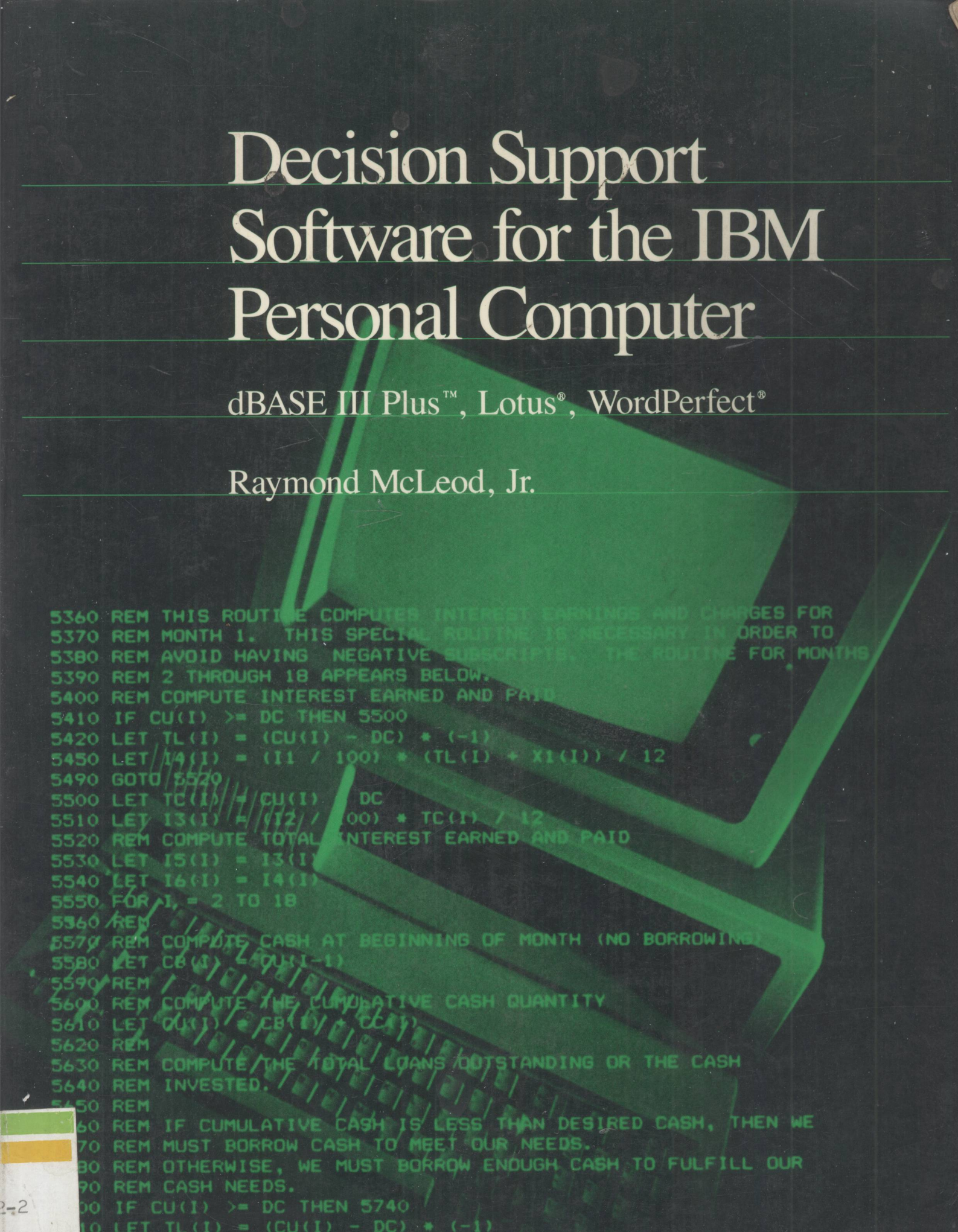
Decision Support Software for the IBM Personal Computer

dBASE III Plus™, Lotus®, WordPerfect®

Raymond McLeod, Jr.



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SRA®
SCIENCE RESEARCH ASSOCIATES, INC.
Chicago, Henley-on-Thames, Sydney, Toronto

To Irvine H. Forkner: educator friend,
and superb judge of talent.

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Contents

Preface

Only a few years ago, there were no textbooks on the market that included multiple software packages for small-scale computers. The four most popular packages were BASIC, dBASE II™, VisiCalc™, and WordStar™, but you had to buy four books if you wanted to learn them all. In response to that need, a decision was made to include all four packages in a single text. After a successful pilot test at the University of Colorado at Boulder during the Spring 1984 semester, the initial version of *Decision Support Software for the IBM Personal Computer* was published. That version was then updated by replacing VisiCalc with Lotus 1-2-3 when it became clear that 1-2-3 would soon be the premier electronic spreadsheet.

This edition is a major revision of those two earlier efforts. The BASIC chapters have been updated to incorporate structured BASIC, dBASE II has been replaced by dBASE III Plus™, Lotus® Version 1A replaced by Version 2.01, and WordStar replaced by WordPerfect®.

Why These Software Systems?

The two main choices facing managers who wish to create computer-based decision support systems are to either: (1) create their own programs using a procedural language, or (2) use a prewritten software system, or "package."

Why BASIC?

For the majority of its short life, the microcomputer has relied on the BASIC language as a means of creating customized programs. There are other languages, such as Pascal, FORTRAN, and COBOL, but BASIC is by far the most widely used. In a 1987 survey of 169 colleges and universities conducted by Science Research Associates, 85% identified BASIC as the language that should be taught in the introductory computer course.

Why dBASE III Plus, Lotus, and WordPerfect?

The participants in the SRA survey also listed electronic spreadsheets, data base management systems, word processing systems, and computer graphics as the top four prewritten software systems to be included in the introductory course. There was little question about which software systems were perceived to be the most important.

The next step was to select the particular brands of prewritten software systems. The selection process placed much weight on the level of adoption. The reasoning was that the schools would more likely have copies of the most widely adopted packages and the instructors would already be familiar with their use. Applying this logic, dBASE III Plus was selected as the data base management system, Lotus 1-2-3 as the electronic spreadsheet, Lotus PrintGraph® as the graphics package, and WordPerfect as the word processor.

This selection also ensures that the packages are exceptionally user-friendly since that is a necessity in a course where the student will be introduced to several packages.

This text is clearly on target in terms of describing the types of microcomputer software that are perceived to be the most important.

Why the IBM Personal Computer?

When an author writes a book about software, the best results can be expected when the description is based on a specific computer system. Otherwise, too much

attention must be given to minor (but important) differences between the software versions for the different systems, and the main points become obscured.

Once the decision was made to address a specific computer rather than several different brands or microcomputers in general, the choice of the particular computer was easy. Practically from the day of its introduction, the IBM Personal Computer (PC) has been the leader of the small-scale computer market. The best evidence of this leadership is the large number of "IBM PC compatibles"—computers designed to execute software written for the PC—that have come onto the scene. The PC is a good choice for the text not only because of its own large following but also because of the following of the PC compatibles.

Another point in favor of the PC is the fact that it will probably be in use for a long time to come. This feature is not easy to come by in the ever-changing computer field. The announcement by IBM of additional members to the "PC family" since the introduction of the first model indicates a commitment by that organization to the PC line.

The Organization of the Text

The text is organized into seven modules:

1. The IBM PC
2. Decision Support System Concepts
3. Procedural Programming Languages
4. Data Base Management Systems
5. Electronic Spreadsheets and Computer Graphics
6. Word Processing
7. Overview of Software for the IBM PC

Modules 3 through 6 describe the software—BASIC and the software systems. Each module includes a chapter describing how that software fits into a DSS, an introductory chapter, and one or more advanced chapters.

The book can be adapted to a variety of course formats. It is possible to design a course including only certain software systems, or including only certain chapters for particular systems. Also, it is possible to cover the modules in a sequence different from the text. Each module stands alone, providing for complete flexibility.

Intended Use of the Text

The text is intended for use as:

- the only text in a microcomputer course where the intent is to teach both hardware and software.
- the only text in an IBM PC course where the intent is to teach only that system.
- the only text in an introduction to computing, MIS, or DSS course where the emphasis is on student use of decision-support software.
- a supplement to an introduction to computing text or an MIS text where the experiential activity is to consist of DSS-oriented laboratory assignments.
- the only text in an adult short course where the intent is to update participants on small-system hardware and software.

DSS Emphasis

All of the material is presented in a decision support system (DSS) context. The aim is to show how a manager can use a small computer and a combination of software systems as a decision support system. Neither the examples nor the overall tone of the book are geared to data processing, record keeping, or clerical activities. The book focuses on management problems and solutions. The intended audience includes both current and future managers.

Recognition of Support

This book would not have been possible without the support of many people. First, I recognize the assistance provided by the faculty, administration, and students at the University of Colorado at Boulder (UCB), where the material was first used. Donald R. Plane, head of the Information Systems Department at UCB and now at Rollins College, approved the approach of teaching multiple software packages in the introductory computer course. Edward J. Maes and his administrative staff of Nanci McCutcheon, Carla Williamson, and Lisa Spencer made it possible to meet some tight deadlines in getting handout material to the students. Special recognition goes to Lisa Spencer for typing the initial manuscript. In addition, the students who used the material played a key role by providing suggestions for improvements and confirming that multiple software packages can be covered as the experiential portion of an introductory computer course.

Program language examples were provided by Professors R. Wayne Headrick, Bala Shetty, Jane Carey, and Marietta J. Tretter, of Texas A & M; Professor Irvine H. Forkner of Metropolitan State College in Denver; and Donald H. Bender of Government Personnel Mutual Life Insurance Company of San Antonio. Professor Joe L. Poitevent of Texas A & M reviewed the chapters on structured BASIC. My graduate assistant, Gordon Carruth, made suggestions of a technical nature for the chapters dealing with the IBM PC and BASIC, as well as the appendix. I also acknowledge the technical assistance, literature, and illustrations provided by several firms—Computer Connection, Computer Source, Computer Works, ComputerLand, Epson America, International Business Machines, Statistical Graphics Corporation, and Tandy Corporation.

Special recognition goes to Eileen Bechtold Dlugoss of Cuyahoga Community College in Ohio, Peggy White of Saint Johns River Community College in Florida, and Dean Defino of Salisbury State College in Maryland for their review of the text. Professor Dlugoss has performed this function for all three versions of the text.

As always, I am indebted to my typist, Chris Davis of Words-to-the-Wise of Boulder, Colorado, for her keyboarding support. Chris keyed the previous manuscript onto word-processing diskettes so that I would not have to begin this revision with a blank screen.

Finally, I thank the people at SRA, especially my editor Michael J. Carrigg who was quick to recognize the need to put this type of text into the hands of persons wishing to learn how to use the IBM PC as a decision support system. Special thanks also go to Elizabeth Sugg for coordinating all of the activities that are involved with getting a book such as this published.

As author, I alone am responsible for any errors that appear on these pages. However, if you, the teacher or student, are pleased with the book, the credit goes to the SRA organization. I have been a part of the SRA team for almost 10 years, and I have always been impressed with their professionalism.

Raymond McLeod, Jr.
College Station, Texas

Module 1
The IBM PC

1 Introduction to the IBM Personal Computer

This chapter briefly reviews the evolution of computing and how we reached this period in our history when the small computer is having such an impact on record keeping and management,—both in business and at home. In the review, the major computer concepts and terms are presented. This material forms the important foundation upon which you will build as you improve your understanding of computing. Suggestions are provided that will enable you to learn more about small-system computing, especially the IBM Personal Computer (PC). The majority of the chapter describes the various units comprising the PC system.

How It All Began

The computer era began only a little over thirty-five years ago. In the mid-1950s, business firms and government bureaus began using computers to process large volumes of data. The first computers were very large and were so expensive that only the largest organizations could afford them. The IBM RAMAC 305, illustrated in Figure 1.1, is an example of these early systems.

Early Computer Applications

For the first ten years or so, computers were used almost exclusively for **data processing**—such as the basic accounting applications of payroll and accounts receivable. In the mid-1960s a new use of the computer received attention. The idea of the computer as a **management information system (MIS)** captured the imagination of managers. Up until that time, managers had received some information from the computer, but the main focus was on data processing. Any information that the managers received was an automatic by-product of the data processing. For example, a sales manager would receive sales statistics (sales by customer, sales by item, and so forth) from data that had been assembled for the billing operation. As organizations implemented the MIS concept, new computer applications were added specifically to benefit management.

The Small-Computer Boom

During the 1970s, the computer field continued to expand and change. A new category of small computers was introduced. These first small computers were called **minicomputers,** or simply **minis.** Although they were smaller and less costly than the larger computers, now called **mainframes,** the minicomputers often outperformed their predecessors.

The smaller-the-better trend received its biggest boost from the development of the **microprocessor**—computer circuitry on a small, metal-oxide-semiconductor (MOS) chip. This chip, smaller than your fingernail, became the basis for a computer system that was even smaller than the mini. The new computer was called a **microcomputer** or **micro.** An example of an early microcomputer is the Tandy Radio Shack TRS 80™ pictured in Figure 1.2. It was so small, it could fit on a desk top.

Figure 1.1 The IBM RAMAC 305

Innographics Photo

Today, there are three basic categories of computers, based on their size: mainframes, minicomputers, and microcomputers. The physical components that make up the computer systems are called **hardware**. Most of the attention today is directed at the microcomputers. Used in business offices, they are called **small business systems.** Used by individuals, in homes or offices, they are called **personal computers.**

The Evolution in Computer Programs

While the trend in hardware was toward smaller size, the trend in programs used by the computers took another direction. A **program** is a list of instructions that tells the computer what to do. A computer is useless without a program. A separate program is written for each application that the computer is to perform. A firm usually develops or buys many programs so that the computer can be used in many ways. The popular term **software** refers to programs—the "nonhardware" component of computer systems. Figure 1.3 provides an example of a short program that multiplies hourly rate times hours worked to calculate gross earnings.

As the MIS concept gained support among managers, computer specialists responded by creating programs that could provide as much information as possible. Some of these programs were mathematical models that contained hundreds or even thousands of equations. These equations were intended to **simulate**, or represent, the operations of the firm. Although the intent was good,

Figure 1.2 A TRS 80 Microcomputer System

Radio Shack, a Division of Tandy Corp.

many designs became too large and cumbersome. The systems were not easy to use, or they failed to give the manager the information that was needed. In some cases, data was inaccurate or incomplete. Many companies scrapped their MIS efforts.

The Decision Support System Concept

A fresh approach began in the early 1970s. A new concept, called the **decision support system (DSS)**, was more modest in scope. A DSS does not attempt to provide a manager with *all* of the information needed to do his or her job. Instead, the DSS focuses on a single problem and attempts to provide information about that problem. Since a manager is faced with many problems, a set of DSSs is used. For example, a sales manager will use one DSS to help decide how many salespersons are needed, another DSS to help decide where the salespersons should be located, another to help determine how the salespersons should be compensated, and so on. The emphasis is on the word *help.* The DSS does not make the decision for the manager. The DSS only supports the manager, who must use intelligence, experience, and common sense in making a decision.

MIS Versus DSS

Some people believe that DSS replaced MIS. This idea is difficult to accept since the term MIS is still so popular. Many businesses have MIS departments (often shortened to **IS** for **information systems**), and executives in charge of MIS. A good

Figure 1.3 A BASIC Program

```
10  READ RATE, HOURS
20  LET GROSS.PAY = RATE * HOURS
30  PRINT GROSS.PAY
40  DATA 12.75, 40
50  END
```

way to think of DSS and MIS is to regard MIS as the overall effort in the firm to meet the manager's information needs, and to regard the DSSs as the elemental parts of the MIS. It is as if the MIS were a wall and the DSSs were bricks in the wall.

The Situation Today

The computer era has evolved through phases in hardware, software, and use. There are computers of all sizes, so that the smallest organizations, and even individuals, can afford them. The computers are used both to process data and to provide management information.

The most popular computer today is the IBM Personal Computer (PC), introduced in 1981. The popularity of the PC is based partly on the wide variety of software that has been developed for it. Special software packages are available to meet the needs of specific *industries,* such as real estate and construction, and to perform certain *applications or tasks,* such as inventory control and payroll. Some of the software is available from IBM, but most has been developed by other organizations. There are some 13,000 separate packages available for the PC.[1]

In addition to the tailoring of software to the PC, a large number of other computer manufacturers have designed competitive hardware systems that are **PC compatible**. More than 170 of these PC compatibles can run some or all of the programs written for the PC.[2]

So when you learn how to use the PC or a PC compatible, you have available a large selection of software. While there are many other excellent computers on the market, such as the Apple line, there is no question about which one is the focal point of small-systems activity. It is the PC.

The Facts of Life

Before we begin our discussion of the PC, there are a few things that you should know. First, there are a variety of places where you can buy a PC. IBM has its own retail outlets (called IBM Product Centers). In addition, IBM has licensed a number of computer stores such as ComputerLand and CompuShop to sell the PC. If any of these retail outlets are in your city, you can go in and shop around. In addition to the stores, you can buy a PC by mail order. While you are in a computer store, browse through its magazines. There are several magazines published specifically for the PC, such as *PC Magazine* and *PC World*. If you examine one of these magazines,

1. *The Software Encyclopedia 1986/87,* vol. 2 (New York: R. R. Bowker) 927–1476 passim.
2. *Computer Buyer's Guide & Handbook,* May/June 1987, 66–85.

the first thing that will impress you is the huge market that has grown for products to use with the PC—accessories, furniture, supplies, and so on. You quickly get the idea that, although computer prices have been going down, you could drop a bundle if computing becomes a habit.

While you are educating yourself to the facts of life as they relate to small-system computing, keep an eye on your newspaper for computer ads. There is probably a separate category in the classified ads for computers. Also, pick up a copy of *Byte* magazine (at a computer store, bookstore, or your college library) and check out its classified ads. You will see that the same items (including the PC itself) are advertised for varying prices. Now you are getting the second basic idea: In addition to the wide variety of sources and products, the prices vary also. You can make your dollars go farther if you shop around.

You will learn very quickly that you must "speak the language" if you are to be a good shopper. Let us assume that you decide to buy a *diskette* (or a *floppy* as it is often called). The sales clerk points to a display of perhaps a dozen brands and asks questions like "Three-and-a-half inch or five-and-a-quarter?" "Single-sided or double?" "Soft-sectored or hard?"

If you are interested in computing, you must get the best education that you possibly can. Watch computer programs on TV, take courses, read books and articles, and talk with friends who are knowledgeable. You quickly will realize that you cannot learn everything. But do not let that you hold you back. You can learn the basics, and an understanding of the basics will enable you to add more specialized knowledge when the need arises.

PC Architecture

Now that we are up to date on the general situation in the computing field, let us turn our attention to the PC.

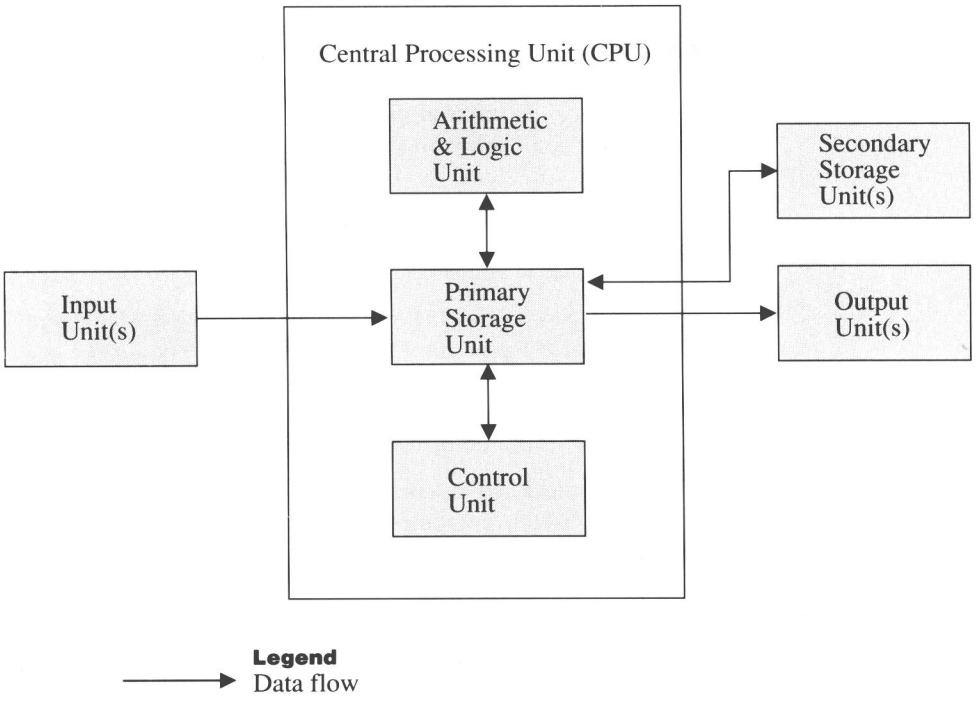
When the first computer class was conducted, the instructor most likely drew a diagram on the chalkboard similar to the one illustrated in Figure 1.4. The diagram is called the **computer schematic,** and it is just as applicable today as it was in the mid-1950s. The schematic shows the basic units of a computer and how data flows through the system.

The main unit is the **central processing unit,** or **CPU**. It houses the primary storage unit, the arithmetic and logic unit, and the control unit. The **primary storage unit** (often called **main memory**) stores the program and the data that is being processed. The **arithmetic and logic unit** (sometimes called the **ALU**) performs the arithmetic and logical operations. The **control unit** controls all of the computer units so that they work together as a coordinated system.

In addition to the CPU, a computer system includes one or more secondary storage units and input/output units. The **secondary storage** (also called **auxiliary storage**) supplements the primary storage by storing additional programs and data. The **input units** are used to enter instructions and data into the computer, and the **output units** record the results of the processing so that they can be viewed by the user.

Although the PC is much more advanced in its design and technology than the first computer, it fits the computer schematic. Figure 1.5 shows a system that contains all of the component units. The CPU of the PC is housed in the **system unit**. All of the CPU circuitry and units (except for primary storage) are contained

Figure 1.4 The Computer Schematic



on a single MOS chip, the Intel 8088™. Some PCs include another Intel chip, the 8087, that is used to speed up certain arithmetic operations. This extra chip is called a **numeric coprocessor**, or simply a **coprocessor**.

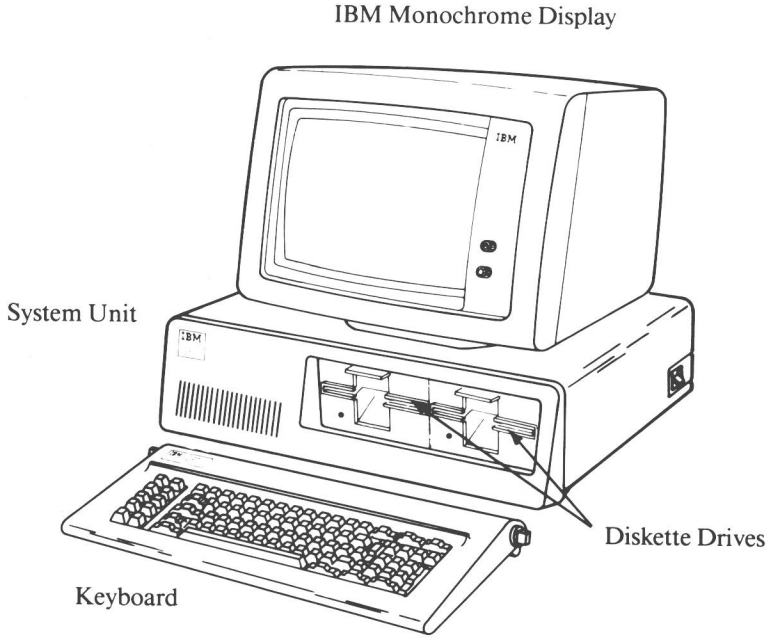
Primary storage is in the form of one or more MOS chips. Each chip has the capacity to store slightly over 256,000 characters. Secondary storage consists of one or two **diskette drives.** Each drive reads data from a rotating plastic diskette into the primary storage where the data is held for processing. After processing, the data usually is written back onto the diskette. The diskette also stores programs in addition to data.

The appropriate diskette must be inserted for each application that the PC is to perform. For example, if you want to process inventory, you insert the diskette containing the inventory program. Perhaps there is also a diskette for the inventory data. If so, it is inserted in the second drive. After the processing has been completed, you remove the diskette. Then you insert the diskette required for the next application.

The primary input unit is the keyboard. It is attached to the system unit by a coiled cord similar to the one found on a telephone. You can move the keyboard around within a few feet of the system unit, but the normal location is just in front—as illustrated in the figure.

The television-like unit sitting atop the system unit provides some or all of the output. If the unit can display only one color (green or amber on a black

Figure 1.5 The IBM Personal Computer



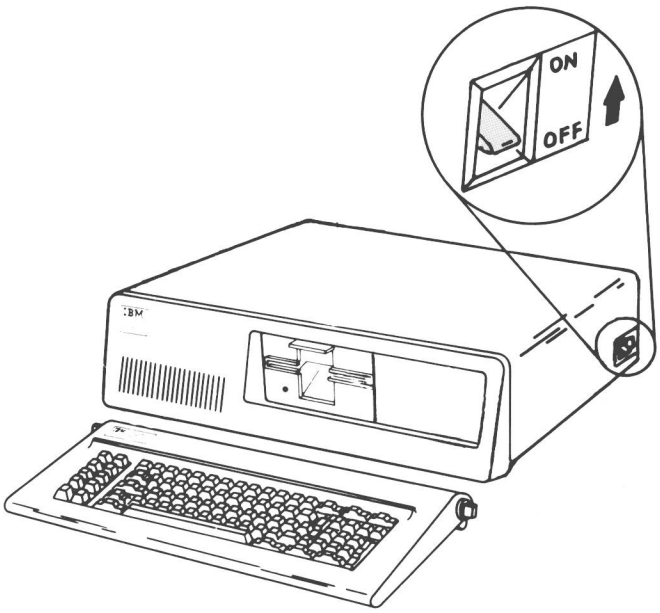
background) it is a **monochrome display**. If it can display all of the colors, it is a **color monitor**. After this introductory chapter, we will make no distinction between the monochrome and the color units, and will use the term **screen.**

Monochrome displays usually include two control knobs—one for contrast and one for brightness. There is no separate on/off knob—the power comes on when you turn on the system unit. On some color monitors (you can buy them from several sources) there are no control knobs—only an on/off knob. You turn on the monitor *before* you turn on the system unit.

If a computer system is composed of several units that must be turned on individually, you always turn on the system unit *last*. The power switch for the system unit is located at the right rear, as shown in Figure 1.6. Also, when turning the units *off,* the system unit is turned off *first*. This practice prevents electricity from surging through the system unit as the other units are turned on and off. The PC is rugged, so do not be afraid that you might do something wrong and break it. Just remember about turning the power on and off in the right sequence and everything will be okay. If you forget, you probably will not cause any damage. But try not to make a practice of it.

The units discussed so far comprise a complete system. All of the component parts of the computer schematic are represented. However, if you want printed output (called **hardcopy**), you need a printer. Printers are necessary when the output is to be kept as a permanent record or distributed to persons in the form of letters, memos, or printed reports. Figure 1.7 illustrates a printer that is very popular—the IBM Proprinter. Many PC configurations include printers manufactured by other companies.

Figure 1.6 The System Unit Switch



We have described the PC in a general way. Now let us take each unit separately and gain a better understanding of its operation.

The Keyboard

The keyboard is pictured in Figure 1.8. The keys in the center (shaded area) are arranged in the same pattern as on an ordinary typewriter. In addition, there is a **numeric keypad** on the right that can be used to enter numeric data as with a pocket calculator. The numbers can also be entered with the keys across the top as with a typewriter.

The keys of the numeric keypad are also used to move the cursor on the screen. The **cursor** is a symbol such as a square or underline mark that indicates where data is to be entered next. Each software package uses the cursor in a different way. We will learn more about the cursor later in the text.

On the left-hand side of the keyboard are two vertical rows of **function keys**, numbered F1 through F10. These keys enable you to perform an operation by pressing a single key. For example, if you want to list your BASIC program on the screen, you type the word LIST. By pressing the F1 key once, the word LIST is entered. The function keys can save you some keystrokes.

There are three keys that are not labeled with names but with arrows. These keys are the oversized **Enter key** (just to the left of the numeric keypad), the **Backspace key** (another oversized key just above the Enter key), and the **Tab key** (just to the left of the Q key). The Enter key has a crooked arrow (↵) on it, the Backspace key has a left arrow on it, and the Tab key has both a left and a right arrow.