of the drudgery and anticipate user errors. So it is no accident that, as computers have become more user-friendly, the software has become larger and smarter.

You can safely assume that both trends will continue. Computer users will become more skilled, and programming languages will become even more intuitive.

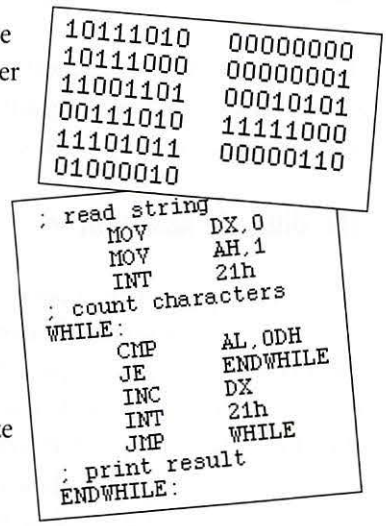
The Ultimate Assistant

Eventually, computer languages will become so sophisticated that the computer will write programs for you without your even knowing it, automating every possible process and freeing you to do whatever you do best. With tools like AppleScript, it is already possible to create what are known as agents. These programs are designed to work on behalf of the user in the background, just like a capable assistant. Eventually, sophisticated programs will be able to recognize patterns in your computing behavior, and create agents for you automatically. For example, the computer might recognize that you read your electronic mail each morning in a particular order. It could then create an agent that presorts the mail, automatically answering routine messages and deleting those that wouldn't be of interest to you. Essentially, the computer could become the programmer, freeing you to focus on aspects of your life that require the human touch—the parts that no computer, no matter how powerful, will ever replace.

Visual Summary

A History of Programming: The First 40 Years

- Machine language, the code that the computer understands, consists entirely of ones and zeros.
- Assembly languages, the second generation of programming languages, use symbols to summarize frequently repeated strings of machine language.

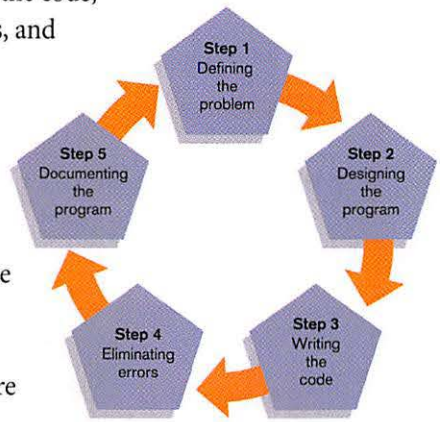


Programming languages, page 104

- A third-generation language is a machine-independent procedural language that requires an interpreter or compiler.
- Five of the most popular third-generation languages are FORTRAN, COBOL, BASIC, Pascal, and C.

Traditional Programming with Third-Generation Languages

- Programming is a five-step, problem-solving process that consists of defining the problem, designing the program, writing the code, eliminating errors, and documenting the program.
- Step 2, designing the program, is the stage for which the techniques of structured programming were invented.



The programming process, page 106

- Structured programming involves creating a top-down design.
- Programs written in procedural languages use three types of logic structures: sequence, selection, and loop.

Object-Oriented Programming

- Object-oriented programming takes a completely different approach than traditional, structured programming.
- With OOP, the programmer creates objects, which are often elements on the screen, such as data fields and buttons.
- Objects are defined in terms of their characteristics and behavior.
- Graphical user interfaces lend themselves well to object-oriented programming because each window, menu, palette, and button can be defined as an object.

Fourth-Generation Languages

- Fourth-generation languages tend to be designed for specific areas of program development. They include code generators, application generators, scripting and macro languages, authoring tools, and query languages.
- Most application generators let programmers create high-powered database applications.
- Scripting and macro languages let the programmer automate processes within the confines of a single application.
- Authoring tools, such as HyperCard, allow nonprogrammers to create applications that incorporate a wide variety of data types.
- A query language, such as SQL, is designed for obtaining data from large databases.

```
SELECT [First], [Last], [Phone]
FROM Contact.DBF
WHERE (AC="213")

Greg        Brady      555-1284
Vivian      Leigh      555-4993
Keiko       O'Brien    555-7854
James       Kirk       555-3341
Fred        Mertz      555-8882
```

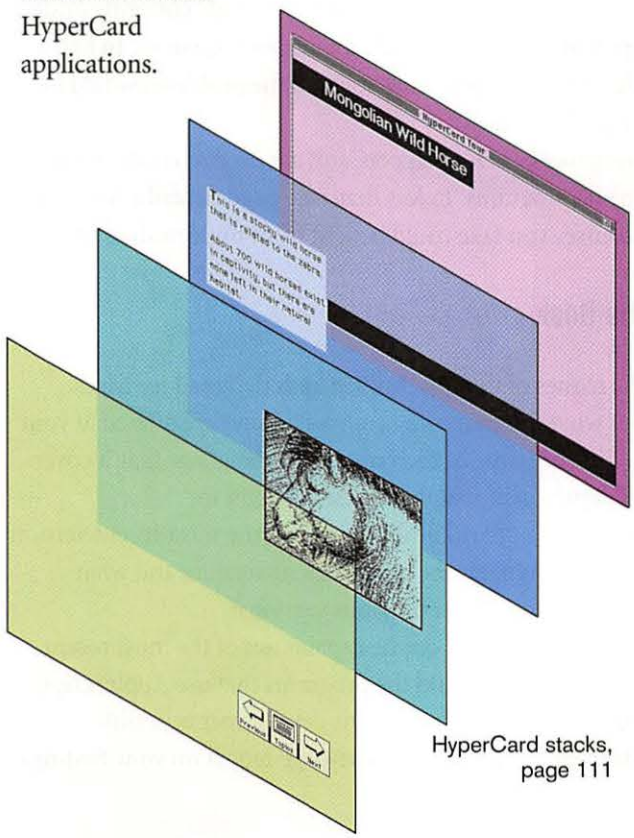
Query languages, page 109

The Power of HyperCard

- HyperCard applications are called stacks.
- Some examples of HyperCard stacks include "Which Mac Should I Buy" and "The In-Out Board."

What you can do with HyperCard, page 110

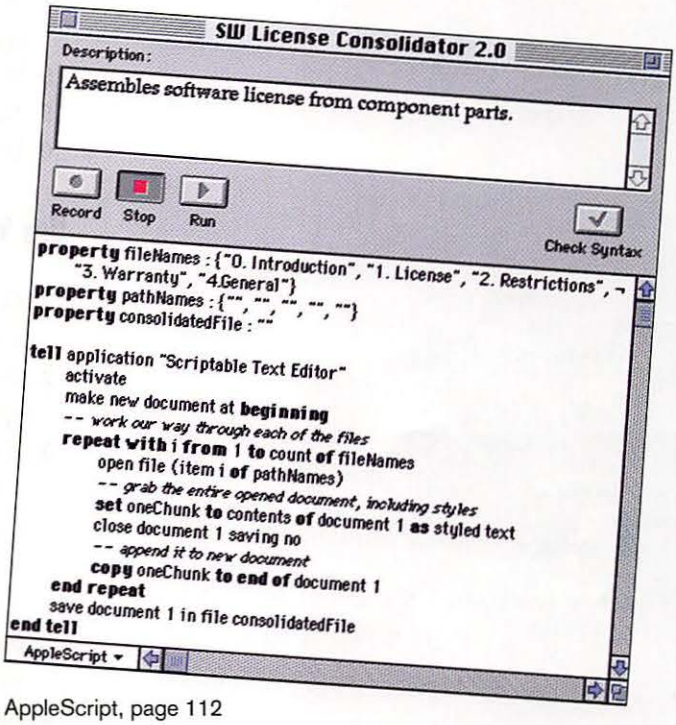
- HyperCard stacks consist of sets of cards.
- Each card can include buttons, fields, and images, each of which exists in a separate layer of the card.
- Fields contain text, and buttons initiate actions.
- HyperTalk, HyperCard's scripting language, lets you further customize HyperCard applications.



HyperCard stacks, page 111

AppleScript: System-Level Scripting

- AppleScript allows system-level scripting, which means that it lets users customize the way programs work with each other and the way the system works.
- AppleScript takes advantage of the new Open Scripting Architecture, devised by Apple and adhered to by many software developers.
- AppleScript is made possible by software developers using object-oriented programming.



AppleScript, page 112

Freedom

- When the computer industry was dominated by the corporate mainframe, there was a clear distinction between the user and the programmer.
- The widespread popularity of microcomputers has made the user more sophisticated.
- At the same time, programming languages have become more intuitive, so that today a high percentage of users are capable of programming with fourth-generation languages.
- Eventually, the computer itself may take over the programming process, freeing the user to do the things that require the human touch.

New Terms

After completing Chapter 6, you should understand the following terms. They appear in bold in this chapter and are listed in the Glossary.

AppleScript
application generator
assembly language
authoring tool
background
BASIC
button
C
card layer
class
COBOL
code
compiler
field
flowchart
FORTRAN
fourth-generation language
interpreter
logic structure
machine language
macro
object
object-oriented programming
Pascal
programming
programming language
pseudocode
query language
script
scripting language
structured programming
third-generation language
top-down design

Chapter Exercises

Review Questions

1. What is the difference between machine and assembly language?
2. What is the name of the first third-generation language, and for what types of problems is it best suited?
3. Name two languages created to help teach programming.
4. Name the five steps of the programming process.
5. Name the three logic structures used when programming with a procedural language.
6. Briefly explain how object-oriented programming differs from programming with a procedural language.
7. What types of applications are most often created with application generators?
8. What kind of fourth-generation language is SQL?
9. Name two types of actions that a HyperCard button can initiate.
10. What is HyperTalk?

Use Your Imagination

1. Describe a useful application that you might be able to create with HyperCard.
2. Describe a useful way that you might use AppleScript to combine application features.
3. If you were to learn any programming language, which would it be, and why?
4. Imagine a programming language in which you could write programs in standard English (this technology, currently under development, is called Natural Language Processing). In half a page, describe what you think some of the problems would be with such a language.
5. Authoring tools, such as HyperCard, are used to create many multimedia programs. In less than one page, describe how one of the courses you take could benefit from multimedia software.

Beyond the Book

1. Find the names of three authoring tools designed for Macs.
2. Find out what programming courses (if any) are offered at your school. List the name of each course, the language that it covers, and the department that the course is taught in.
3. Use the computer periodicals to find out the most recent version of HyperCard. What is the most current version, and what features does it offer over previous versions?
4. Write a one-page report on the capabilities of the most recent version of AppleScript and the programs that use AppleScript.
5. Use your library to research recent developments in fifth-generation languages. Write a one-page report on your findings.

Basic Mac Skills

7

THIS IS A TUTORIAL, so you are meant to read it and follow the instructions while you are sitting at a Macintosh. It requires very little computer knowledge. It does, however, contain a few basic terms, all of which are covered in Chapters 1 and 2. It may be best, therefore, to complete this tutorial after Chapter 2 and before Chapter 3. If you find any words that you don't understand, be sure to look them up in the Glossary.

If you are sitting at a Mac, you're ready to begin.

Objectives

When you have finished this tutorial, you will be able to do the following:

- Turn the Macintosh on and off properly.
- Name the parts of the Macintosh Desktop and the standard elements of Macintosh windows.
- Use the mouse effectively.
- Create and move folders within a hierarchical file system.
- Use and switch between the By Icon and By Name views.
- Access the Calculator and the Alarm Clock.
- Switch between active programs.
- Obtain online help.

Contents

118 Turning On the Macintosh

118 Parts of the Macintosh Desktop

119 Using the Mouse

122 Menu Options and Dialog Boxes

125 Manipulating Windows

128 Creating and Moving Folders

129 Viewing Files and Folders by Name

132 The Apple, Help, and Application Menus

135 Turning Off the Macintosh

136 Chapter Exercises

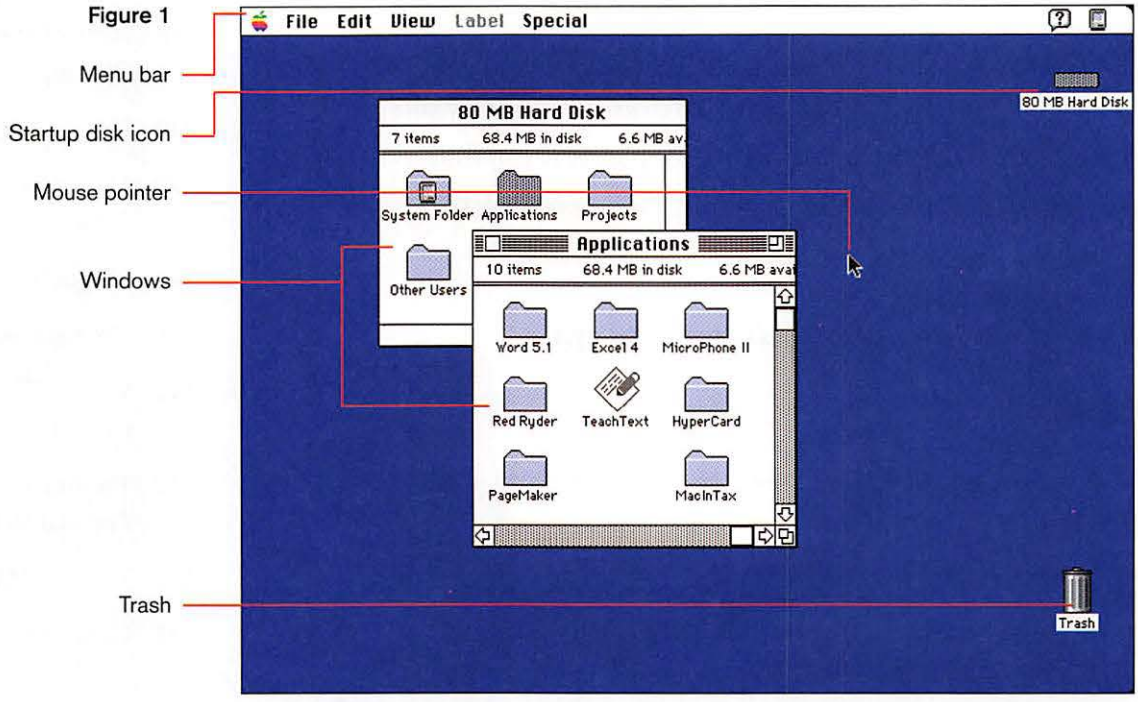
Turning On the Macintosh

To begin, you need to turn on the computer, if it isn't on already. Turning on a Macintosh is a simple process, but it is different for different kinds of Macs. Your instructor will tell you how to turn on the Macs in your school's lab.

1 Follow your instructor's directions for turning on the Mac.

It takes a few seconds before the computer is ready. Before the Mac can accept any input, it has to load the operating system. (This tutorial is written for System 7, a recent version of the operating system.) When the Mac is done loading the operating system, your screen will look similar to (but not exactly like) Figure 1.

Figure 1



Parts of the Macintosh Desktop

Right now, you're looking at the Desktop, the background for everything you do on the Mac. The Finder file (which is part of the operating system) is in charge of controlling the Desktop, so the terms Finder and Desktop are used interchangeably.

There are several things that are always visible on the Desktop:

menu bar Contains a list of menu titles. With the mouse, you can access a list of menu options (also called commands) under each menu title.

startup disk icon A picture representing the disk on which the operating system is stored. Usually, it's the Mac's internal hard disk.

Trash You use the Trash to delete files and eject floppy disks from the floppy drive.

windows Your screen may or may not have open windows on it. On the Desktop, a window shows the contents of a disk or a folder. Each disk is like a file cabinet. The files in it are organized into folders, which can contain files and other folders. To keep your files organized, you can create and discard folders and move your files around from one to another.

Using the Mouse

Your primary tool for working with the Desktop is the mouse. The mouse controls the pointer, the arrow that appears on the screen. There are four mouse techniques you need to know.

Pointing

Pointing means moving the pointer to the desired place on the screen.

1 Move the mouse around on your desk (or on the mouse pad, if you have one) to see how the mouse controls the pointer.

Nothing important happens when you just point with the mouse. To perform most actions, you need to use the mouse button.

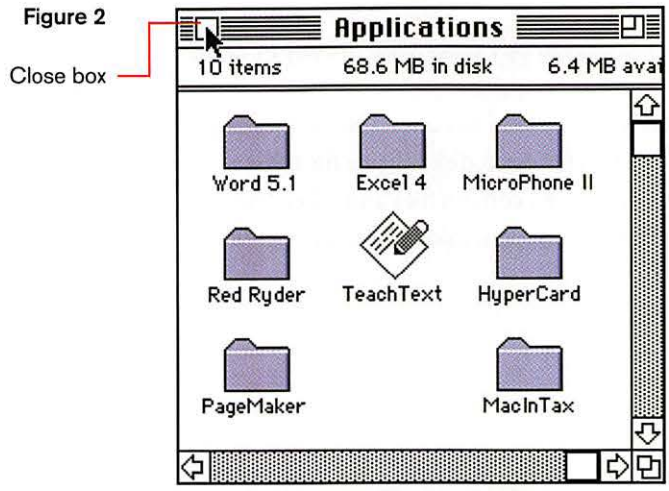
Clicking

Clicking means pointing to a place on the screen and pressing the mouse button once. You don't hold the mouse button down—just press and release, like you do when you press a key on the keyboard.

There are many actions that require clicking. For example, say you want to close the windows that are open on the Desktop. (If there aren't any windows open on your Desktop, just skip the next three steps. You'll get plenty of practice clicking in the next few pages.)

2 Use the mouse to point to the small box in the upper-left corner of any window, as shown in Figure 2.

Figure 2



3 Click the mouse button.

The window should disappear. Clicking on the close box of any window closes the window. If the window didn't close, you probably missed the box. Keep trying until you get it.

4 If there are other windows open on the Desktop, use the same technique to close each of them.

Double-Clicking

The third mouse technique, double-clicking, consists of pointing and pressing the mouse button twice very quickly. Double-clicking is a shortcut for selecting an item on screen and issuing a command in one step. For example, say you want to open a window that shows the contents of the startup disk. You could click on the disk icon to select it, then select the Open command from the File menu (you'll learn how to select commands in the next section). But a faster way to open the window is to double-click on the icon.

5 Double-click on the startup disk icon (the picture of the disk, not its name).

Don't worry if the window doesn't open the first time. If you've never used a mouse, double-clicking can seem difficult. Try the same step again, and try pressing the mouse button more quickly. When the window opens, the Desktop should look similar to Figure 3, though the contents of the window will be different.

Opening a folder window is just like opening a disk window. For example, say you want to see the contents of the System Folder. Every Mac has a System Folder in the startup disk, so you should be able to find it in the window you just opened. If you

can't find it, try clicking on the scroll arrows (see Figure 3) to bring other parts of the window into view.

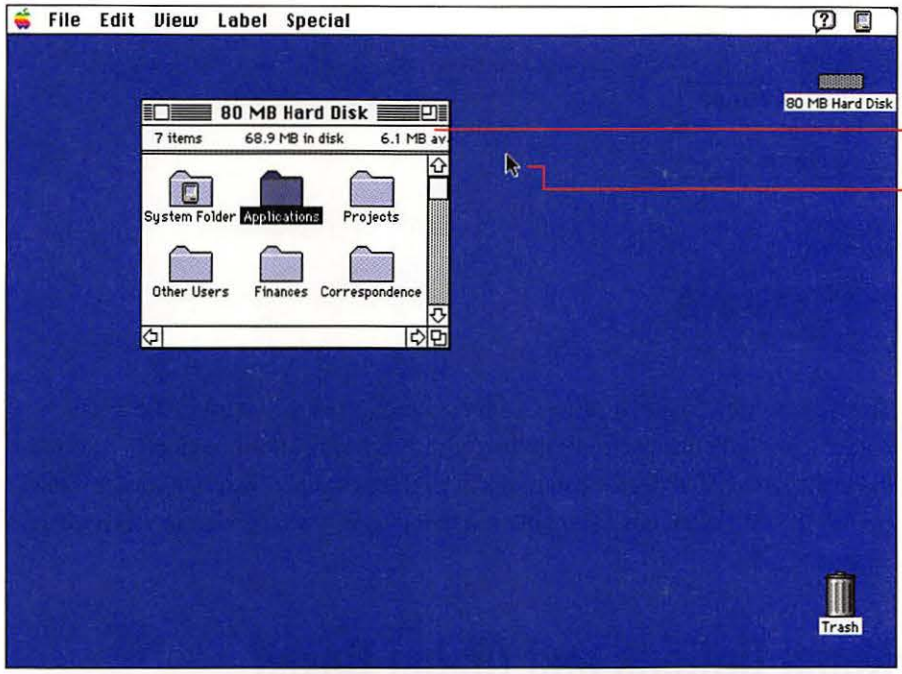


Figure 3

To open the System Folder,

6 Double-click on the System Folder icon.

Take a minute to look at what is in the System Folder. When you are done,

7 Click on the close box to close the System Folder.

Dragging

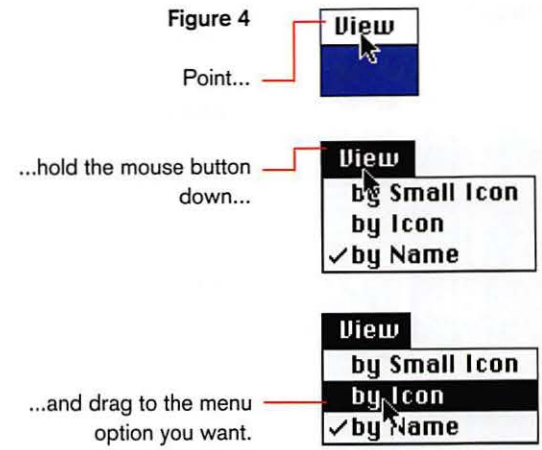
To perform the last mouse technique, dragging, you hold down the mouse button while moving the mouse. Once again, the technique may seem a little awkward when you first try it, but you'll get used to it after some practice.

Dragging is used to select menu options and to move certain items, such as windows, files, and folders, around on the screen.

One reason your screen might look different than the ones shown in the last three figures is that there are several different ways to display the contents of a disk or folder. The different options are listed in the View menu. In the last figure, the window was displayed with By Icon selected in the View menu. To make sure the disk window on your screen is displayed the same way,

8 Select By Icon in the View menu. In other words, point to View in the menu bar, hold down the mouse button, drag the pointer down to By Icon (as shown in Figure 4), then release the mouse button.

Figure 4



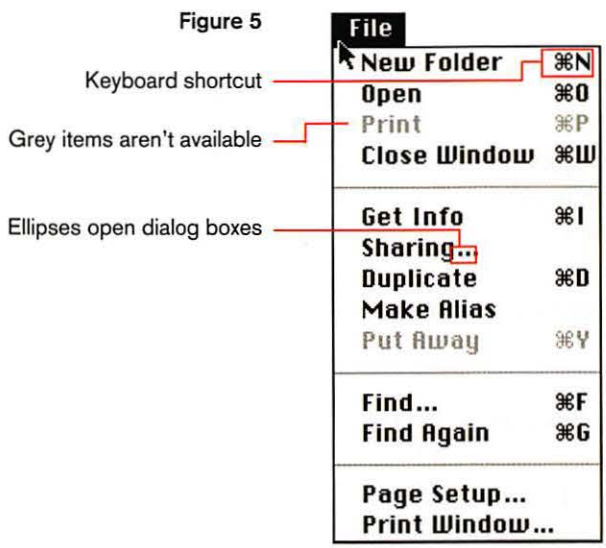
The By Icon view makes it easier to tell the function of each item in the folder. Folder icons look like file folders. Program icons have customized icons. And most file icons (also called documents) look like pieces of paper with one corner folded over. A file icon often has a symbol on it that tells you what program was used to create the file.

Menu Options and Dialog Boxes

Now that you know how to select menu options, you should take a moment to browse through all the menus. Start with the File menu:

1 Move the pointer to File and hold the mouse button down. You should see the menu shown in Figure 5.

Figure 5



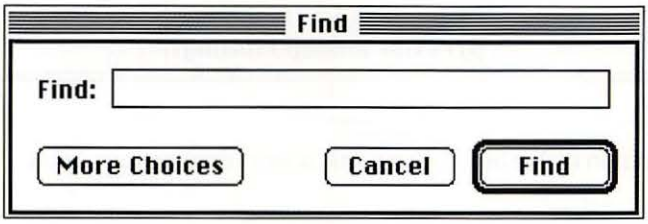
Notice that some of the options are gray, while others are black. Different options are available at different times. For example, some of the options in the File menu are only available if you have selected a file or folder. The options that are gray (dimmed) are not currently available.

Notice also that some of the options have three dots following them. This symbol is called an ellipsis. The ellipsis tells you that the Mac will display a dialog box if you select that menu option. A dialog box is the Mac's way of getting more information from you. For example,

2 Select Find from the File menu. In other words, point to File in the menu bar, hold down the mouse button, drag down to Find, and release the mouse button.

The dialog box shown in Figure 6 appears.

Figure 6



The Find command is used for locating files and folders. To execute the command, the Mac needs to know what file or folder you want to find, so it displays this dialog box. All you have to do is type the name of the file or folder in the box (called a text box) where the cursor is blinking, then click on one of the buttons (More Choices, Cancel, or Find) with the mouse. The default button, Find, has a heavy border around it. Pressing the Return key does the same thing as clicking on the default button. To complete the dialog box,

3 Type **Clipboard**

4 Click on the Find button, or press the Return key.

The Mac opens the System Folder and highlights the Clipboard file so you know where it is.

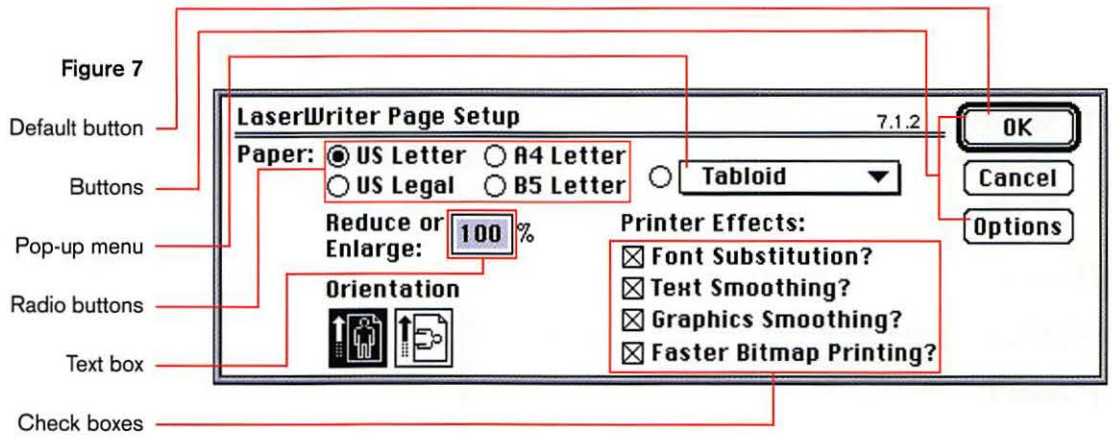
5 Click on the close box to close the System Folder window.

The Find dialog box is a simple one, because it has only two types of elements: a text box and buttons. The Page Setup dialog box has several other elements that are commonly found in dialog boxes. To see it,

6 Select Page Setup from the File menu. You should see the dialog box shown in Figure 7.

(The dialog box on your screen may look a little different. It depends on the kind of printer that is attached to your Mac.)

Figure 7



These are the most common dialog box elements and a short explanation of how they work:

button Every dialog box has buttons, which start actions when you click on them.

text box You complete text boxes by typing information at the keyboard.

pop-up menus Pop-up menus let you select from a set of options. You click on the down-facing arrow, and drag down to the option you want, the same way you use a pull-down menu. The currently selected option is displayed at the top of the drop box.

radio button Radio buttons give you another way to select from a set of options. When you click on a radio button, it appears black and the other buttons in the set turn white.

check box Check boxes work like radio buttons, but more than one of them can be selected at a time. When you click on one, an X appears in the box. Click again and the X disappears.

list box A list box is similar to a drop box or pull-down menu—you select from a list of options. But the contents of the list can change. If there are more options than fit in the list, the box will have a scroll bar along the right edge.

To close the dialog box,

7 Click on the Cancel button.

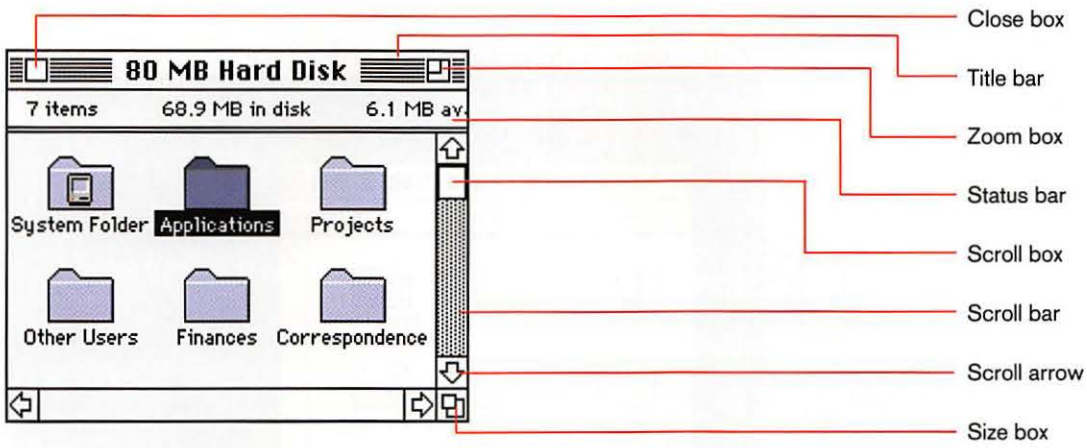
Before you go on to the next section,

8 Use the mouse to browse through the rest of the menus.

Manipulating Windows

Whether you are moving and copying files on the Desktop or creating documents by using application software, there is usually a window visible. All Macintosh windows have certain standard elements. Figure 8 shows the names of the most important ones.

Figure 8



title bar Shows the name of the disk, folder, or document that is displayed in the window. You can move the window around the Desktop by dragging the title bar.

status bar The status bar tells you how many items are in the folder, how much storage space is being used on the disk, and how much space is still available. In document windows, the status bar is often at the bottom of the window, and it contains information relevant to the program being used.

close box Clicking on the close box closes the window.

zoom box Clicking on the zoom box resizes the window to its optimum (best) size, as determined by the Finder.

size box You can change the size of the window by dragging the size box.

scroll arrow Clicking on a scroll arrow lets you move up or down (or left and right, if there is a horizontal scroll bar) through the contents of a disk, folder, or document. You can hold down the mouse button to keep moving in the same direction.

scroll box The position of the scroll box in the scroll bar shows the relative position of the material that is visible in the window. To scroll up or down through a window, you can click in the scroll bar above or below the scroll box, or you can drag the scroll box to any position on the scroll bar.

Right now, there should be one window open on the Desktop, displayed in By Icon view.

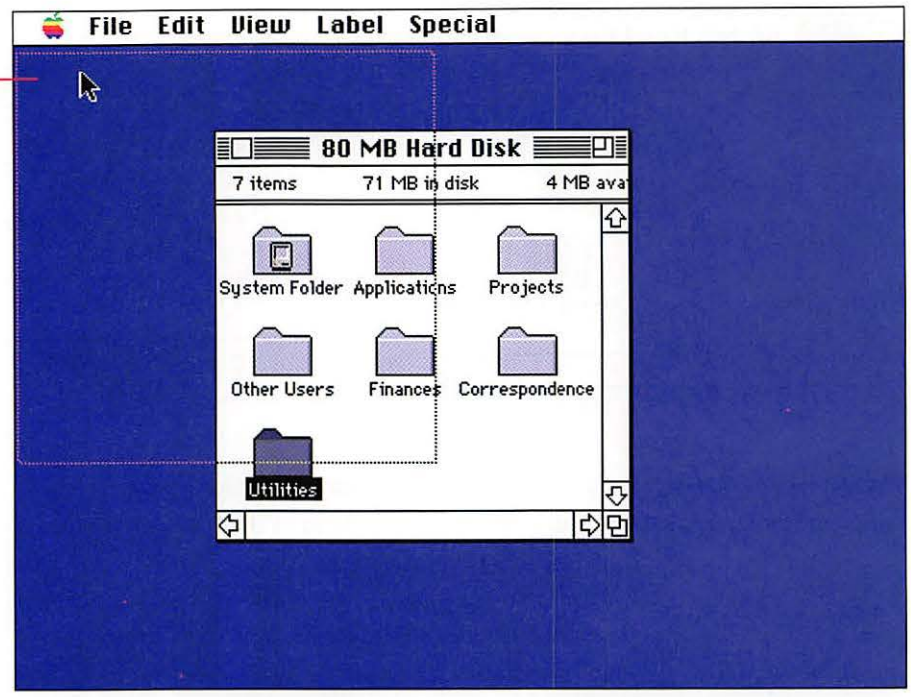
1 Click on the zoom box.

The window is resized to hold all the files and folders (or as many as fit on the screen).

2 Position the pointer on the window's title bar, and drag the window to the upper-left corner of the Desktop, as shown in Figure 9.

Figure 9

While you are holding down the mouse button, only the window's outline appears to move.



3 Drag the size box up and to the left as far as it will go.

The window is just big enough to display one file or folder.

4 Move the pointer to the down-facing scroll arrow and hold the mouse button down to scroll to the bottom of the window.

5 Drag the box in the horizontal scroll bar from the left end of the scroll bar to the right end.

6 Click on the zoom box again to restore the window to its optimum size.

7 Double-click on the System Folder to open it.

8 Drag the title bar of the System Folder window so it partially overlaps the bottom of the startup disk window, as shown in Figure 10.

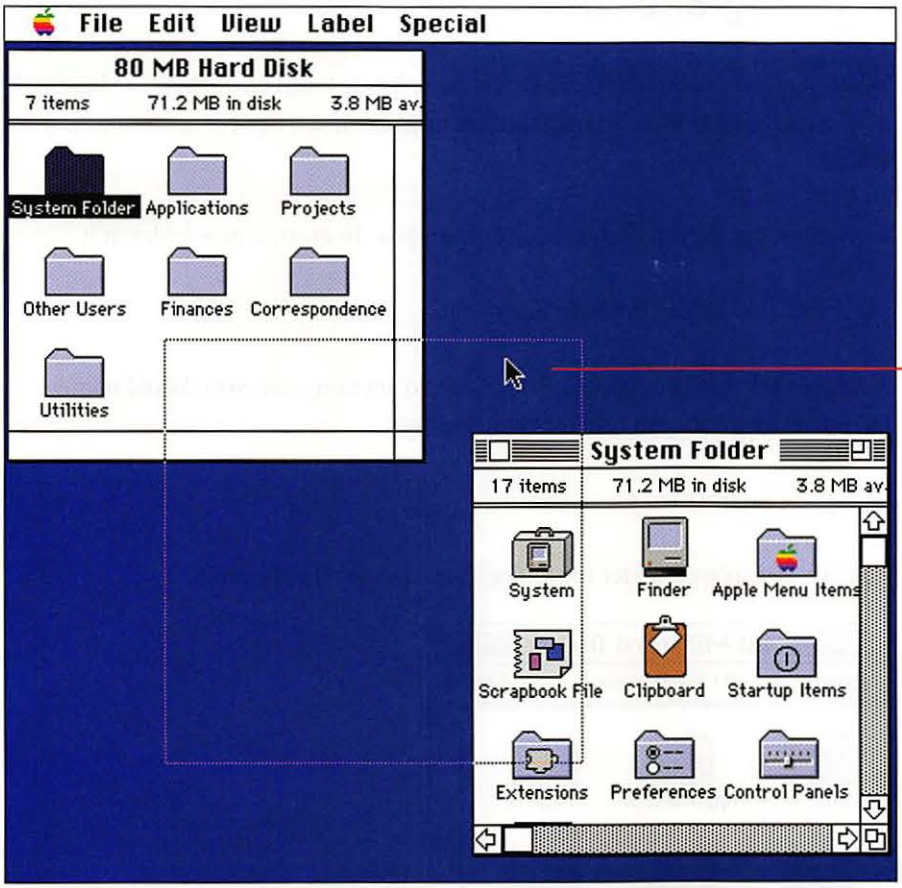


Figure 10

Outline of the System Folder window should overlap the startup disk window.

Notice that the title bar for the startup disk window looks different than before. The title is gray, and the horizontal lines on either side of the title have disappeared. This shows that the window is no longer active. On the Mac, only one window can be active at a time, and the System Folder is active right now.

To make the startup disk window active,

9 Click anywhere on the startup disk window.

The startup disk window jumps to the foreground. Its title bar is black with horizontal lines.

10 Click on the System Folder again to make it active.

11 Click on the close box of the System Folder window to close it.

Creating and Moving Folders

When you use a computer every day, it doesn't take long before there are hundreds of files on the hard disk. To keep the files organized, you need to create and use folders.

Right now, the startup disk is the active window. To create a new folder in it,

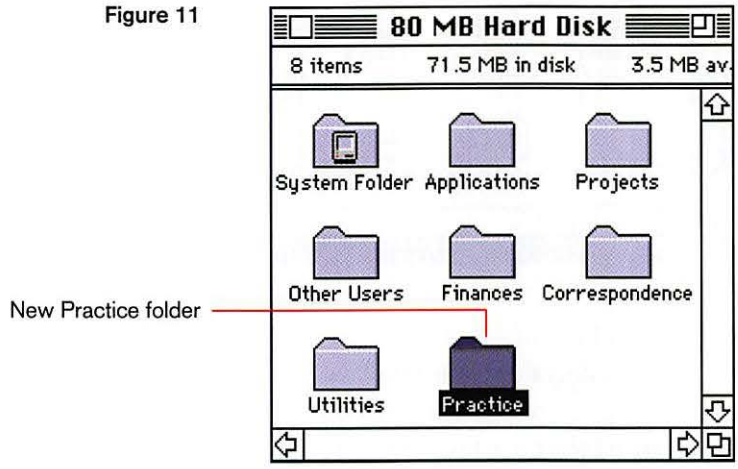
1 Select New Folder from the File menu.

A new, untitled folder appears. Before you do anything else, you should name the folder. To do so, you can just begin typing:

2 Type **Practice** then press Return.

The title is displayed under the folder icon, as shown in Figure 11.

Figure 11



3 Double-click on the Practice folder to open it.

4 Select New Folder again from the File menu.

5 Type **Memos** and press Return.

The Memos folder is said to be nested in the Practice folder.

To move a file, a folder, or a group of nested folders around on a disk, you simply drag it to its new location. For example, say you want to move the Practice folder (and the Memos folder nested in it) to the System Folder:

6 Click on the startup disk folder to make it active.

7 If necessary, use the size box to resize the window so that both the System Folder and the Practice folder are visible.

8 Drag the Practice folder to the System Folder. In other words, point to the Practice folder, hold down the mouse button, drag to the System Folder, and release the mouse button when the System Folder turns color (indicating that it is selected).

The Practice folder disappears.

9 Double-click on the System Folder to open it.

You should now be able to find the Practice folder in the System Folder.

Incidentally, you will often use multiple disks (such as the hard disk and a floppy disk) to manage your files or give files to other users. When you drag a file or folder from one disk to another, the Mac makes a copy of it, rather than moving it.

Viewing Files and Folders by Name

So far, you have been using the By Icon view, which you selected at the end of the second section. Many users prefer to work with this view, because the icons are large, easy to grab with the mouse, and easy to recognize. There are, however, several other views to choose from. Using the By Name option is especially popular because it lets you see many files at once and because you can explore an entire system of nested folders in one window.

To experiment with the By Name view, you should first close all the windows, then reopen just the startup disk window. Here's a fast way to do it:

1 Hold down the Option key on the keyboard and click on the close box in the active window.

All the open windows close.

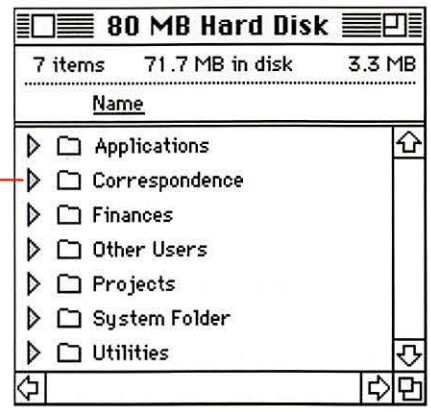
2 Double-click on the startup disk icon to open it.

3 Select By Name in the View menu.

4 Click on the zoom box to resize the window.

The startup disk window should look similar to that shown in Figure 12.

Figure 12



The information displayed to the right of each file and folder name in your window may be different than that shown here.

Exploring Nested Folders in a Single Window

Notice that each folder has an arrowhead, or triangle, next to it. The arrowheads are pointing towards the folders. To see the contents of a folder without opening a new window, you can click on the arrowhead next to it. For example, to see the contents of the System Folder,

5 Click on the arrowhead next to the System Folder.

The arrowhead turns down to tell you that the contents are displayed. The contents of the folder are indented below the folder.

6 If necessary, scroll down to find the Practice folder in the System Folder.

7 Click on the arrowhead next to the Practice folder.

The Memos folder appears below the Practice folder.

8 Click on the arrowhead to the left of the Memos folder.

Notice that the arrowhead turns down, but no new files or folders appear (see Figure 13). This is because the Memos folder is empty.

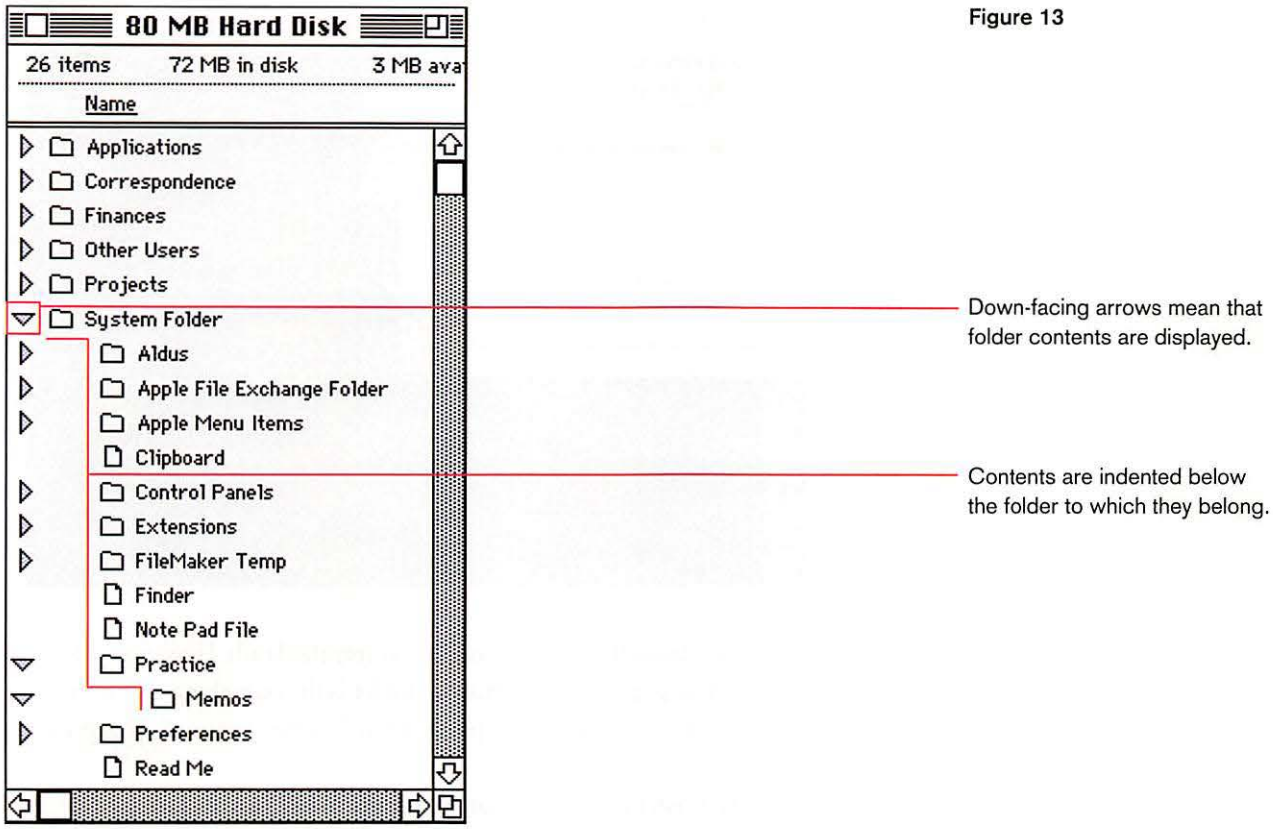


Figure 13

To close open folders in By Name view, simply click on the arrowhead again. For example,

9 Click on the arrowhead next to the Memos folder.

10 Click on the arrowhead next to the Practice folder.

Using the Trash

I don't want you to make any permanent changes to the System Folder, so let's get rid of the Practice and Memos folders. To erase the Practice folder (and the Memos folder in it),

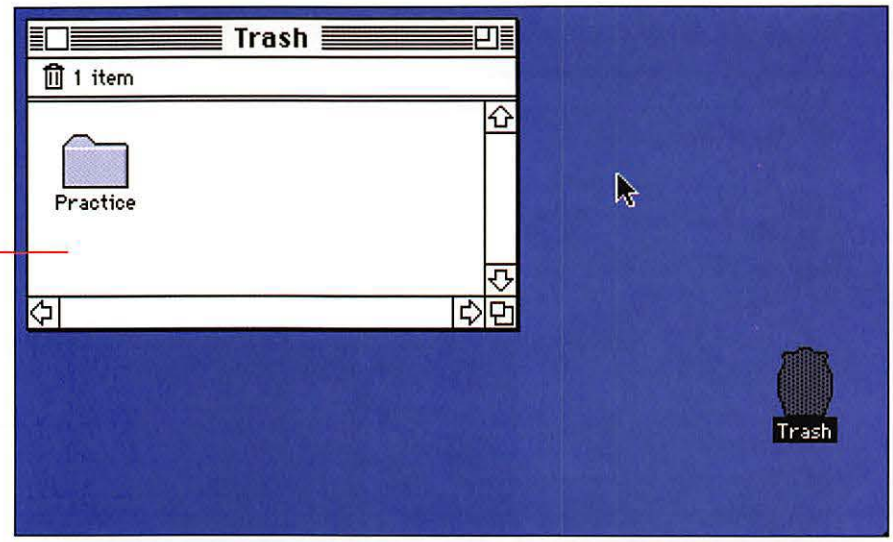
11 Drag the Practice folder from the System Folder window to the Trash.

The Trash is highlighted (changes color) when you have dragged the folder to the right place. When you release the mouse button, the Trash gets fatter to let you know that it has something in it. Actually, dragging files and folders to the Trash doesn't really delete them. They still exist, but only in the Trash:

12 Double-click on the Trash to open it.

A Trash window appears, as shown in Figure 14.

Figure 14



To erase the folders from the disk, you need to *empty* the Trash. However, you should complete this step only if the Practice folder is the only thing visible in the Trash. If there are any other items (placed there by other users), skip step 14.

13 Select Empty Trash from the Special menu.

14 Click on the close box on the Trash window.

By the way, you don't have to open the Trash window to empty the Trash.

15 Click on the arrowhead next to the System Folder to hide its contents.

The Apple, Help, and Application Menus

You may have noticed that three of the items in the menu bar are icons rather than words. In this section, I'll give you a short tour of these three menus, which are called the Apple menu, the Help menu, and the Application menu.

The Apple Menu

The Apple menu, at the far left of the menu bar, contains a list of tools that you can use any time the Mac is running, even if you are already using application software. Take a minute to look at the menu:

1 Move the pointer to the Apple icon and hold down the mouse button. You should see the menu shown in Figure 15.

Figure 15

Some of the tools shown in your Apple menu may be a little different than the ones in mine, because it's possible to customize the contents of this menu. But several of our tools are probably the same. One handy tool is the Alarm Clock.

2 Select Alarm Clock from the Apple menu.

3 If the Alarm Clock looks like Figure 16a, click on the lever to the left of the time, to display the expanded Alarm Clock, shown in Figure 16b.

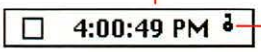


Figure 16a

Small Alarm Clock

Click here to expand

Figure 16b

Expanded Alarm Clock

Click here to shrink

The three different icons at the bottom of the Alarm Clock let you set the time, the date, and the time the alarm will go off. Do not change the time or date, unless they are incorrect.

The Application Menu

The icon at the far right side of the menu bar changes, depending on which program is currently active. You may have noticed that it looked like a compact Mac when you first turned on the computer. The Mac icon is displayed when the Desktop is active. Now it looks like a clock, because the Alarm Clock is the active program.

4 Move the pointer to the Alarm Clock icon in the menu bar and hold the mouse button down. You should see the menu shown in Figure 17.

Figure 17

To switch to any currently loaded program, you can either click on the application itself (if it is visible) or select it in the Application menu. You can also use the Application menu to hide programs without quitting them.

5 Select Hide Others from the Application menu.

The only program still visible is the Alarm Clock.

You will find the Application menu is extremely handy when you are working with multiple applications, such as a word processor and a spreadsheet.

The Help Menu

If you ever get stuck and need help, try consulting the Help menu first. In System 7, the Help menu icon looks like a cartoon dialog bubble with a question mark in it.

No matter what you are doing on a Mac with System 7, there are usually two different help features available. The first is Balloon Help, which lets you find out about different screen features simply by pointing at them. To see how it works,

6 Select Show Balloons from the Help menu.

7 Use the mouse to point to different parts of the Alarm Clock and find out how they work.

8 When you are through learning about the Alarm Clock, select Hide Balloons from the Help menu.

Most applications contain help systems that you can access through the Help menu. The exact name of the Help option depends on the application. The Desktop is also accompanied by a Help feature. To see it,

9 Select Finder from the Application menu.

10 Select Finder Shortcuts from the Help menu.

The Finder Shortcuts are a set of five windows that help you use the Desktop (Finder) more quickly with the help of the keyboard. You navigate through the five windows by clicking on the Previous or Next buttons at the bottom of each screen. Go ahead and read through the screens now. You'll find some handy tips there. When you are done,

11 Click on the close box.

Turning Off the Macintosh

When you are through working with the Mac, your instructor or lab assistant may want you to turn the machine off (some schools leave their computers on; check to see what you are supposed to do). There's a correct way to turn off a Mac. First, if you have been working with application software, you should be sure to save your work. If you forget, don't worry—the Mac will automatically ask you if you want to save before you quit any program or shut down the computer. Still, saving your work often is a good habit.

Next, to turn off the Mac (if your instructor or lab assistant hasn't asked you to leave it on),

1 Select Shut Down in the Special menu (see Figure 18).

Figure 18

Selecting Shut Down lets the Mac complete any tasks it is currently working on and close down in an orderly fashion. The process will take a couple of seconds. The screen will then go blank, or you will see a message telling you that it's okay to turn off the power switch. If the screen goes blank, remember to turn off the monitor. If you see the message, click the power switch to OFF.

Knowing the Facts

1. Where do you click the mouse pointer to close a window?
2. Which disk icon is displayed near the upper-right corner of the screen, immediately below the application menu?
3. Describe the process of deleting a file or folder from a disk.
4. Which mouse technique is used to see the contents of a disk or folder?
5. How is it possible to see a system of nested folders within a single window?
6. How can you tell that a menu option will activate a dialog box?
7. Which folder stores the operating system files?
8. Say you are looking at a folder window, but not all the contents of the folder fit in the window. How can you change the folder window to see more of the folder's contents?
9. Which menu option should you choose when you want to turn off the Mac?
10. Without opening the Trash window, how can you tell if the Trash has something in it?

Chapter Exercises

Using Your Skills

The following hands-on exercises give you practice with the new Mac skills you have learned and direct you to some other features that were not covered in the Introduction. You need to use a Mac to complete them.

A With the Finder active, select About This Macintosh from the Apple menu. Use the window that is displayed to answer the following questions:

1. What model Macintosh are you using?
2. What is the version number of the System Software that is loaded on the machine?
3. How much built-in memory is in the computer? The memory is measured in KB (kilobytes), which stands for thousands of bytes. One byte can represent a single text character, so 1KB can represent about 1,000 text characters.

B Open the startup disk window. The window's status bar should show how much storage space is currently being taken up by programs and documents (if this information isn't displayed in the status bar, see question G). The storage space is measured in MB (megabytes), which stands for about 1,000 KB or about 1,000,000 bytes.

1. How much storage is currently being used on the startup disk?
2. How much storage is still available?
3. How many items are there in the startup disk window?

C Open the startup disk window and make sure it is displayed in By Name view. Click on the size box to optimize the size of the window. Select Show Balloons from the Help menu. Use the Balloon Help feature to find out the meaning of the information that is displayed to the right of each file and folder in the window. What information is given about each file and folder?

D Open the startup disk window. Make sure its size is optimized and it is displayed in By Name view. Select Print Window from the File menu to print a copy of the window.

E With the Finder active, select Finder Shortcuts from the Help menu and use the feature to answer the following questions:

1. How do you copy a file from one folder into another (instead of moving it)?
2. How do you select more than one item in a window?
3. When you are looking at the window of a nested folder, how do you open the window that holds the active folder?

You can customize many aspects of the Macintosh environment using the Control Panels. To see which Control Panels are available on the Mac you are using, select Control Panels from the Apple menu. To open a specific Control Panel, simply double-click on it. Use the Control Panels to complete questions F through J.

F Open the Mouse Control Panel. Note the current settings before you change any of them. After experimenting with the settings, answer the following questions:

1. What happens when you slow down the mouse tracking speed?
2. Which double-click speed do you prefer? Why?

Change the settings back when you are done.

G The Views menu lets you control what information is displayed in the list views (By Name, By Size, and By Date). List the options that are available for displaying information in list views. (If you were not able to answer question B because the disk information was not displayed in the status bar, click on the Show Disk Info In Header check box to select this option. You can now complete question B.)

H You may have trouble because you are holding down the keys too long when you type (so multiple characters appear). How can the Keyboard Control Panel help you?

I Explore the Map Control Panel. What can you do with it?

J Many user actions cause the Mac to beep. You probably hear the beep every time you turn on the Mac. Explain how to turn down the volume.

Photo Credits

Chapter 1

Page 6: IBM; Apple Computer, Inc.; ZEOS. Page 7: Apple Computer, Inc.; Apple Computer, Inc.; Apple Computer, Inc. Page 8: Cray Research, Inc. Page 9: Silicon Graphics; Apple Computer, Inc. Page 12: Broderbund Software, Inc. Page 13: Chrysler.

Chapter 2

Page 20: Intouch. Page 23: Apple Computer, Inc. Page 24: Apple Computer, Inc.; Hewlett Packard. Page 25: Hewlett Packard. Page 28: NCR. Page 32: Conner Peripherals; Kalok Corp. Page 37: Berkeley Systems.

Chapter 3

Page 45: IBM.

Chapter 4

Page 62: Intuit.

Chapter 5

Page 96: Software Publishers Assoc. Page 97: Bantam Books.

Glossary/Index

8-N-1 The most common set of line settings. It means that data is sent in packets with 8 data bits, no parity, and 1 stop bit. 93

(⌘) Command key, 18

486 microprocessor, 28

A

A:\>, as A-drive prompt, 42

About This Macintosh command, 52

access privileges Refers to each user's ability to read and write files from and to a remote computer. 90

accounting software An application that has built-in features for keeping track of payroll, inventory, accounts payable and receivable, and other accounting systems. 76

ADB port Apple Desktop Bus port. It is used to connect the primary Mac input devices, including the keyboard and the mouse. 35

address bus The set of electronic pathways that the CPU uses to transmit the location of data. For example, to request data from memory, the CPU sends a number that indicates the location of the memory to the RAM chips through the address bus. The RAM chips send the data to the CPU through the data bus. 34

Adobe Illustrator, 72

AI (artificial intelligence) and expert systems, 77

Alarm Clock, 52, 133

Aldus FreeHand, 72

Aldus PageMaker, 74

algorithm A prescribed set of steps for solving a specific type of problem.

alias A Desktop icon that looks like a file, but is actually a pointer to another file. Double-clicking on an alias opens the file that the alias refers to. If you put an alias for an application icon in the Apple Menu Items folder, the name of the program appears in the Apple menu. Selecting the alias starts the program. 52

America Online, 95

analog Refers to a device that presents continuously variable data in a form that resembles the source of the data. For example, an analog watch gives data about the rotation of the earth with rotating hands.

analytic graphics A chart that illustrates numeric data. The most common types are bar graphs, line graphs, and pie charts. 69

animations, 54

antivirus utility A program that detects viruses. It may also eradicate them. 57

Apple Computer (Company), 6

Apple File Exchange A program that enables a SuperDrive to emulate a floppy drive for a DOS-based PC. With Apple File Exchange, you can copy files to and from a disk that was formatted (initialized) on a PC. 91

Apple menu, 52–53, 59, 132–133

AppleScript A system-level programming language that lets the user combine features from different applications and automate tedious procedures. 79, 112, 114

Apple Standard /Extended Keyboards, 18

AppleTalk Apple's proprietary networking system. AppleTalk networks are described as plug-and-play because every Mac comes with the necessary network hardware built in, and System 7 includes the necessary software. 88, 90

Application Folder, 49

application generator Software designed for creating special-purpose programs, commonly involving database programs. 108

Application menu, 133–134

applications Application software. The task that application software helps you perform. 61
  combining, 78–79, 81

application software Programs that are used to get things done. Contrast with system software, which controls the computer's basic functions. Application software includes word processing, spreadsheet, database, graphics, and many other kinds of programs. 4

ASCII The American Standard Code for Information Interchange. The most common system for translating bytes into alphanumeric characters. 27

assembly language A programming language that uses symbols to represent common strings of machine language code. Assembly language is translated into machine language, using a program called an assembler. 104

AT&T Bell Laboratories, 45, 105

ATM Automatic Teller Machine. A special-purpose computer that offers basic banking services to customers. Also, Adobe Type Manager, a font display technology by Adobe Systems. 13

authoring tool A type of fourth-generation programming language designed for nonprogrammers. Authoring tools, such as HyperCard, are commonly used to create multimedia presentations and interactive programs. 109

AutoCAD, 73

B

backing up Creating a second copy of data or software. 32

backup A second copy of data or software, created in case the original is damaged or lost. 31

backup utility A program that streamlines the process of backing up a hard disk. 56

Backus, John, 104

Balloon Help, 47, 134

bandwidth The transmission capacity of a communication channel. Bandwidth is usually measured in bits or bytes per second. 88

bar-code reader An input device used by many stores to read UPC symbols. 21

BASIC A third-generation programming language originally developed for teaching programming, but now an important language in its own right. 104, 105

baud The number of signal changes per second. Baud is often used to describe modem speeds, although *bits per second* (bps) is the correct term. 92

BBS *See* bulletin board service (BBS)

Bernoulli removable hard disk, 32

binary code Data represented with ones and zeros. The form in which data is processed by the computer. 5, 26

bit A single unit of data, represented as a 1 or 0. Bit is a contraction of *bi* nary digi *t*. 27

bitmap A graphic file that lists information about every pixel on the screen. 72, 73

bits per second *See* bps.

boxes *See* check box; dialog box; list box; text box

bps Bits per second. A unit for measuring data transmission speeds. Modems and networks are compared in bps. 92

Bricklin, Dan, 10

bug A programming error or hardware malfunction.

bulletin board service (BBS) An organization that lets computer users logon, via modem, and participate in electronic roundtable discussions or exchange messages with other users. 94–95

bus The data bus. The set of electronic pathways that transmit data to and from the CPU. 34

bus topology A network configuration in which all of the computers are connected to a single wire that acts as a backbone for the network. 89

button A screen element that initiates an action. The most common place for buttons is in dialog boxes. They are also found on HyperCard cards, where they often form links that let the user jump from one card to another. 50
  in dialog boxes, 50, 124
  in Hypercard, 111

byte A set of eight bits. One byte can represent a single letter, number, punctuation mark, or other symbol. 27

C

C++ An object-oriented derivative of the C language.

C The most widely used third-generation programming language for developing microcomputer applications. 104

cables for networking computers, 88

Calculator, 53

calendars, 76

Cancel button, 124

Caps Lock key, 18

card A group of graphics, text and buttons that are presented on the screen together when using HyperCard. A set of cards comprise a HyperCard document, called a stack. 77, 107, 111

carpal tunnel syndrome (CTS) A type of repetitive-stress injury that results from holding the wrist in a flexed position for an extended period. The carpal tunnel is a sheath in the wrist that contains the nerves that go to the fingers. In CTS, the sheath is deformed and the nerves are pinched. 36

CD-ROM Compact disc read-only memory. A storage technology in which data is held on a piece of textured foil that is sandwiched between clear plastic. The technology is identical to that used on audio compact discs (CDs). 33

cell A location in a spreadsheet. The intersection of a row and a column. 68

central processing unit (CPU) The part of a computer that performs the mathematical and logical manipulations of data that are referred to as processing. The CPU of a microcomputer consists of a single microprocessor. When speaking of microcomputers, the terms *CPU*, *microprocessor*, *processor*, and *computer chip* all mean the same thing. 28

charts, 69

check box A dialog box element that turns a software feature on and off. Clicking in a check box selects it; clicking again deselects it. 51, 124

Chooser command, 53

ClarisWorks, 76

class In object-oriented programming, a group of objects that share the same properties. 107

cleaning the mouse, 19

clicking Pressing and releasing the mouse button. 19, 119–120

clip art Small, ready-made images that can be selected from a library of such images and pasted into other documents. 73

Clipboard A Macintosh (also Windows) feature that allows the user to cut or copy data and paste it in a new location. The new location can be a different document, or even in a document created using a different program. 66, 78

clock cycle A single tick of the system clock. 29

clone *See* IBM-compatible.

close box A Mac window element (upper left corner). Closes the folder or document when you click on it. 48, 120, 125

closing Closing a document, dialog box, or window from the screen and from memory.
- dialog boxes, 124
- documents, 65
- windows, 120

coaxial cable A communication conduit sometimes used in networks. It consists of a central insulated wire, surrounded by a woven wire sleeve. 88

COBOL A third-generation programming language, often used for business and accounting applications. 104, 105

code A general term for program instructions. 104

code generators, 108

Color control panel, 53

color monitor An output device that displays images in color. Also called an RGB (Red, Green, Blue) monitor. 22

Command (⌘) key, 18

Command key combinations
- ⌘-N for creating new items, 50
- ⌘-S for saving, 18, 65
- ⌘-X/C/V for cut/copy/paste, 66

command line interface A user interface in which the computer is controlled by commands that are typed at the keyboard. 42

commands
- initiating by double-clicking, 120
- *See also* menus.

communication device Hardware that is used to transmit data to and receive it from other computers. Includes modems, fax modems, and networking hardware. 4, 83

communication software A program that is used in conjunction with a modem or fax modem to transmit or receive files through the phone lines. 10, 93, 100

compact Macintosh Any Mac that conforms roughly to the design of the original Macintosh, with a 9" monitor built into the system unit. 7
- *Compare* modular Macintosh.

compiler A program that translates a program written in a third-generation language into machine language before the program can be run. 104

compressing files, 56–57

CompuServe, 2, 95

computer A collection of electronic machinery that accepts, processes, and presents data. 4
- advantages of, 1–3, 10–13, 14, 15
- ergonomic issues, 36, 39
- evolution and history of, 8–9, 14
- hardware and software, 4–5, 14
- how it processes data, 26–29, 38
- peripherals, 34–35, 39
- protecting, 37, 39
- turning on and off, 37, 39, 118, 135
- types of, 6–7, 14

computer-aided design (CAD) software A program that lets the user create electronic models. 10, 73

computer system A collection of hardware, the software that makes it run, the person (or persons) who uses the computer, and the data that the person wants to process. 4

connect time charges Fees charged to users of bulletin board services and information services based on the time that the user was logged on to the service. 94

context-sensitive help A help feature that automatically displays information that is relevant to the task that the user is trying to perform. 63

control panel A dialog box that lets the user control a set of system parameters. The control panels are accessed by selecting Control Panels from the Apple menu. 53

copying Creating a replica of a highlighted set of data and placing it in the Clipboard. 66
- between documents, 78
- items with Duplicate command, 52

copyrighting (licensing) of software, 63

CorelDRAW, 72

CPU *See* central processing unit.

Cray supercomputers, 8

CRT monitor Cathode ray tube monitor. An output device that generates an image with an electron gun, which illuminates a grid of phosphor dots on a glass screen. 22

cursor The point on the screen where text and numbers are being entered. In word processing programs for the Mac, the cursor is usually displayed as a blinking vertical line between characters. 18

cursor movement keys The four keyboard keys that are labeled with arrows and are used to move the cursor around the screen. 18

cutting Removing a highlighted set of data and placing it in the Clipboard. 66

D

daisy-chaining Connecting peripherals or computers in sequence. 35

daisy-chain topology A network configuration in which the computers are connected in sequence. 89

data Raw facts. In a computer, *data* can refer to numbers, letters, images, or sounds. The computer processes data and turns it into useful information. 5, 26–29

database An orderly collection of related information. 10, 70

database management system (DBMS) Software for creating, sorting, querying, and creating reports on databases. 70

database software, 11, 70–71, 80–81
See also database management system (DBMS).

data bits The number of bits in each set of data sent by a modem.

data bus *See* bus.

data encryption The process of encoding data that is sent through communication channels or stored on a network. 97

data superhighway A nationwide web of communication channels that could provide a national infrastructure for data communication. 99

dBASE, 108

default button The dialog box button with a double border. Pressing the Return key performs the same action as clicking on the default button.

Desktop The Mac's graphical background, which includes the Trash, the disk icons, and any open file folders. The Desktop is controlled by the Finder file, and *Desktop* and *Finder* are often used interchangeably. 46–47, 58

desktop model A personal computer with a modular design and a system unit designed to sit horizontally on a desktop. 6

desktop publishing (DTP) The creation of polished, professional-quality printed documents using a computer system. 10, 74–75, 81

desktop publishing software A program that allows the user to create professional-quality documents, such as books, magazines, and newsletters. 10, 74–75,

devices, 17

dialog box An on-screen window that requests additional information necessary to complete a command. 50–51, 123–124

dictionaries on reference software, 76–77

digital Refers to a device that represents data with binary numbers.
Compare analog.

dimmed menu options, 122

discussion group In a BBS or information service, a group of users who are discussing a specific topic. 94

disk crash A hard disk malfunction in which a read-write head makes contact with a disk surface (or pushes a foreign particle against the disk surface). The result is a damaged disk and lost data. 31

disk defragmentation utility A program that reorganizes files on a disk so that the data for individual files are stored in contiguous sectors. The result of using this kind of utility is faster disk drive performance. 57

diskettes *See* floppy disk.

diskless workstation A networked computer that relies on the file server for its storage needs. A diskless workstation has no internal hard disk. 87

documentation The books that come with a program when you buy it. 62

document imaging The process of scanning and storing documents in a computer. 21

documents Data files created using application software. 5
active and inactive, 65
closing, 65
copying between, 78
opening, 64–65
saving, 65
templates for, 64

document window The type of window that is displayed when using application software on the Mac. It displays the contents of a data file. 64

DOS Disk Operating System, the most common operating system used on PCs. Microsoft's first operating system, which came with the original IBM PC. 44

dot-matrix printer A device that prints characters or images by pushing an inked ribbon against paper with a group of pins. Apple's ImageWriter is a dot-matrix printer. 24

double-clicking Positioning the mouse pointer, then pressing and releasing the mouse button twice in rapid succession. A technique often used as a shortcut for selecting an item and initiating a command, such as opening a file or completing a dialog box. 19, 120–121

downloading Receiving a file from a remote computer.

dragging Holding down the mouse button while moving the mouse. A technique used to move items on the screen or select a set of text characters. 19, 121

draw program A type of graphics software that stores files as object graphics. 72–73

drives, 30, 31

DTP *See* desktop publishing (DTP).

Duo and Duo Dock The Macintosh Duo is a subnotebook that can be slid into a docking station, called the Duo Dock, and act like a modular Macintosh, with a full-sized keyboard and monitor. 7

E

Easy Access control panel, 53

Eckert, John, 8

editing Changing an existing document. 64

edition A set of data that has been published using System 7's publish and subscribe feature. 79

educational game A program designed to teach a topic or skill, but created with a game format to make learning more enjoyable or engaging. 12

ejecting floppies, 47

electronic mail *See* E-mail.

Electronic Frontier Foundation (EFF) A Washington, D.C.-based organization that gives legal aid to computer users whom the EFF believes are being unjustly prosecuted. The EFF also develops policies and conducts lobbying efforts on issues related to intellectual property law and privacy. 97

ellipses (...), 50, 123

E-mail Electronic mail. A network messaging system that lets users leave notes for each other. 2, 10, 87

Englebart, Doug, 19

ENIAC Electronic Numerical Integrator and Calculator. The first electronic digital computer, developed by John Eckert and John Mauchly, and completed in 1946. Because of the ENIAC, 1946 is often considered the beginning of the computer age. 8

erasable optical disk, 32

erasing *See* Trash.

ergonomics The study of the physical relationship between people and machines. *Ergonomic* is often used to refer to devices that are specially designed for comfort or physical safety. 36

Ethernet A popular network protocol, developed by Xerox, Digital, and Intel. Ethernet networks use a bus topology. 89

expansion board A printed circuit board that connects to the bus (via an expansion slot) and provides a port for a specific peripheral. 35

expansion slot A connection on the motherboard where an expansion board can be plugged in. The bus connects the expansion slot to the processor. 35

expert system A type of artificial intelligence program that can simulate human expertise and decision-making in a specific subject area. 77

F

fax modem A hardware device that includes both modem and fax capabilities. 92
  example of use of, 3

fiber optic cable A communication conduit used in computer networks. The cable is made of glass fibers that transmit light. Fiber optic cable has the highest bandwidth of any communication channel. 88

field In a database record, a place for data entry or display, such as a blank in a form. In HyperCard, an area on a card that contains text.
  in database record, 70
  in Hypercard, 111

file compression utility A program that uses algorithms to make data files take up less storage space. 56–57

FileMaker, 108

File menu, 52, 59, 122

files Named sets of data or program instructions. 5
  management of, 48–49
  viewing by name or by icon, 49
  viewing lists in directories, 42

file server A computer (frequently a microcomputer) with a large hard disk that acts as the central storage device for a network. 86–87

FileShare The software that allows multiple Macs on an AppleTalk network to exchange data in a peer-to-peer relationship. 90

file transfer The process of moving a file from one computer to another through a network or over telephone lines. 86

find and replace *See* searching and replacing

Find command, 52, 123

Finder The program that presents the Desktop and the rest of the Mac's GUI. The term is often used interchangeably with *Desktop.* 44, 135

flat-file database A database composed of a single file, representing a single collection of data. 70–71

flat-panel monitor A thin type of screen often used on notebook computers. The most common technology used is the liquid crystal display, or LCD. 22, 23

floppy disk A plastic disk, coated with magnetic particles and encased in a plastic shell or envelope. The disk is referred to as a storage medium. Also called a *floppy* or *diskette.* 30
  ejecting, 47
  write-protecting, 62

floppy disk drive The storage device that accesses and writes data on a floppy disk. Also called a *floppy drive.* 30

flowchart A diagram that uses a standard set of symbols to show the function of each part of the program. 106

folders The basic organizational element of a hierarchical file system. A folder can contain files or other folders. PC users use the terms *directory* and *subdirectory.* 48, 58
- creating, 128–129
- moving, 121–122
- nested, 48–49, 130–131
- opening, 52
- viewing by icon, 121–122
- viewing by name, 129–130

font A typeface. A set of text characters that have a similar look. Common fonts include Times, Courier, Geneva, and Helvetica. 57

formatting
- cells in spreadsheets, 68–69
- word processing documents, 67

formatting diskettes *See* initializing.

form letters *See* mail merge.

formula In a spreadsheet, a mathematical statement that figures a value based on other values in the spreadsheet. 68

FORTRAN The first third-generation programming language, commonly used to create applications in mathematics, engineering, and science. 104, 105

fourth-generation language A class of programming languages that tend to be both more intuitive than third-generation languages and designed for a specific area of program development. They include code generators, application generators, authoring tools, scripting and macro languages, and query languages. 108, 114

FoxPro, 108

function keys The keyboard keys labeled F1 through F12 or F15. Used primarily on PCs as a way to enter commands. 18

G

games, 11

gigabyte About one billion bytes. Abbreviated GB. 27

grammar checker A software feature that scans a text document and alerts the user to nonstandard syntax and incorrect grammar. 67

graphical user interface (GUI) A user interface in which the user controls the computer with the help of icons and pull-down menus. A GUI (pronounced goo-ey) is normally used with a mouse. 42
- extending with menus and dialog boxes, 50–51
- and object-oriented programming, 107

graphics Electronic images.
- with desktop publishing software, 75

graphics software An application designed for manipulating electronic images. 10, 72–73, 81

gray-scale monitor Similar to a monochrome monitor, but capable of displaying the one color with varying levels of intensity. 22

GUI *See* graphical user interface (GUI).

H

hacker A skilled programmer or computer expert. The term is often used to refer to a criminal hacker who uses computer skills to break into corporate or government computer systems using a computer and a modem. 96

handshake A signal that two modems use to ensure that both are set up with the same line settings. 93

hard disk A magnetic storage device that holds data on a set of metal platters coated with magnetic particles. 31
- removable, 32

hardware The electronic machinery that makes up a computer. Each piece of hardware is called a device. 4, 18–41

hardware requirements The computer equipment required to run a program. The hardware requirements, usually listed on the box in which the software is sold, include the platform and the memory and storage required. 62

help, context-sensitive, 63

Help menu, 47, 134–135

hierarchical file system The system of nested folders and the files they contain on a disk. 48–49

highlighting, 19, 66

Hoff, Ted, 8

host mode A user interface established by a communication program. When the computer in host mode answers a call, the caller sees a menu of options for different operations, including sending and receiving files. 93

HyperCard 109, 110–111, 114
- card example, 107

HyperCard Player The part of HyperCard that lets you open and use but not create HyperCard stacks. 77, 110

hypermedia Programs that let users follow cross-references between all types of computerized data. 77

HyperTalk, 109, 111

I

IBM-compatible A microcomputer, made by a company other than IBM, that conforms to the same basic design, and can run the same software, as the IBM PC, IBM PC XT, or the IBM PC AT. Used interchangeably with *clone.* 6

icons Small, on-screen pictures that represent files or programs.
on menu bar, 46
for startup disk, 119

image editing software A special class of program designed for editing graphics by adding textures, colors, and a wide variety of photographic and artistic effects. 72

indicator lights The lights, present on many keyboards, that inform the user of the keyboard's current settings. They include the Caps Lock, Num Lock, and Scroll Lock lights. 18

infoglut The overabundance of information. 99

information A meaningful set of data. Processed data. The terms *data* and *information* are often used interchangeably. 5

information agent A program capable of roaming through online file systems, looking for specific kinds of information for the benefit of the user. Same as *knowbot*. 99

information service A company that offers a wide range of online services, including discussion groups, E-mail, electronic conferences, shopping, and reference data. 95

information systems department In a large company, the department that takes care of the computer system and creates programs for the benefit of other users. 84

initializing Preparing a disk for storing data. The process involves the creation of tracks and sectors on the disk. PC users refer to the same process as *formatting* the disk. 31

inkjet printer An output device that prints images using jets that spray tiny drops of ink at a sheet of paper. 24

input Data that is entered into a computer. The electronic process of data going from its source to the processor. 4

input device Hardware that you use to get data into the computer. Includes keyboards, mice, trackballs, and scanners. 4, 18–21

installing Copying a program from the floppy disks (or CD-ROM discs) on which it came to the computer's main storage device, which is usually the internal hard disk. The installation process is often automated by an Install or Setup program, and it often involves decompressing the program files. 62–63

integrated software A single piece of software that includes several applications, usually word processing, spreadsheet, and database applications, and sometimes also graphics and communications applications. Microsoft Works and ClarisWorks are integrated software. 76, 81

Intel The world's largest producer of microprocessors for microcomputers. Intel makes the CPUs for most IBM-compatible PCs. 28

Internet The largest network, connecting universities, businesses, and government agencies worldwide. 95

interpreter A program that translates a program written in a third-generation language into executable code (machine language) while the program is running. Many versions of BASIC are interpreted, rather than compiled. 104

K

Kemeny, John, 105

keyboard Input device for typing numbers, letters, and other written symbols. 18
easing use of, 53
proper height for, 36

Keyboard control panel, 53

keyboard shortcut A keyboard combination that, when pressed, initiates a command. Most keyboard combinations include the Command (⌘) key. 50

kilobyte 2^{10} bytes, or 1,024 bytes. Abbreviated KB. 27

knowbot *See* information agent.

Kurtz, Thomas, 105

L

label A group of text characters in a worksheet cell. In a worksheet, a cell can contain a value, a label, or a formula. 68

Labels control panel, 53

LAN *See* local area network.

laptop A small, portable microcomputer. Often used interchangeably with *notebook*, but sometimes considered larger than a notebook. 7

laser printer An output device for creating high-quality printed images. It works much like a photocopier, using a laser to apply static charges to a rotating drum, which picks up toner and transfers the toner to paper. The toner is fused to the paper with heat. 25

LCD monitor A flat-screen monitor that uses a liquid crystal display. Liquid crystal is transparent in its uncharged state, but becomes opaque when a current is applied to it. 23

licensing of software, 63

line settings Settings used to control a modem. 93

list box A dialog box element that displays a list of options. To select an option, you click on it. 51, 124

loading Starting a program. The process involves copying the code from storage into memory. 64

local area network (LAN) A computer network that fits in a room, a single building, or several adjacent buildings. 86, 99
Compare wide area network (WAN)

LocalTalk The cabling system used in AppleTalk networks. LocalTalk cables are a type of twisted-pair wire. 88

logging off (logoff) Disconnecting from a network. 94

logging on (logon) The process of connecting to a network. It usually includes typing an identification name or number and a password. *Login* means the same thing. 94

logic structure One of three basic logical patterns used in procedural languages. The three logic structures are sequence structure, selection structure, and loop structure. 106

loop structure One of the three logic structures. A sequence of program instructions is carried out repeatedly while, or until, a logical test is true. 106

M

machine language The programming language that the computer understands. Machine language consists of binary code, that is, ones and zeros. 104

Macintosh computers
compared to PCs, 6–7
turning on and off, 118, 135
types of, 7

macro A series of program commands that are initiated with a single command. Macro languages are considered fourth-generation languages. 109

Magic Cap, 99

magnetic tape A popular storage medium for backing up hard disks. The tape is encased in a plastic shell, similar to a music cassette. 32

magneto-optical disk A storage medium that holds data in crystals whose polarity can be read by a laser. It takes an electromagnet and a laser to write data to a magneto-optical disk, but a laser alone can read the data. 32

mail merge The process of combining a source document and a data file to create versions of the document for each line of data in the data file. Mail merges are most often used with form letters and address files. Mail merge capability is a common feature of word processing software. 67

mainframe A large-scale computer that can serve the processing needs of hundreds or even thousands of users simultaneously. 8, 10, 84–85

Map control panel, 53

Mauchly, John, 8

megabyte 2^{20} bytes, or about one million bytes. Abbreviated MB. 27

megahertz (MHz), 29

memory An electronic storage area that holds active programs and data files that are currently loaded. 28–29
virtual, 33

Memory control panel, 53

menu bar The area at the top of the Mac's screen that includes the names of the pull-down menus. 46–47, 118

menus, 50, 58–59, 122–124

microcomputer A small, general-purpose computer with its CPU contained on a single microprocessor. Compare with mainframe, minicomputer, and supercomputer. *Microcomputer* and *personal computer* are used interchangeably. 6, 85

microphone, 20

MicroPhone II, 93

microprocessor A computer-on-a-chip. A set of circuitry, etched onto a small piece of silicon, and containing the main processing components (the CPU) of acomputer. 8, 28

Microsoft Corporation, 44

Microsoft Works, 76

MIDI Musical Instrument Digital Interface. A standard system for input, processing, and output of sound, often used to link computers to electronic musical instruments. 20

minicomputer A small-scale, multiuser computer, often about the size of a filing cabinet. 8

MIS (management information system), 84

modem A contraction of the terms *mo*dulator and *demo*dulator. A device that translates a digital signal from a computer into an audible signal that can be transmitted through a telephone line. A modem also translates the audible signal back into a digital signal. 92, 100
examples of use of, 2
See also fax modem.

modifier keys The keyboard keys that are used in combination with other keys. On the Mac, the modifier keys are Shift, Option, Control, and Command (⌘). 18

modular Macintosh Any nonportable Mac with a separate monitor and system unit. 7
Compare compact Macintosh.

monitor A screen that acts as an output device. 22–23
proper placement of, 36
setting colors or shades of gray, 53

Monitors control panel, 53

monochrome monitor An output device that displays images using only one color. 22

MooV The format of a data file that can be played using the QuickTime system extension. 55

motherboard The computer's main circuit board. The CPU, the RAM and ROM chips, the system clock, the bus, and the expansion slots are all mounted on the motherboard. 34

Motorola The company that makes the CPUs used in Macintosh computers.

mouse Input device for controlling an on-screen pointer. It is used for many input tasks, including entering commands, controlling the cursor, and manipulating graphics. 19
easing use of, 53
how to use, 19, 119–122

Mouse control panel, 53

mouse pointer, 46

moving, windows, files or folders, 121–122, 128–129

MS-DOS, 44

multimedia The use of text, graphics, animation, and full-motion video (that is, multiple media) to present information. 23, 59
with QuickTime, 54–55

multitasking The ability to run more than one application at a time. 45, 78–79

MYCIN medical expert system, 77

N

naming, folders, 128

nested Refers to a folder that is inside another folder. 48–49
exploring, 130–131

network A group of computers, connected through a communication channel, such as twisted-pair wire or electromagnetic waves. 10
advantages, 85–87, 100
disadvantages, 96–97, 99, 100
hardware for, 88–89, 100
software for Macintosh, 90–91, 100
See also local area network; wide area network

network administrator An employee who manages access privileges in a centralized network. Peer-to-peer networks do not generally have network administrators. 90

network server *See* file server.

network version A program that is specifically designed to let multiple users on a network use the program simultaneously. The software license for a network version limits the number of machines in the network that are allowed to use the program. 63

New Folder command, 52

node A connection point on a network. Both terminals and computers are considered nodes. 89

notebook A small, portable microcomputer, about the size of an 8^{1}/2 x 11" pad of paper. Notebooks have hinged, flat-screen monitors, and weigh less than 10 pounds. 7

Note Pad, 53

numeric keypad A group of number keys on many keyboards that make it easier to enter numbers. 18

Num Lock key, 18

O

object In object-oriented programming, a combination of data and instructions that is treated as a single entity. 107

object graphics A graphic file in which shapes are mathematically defined. For example, a line segment is stored as a line shape with specific end points. 73
Compare bitmap.

object linking and embedding (OLE) A Microsoft Windows feature similar to the publish and subscribe in System 7. 79

object-oriented programming (OOP) An approach to programming that is radically different than structured programming. Objects, often representing screen elements, act in response to messages sent by the system or other objects. 107, 114

OCR Optical character recognition. A software capability that lets the computer translate a bitmap image into text code that can then be edited with word processing software. 21

OLE *See* object linking and embedding (OLE).

online Refers to a computer that is linked, whether by modem or network communication channel, to a remote computer. A user is said to be online, for example, when he or she has logged onto a bulletin board service. 94, 100

OOP *See* object-oriented programming (OOP).

opening
documents, 64–65
windows or folders, 52, 120

Open Scripting Architecture (OSA), 112

operating system The system software that must be loaded into memory before any other software is loaded. The operating system establishes an application interface, a user interface, and an interface between the CPU and the other hardware. 4, 41, 42–43, 58
five competitors, 44–45, 58
See also Desktop; System 7.

Option key, 18

OS/2 IBM's operating system for PCs. 45

output Processed information in a form that's useful to the user. The electronic process of information going from the processor to an output device. 4

output device Hardware that presents information to the user. Includes monitors, printers, and speakers. 4, 22–25

P

page layout with desktop publishing software, 75

Page Setup command, 52

paint program A type of graphics software that stores images as bitmaps. 72

palette A small window of clickable software tools, similar to a toolbar, but able to be moved around on the screen. 64

parallel port A port that transmits multiple bits simultaneously. The SCSI port is a type of parallel port. 35
Compare serial port.

parity A method of checking for errors in communication. Even parity means there are an even number of ones (each bit is either a one or a zero) in each set of data. 93

Pascal A highly-structured third-generation programming language originally developed to teach structured programming. 104

passwords, 96

paste To insert a copy of the data that is in the Clipboard into the current document. 66

PC An IBM or compatible microcomputer. A personal computer. 6

PC Paintbrush, 72

Peachtree Accounting, 76

peer-to-peer network A network in which users have control over files on their hard disks and can control access to their own files without relying on a centralized file server. 90

pen-based computer A computer that uses an electronic pen as an input device. Some pen-based computers are also called *personal digital assistants.* 9

Performa Mac, 7

peripheral Any hardware device outside the system unit. 34

personal computer *See* microcomputer.

personal digital assistant (PDA) A palmtop or similar device. A highly-portable, specialized microcomputer, often designed as an electronic address book, datebook, and memo pad. Some pen-based computers are also called PDAs. 7

personal information managers Programs that emulate a traditional office tool (such as a calendar, addressbook, or memo pad) on a computer. 76

PICT files, 79

pixel A contraction of *pic*ture *el*ement. A single phosphor dot on a monochrome monitor, or a group of three dots (one red, one blue, one green) on a color monitor. 22, 37, 72

platform The hardware and operating system. Most application software requires a specific platform, such as a Mac running System 7. 61

plotter A type of printer that draws an image with movable pens. Most often used to render CAD images. 25

pointer, 46

pointing Moving the mouse pointer to a specific place on the screen. 19, 119

pop-up menu A dialog box element that is used just like a pull-down menu. The currently selected option in the pop-up menu is displayed above it. 50–51

port A plug or socket where a peripheral can be attached to the system unit. 34–35

PowerBook A notebook Mac. There are several models in the PowerBook series. 7

presentation graphics A type of graphics application that focuses on capabilities for creating visual presentations. 73

printer A device that presents output on paper. 4, 24–25

print server A device (often a microcomputer) that controls the flow of data to the printers on a network. The network printers are connected directly to the print server. 87

procedural language A programming language that forces the programmer to write according to a specific order of actions, built around the three basic logic structures. Most third-generation languages are procedural. 104

processing device Hardware that performs mathematical and logical manipulations on electronic data. Includes memory and the central processing unit (CPU). 4, 26–29

ProComm Plus, 93

program A set of instructions that tells the computer how to perform a task or group of related tasks. Often synonymous with *software.* 4
  starting, 64
  switching, 134

programming The process of creating software. 103, 104–116

programming language A set of words or symbols that are used to write instructions that control a computer. 104–105

protecting your computer, 37

protocol In computer communications, a set of rules for communicating data. Network protocols include AppleTalk, Ethernet, and Token Ring. File transfer protocols for modems include Xmodem, Zmodem, and Kermit. 88, 93

pseudocode Programming code that does not adhere to the strict, syntactical guidelines of the programming language. The use of pseudocode is a technique that allows the programmer to concentrate on the logical structure of the program rather than the syntax. 106

publish and subscribe A System 7 feature that lets the user create and maintain active links between documents, so that a change in one document will be reflected in another. 79

pull-down menu A list of options that is accessed by pointing at the menu name with the mouse, holding down the mouse button, and dragging down to the desired option.

Q

QuarkXPress, 74

query In a database, a listing of records that meet specific criteria. 70

query language A fourth-generation programming language designed for writing database queries. The best known query language is SQL (which stands for Structured Query Language). 109

QuickTime An extension to the Mac's system software that enables that computer to play video clips, animated graphics, and sound. 54–55, 59

quitting Exiting and clearing a program from memory. 65

R

radio button A dialog box element that lets the user choose one option from a small set of related options. 51, 124

RAM Random access memory. A type of chip that holds electronic data as long as it is fed an electric current. *RAM* and *memory* are often used interchangeably. 28–29

RAM disk A part of RAM that is treated as a fast storage device. Configuring part of RAM to be a RAM disk can help notebook computers conserve battery power. 33

raster graphics, 72

README files, 62

read-write head The part of a disk or tape drive that uses electromagnets to read data from, and write it to, a disk. 30

record In a database, a set of data about a specific person, thing, or event. 70

reference software A program that emulates a traditional reference source (such as a dictionary, encyclopedia, or almanac) on a computer. 76–77

refresh rate The number of times each second that the phosphor dots on a CRT monitor are illuminated by the electron gun. Refresh rates are measured in hertz (Hz), which means cycles per second. 23

relational database A database in which multiple files can be related to each other, as long as each file shares at least one field with at least one other file. 71

removable hard disk A storage medium similar to a standard hard disk, but removable from the computer. The case that holds the disk is called a *hard disk cartridge*. 32

resolution In reference to a monitor, a measurement of the number of pixels per inch, given in dpi (dots per inch). Most Mac monitors display 72 dpi. Resolution can also refer to dot-matrix, inkjet, and laser printers (also in dpi). 23, 24

Ritchie, Dennis, 105

robot A special-purpose computer that performs a physical task. 13

ROM Read-only memory. A type of chip that stores data permanently. The computer can read from, but not write to, a ROM chip. ROM chips often contain basic information that the CPU needs during startup. 28–29

root The folder that contains the first level of storage in the hierarchical file system on a disk. On the Mac, it's the folder you see when you open a disk icon. 48

S

Save As command The command that you use to give a new name and location to a document. 65

Save command The command that you use to save a document under its current name in its current location. 65

saving Copying a file from memory to storage. 65

scanner Input device capable of reading a printed image and generating an electronic file from it. 21

Scrapbook, 53

screen saver A program that turns the screen blank or displays moving images when no user-initiated change (input) has occurred for a specific amount of time. 37

script A short series of instructions that are carried out when an object receives an instruction. 108–109

scripting language A type of fourth-generation programming language, typically comprised of plain-language words, and used to automate application, or system-level procedures. 108

scroll arrow A window element, found at the end of a scroll bar, that is used to move gradually through a folder or document. You use a scroll arrow by clicking on it or by pointing and holding down the mouse button. 48, 125

scroll bar A window element that lets you move through a document or an open folder, displaying data that was not originally visible. 48

scroll box A window element within a scroll bar that shows the approximate position of the data that is currently visible in the window. You can move to any position in a document or folder by dragging the scroll box along the scroll bar. You can move up or down through the document or folder, one screen at a time, by clicking above or below the scroll box in the scroll bar. 48, 125

Scroll Lock key, 18

SCSI port Small Computer System Interface port (pronounced scuzzy). A fast type of parallel port commonly used on Macs. 35

searching and replacing Two similar features found in word processing programs, as well as some other types of software. With *search* (also called *find*), the computer locates occurrences of a specific set of characters. With *replace*, the computer searches for a specific set of characters and replaces the set with another that the user has entered. 66

security issues, 96–97

selection structure One of the three logic structures. Data is subjected to a logical test. If it passes the test, one instruction is performed. Otherwise, a different instruction is performed. 106

semiconductor A material that conducts electricity in its charged state, but doesn't do so in its uncharged state. 26

sequence structure The simplest logic structure. A linear progression of program instructions.

serial port A port that transmits data in sequence, one bit at a time. The Mac's ADB port is a type of serial port. 35
Compare parallel port.

Shift key, 18

Shut Down command, 135

SIMM Single In-line Memory Module. A printed circuit board that holds RAM chips. SIMMs can be plugged into special slots to increase a computer's memory. 28

simulation software A program that uses the computer to re-create a situation or phenomenon. The best-known example is the flight simulator that trains pilots. 12

site license A software license that permits an organization to install a program on a specific number of computers. A site license to use a program on, say, ten computers is generally less expensive than buying ten separate copies of the program. 63

size box A window element, in the lower-right corner of every window, that lets you control the size of the window. To change the size, you drag the size box. 48, 125

"sleep" mode, 29

Smartcom II, 93

Smart House, 11

software Electronic instructions that control the computer. A set of instructions is called a *program*, but the two terms are often used interchangeably. 4
installing, 62–63, 80
shopping for, 62, 80
upgrading, 63

software license An agreement between a software company and a customer that permits the customer to install a piece of software on a specific number of computers. Most software licenses permit the program to be installed on only one machine. 63
See also network version; site license.

software piracy Any breach of the software license, whether by loading the program onto more machines than the license permits, or by giving away or receiving an unlicensed copy of the software. 63, 96

Software Publishers Association (SPA) An organization of software developers whose activities include investigation and prosecution of software pirates. 63, 96

sorting Rearranging the records of a database file according to the data in one of the fields. 70

Sound control panel, 53

sound input, via microphone, 20

sound output, 23

Special menu, 135

special-purpose computer A computer—sometimes just a microprocessor in an appliance or tool—designed for a specific type of task. 13

speed issues, 29, 53

spelling checker A software feature that looks up all the words in a document and compares them to those in a built-in dictionary. When a word isn't found in the dictionary, the spelling checker alerts the user with a dialog box. Spelling checkers are very common in word processing and DTP programs, but are also found in other types of software. 67

spreadsheet A piece of software designed for creating budgets, tracking expenses, developing business projections, and doing other tasks that involve manipulating sets of numbers. Also a formatted table of text and numbers; that is, the output generated by spreadsheet software, or the computerized version of a ledger. In this sense, *spreadsheet* and *worksheet* are synonymous. 10, 11, 68–69, 80

SQL (Structured Query Language), 109

stack A HyperCard document, consisting of a group of cards. Because HyperCard is an authoring tool, a stack can also be considered a program. 77

starting programs, 64

star topology A network configuration in which all of the computers are connected to a central hub or ring. 89

startup disk The disk (usually a hard disk) that contains the operating system. A startup disk must be present for the Mac to begin operation. The icon for the startup disk is displayed in the upper-right corner of the Desktop. 47

startup disk icon, 119

status bar, 125

stop bit A bit that signals the end of a set of data sent by a modem.

storage device Hardware that holds data when it isn't being used by the processing devices. Strictly speaking, storage devices write to and read from storage media, so a floppy disk drive is a storage device and a floppy disk is a storage medium. Storage media include floppy disks, hard disks, CD-ROM disks, magnetic tape, and so on. 4, 30–33

structured programming An approach to programming using third-generation languages that involves the use of top-down design, in which a program is broken into subroutines or modules. Structured programming may also involve the use of flowcharts, pseudocode, and logic structures. 106

styles with desktop publishing software, 75

subnotebook The smallest class of general-purpose computers. Subnotebooks look like notebook computers, but usually weigh less than five pounds. 7

supercomputer An extremely powerful computer, usually designed for complex mathematical processing. 8

SuperPaint, 72

surge suppressor A set of electrical outlets connected to a circuit breaker. It protects electronic equipment from electrical surges and spikes. 37

SyQuest removable hard disk, 32

System 7 A recent version of the Mac's operating system. 44

System The name of the Mac's operating system file. 42, 44

system board *See* motherboard.

system clock A quartz timing device used to synchronize processing operations. The speed of the system clock, which is the number of times the clock ticks each second, is measured in megahertz (MHz), which stands for millions of cycles per second. 29

System File The file that comprises the core of the Mac's operating system. It works in conjunction with the Finder program, which controls the user interface. 44

System Folder The folder in the startup disk that contains the Mac's operating system. 44, 49

system software The set of programs that runs the computer, controlling its basic functions. System software includes the operating system, utilities, programming languages, and the startup routines contained in ROM. 4

system unit The main case of a microcomputer. The system unit houses the CPU, memory, bus, ports, expansion slots, power supply, and usually the main storage devices, such as the hard disk and one or more floppy disk drives. 6

T

tax preparation software A program that automates, as much as possible, the preparation of standard tax forms. 77

technical support A service offered by a software developer in which staff members answer customer questions over the phone. Also known as *telephone support.* 63

telecommuting Refers to working at a location other than the office (usually at home or on the road) while staying in touch with the help of a modem. 98

template A generic master document that is modified to create other documents. 64, 74

terabyte About one trillion bytes. Abbreviated TB. 27

terminal A keyboard and monitor used to access a multiuser computer, such as a mainframe. 8

text
- editing and formatting, 66–67
- representing with ASCII, 27

text box A dialog box element in which text can be entered. 50, 124

TEXT files, 79

thesaurus A software feature that provides the user with synonyms and antonyms of selected words. 67

third-generation language A machine-independent procedural language that requires a machine-specific interpreter or compiler. 105, 114

thread In a discussion group, a series of messages that respond to one message or to other responses to that message. 94

time-sharing Refers to a large-scale computer system in which many users can access programs and data simultaneously. 84

title bar A window element that displays the name of the open folder (for a Desktop window) or the name of the open document (for a document window). 48, 125

Token Ring A network protocol developed by IBM. 89

toolbar A screen feature of some software, consisting of buttons that give the user quick access to the most commonly used program commands. 64

top-down design The central technique of structured programming, in which the overall task to be completed by the program is broken down into smaller, more manageable tasks, which are accomplished by modules or subroutines in the program. 106

topology The pattern of connections between the nodes on a network. 89

touch screen A monitor that can sense when the screen is touched and thereby accept input. 20

tower model A personal computer with a modular design and a system unit designed to stand on end, usually on the floor. 6

trackball Input device that offers the same functionality as a mouse. The pointer is controlled by a ball that rolls within its housing. Trackballs are very common on notebook computers. 20

transistor An electronic switch that can be on or off. 26

Trash A temporary storage area for files that the user wants to delete. The first step of deleting a file is to drag it to the Trash. The second is to choose Empty Trash from the Special menu. Dragging a floppy disk icon to the Trash ejects the disk. 47, 119, 131–132

turning your Macintosh on and off, 37, 39, 118, 135

tutorial A program designed to teach a topic or skill. 12, 54

twisted-pair wire A common communication channel used in networks. It consists of two insulated wires that are twisted around each other. LocalTalk cables are a type of twisted-pair wires. 88

typesetting with desktop publishing software, 75

U

uninterruptible power supply An electrical connection with a built-in battery that supplies current for a short time if the regular supply of electricity is cut, as in a blackout, providing enough time to save work to a disk before power runs out. 37

Unix An operating system, originally developed by AT&T's Bell Laboratories, but sold by many different companies. The most widely used operating system on workstations. 45

upgrade A new version of a program, usually offering more features or other improvements over the previous version. 63

uploading Sending a file to a remote computer.

USENET, 95

user The person operating the computer. 5

user-friendly, 5

user group A group of users who meet and discuss a specific piece of hardware or software. Some user groups meet in person, while others meet electronically, through BBSs or information services. 94

user interface The set of on-screen features that let the user control the computer. The most common types of user interface are the command-line interface and the graphical user interface (GUI). 42

utility software A type of system software that enhances the operating system. Examples include backup programs, file compression utilities, and antivirus utilities. 56–57, 59

V

value A number in a spreadsheet. In a spreadsheet, a cell can contain a value, a label, or a formula. 68

vector graphics *See* object graphics.

Ventura Publisher, 74

video with QuickTime, 54, 55

Views control panel, 53

virtual memory A part of the hard disk that is used like RAM. Setting aside disk storage space for virtual memory lets System 7 open more programs and documents than available RAM allows. 33

virus A rogue program that can reproduce itself in other programs or on other disks. Some viruses are harmless, while others can destroy data. 57

VisiCalc, 8, 10

voice recognition A computer's ability to translate spoken words into text or to accept them as commands. 9, 20

volatility of computer memory, 29, 30

W

WAN *See* wide area network (WAN).

Wastebasket, 47

wide area network (WAN) A group of smaller networks (LANs), connected across a broad geographical area. 86, 99
Compare local area network (LAN).

window On the Desktop it is an area on the screen that displays the contents of a folder. In an application, a window displays the contents of a data file. 48
closing, 120
how to use, 48, 58, 125–127
moving, 121–122
on Desktop, 119
opening, 120

Windows A GUI, made by Microsoft and used to make DOS-based PCs more user-friendly. 44–45
as GUI operating system, 42

Windows NT Microsoft's powerhouse operating system, which competes with Unix and OS/2. 45

wireless communication Refers to a network that uses electromagnetic waves as a communication channel. Data can be transferred using microwaves, infrared, visible light, and common radio frequencies. 88

word processing The process of entering and formatting written documents on a computer. 10, 66–67, 80

word processing software A program for entering and formatting documents. 10–12

word processor A word processing program. A computer specifically designed for word processing.

word wrap A word processing feature that automatically determines where each line of text should end. With word wrap, you don't have to (and shouldn't) press Return or Enter at the end of each line. 66

workgroup computing Refers to the cooperative arrangement of a peer-to-peer network. 90

worksheet A data file created using spreadsheet software. The word *spreadsheet* is often used to mean *worksheet.* 68

workstation A computer designed for engineering or graphics work. 9

write-protect To mechanically prevent a disk from being written to. 62

Z

zoom box A window element, in the upper-right corner of every window, that changes the size of the window between the optimum size (as determined by the Finder) and the last size that was set with the size box. To use the zoom box, you click on it. 48, 125, 126

ISBN 0-02-801051-5

GLENCOE
McGraw-Hill