THE IBM PCjr
USER'S GUIDE

THE ONLY MANUAL YOU NEED TO UNDERSTAND & GET THE MOST OUT OF YOUR HOME COMPUTER

HOW TO SET UP AND OPERATE THE IBM PCjr

HOW TO EXPAND YOUR SYSTEM THROUGH ADD-ONS

A CONSUMER GUIDE TO THE BEST SOFTWARE

GLOSSARY OF KEY TERMS AND ADVICE ON SERVICING

Text by Michael Bane. Edited by Roger C. Sharpe and Mark Brownstein

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THE MACMILLAN
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The PCjr is the first computer to provide a remote control keyboard

INTRODUCTION

Simply stated, a computer is a machine for juggling informa-tion. It can be numbers, such as those in your checking ac-count or yearly tax preparations; even words, like this book which was, in fact, written and edited on a personal computer. A com-puter makes manipulating information *easier*, so much easier that we speak of a "computer revolution."

Admittedly, computers can't do anything we all can't do by hand. But they are much, much quicker. For example, the writing of this book would have taken at least twice as long without com-puterized "word-processing." Computers are also very adept at rearranging information in any order you want it. In fact, infor-mation on demand is the heart of the computer revolution.

Your PCjr, in either its Entry or Enhanced version, represents the very cutting edge of that revolution. Many analysts suggest that what IBM has done with the introduction of the PCjr is totally redefine the home computer market, with an introduction as major as the PC was just a couple of years ago.

What IBM has done with the PCjr is bring the power of a 16-bit computer to the home. No other model offers such poten-tial in what is a very handy package. The entire range of IBM add-ons, peripherals and software packages will no doubt soon find their way for use with the PCjr as a result.

The PCjr is available in two versions. The Entry version comes in three parts, including a keyboard, the main system unit, that houses the part of the computer that does the computing (in this case an 8088 microprocessor), and a box containing the transformer for providing electricity to the unit. The Entry PCjr has 64K of RAM and two cartridge slots on the front for inser-ting ROM program cartridges.

The Enhanced PCjr, by comparison, adds an additional 64K to bring the total up to 128K. There's also a built-in disk drive. This version is capable of displaying a screen 80 characters wide, which is an important consideration if you're going to be doing word processing.

A *home* computer, even your PCjr in either version, is a machine designed primarily for home management, entertainment, and education. It can be expanded for some business purposes, such as word processing and financial management, but it is really not suitable as a business-only computer. In general, a home computer is designed to be connected to your family's television, rather than a special monitor.

One important way to look at the many computers now available is not on the basis of the price of the main unit itself, but the total cost of getting a machine that will *do* something. Some smaller computers can be purchased for a couple of hundred dollars, but by the time you get them to the point where they will perform the three functions of a home computer—home management, entertainment, and education—your investment might well increase to over $1,000.

With the PCjr, IBM has attempted to do with home computers what it did with the PC in the business market, that is, to define the target audience. Only time will tell whether they are successful, but all the signs are positive.

Already the PCjr is benefiting from the vast number of attachments and software available for its big brother PC. In fact, it is the shared expandability which both systems offer that has generated the most excitement and support. After all, one of the great secrets of purchasing a personal computer is that you really don't know what you need and want until you have a system to work with for a period of time. No matter how extensive your research and planning might be, you'll find yourself wanting to change some component part down the road. With the IBM-PCjr, these worlds of change are open to you.

The IBM PCjr is a *16-bit* computer, as opposed to the more common *8-bit*. What this means for you is that your PCjr is capable of using much more sophisticated programs. In fact, it will *do* more and more as program authors reach out to take advantage of the machine's power. If you've started out with 64K (which is a good starting point), you can add an extra 64K as you need it. Thankfully, IBM has seen to it that you'll never be limited in terms of potential options.

One other consideration you're likely to face early on is the question of a disk drive. If you only have the Entry PCjr, you're going to find yourself longing for that disk drive included with the

The PCjr with keyboard and monitor—a complete system

Enhanced model. The reason is that all the information the PCjr can juggle doesn't do you much good unless you have someplace to put it. Once you turn the computer off, everything you've done disappears because RAM forgets. So what you need is someplace to store the information until you want to work with it again.

You do have a couple of options, such as a cassette tape recorder or a disk drive. However, IBM doesn't make a cassette recorder specifically for the PCjr. The reason could well be due to the fact that cassette recorders are notoriously inefficient machines for storing data. They are slow (loading a program can take five or even ten minutes), and too many times they are inaccurate, requiring you to attempt to load a program more than once.

That's where the disk drive shows its strength. A floppy disk, or floppy, is the storage bin that holds the information, while the disk drive is the machine that allows you to move information from RAM to disk. Think of it exactly as you would a cassette recorder attached to your stereo, because that's exactly the way it works. In your audio system, you hit RECORD and everything that is playing on your stereo is recorded on a special magnetic tape. Similarly, with your computer system you hit SAVE, and everything that is playing in your RAM is recorded on a special

magnetic disk.

Given this basic explanation, there are two important points to keep in mind regarding disk drives. The first is that you want your disk drive to be able to read the programs you want to run. The second factor has to do with how much the disk will hold. This value is usually described in bytes. The PCjr double-sided, double-density disk, for example, has a capacity of 360,000 bytes or 360K. Since very few of us think in bytes, it's handy to have a real-world reference. The best is to compare double-spaced typewritten pages.

To translate from kilobytes to double-spaced pages, simply divide the kilobytes by two. The PCjr's drive holds around 180 double-spaced typewritten pages. As a general rule, more storage is a handy feature to have, if for no other reason than to keep floppy disks from cluttering up your work space. More importantly, the greater the storage capacity, the easier it is to juggle information, which is what you purchased the computer for in the first place.

This brief overview has covered some of the basics you'll be reading more about in the rest of this book, but, for now, let's take a look at the giant that spawned the PCjr. Perhaps the most interesting feature about the PCjr and its big brother is that they come from International Business Machines, which has not made its worldwide reputation (and countless billions of dollars) by thinking small.

The PC and PCjr represent a major change in IBM's business philosophies. Instead of being built strictly in-house, both are assembled of parts made by other manufacturers. The systems are sold and serviced through retail outlets such as ComputerLand, rather than through IBM's justifiably acclaimed sales network. In fact, IBM has encouraged, rather than discouraged, third-party suppliers to make hardware and software compatible with the computers to such an extent that the PC and the PCjr are quickly becoming the best supported personal computers in the short history of microcomputers.

More and more it seems that IBM has created a de facto standard. As a result it isn't uncommon for various personal computers to be judged on whether they're "IBM-compatible," whether they'll run IBM software, or use IBM peripherals. For

you, the PCjr owner, it means that you have the best of all possible worlds. Because, as developments happen in hardware or software design, you can be certain that one of the systems receiving the most attention will be none other than your PCjr.

1 SYSTEMS ANALYSIS

With the exception of its infrared keyboard, the IBM-PCjr isn't a spectacular system in the sense of state-of-the-art technological advances or hardware that's available nowhere else. However, before you feel disappointed by this opening statement, realize that this is a big advantage for a small computer. After all, you don't want to find yourself in the position of being a guinea pig for the XYZ Computer Company. The reason you bought your IBM PCjr was to solve your problems, not someone else's.

Thankfully, the PCjr is a superior tool for the three important functions of a home computer—home management, entertainment, and education. In fact, what makes the PCjr such a great computer is that it is relatively quirk-free. When you buy a computer, you want to be able to take it out of the box, turn it on and immediately start doing whatever it was that you bought the computer for.

So be aware that the IBM PCjr is leading the way in home computers. In addition to its substantial entertainment aspects, which include superior color graphics and some of the most sophisticated sound generation on any computer, the PCjr can serve as an important problem-solving tool. Programs such as *Multiplan* and *VisiCalc* immeasurably expand the PCjr's universe and guarantee that you won't "outgrow" this home computer.

No matter how good any computer is, and the PCjr is at the top of the list, it is still a tool without a specific purpose. It's up to you to determine that purpose through the software you'll be using. That fact alone is the single most important thing to remember about small computers.

As we mentioned earlier, the PCjr has no particular quirks waiting to jump out of the box and set your computing back a couple of months. The system is easy to assemble, reasonably easy
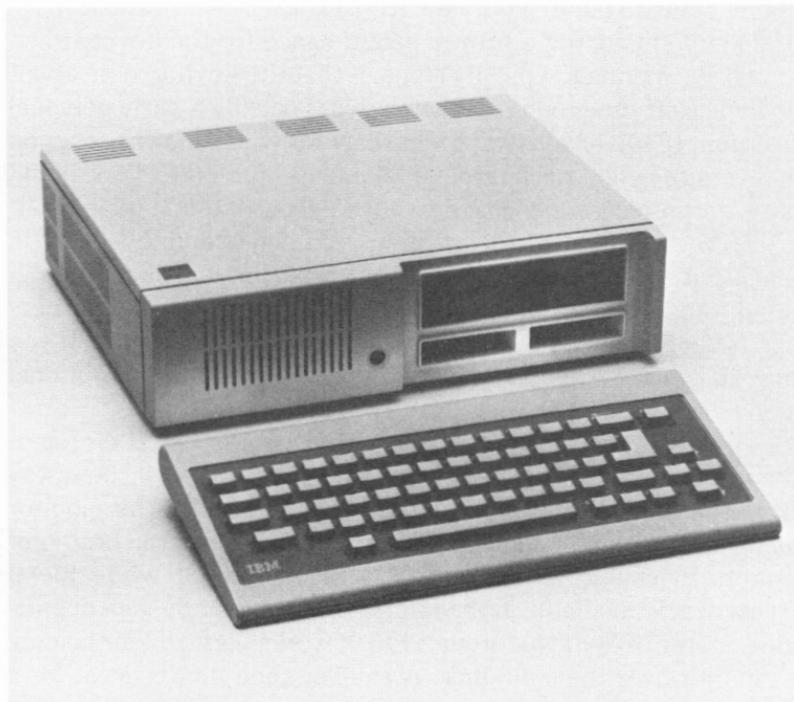
The PCjr with disk drive—a good starter system

to use and does exactly what IBM claims it will do. While this may sound elementary, you'd be surprised at the number of systems that can't make those same three claims.

Depending upon where you purchase your system, most computer stores are, or should be, willing to set it up for you and run the basic tests built into the PCjr. These include checking each part of the system: the main processing unit, the keyboard and any peripherals. This is an important step that can save you considerable grief. Speaking from painful experience, there is nothing more irritating than carting a system home, setting it up and discovering that some basic component doesn't work.

Given the price of computer systems, it's not unreasonable to ask the store to see if it works before you take it home. In fact, it's standard operating procedure at most ComputerLand stores, along with a brief introduction to your new PCjr.

Also, before you bring your system home, think about where

you're going to put it. Your new IBM-PCjr will need a small space of its own, including a proper height space for the keyboard.

Office manuals typically suggest that the keyboard be about 25 inches off the ground, although this is usually a fairly personal decision. If you have always worked with your typewriter set on an average-height desk (around 30 inches high), then you should have no problem with placing your keyboard at a similar level.

IBM's cordless keyboard gives you considerable leeway in placing it, even to the extent of putting it in your lap. Keep in mind, though, that the infrared beam cannot go around corners and is badly affected by bright lights, such as fluorescents. If you plan to use your PCjr in a brightly lit environment, an optional keyboard cord is available from IBM.

In terms of the PCjr's monitor, you shouldn't sit it on top of the main unit. In fact, it needs to be placed at least six inches away from the main unit. Your solution here is to place the monitor alongside the unit or on a shelf over the unit. One of the best-kept secrets in computerdom is that a plastic-coated white metal freezer rack, available in the kitchen department of such department stores as Sears for around $5.00, works perfectly for holding a monitor over the main unit. A smaller shelf unit is great for a printer stand.

Keep the computer away from heat ducts, radiators, or direct sunlight—microchips are heat sensitive. The IBM-PCjr's temperature operating ranges are between 60 and 90 degrees Fahrenheit, although, from personal experience you can stretch it a little in either direction.

Your PCjr will also need electricity. It's a good idea to never run the computer without some sort of voltage surge suppressor (available from computer, electronics and some hardware stores at prices from $15 up into the hundreds). Some power systems are better than others in delivering regulated voltage, and even in the best systems a thunderstorm can raise havoc with the power lines. A voltage surge can erase data or even destroy the delicate chips.

The simplest surge protector plugs onto the end of the power cord and costs around $15 (the one made by RCA is the most common type). Most Radio Shack stores carry this or a similar suppressor. Others plug into the wall outlet itself or look like fat extension cords with multiple plugs on the end. The more expen-

sive units, such as the Computer Accessories Corporation Power Director, protects against all manner of voltage surges, power line and radio noise, and provides switches for each of your computer accessories. It sits on top of your desk and is available in stylish IBM beige for $119 (7696 Formula Place, San Diego, CA, 92126). After laying out all this money for a computer, a surge protector is a small price to pay for insurance.

If you plan to use a modem on your PCjr, you'll need to be sure to have a telephone line near where you've selected to place the computer. A couple of points to remember on modem care is that if anyone should pick up the telephone while you're "on-line," the connection can be broken and you may lose data. Also, if you have the common "hold" feature on your telephone, a second incoming caller will sound a tone on your line, and this can also break your connection. A solution to the first problem is to get a second, dedicated telephone line for the computer only, if you plan to do a lot of telecommunicating. For the second problem, ask the phone
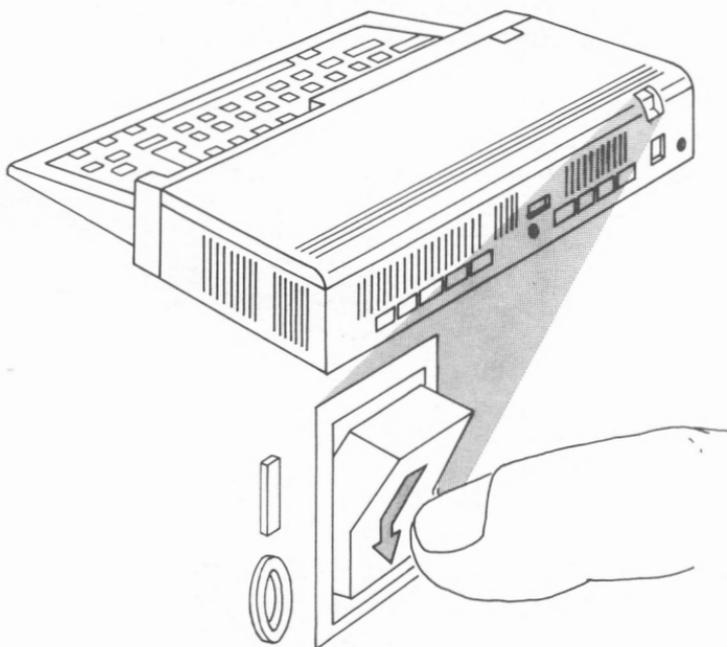
The on-off switch is easily located

company to give you "call-forwarding," another optional feature available where "call-waiting" is available. Then, when you use the computer, use the call-forwarding feature to forward the calls coming into your computer's phone to another phone number.

THE SYSTEM

When you start unpacking boxes, you'll find three main units—the system unit, which includes the computer itself, the memory (RAM and ROM), expansion slots (some might be filled with options you selected), two cartridge slots and one disk drive (depending on which model Junior you have), the infrared keyboard, and the transformer.

Set-up couldn't be easier. Remove your PCjr from the protective Styrofoam packing, plug the black power transformer (similar to units for tape recorders and the like) into the wall; plug the other end of the transformer into the computer, then attach your television or monitor. That's it—the PCjr is ready to go.

Don't be scared by all the connectors on the back of your unit. There are 14 in all. Thirteen are easily explained; the fourteenth is one of IBM's little secrets. From right to left:

1. The OFF-ON switch
2. A for external audio (a speaker)
3. P for the power cord from the transformer
4. C for connecting a cassette recorder
5. S for serial port (see chapter 5)
6. D direct drive, for an RGB color monitor
7. M phone line for the optional IBM modem
8. V for composite video (we'll explain later)
9. T for the IBM RF cable for television hookup
10. LP for connecting a light pen (optional)
11. K for the optional keyboard cord
12. L IBM's little secret
13. & 14. J for joysticks.

Let's take a peek at the heart of the IBM-PCjr—the system unit itself. Unlike the PC, the PCjr's case is hard molded plastic, coated on the inside with a metallic paint to keep down interference with radios, televisions, and stereos. Inside the plastic

box is the *motherboard,* a single glass-epoxy circuit board that contains all the "computing" parts of the PCjr, the Central Processing Unit (CPU), the Read-Only Memory (ROM) and the Random-Access Memory (RAM).

In a microcomputer like the PCjr, the CPU is a single microchip, in this case an Intel 8088. The CPU does the actual processing, that is, the addition and subtraction arithmetic functions that makes a computer compute, and regulates the flow of information throughout the system.

As we mentioned earlier, the 8088 is a 16 bit microprocessor, which means that the chip can handle information in 16-bit segments at a time. The use of the 8088 translates into a number of good things for IBM-PCjr users. For a start, it's faster than the older microprocessors. Secondly, 16-bit processors can work directly with a much larger amount of memory, one megabyte (one million bytes) as opposed to 64 kilobytes (64,000 bytes), for the average 8-bit chip. However, some newer 8-bit computers have ways of *addressing* larger amounts of memory by breaking the memory into 64K chunks, called *banks.* It is still a slower process than that used by 16-bit machines.
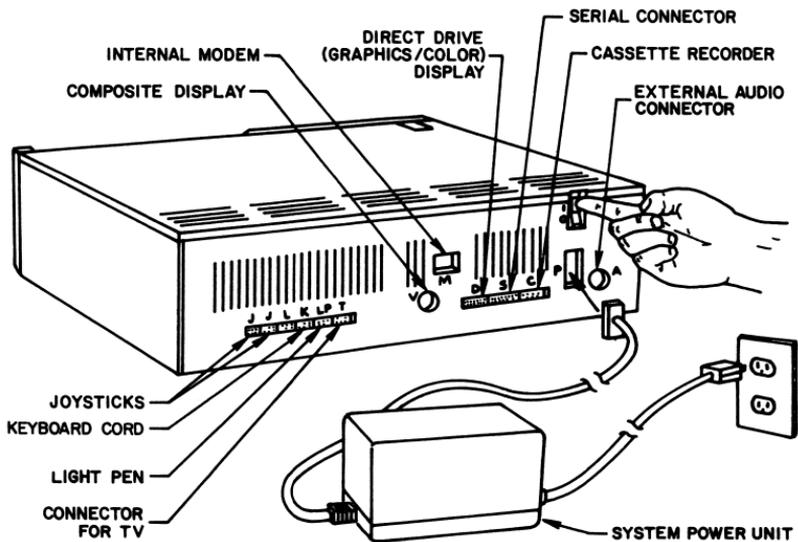
PCjr's rear panel connections

This is important for you because it allows software authors to create sophisticated programs that require a large amount of memory to function. It also allows you to manipulate larger files at one time.

The motherboard is also the home of ROM, which is the portion of memory that tells the computer what to do when it is turned on. A computer's memory is the desk on which the computer works, holding programs the computer uses to do various tasks and workpads for data. The most basic ROM is preprogrammed and remains even when the PCjr is turned off. This includes the basic input/output system, or BIOS. The BIOS is a collection of subprograms that control the flow of characters between the computer and the other devices connected to it.
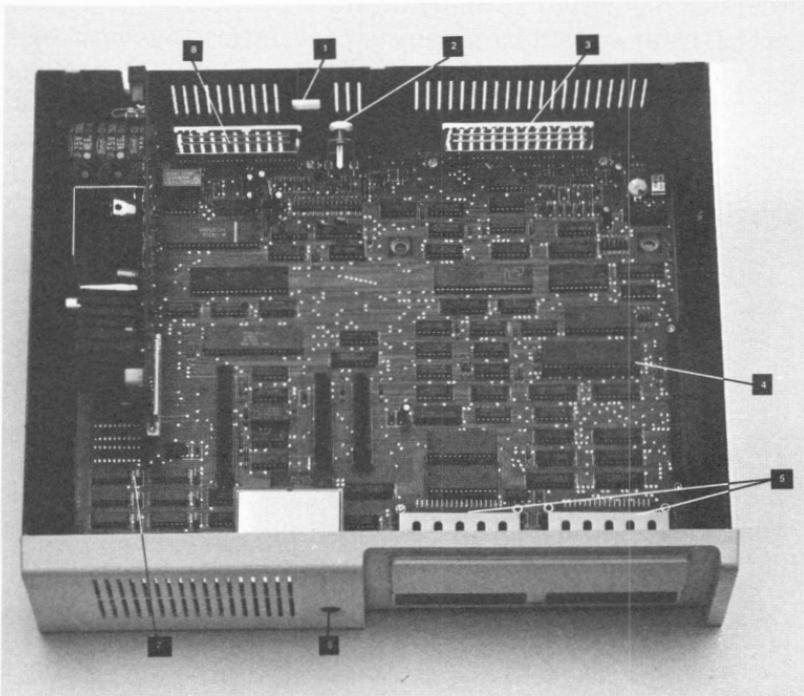
1. Space for internal modem connector and cable. 2. Connector for composite video. 3. Connectors for (l to r): RF modulator (for TV output), light pen, cable for keyboard, reserved by IBM, 1st joystick, 2nd joystick. 4. 8088 CPU. 5. Cartridge slots and connectors. 6. Infrared receiver for keyboard. 7. RAM memory. 8. Connectors for (l to r): audio, transformer power cable, cassette recorder, serial port.

The computing part of a computer is that main microchip, but that chip really only comprises a small part of what we call a "computer." All the various components have to be able to talk back and forth in a coherent way, and the BIOS provides the means for that chatter. The BIOS also conducts a self-test every time the PCjr is turned on. When you hear the "beep" about thirty seconds after you turn your PCjr on, it means that the BIOS has completed its testing and everything is okay.

One of the tremendous advantages of a 16-bit computer like the PCjr is that a large amount of ROM can be included without any penalty to the RAM. Both ROM and RAM are memory, and a standard 8-bit computer can only address 64K of *overall memory,* not just RAM. The amount of ROM is usually kept small to give the maximum usable RAM space.

That's not a problem with a 16-bit machine, like the PCjr, which can address one megabyte of memory with no problems. Consequently, the PCjr's ROM is a full 64K, as large as the entire memory space of many 8-bit computers. In addition to the BIOS and self-test, the additional ROM space is used for:

—Cassette BASIC
—a cassette operating system
—a routine for starting a floppy disk drive
—the PCjr diagnostic routines
—the Keyboard Adventure game
—dot pattern for the graphics video characters.

This means that a version of the BASIC programming language is included in the ROM, as well as an effective tutorial (Keyboard Adventure) on the PCjr's keyboard and a comprehensive set of diagnostic routines to thoroughly test the PCjr when something goes wrong. The routine for starting the disk drive is important because when a drive is installed, the computer needs to know what to do next. This routine tells the PCjr to try and load the software Disk Operating Systems (DOS). The cassette operating system allows you to use a cassette tape recorder to load and store data.

The reason for all this extra ROM is to make the PCjr an easy-

to-operate computer. For example, putting Cassette BASIC into ROM allows you to start programming with a sophisticated computer language as soon as you turn the machine on. And the fact that the language is in ROM means that you'll have more RAM workspace. The cassette recorder operating system allows you to quickly and easily hook up a tape recorder for data or program storage. The diagnostic routines make it a snap to find out what's wrong with your PCjr, a task which is harder than you might think in some computers. The PCjr ROM structure offers one of the best thought-out memory structures available in a home computer.

Random Access Memory (RAM) is also on the system board. Your machine probably has either 64 or 128 kilobytes. The 64K Entry PCjr is expandable through the use of the 64K Memory and Display Expansion board, which plugs into a special 44-pin slot inside the system unit. Although the present version of the PCjr is limited by its internal design to 128K RAM, the computer itself is capable of handling as much memory as the IBM-PC, effectively about 640K. It is not unreasonable to expect aftermarket memory
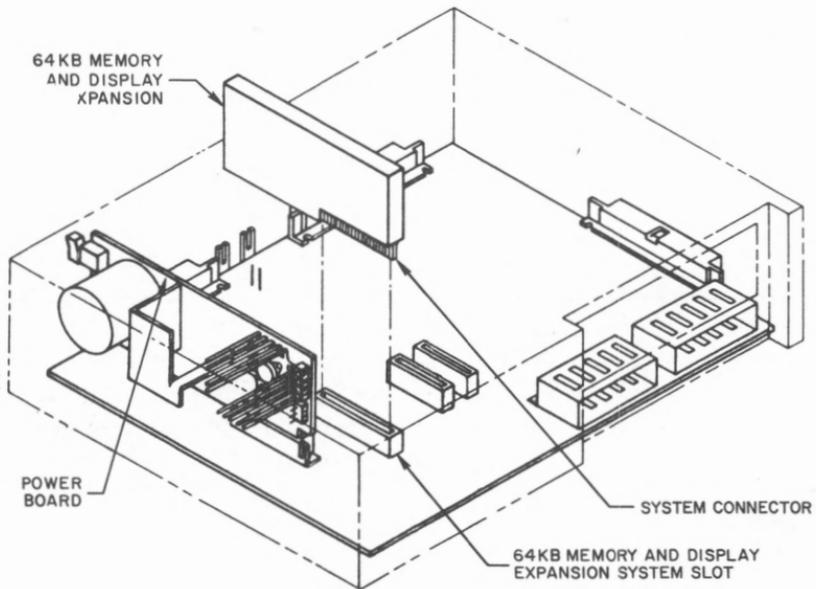
The 64K Memory Expander/Graphics Board plugs right into the PCjr

upgrades for the PCjr in the form of plug-in "cards" or an out-board expansion box that attaches to the PCjr's expansion plug (presently used for the Parallel Printer Adaptor).

RAM is your work space inside the computer. Before the coming of the PC, the most work space you were ever likely to need was 64K (with the exception of such memory-gobbling tasks as inventory control or large financial analysis). Since this was the top-end for most 8-bit computers, there was no market impetus for software developers to expand beyond that. Now some of the most popular programs developed for the PC, such as Lotus' *1-2-3* spreadsheet/database-management/graphics program, require 128K or even 256K.

Another point to consider is that the video display and Cassette BASIC eat up RAM, as does the DOS (Disk Operating System). Cassette BASIC needs approximately 4K RAM. An Enhanced PCjr with 128K RAM loses 16K to the video buffer and a whopping 30K to Cartridge BASIC, plus the DOS, leaving only 82 usable RAM, which is still more memory than most older computers had.

We recommend the 64K Memory and Display option, available for $140, for almost all computers. There is nothing more frustrating than a computer that won't do the things you bought it to do. Time and time again we've seen families purchase a stripped down, bottom line computer, and then give up computing in disgust when the machine proved capable of much less than promised. You *must* have the additional memory and display board if you have:

—the disk drive and DOS Ver. 2.1
—an 80-character video display
—software that needs more than 64K

Most software other than games is going to require the Memory and Display option. Even software that will run without it will probably require the board to make full use of the software's features.

The PCjr has only three expansion slots on the motherboard, as opposed to the PC's five and the PC-XT's eight. These slots allow you to "customize" your PCjr in the way that best meets

your needs. Right now, there are three plug-in options—the Memory and Display board, an internal modem (covered in future chapters) and a disk drive adaptor board.

The advantage of the expansion slots is that you don't have to hire a computer tech.ician to modify your PCjr—you can plug the cards into the slots yourself. Although all cards come with detailed instructions, the procedure is basically the same.

Slide the main unit out of its beige plastic cabinet. With the front of the unit closest to you, the expansion slots will be center and left. Insert the appropriate card in the appropriate slot—the memory and display board, in its distinctive metal case, goes in the far left, longer slot. The IBM Internal Modem goes in the middle slot and the disk drive controller goes in the right-hand slot. The modem requires a plug-in connection as well.

Although those are the only options presently available for the PCjr, you can expect the huge IBM-PC aftermarket to come up with a wide array of expansion modules to fit the slots. The aftermarket board manufacturers specialize in "multifunction" boards, that is, expansion boards which serve more than one function. A typical multifunction board for the PC might include additional RAM, a clock/calendar, a parallel port and one or more serial ports. You can safely expect the PCjr to grow in this area.

Another possibility for expansion is the I/O (input/output) expansion bus on the right side of the PCjr. The main use of this is to connect a parallel printer, about which more later, to Junior, but it should serve well for a second disk drive or some of the more esoteric expansions.

In short, in terms of expansion and memory, Junior is just a baby, but keep your eyes open for rapid growth.

THE PCjr KEYBOARD

For reasons known only in the depths of IBM, the company that pioneered the IBM Selectric™ keyboard and made it an American standard chose not to use it on either the PC or the PCjr. On the PC, IBM created a new, almost flawless keyboard, good enough to cause flutters in the hearts of typists everywhere. For the PCjr, though, IBM opted for "Chiclet" style keys—small, unlabeled and mushy to the touch. One magazine described the feel of the keyboard as "typing on a fresh fruitcake." Although we feel that view is, perhaps, a speck harsh, we were unable to
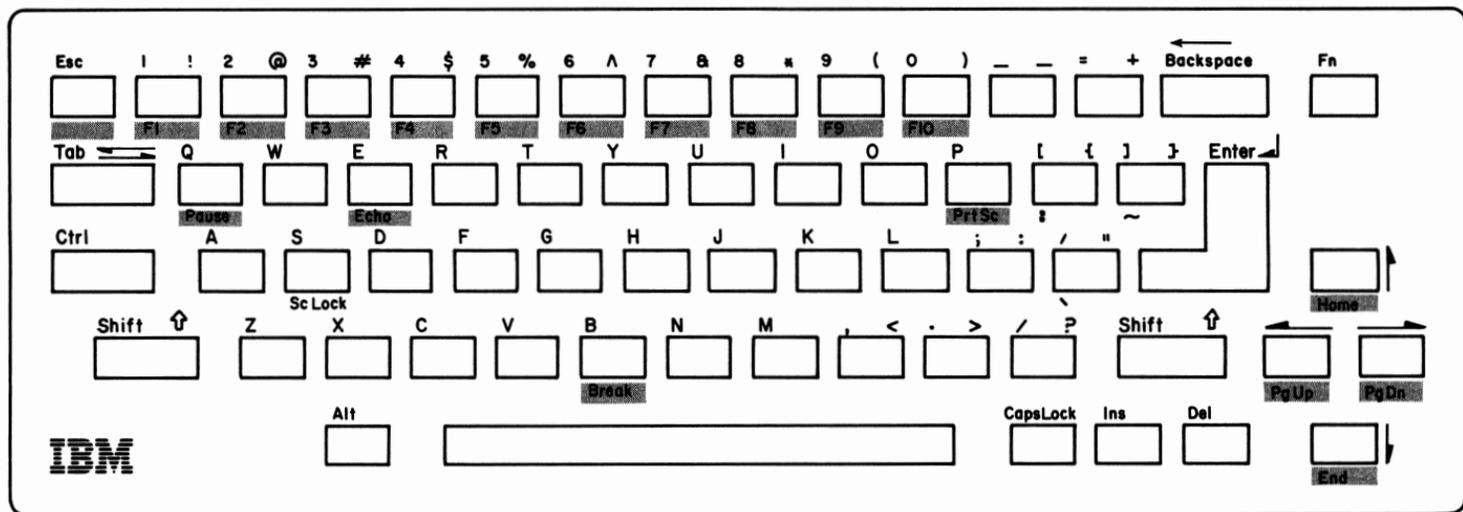
The PCjr keyboard

consistently touch type on a PCjr keyboard. The bad feel comes from the fact that the PCjr's keyboard consists of hard plastic buttons riding on a plastic foam. When you press a key, the foam squashes until contact is made. The keys are smaller than standard typewriter keys, and spaced farther apart. Finally, the keys themselves aren't labeled; instead, IBM provides key overlays for each program.

There are, of course, solid—if questionable—reasons for all of the keyboard's features. One of the biggest is price. A keyboard is an expensive component, and a compromise had to be made somewhere to keep the price of the PCjr down. The smaller keys and wider spacing may also be more attractive to children and younger users, who will find the keyboard easier to manipulate than a standard typewriter keyboard. Finally, the overlays are used because, according to IBM, the keyboard is *soft,* controlled by the software. The software dictates what the keyboard will be, and changeable overlays take full advantage of this feature. We would suggest that you obtain several duplicate overlays for each program you use regularly, as even in the best of circumstances,
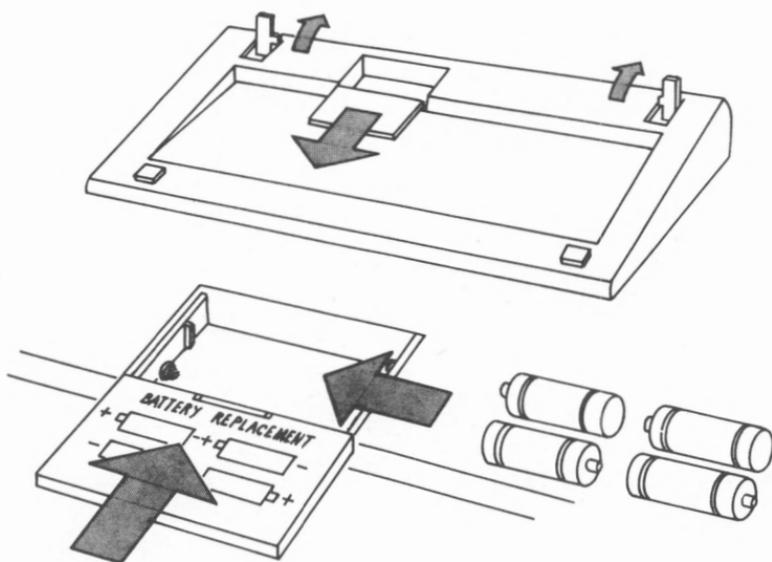
Battery installation for the infrared keyboard is easy

keyboards take a battering.

The keyboard is also the most revolutionary aspect of the whole computer. Instead of connecting to the main unit by a cord, there's an infrared link, powered by four AA batteries in the keyboard. Two infrared light-emitting diodes (LEDs) transmit your keystrokes from the back of the keyboard; a single eye on the main unit receives the transmitted signal. While this is a major jump forward in sheer technical design, we're still withholding judgment on how useful the cordless keyboard really is. For some applications, especially entertainment, it will be convenient to place the computer on top of a television set and work the keyboard from the couch. The unit has a transmitting range of 20 feet with new batteries, which shouldn't cause any problems in most homes. However, the real factor tying you to your computer is the screen, not the keyboard. For home management and most educational applications, proximity to the screen is necessary. Also, computers tend to create computer clutter—disks or cassettes, paper for the printer, manuals, programs, and the like. Most people find it easier to keep it all in one place.

Although the 62-key PCjr keyboard lacks some of the keys of the 83-key PC unit (the ten function keys and a numeric keyboard), all key functions on the PC can be done with the PCjr, although this might take two keystrokes. For example, pushing "Fn" and the number "1" on the PCjr duplicates the PC's "F1" key.

If you absolutely hate the keyboard, don't despair. Rumor has it that IBM has an 83-key standard keyboard waiting in the wings. If you can't wait, such a keyboard is already available from Key Tronics (P.O. Box 14687, Spokane, Washington, 99214), makers of some of the best computer keyboards available.

GET GOING

Hooking up the PCjr is simple. Unbox the system—main unit, keyboard, and transformer. Use the special television adaptor cable to connect your PCjr to the antenna input of your television screen, or connect your monitor to the appropriate plug on its back panel. You can also leave your television antenna connected, if you'd like.

Turn the keyboard upside down and place the four AA bat-
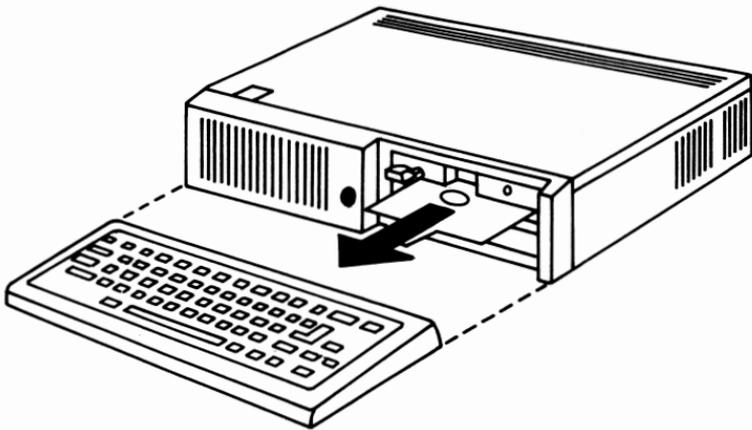
Keyboard, disk drive, and console all fit neatly together

teries in the battery compartment, then turn it back over and position the keyboard in front of the PCjr. Turn the keyboard on.

Plug the transformer unit into your surge suppressor, plug the suppressor into the wall, connect the other end of the transformer into the PCjr, and turn on the switch on the back of the unit. If you've got a disk drive, you should hear the fan in the rear begin to hum, and in 30 seconds or so the PCjr should "beep," telling you everything is all right.

The first screen you'll see on a color television screen or color monitor is the IBM logo and 16 color bars. In the lower right-hand corner of the screen the PCjr will tell you how much memory is installed.

After the beep, the PCjr will load Cassette BASIC from ROM. Now you're ready to begin programming.

If you have the optional disk drive, your very first operation on the IBM-PCjr should be to make a back-up copy of your PC-DOS disk. This way, if anything happens to your PC-DOS Disk, you will always have a "safe" spare.

In fact, you might as well start getting used to backing up your disks. Whenever you get a new program, your first step should always be to make one or two back-up copies. Coffee spills, puppies nibble and sometimes disks just plain wear out. The ideal situation is to make a couple of copies, then take the master disk and put it in a nice temperature-controlled safe deposit box at your bank. It's cheap insurance.

The copy procedure is explained below.

The second thing you should do is use one of your DOS back-up disks to "format" the box of blank floppy disks you bought (see DOS manual).

You did buy a box of blank disks, didn't you?

A box of paper for your printer, if you purchased a printer?

A cable to connect the printer to the PCjr?

An applications program?

One of the biggest mistakes new computer owners tend to make is to obey the urge to buy the computer first, and then figure out what it'll do later. Some publications have lately been full of articles demanding to know what it is that these home computers do, after you've played a couple of games. We suggest getting at least one applications program on disk or cartridge, whether it is word-processing or a home-arcade game, so you can start using your computer immediately.

PC-DOS WITHOUT TEARS

If you have the optional disk drive, you're soon going to begin close encounters with PC-DOS (PC-Disk Operating System), your PCjr's operating system. PC-DOS is a powerful friend; the more you use it, the more you realize how useful it really is.

So just what is an operating system, anyway?

An operating system is a group of programs that directs the overall operation of the computer, the "traffic cop" that keeps everything moving the right way. The operating system handles the flow of traffic between the microchip and the keyboard, screen, printers, disk drives, and the other devices connected to the chip, or central processing unit (CPU). When you type in a command, it is the operating system that carries out the hundreds of steps involved in executing that command.

When disk drives are present, the operating system handles file management—where your files go on the disk and where and how the CPU can get to them when needed. The operating system runs interference between the CPU and sophisticated applications programs such as data base management and word processing, making sure that the applications program has full access to the computer's many features.

The operating system has a second function in addition to its

traffic cop duties. This function is housekeeping. The operating system allows you to move files around from disk to disk, or disk to printer or modem, to rename or erase files, and numerous other functions related to keeping your computing nice and orderly.

IBM's DOS appears to be a de facto standard for 16-bit machines. The tremendous success of IBM in the personal computer marketplace has created a gold-rush run of software designers hoping to get on the IBM bandwagon. Although a version of the CP/M operating system is available for the IBM (and is supported by IBM), the overwhelming majority of users stick to PC-DOS.

PC-DOS is more user friendly than CP/M, plus having better file-handling characteristics (although the newest version of CP/M has expanded its own file handling). In addition, PC-DOS is also faster than CP/M.

The PCjr uses Version 2.1. The various versions are explained in an accompanying box.

The PCjr has outstanding color graphics capabilities—better, in many ways, than the PC. Substantially better, in fact, the PCjr comes with color graphics, while the PC requires the optional Color/Graphics board.

The PC with Color/Graphics has seven different video modes (actually eight, with one dedicated to the monochrome adaptor). Four of those modes are text modes, 40 and 80 columns, color and black and white. There are three graphics modes—medium resolution graphics, black and white; medium resolution graphics, color; and high resolution graphics, black and white.

What this means is that on a PC you can have high resolution graphics in black and white and medium resolution graphics in either color or black and white.

The PCjr goes several steps farther, adding three new graphics screen modes—*low* resolution graphics, medium resolution color with the full use of all 16 colors and high resolution four color graphics—plus new statements in PCjr's BASIC language to control them.

Color resolution is defined by how many dot positions, called *pixels,* are available on the 200 lines that fill the screen from top to bottom. The more pixels available, the more finished the graphics design will appear, much like the differences between

HOW TO FORMAT A BLANK DISK

YOU MUST FORMAT EACH BLANK DISK BEFORE USE!

The best way to use FORMAT is as soon as you purchase a box of disks. Sit down and run each disk through the FORMATTing; that way you'll know you always have a fresh formatted disk if you need it.

To use FORMAT with an Enhanced PCjr, make sure you have the A> prompt and your newly created DOS back-up disk is in the drive. Type:

FORMAT A:/S and press ENTER

When you use the /S, you are placing a copy of the operating system on the disk. This is necessary if you plan to copy an application program on the disk or write your own program onto the disk, since the DOS is necessary to make the computer start up, or "boot."

The screen will read:

Insert new diskette for drive A:

and strike any key when ready

As soon as the red light goes out on drive A, remove the DOS back-up and insert the blank disk to be formatted. Strike any key. The screen will tell you that formatting is going on and, finally that:

Formatting... Format complete

System transferred

xxxxx total disk space

13824 bytes used by system

yyyyy bytes available on disk

Format another (Y/N)?

Type: N

One important fact to remember is that *formatting erases any and all data on a disk.* If you reformat a disk, everything on it will be lost. Reformatting is a handy way to get rid of a lot of junk files on a disk and start over.

COPYING YOUR DOS DISK

Making copies of disks is one of those chores that will make many PCjr owners long for a second disk drive. The first disk you copy should be your DOS master disk, since you will use this constantly.

The first thing to do is make sure your DOS prompt, A⊓, is displayed and the DOS original disk is in drive A. Do this by inserting the DOS master disk provided by IBM into your disk drive, with the label side up. Close the drive door, turn on your monitor and printer, then turn the PCjr on. The computer will run a short (about 30 second) self-test to make sure everything is working correctly, then you will see:

Enter today's date (mm-dd-yy):

Type the date, or, if it's not important, hit the ENTER key. The computer will ask:

Enter correct time (mm:hh:ss):

Again, type the time (00:00:00 is midnight on the PCjr's 24-hour clock) or hit ENTER. The screen will read:

The IBM Personal Computer DOS

Version 2.10 Copyright IBM Corp. 1981,1982,1983

A>

Now you've got your DOS A> prompt.

Type: A> DISKCOPY and press ENTER

The screen will read:

Insert source diskette in drive A

Strike any key when ready

Since your source disk, the DOS master, is already in drive A, press a key.

The screen will read:

Copying 9 sectors per track, 1 side(s)

When it's finished copying a portion of the DOS into RAM, the screen will read:

Insert target diskette in drive A

Strike any key when ready

BEFORE YOU STRIKE ANY KEY:
1. Remove the DOS master disk
2. Insert the blank back-up diskette; this is the target diskette.
3. Press any key.

After a brief delay, the screen will display this message:

Formatting while copying
Insert source diskette in drive A
Strike any key when ready

BEFORE YOU STRIKE ANY KEY:
1. Remove the back-up disk
2. Insert the DOS master disk
3. THEN press any key.

Keep shifting from master to back-up until the screen displays this message:

Copy complete
Copy another? (Y/N)

Type: N

At this point it's a good idea to run the DISKCOMP command to make sure the copies came out correctly. Do this by typing DISKCOMP after the A> and then following screen instructions.

* * *

From now on use only the back-up copy of your DOS disk. Not only are disks basically fragile, they do eventually wear out. Place your master DOS disk, along with other master programs you obtain, in a safe place. You should be careful to store your disks *away* from magnetic fields (electric motors, fluorescent light ballast registers, magnetic paper clip dispensers, etc.).

If you have a number of expensive programs, a safe deposit box is an excellent investment. Make *two* back-up copies and keep the master in the safe deposit box. The second back-up will keep you from sitting around in the middle of the night with nothing to do because the dog ate your first back-up and the master is safe in the bank.

HOW DOS VER. 2.1 DIFFERS FROM DOS VER. 1.1

Programs seldom stay the same forever. After they are released, there are a number of reasons for changing them, including clearing up bugs that turn up after extended use, updating to accommodate new hardware, and simply adding new features to the program. The first program is usually titled Version 1.0. Minor revisions of the program result in changing the number to the right of the decimal place, for example, Version 1.1 would be a minor revision of Version 1.0. Larger revisions change the number on the left, Version 2.0 would be a major revision of Version 1.1, for example.

The most common IBM PC-DOS is Version 1.1, the version used on most PCs. Ver. 1.1 corrected a few problems with Ver. 1.0, including the lack of provision for a serial printer in Ver. 1.0. When IBM decided to release a PC with a hard disk for mass storage, the PC-XT, a newer version of PC-DOS was needed to help manage the data on the hard disk. You can have literally thousands of files on a hard disk. Obviously, when you want a specific file, you may have to look through an entire directory. DOS Ver. 2.0 provides a method of setting up multiple disk directories with a tree-like structure, allowing you to follow a *path* to the directory and, eventually, the file you want. DOS Ver. 2.0 also provides other hard disk functions, such as the BACKUP command, which copies all the hard disk files to floppy disks, and its opposite, RESTORE, which copies files from floppies to the hard disk.

DOS Ver. 2.0 also offers you expanded *batch* processing. Batch processing allows you to create a file with several DOS commands in it which can be executed by typing in a single command. It also allows you to custom-tailor the AUTOEXEC.BAT file, which is a batch file that is automatically executed (AUTOmatic EXECution) whenever DOS is booted. The 2.0 version of DOS adds several commands specifically for batch processing, including ECHO, FOR, GOTO, IF ¼NOT¢, SHIFT, PAUSE and REM. This allows you tremendous flexibility in making your PCjr work the way you want it to.

The main difference between DOS Ver. 2.0 and Ver. 2.1—the version supplied with the PCjr—is that the PCjr version takes into account the half-height disk drive of the Junior.

a high quality color photograph and a poor reproduction of that photograph on newsprint.

On the PCjr, the color resolution is:

Low Resolution—160 pixels by 200 pixels

Medium Resolution—320 pixels by 200 pixels

High Resolution—640 pixels by 200 pixels

The reason IBM includes *low* resolution graphics is that the PCjr is a *home* computer, designed to be connected to a color television set. Medium and high resolution graphics don't work very well on low definition television screens.

The PCjr graphic modes also have more flexibility than their PC counterparts. PCjr's medium resolution graphics mode, for example, allows full use of all 16 colors, while the PC's medium resolution graphics mode allows the use of only four colors at a time.

There are also three new statements in PCjr's BASIC language to control the colors—SCREEN, COLOR and PALETTE. The result is super flexibility and the potential for color graphics that goes far beyond what IBM has offered to date.

What this means to you is that software designers, especially designers of educational and entertainment software, can take advantage of this expanded color graphics ability to give you some of the best color and graphics available on any small computer. Watch, for example, the PCjr Demonstration Program.

If you choose to program, you have a powerful tool at your disposal. Graphics programming offers some of the most rewarding programming you can do. While you might not be able to sit down and write another *WordStar,* using IBM's BASIC language you can still design some impressive color graphics.

PCjr SOUNDS OFF!

BAM! CRASH! CRUNCH! WHOOMPH! And, of course, the final sweet musical strain of victory. No doubt about it—computer games are noisy business, and the PCjr is right in there shouting with the best of them. Better, in fact, than anything else in the IBM line. The secret is that the PCjr uses a Texas Instruments (TI) SN776486N microchip sound generator, allowing the PCjr to shout or sing with four "voices" at one time. Three of those voices

DOS Top Ten

Your DOS can prove to be a powerful friend, sort of a permanent housekeeper for your PCjr. There are ten DOS commands that you'll use more than any of the others, sort of a top-ten hits list. The way you use them is simple: place your back-up copy of the PC-DOS disk in your disk drive, then type CONTROL-ALTERNATE-DELETE, which resets the PCjr. Answer the date and time questions (if you don't care whether the date or time are logged, simply hit RETURN at each question), then you'll see A.>, which is the "DOS Prompt," or, in other words, the DOS is waiting for you to tell it to do something.

Here's what you can tell it to do:

1. DIR: Gives you a directory of all the files on a particular disk. It also shows the exact size of the file (the number of bytes) and the date the file was last changed. You can specify disk drives (on multidrive systems) by typing DIR B: to get the directory for disk drive B, for example.

2. COPY: Copy can do all sorts of things, but you'll probably use it most often to copy a file from one disk to another.

3. ERASE: Erases a file.

4. RENAME: Renames a file.

5. Fn-PrtSc: Fn (Shift)-PrintScreen prints whatever is on the screen. You'll only realize how handy this function is if you use a computer without it.

6. DISKCOPY: Copies all the programs from one disk to another, making back-ups a snap.

7. DISKCOMP: Compare two diskettes to see if they're identical, usually used after DISKCOPY.

8. COMP: COMP compares two files to see if they're identical or how they're different.

9. CHKDSK: This command tells you how much disk and RAM space is available, which keeps you from overflowing your disk space (some programs commit suicide when faced with too little disk space).

10. FORMAT: Prepares a diskette to hold information. Each new diskette must be FORMATted before it is ready for use.

BASIC BASIC

Beginners All-Purpose Symbolic Instruction Code, reduced to BASIC, is the best-known and most used computer *language* in the world. Although it seems like BASIC has been around forever, it was created in 1972 to quickly teach students how to program a computer. A language is a way for you to explain to the computer what it is you want it to do. Computers are basically (forgive the pun) stupid—very sophisticated pocket calculators. Telling them what to do is something of a trick itself. It involves a specialized language, with its own grammar and its own special words, called *commands.*

There are two kinds of BASIC for the PCjr—Cassette BASIC, which is based in the ROM of the whole IBM line of personal computers, and Cartridge BASIC, an enhanced version of BASIC on a ROM cartridge. On the PC, enhanced BASIC is called Advanced BASIC (BASICA) and is disk-based.

Cassette BASIC is a full-fledged BASIC, with 135 commands and functions. You can, in fact, begin using Cassette BASIC as soon as you get the machine out of the box and plugged in. IBM offers a BASIC guide for children (and recalcitrant adults) called *BASIC Made Easy for the IBM PCjr,* which you can purchase to supplement the *Hands-On BASIC for the IBM PCjr* manual that comes with each computer. You'll be up and programming in no time.

Cartridge BASIC has expanded graphics statements, enabling you to manipulate the PCjr's fine color graphics. There are also extensive commands for manipulating sound, another strong point on the PCjr.

Cartridge BASIC and its excellent reference manual will cost you about $75, and since many cartridge programs require Cartridge BASIC in one of the slots to function, it's not really an "accessory", per se. You might as well figure its cost into your computer system.

PCJR AND ACCESSORIES – SUGGESTED LIST PRICES

Component Name	Serial Number	Price
PCjr Entry Model	8600004	669.00
PCjr Enhanced Model	8600067	1269.00
PCjr Diskette Drive*	8600005	480.00
64k Memory and Display Expansion*	8600007	140.00
PCjr Internal Modem	8600008	199.00
Parallel Printer Attachment	8600009	99.00
Joystick	8600010	40.00
PCjr Keyboard Cable	8600012	20.00
TV Connector	8600020	30.00
IBM Color Display	5152002	595.00
Adapter Cable for IBM Color Display	8600021	20.00
Adapter Cable for Cassette	8600022	30.00
Adapter Cable for Serial Devices	8600026	25.00
IBM Compact Printer	5181001	175.00
IBM Graphics Printer	5153001	680.00
PCjr BASIC Reference Manual with Cartridge	6024101	75.00
DOS 2.1	6024120	65.00
Black and white monitor with cable		approx. 200.00

*Standard with Enhanced Model

SYSTEM SPECS SIDEBAR
PCjr.
Height: 3.8 inches
Width: 13.9 inches
Depth: 11.4 inches
Weight: 9 pounds (with disk drive)
6 pounds (without drive)

Transformer
Weight: 2 pounds, 13 ounces
Power Supply: 33 watts

Keyboard
Height: 1.02 inches
Width: 13.45 inches
Depth: 6.61 inches
Weight: 1 pound, 9 ounces
Cordless (Infrared transmitter)
Optional cord
Requires 4 AA batteries for operation

are pure tones (notes), while the fourth is noise. The volume is independently adjustable on all four voices. The speaker in the PCjr can best be described as a "squeaker," adequate, but just barely so. The PCjr, however, can pump its sound out to a quality sound system or through the speaker on your television set.

2 PERIPHERAL VISIONS

In the ideal world a newly purchased personal computer would be ready to go—just take it out of the box, plug it in, and watch it do miracles. Although personal computers do seem to be drifting in that direction, they still more closely resemble component stereo equipment—a collection of pieces put together by the user or the dealer.

Unlike component stereo, though, some of the computer's components, called peripherals, don't really spring to mind when you're assembling your system, since they are peripheral to the actual operation of the computing unit, and their functions are not always totally clear. A turntable or stereo amplifier's function is self-explanatory, but a Parallel Printer Adapter is a little more vague.

Before we even begin a discussion of peripherals for the PCjr, it's worth mentioning again that the secret to being happy with your computer is knowing *in advance* what you want your computer to do. Recent articles have sung the old, "I bought it, and now I don't know what to do with it" blues. Some forethought before the purchase could have prevented those blues. This advice applies especially well to peripherals.

If the experience with the PC is any indication, there will soon be enough devices that plug in, screw on, and otherwise attach to Junior to stagger your imagination and permanently cripple your pocketbook. Some you will find you literally can't do without. Others, unless you have a specific need, will be pretty much worthless to you. There are various categories and types of peripherals, from electronic components that work invisibly inside the PCjr, to printers, modems, and the like. We'll take it a step at a time, beginning with the peripherals available from IBM as options for the PCjr.

The first category of peripherals includes those that are really necessary if the computer is to be of much value. In the PCjr's case, there are two such items—some sort of video display, and a device to store and retrieve data.

MONITOR MADNESS

You obviously need some kind of display, or screen, to use your PCjr. The first and most obvious candidate for this job is your television set, and IBM has arranged the PCjr to make using your TV as easy as possible. A special cable is available from IBM (about $30) to attach your PCjr to the antenna terminal of a home television set. This cable converts the stream of data from the computer into a signal the television can recognize. In effect, the cable converts your PCjr into a very low-powered television transmitter.

The only drawback of using a television set for a monitor is that televisions were never designed to display lines of type or high-quality graphics. IBM took this shortcoming into account with their whole line of computers by offering either a 40- or 80-character display. The 40-character display (the only option offered on the Entry PCjr without the 64K Memory and Display option) works well on a television set.

A television set, however, cannot take complete advantage of the PCjr's superior color graphics. To do that, or to use 80 columns and color, you're going to need a color monitor, such as the IBM Color monitor. These monitors are referred to as RGB monitors, because the PCjr sends out a separate signal for each of the three primary colors used to display color video—red, green, and blue. A special plug on the back of the PCjr, marked D for direct drive (the computer directly drives each color), connects the PCjr to an RGB monitor. Although it's more complicated, the result is spectacular color and visually stunning graphic displays. The catch is that RGB color monitors are expensive—the IBM unit sells for almost $600. However, the price of color monitors is coming down. Many other suppliers, including Quadram, Amdek, and NEC, offer top-quality color monitors, and even the exceptional Sony Profeel color monitor is adaptable to the IBM.

The PCjr can also be used with a *composite video* monitor. In composite video, which gives better resolution than a television
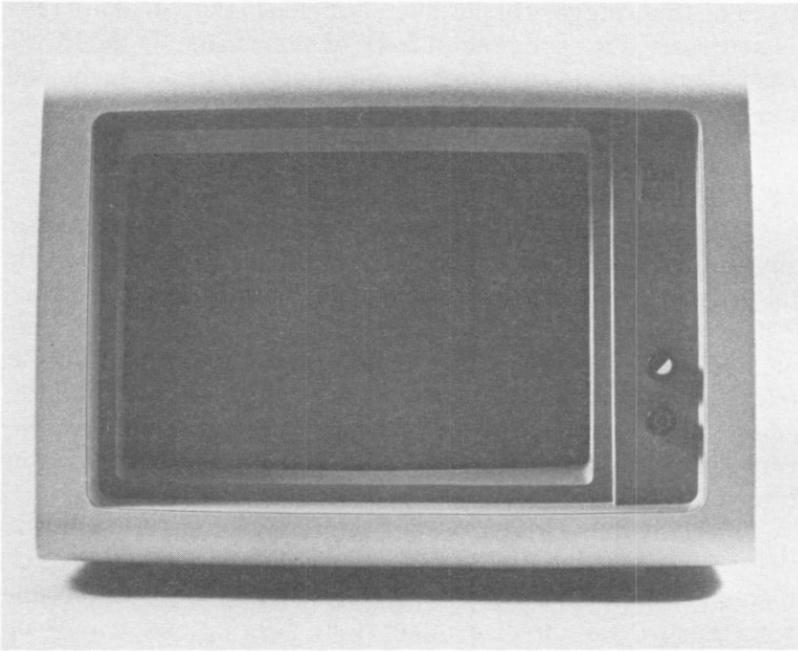
THE IBM COLOR MONITOR

set but not as good a picture as an RGB color monitor, the computer mixes the color information before it sends it out to the screen. One advantage of composite video is that it allows you to use a monochrome monitor (but not the IBM-PC Monochrome Monitor, which won't work on the PCjr). It's called monochrome because there is only one color, usually either a green or amber phosphor on a dark background, or white letters on a black background. Some people prefer the green letters, others the amber. Amber appears to be easier on the eyes, but with a home computer rather than an eight-hour-a-day business machine, that's probably not a major problem. And amber characters often look "fuzzy." Nobody likes white characters on a black background and for good reason—it really is hard on the eyes. With a monochrome monitor, you can get 80 columns (with the 64K Memory and Display option) and graphics, but no color. If you plan to use your PCjr primarily for home management, and will be using financial programs, word processing and list programs, a monochrome monitor's a good idea.

Like the PC, the PCjr is an "open" system, meaning that you don't have to buy only IBM parts to hook up to it. Good monochrome monitors with many excellent features can be purchased for around $150 to $200. A good example is the USI Pi. We use a USI amber monitor on one of our computers and have found it superior to any other type of monitor. The amber characters on a brown background are standard in Europe and, in fact, mandated by law in some European countries as easiest on the eyes. For those of us who use the computer every day for long lengths of time, an amber monitor is hard to beat. A USI monitor, which easily plugs into the PCjr, is available for roughly $160 from any one of a dozen mailorder houses. Other monochrome monitors to look for include Amdek, NEC and Taxan, all of which offer either green and amber versions. There are some exceptionally low priced monitors available for as little as $100. Our advice is to avoid them. A high-quality monitor is only a few dollars more, and you'll have many, many fewer headaches. When purchasing a monitor, especially mailorder, be sure to ' specify that it is for a PCjr and ask that the necessary cable be included. This will make installation a snap.

SPINNING OUT

There's not much any computer can do without some means of storing programs and data. Say you've used the BASIC in ROM to write a great program. As soon as you turn the PCjr off, that

COMPUTER/TELEVISION SWITCH

CHANNEL SWITCH TO 3 OR 4
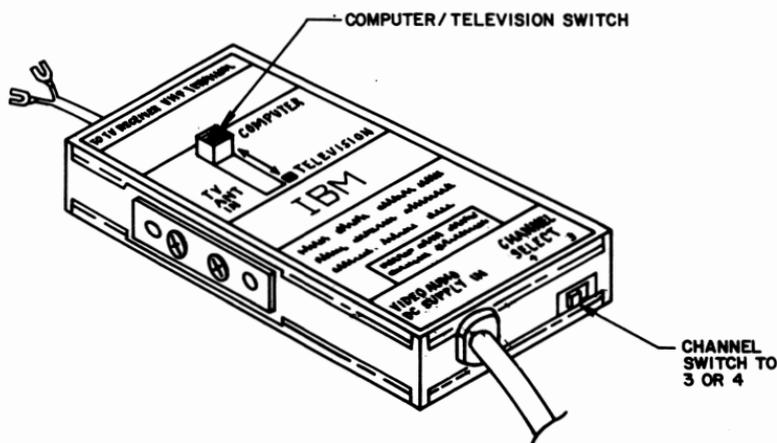
program heads into the ozone unless you've got some place to store it. There are two options.

The first is a standard, music-quality cassette recorder. IBM doesn't sell a cassette recorder for the PCjr, which should give you some idea of what they think of cassettes. They do, however, make a cable that plugs the PCjr into a cassette recorder. One end of the cable plugs into the PCjr, the other plugs into the Auxiliary, Earphone and Remote jacks of a tape player.

There is a major problem with using cassette recorders for data storage and retrieval—they don't work very well. Loading a game program can take five minutes or more, as can saving a program from the computer to the recorder. Some recorders are notoriously fickle when it comes to accuracy. It's not unusual for it to take two or three tries to correctly load a program.

Still, with the Entry PCjr, the cassette recorder is the only option you have. Ask your computer salesperson for suggestions, as the quality of cassette recorders varies wildly from manufacturer to manufacturer. You don't want a super good unit—cassette recorders that work best for music have a number of built-in filters that hinder the transfer of data. Expect to pay approximately $50 for a good unit.

Much more efficient as a storage device is a disk drive. A disk drive functions exactly like the cassette recorder, except that in place of cassette tape, a disk drive uses a 5¼ inch (or eight inch) disk of plastic coated with metal oxides. The advantages a disk drive has over a cassette recorder are twofold. First, the disk drive is much, much more precise than a cassette recorder, and second, the disk drive has the ability to skip around on the disk, looking for a specific piece of information. This is called random access. A cassette recorder has to search sequentially. The IBM disk drive can transfer information to the computer over *200 times* faster than a cassette recorder!

A disk drive is precise and fast, which is why IBM offered it in the Enhanced PCjr. The IBM unit is a special half-height drive, slightly less than two inches tall. It fits in the PCjr's cabinet right above the ROM cartridge ports. With the addition of the disk drive, the PCjr becomes a powerful computing machine, able to use much of the sophisticated software available for the PC. The programs are *loaded* from the disk just as from a ROM cartridge.

You then remove the program disk and insert a formatted storage disk.

The double-sided, double-density disk drive holds 360K of data, the same as the drives for the PC. Double-sided, double-density simply means that the disk drive can read from both sides of the special high density disks. You can store over around 180 pages of double-spaced papers on a single disk, substantially more than on most other home computers.

If you bought the Entry PCjr, you can upgrade to the disk drive by purchasing and installing the following components:

—the disk drive

—the disk drive adaptor board

—three cables

Installing the drive is simply a matter of removing the cover of the PCjr, plugging the adaptor card in the right slot, installing the drive in its proper place and plugging in the cables.

Of course, you need the DOS to make the disk drive do anything.

PRINTER PANIC

We now get into a category of peripherals that aren't stuffed into the main processor's box. Probably the biggest can of worms you'll face is the decision of which type of printer to buy. More people buy printers than any other peripheral, and, consequently, the printer market has all the subtlety of California in the gold rush. Before we wade in, we need to touch on how the IBM "talks" to its printers. If you recall from our discussion of multifunction cards, printers can be connected to the computer through either parallel or serial ports.

In a parallel connection, an entire character or word is sent at one time over a computer line. In serial communication, each character is broken into its component parts and the parts are sent one after the other, then reassembled at the printer. Parallel communication is simpler and faster, but because of interference problems, the cable can't be longer than 10 feet.

IBM offers three printers for their personal computers. The newest member of the line is the IBM Compact Printer, introduced at the same time as the PCjr and tailored specifically for the Junior. The Compact Printer uses *thermal* paper to create each

character or graphic screen image. In fact, tiny pins in the printer actually burn the image, in the form of dots, onto the special paper. The printer runs at 25 characters per second, slower than many other types of printers. It is, however, tiny, 3.5 inches high by 8.8 inches deep by 12.3 inches wide, and very quiet, a major asset.

The Compact Printer will print an 8-inch line on standard 8.5 inch wide paper and can reproduce any graphic design from the PCjr's screen. You can also get standard-width characters, double-width characters, and compressed characters from the little printer.

The really good news is that it's only $175, substantially lower than many other printers. The bad news is that thermal paper is expensive, and after a period of time, the paper turns black.

The Compact Printer is an *entry-level* printer, not really suited for serious work, but better than having no printer at all. Many people make the mistake of assuming that a printer is a computer frill they can do without. But many of a home computer's best tricks—word processing and list making, to name a couple—require a printer to be effective. The IBM Compact Printer provides you with a way to get hard copy without breaking the bank.

The other two IBM printers are standard, inked ribbon or film dot-matrix printers, the characters formed by a rectangle of dots. The printers are faster (80 characters per second), use standard paper and are both larger and heavier, not to mention much more expensive. One reproduces graphics, the other doesn't. Both require a *parallel printer interface*, which attaches to the right side of your PCjr. The Compact Printer attaches to the serial port.

Serial printers other than the Compact Printer can be a problem to hook up. We once spent three months trying to get a top brand serial printer to run on an IBM-PC. While the printer could be made to *print*, it would never run at the speed it was supposed to run and it would not run at all with some programs including *WordStar*, the word processing program we used. The printer's manufacturer said the fault was in the computer. The computer people said the fault was in the printer, and finally both agreed that the problem must be in the software. Eventually the printer manufacturer admitted there was no way they knew of to correct the problems and gave us a new, slightly modified machine. The
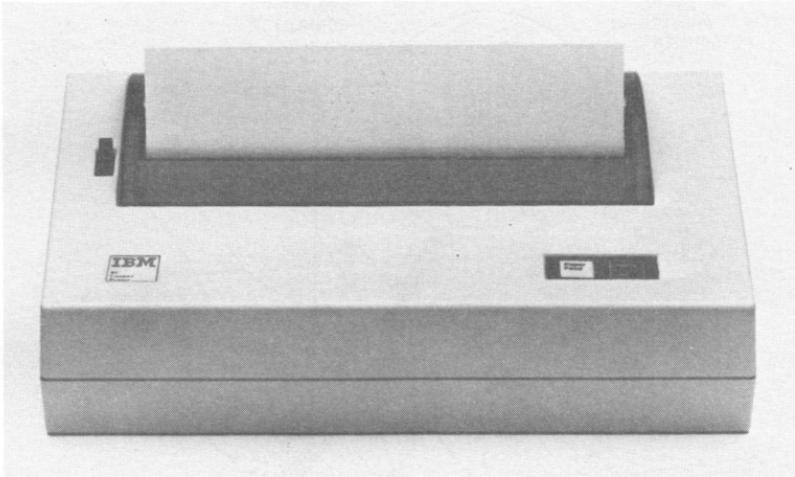
The IBM Compact Printer

problem was a touchy one of compatibility—everything worked just fine, the parts just wouldn't work with each other. Top of the line printers have become extremely sophisticated, with their own memories and advanced typesetting features like justification. The more sophisticated the machines are, the more perfectly they have to match in order to work together. At the very least, if you must get a serial pr̄inter, insist on seeing it run on your IBM or on having the privilege of returning it if *it does not run to your satisfaction*!

If you choose not to buy an IBM printer, you must decide whether you need a dot-matrix printer ὸr a letter-quality printer. Dot-matrix printing is what people refer to when they say "computer" printing. Each character is comprised of tiny dots. Dot-matrix printers tend to be faster and less expensive than daisy-wheel printers, which create characters in the conventional method of typing, with a print wheel striking a ribbon. If you plan to print graphics you create on the screen, a dot-matrix printer is a must, since a daisy-wheel printer cannot reproduce screen graphics. Recently, though, two interesting things have happened to printers—dot-matrix models have gotten better, and daisy-wheel versions have gotten less expensive. More dots are being
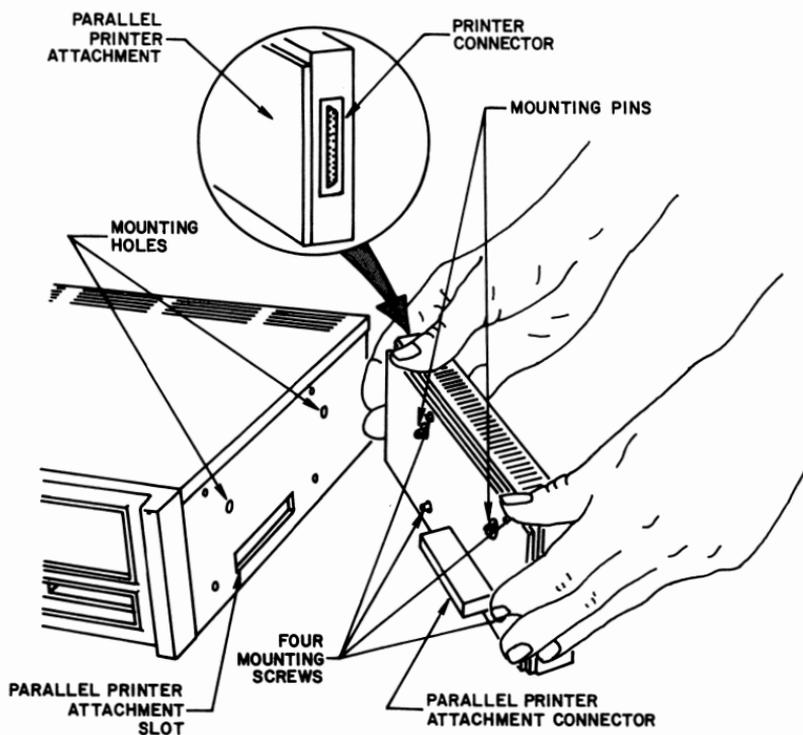
The parallel printer attachment allows connection to many peripherals

used by some printers to create denser, correspondence-quality printing. Good—although slow—daisy-wheel printers are now available at prices rivaling dot-matrix printers. Again, deciding which printer is best for you depends on your needs.

Most printers print either 80 or 132 characters on a line. The smaller, 80-character printers print on standard 8½ by 11-inch paper, while the larger 132-character printers can print on paper up to 11 inches wide. While it's handy to have 132 characters if you need them, when was the last time you used anything but standard-sized paper? Most high-quality letter printers have extra-wide carriages anyway, giving them the ability to use up to 14-inch wide paper. The extra-long carriages are useful for printing small financial spreadsheets (such as those generated by VisiCalc) and graphics, which sometimes refuse to conform to 8½ by 11-inch

formats. Keep in mind that the long carriage printers take up substantially more desk space than the smaller models, a consideration when space is at a premium.

We recommend with any printer the optional *tractor feed* mechanism. This is the device that allows the printer to use "computer paper," paper perforated on each side. The perforations are ripped off, leaving an 8½ by 11-inch sheet of paper. Modern perforated paper is so good that it's hard to tell whether it's computer paper or not. You can get high-quality bond paper for your computer. Although a tractor feeder is an added expense (varying with each machine from a few dollars to over $300), the huge advantage is that you can leave the room while your material is printing, get a cup of coffee or something, and not worry about feeding the printer. Feeding paper into the printer one sheet at a time is about as exciting as watching paint dry. One tip for using a tractor feed—buy the heavier 20-pound paper. It only costs a few pennies more than flimsy 16-pound paper, and in inexpensive printers such as the Epson, the heavier paper feeds much more reliably. Also, shop around for your paper. You should be able to find 20-pound paper with superfine perforations at office supply stores
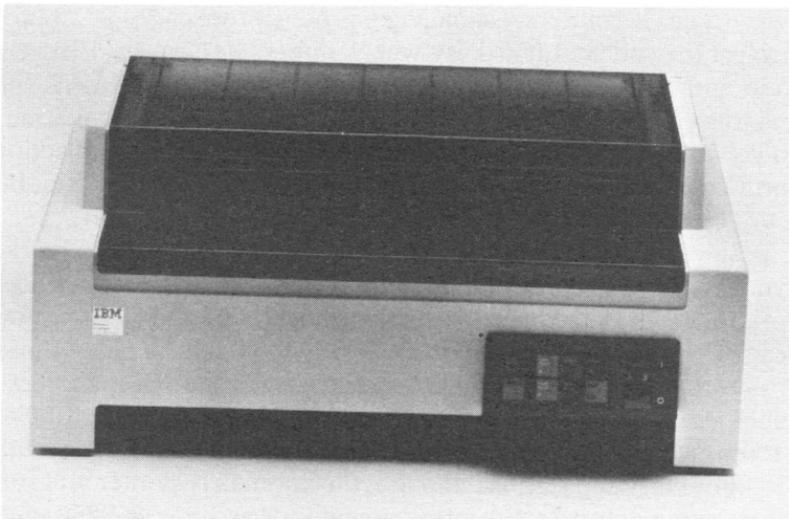
The IBM Color Printer
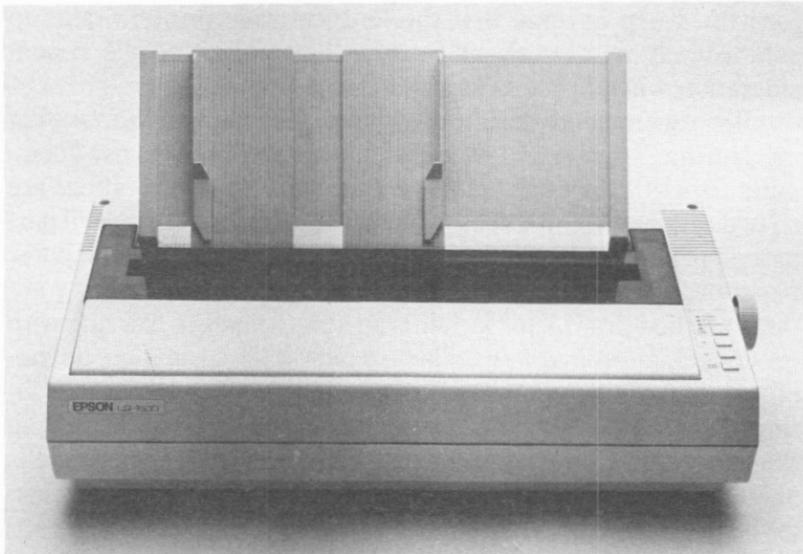
Epson high speed dot matrix printer

for around $25 for 2500 sheets. Most computer stores charge almost twice that for inferior paper.

For business correspondence, a daisy-wheel printer is the only way to go. If your correspondence is only a few pages at a time, look at the under-$1,000 daisy-wheel printers by Comrex, Brother, and Smith-Corona. These printers are slow (80 to 150 words per minute), but are still much faster than you can type. In addition, if you are a writer, many publishers will not accept a manuscript printed on a dot-matrix printer. If you're a professional writer, be sure to check with your editors before you buy a printer.

If you'll be printing a large volume of letter-quality work, you'll need to grit your teeth and buy an expensive daisy- wheel printer, such as the ones by Diablo, Qume, NEC and C. Itoh. You can typically expect to pay from $1,500 to $3,000. Most of these printers include an interface specifically for the IBM, so make sure that's the model you get. These printers are good for 350 to 400 words per minute, built like tanks and built for the long haul.
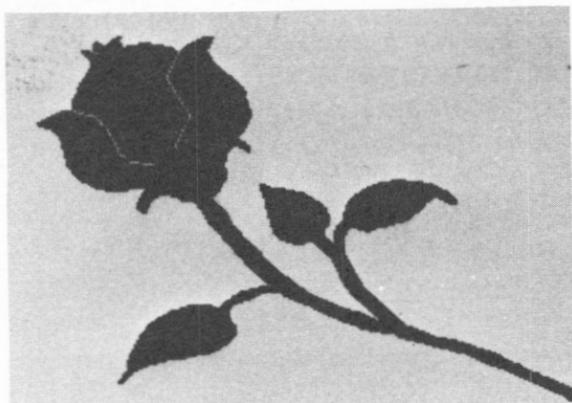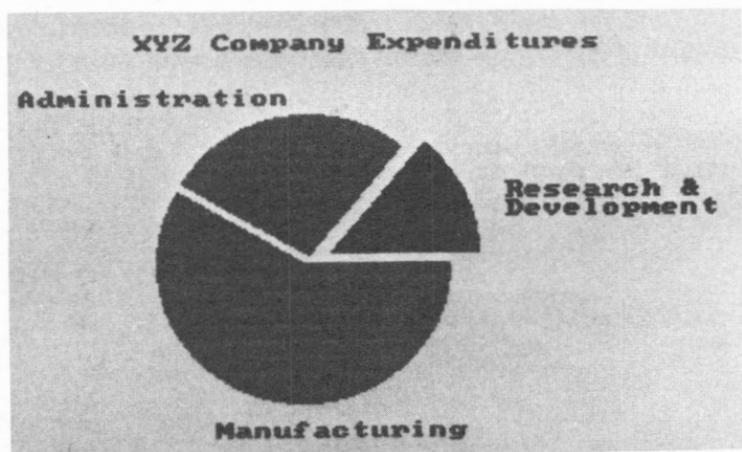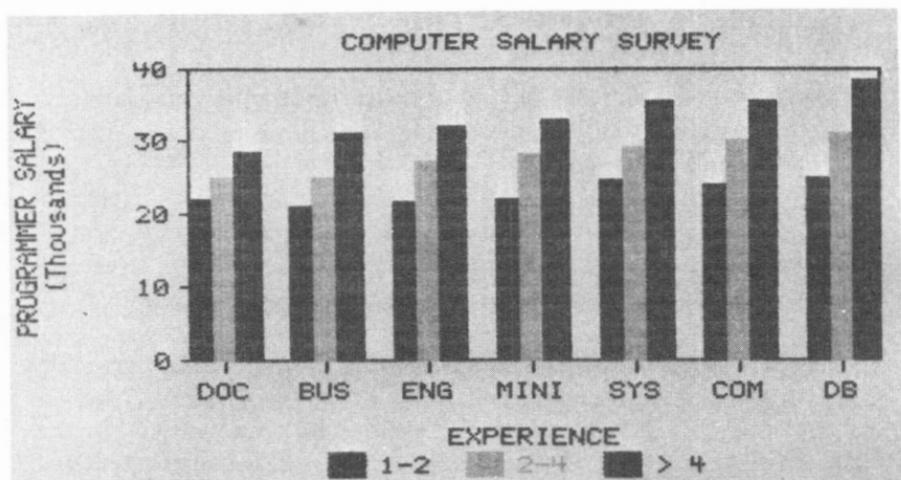
For most applications, though, the dot-matrix printer will suffice. Some dot-matrix printers now go for as little as $250, and prices seem to be dropping. It's hard to go wrong with any one

of the Epson series of dot-matrix printers—they are sturdy, well-made and slightly better buys than the IBM printer, which is also made by Epson. For a similar price, you can get the Epson printer with the graphics option—an important consideration if you plan to do a lot of graphics work.

The final method of getting words on paper is through a converted electric typewriter. Some, such as the Bytewriter, are typewriters remanufactured to serve as computer printers. Other companies provide an interface (typically for $150-200) to connect an electric typewriter to a computer. The interface converts signals from the computer into information the newer electronic typewriters can understand. The speed is usually on par with the slower daisy wheel printers, and if you already own an electric typewriter such as the Olivetti Praxis or one of the newer Smith-Coronas and only need a light-duty printer, an interface is a good way to go. Keep in mind that most typewriters were developed to be used as *typewriters*, not as computer printers. Even the

Brother EP-44 printer/typewriter

COMPUTER SALARY SURVEY

PROGRAMMER SALARY (Thousands)

EXPERIENCE: 1-2, 2-4, > 4

XYZ Company Expenditures

Administration

Research & Development

Manufacturing

fastest typist types more slowly than a computer prints, and typists take breaks. The steady pounding of computer printing is tough on a printer—the reason why high-speed letter-quality printers resemble tanks. Some of the newer typewriter/printers, such as those made by Brother, were designed as printers with a typewriter keyboard tacked on. This is an altogether better system, and the price at $1,000, is excellent.

Also becoming available for the first time are reasonably priced (less than $1,000) graphics plotters and color printers. As you might expect, a color printer can reproduce color images from the screen to paper, while plotters can trace out sophisticated graphics either on paper or on clear plastic for use in a projector. Unless you're particularly enamored with seeing everything in living color, both color printers and plotters are primarily business tools, useful in producing high-quality reports and presentations. The least expensive is the Sweet-P plotter at $795, while Transtar (P.O. Box C-96975, Bellevue, WA 98009) makes an excellent small color printer for only $599. Hewlett-Packard also makes a dependable plotter, the Personal Computer Plotter, for only $1,095.

Before we leave printers, a word or so about cables is appropriate. Cables are some of those sneaky hidden expenses that nobody mentions. You'll need a cable to connect your printer to your computer (or your computer to the interface box, and one for the interface box to the electronic typewriter). At a computer store, expect to pay around $50 per cable. That little piece of wire is worth fifty bucks? Actually, it isn't. You can get the same cable made for you locally for about $15. Check in your Yellow Pages under "Cable" or "Wire" and look for such tip-offs as "computer cable experts."

INPUT TRICKS

There's a whole category of peripherals that are becoming more and more popular—input devices such as the light pen, voice recognition cards, touch screen and pads, joysticks and the now-famous mouse. You're probably most familiar with game joysticks. Joysticks allow you to play arcade-style games on your PCjr. The joystick moves the cursor around, smashing the galaxy, eating energy pills and what-have-you, letting you drive a racecar around your screen. Joysticks, however, are not just for games.

The TG joystick is one of many available controllers

Some of the new programs for the PCjr, including *Home Word*, can use the joystick to move the cursor around the screen. And you can use a joystick to "draw" on the screen with some graphics programs.

IBM reasoned correctly that since the PCjr was a home computer, the circuitry for interfacing joysticks with the PCjr should be built into the machine. There are connections for two joysticks, and IBM makes a set of joysticks to match those connections.

They are really excellent joysticks, with two fire buttons and the means of switching the main "stick" to either free-floating, which means the stick remains where you place it, or spring-loaded, to return the stick to the center. The advantage is that you can use the IBM joysticks on games and programs that call for either type of joystick. They are built with the usual sturdy IBM quality.

Joysticks from other manufacturers are pretty standard items—try out a few at the computer store and pick the one you like best. Be aware, though, that a joystick's weakest point is the cable that connects it to your PCjr. A joystick will be plugged in and unplugged many more times than any other peripheral. If the cable connections appear flimsy, pass them by, or you're going to be spending $10 here or $20 there getting the cable reconnected. You're probably better off with the IBM units.

Voice recognition and speech synthesis are both part and parcel of making the computer chatty. We've already talked about

the PCjr's outstanding sound capabilities. With voice recognition—still in its infancy—you can talk to the computer. In speech synthesis, it talks back. In voice recognition, you say simple words to the computer and it responds as if you'd typed in a command. This comes under the heading of "next year's miracle"—computers can only recognize a few hundred words, so you can expect a fairly long wait until you can carry on a conversation with your PCjr. Speech synthesis is another matter. Speech synthesis units—with which the computer can generate sounds that make up speech all on its own, like a tape recorder with stored words—are readily available from Tecmar, and Street Electronics (1140 Mark Ave., Carpinteria, CA, 93013). Talking computers are cute (remember HAL in the movie *2001: A Space Odyssey?*), but their real utility comes in opening the world of computers to the handicapped. A blind person can use a PCjr with a speech unit, and a mute person can make the PCjr talk for him or her. Probably the broadest application is in education, and you can expect to see bigger advances in talking computers along those lines.

Touch pads and light pens allow you to input information without using the keyboard; by drawing on the screen or drawing with your finger on a pad. Originally, light pens and touch pads were the province of graphic artists and architects, who needed the ability to get information onto the screen quickly and who could afford the sky-high prices. Recently, this technology has trickled down to the home user, and the PCjr is ready for it. There's a plug on the back of your Junior to accept a light pen with no special additions or modifications required, and IBM's BASIC has provisions for utilizing such an input device. A light pen allows you to input information by just pointing the light pen at the screen. Instead of manipulating the cursor keys to select one of a list of actions, you can simply point the light pen at the appropriate symbol on the screen.

One of the most fascinating input peripherals for the PCjr is the KoalaPad (Koala Technologies Corporation, 4962 El Camino Real, Suite 125, Los Altos, CA 94022 or 3100 Patrick Henry Dr., Santa Clara, CA 95050), a low-cost touch pad that allows you to draw on the pad, just like you would a piece of paper, and see the image translated on the screen of your PCjr. You can redesign your home, draw impressive graphics or just get involved in high-

tech doodling for around $150. The KoalaPad substantially expands the horizons of the PCjr.

Since the introduction of Apple Computer's super sophisticated Lisa, though, the "sexiest" peripheral award would have to go to the lowly mouse. A computer mouse has nothing to do with rodents. It's been described as a rolling function key, a way of quickly moving the cursor from point to point without tapping on the cursor movement keys. The mouse also features buttons for editing and selecting many choices.

The idea is that mice make it easier for people to interact with computers, and the premise will soon be put to the test. There are already a couple of mice available for the PC and soon for the PCjr, one from Mouse Systems and another from the giant Microsoft, authors of the IBM operating system. Microsoft has released a word processing program designed to take full advantage of its mouse, and more mouse-driven software products are just beyond the horizon. The most ambitious is the *VisiOn* series from VisiCorp, of *VisiCalc* fame. The VisiOn concept, similar to the Apple Lisa and Macintosh, provides an on-screen representation of a desk top, presumably uncluttered as a working desk top should be. The desk top includes word processing, spreadsheets, and data management programs, all accessible by rolling the mouse to position the cursor over the appropriate program and pressing a mouse-button. All the programs are integrated, working together, allowing you to shift from one thing to another in a logical work sequence.

The mouse, connected by its "tail" cable to an RS-232 port, may be the most popular peripheral of the future.

A final category of peripherals makes life with the computer a little easier, or expands the capabilities of the computer in completely different directions. In this category are outboard print buffers, essentially storage cabinets for information on the way to the printer. The computer dumps the file to be printed to the buffer and is then ready to go back on-line. The buffer then communicates with the printer, leaving the computer free to do other things. Some buffers allow you to make multiple copies of files, a handy option perversely missing in some word processing programs. Buffers are available from a variety of suppliers, with a variety of memory sizes. Most buffers have expandable memory,

which is a good idea since your needs might change in the future. The first time you wait for your printer to creep through a document, you'll appreciate a print buffer. With prices beginning around $200 and units available from such fail-safe suppliers as Quadram and Practical Peripherals, they're an excellent buy. Print buffering is also available in software. When you use an expanded memory card, a portion of that memory can be used as *inboard* storage, just as the add-on buffers represent *out-board* storage. The prices are good if you're buying additional memory anyway—many manufacturers toss in the print buffering software for $20 or so with the purchase of one of their cards. If you do a lot of word processing, you may quickly find that you need a buffer.

Because the PCjr is a new machine, our discussion barely scratches the surface on the topic of peripherals that will soon be available. One certainty is an *expansion chassis*, an outboard box that will allow the PCjr to use some of the sophisticated *multi-function* boards available for the IBM-PC. You'll be able to expand your PCjr's memory to 256K and beyond, plus add a second disk drive. One thing to keep in mind when you're thinking of add-ons in this area is that the PCjr's power supply is limited, only one-half the wattage of the PC. The PCjr's power supply may not be sufficient to run many added devices. An expansion chassis with a separate power supply, if available, would be desirable. Also, the expansion chassis should include provisions for a fan if another disk drive is included, because disk drives generate heat, and heat is the nemesis of computer parts.

The important thing to remember in choosing peripherals is your own needs. High-speed letter-quality printers are convenient, to be sure, but is that convenience worth the large price you'll pay to get it?

In addition, be willing to shop around, but don't go overboard. You might, for instance, be willing to order a printer from one of the many discount mail order houses, but have your local dealer install additional memory. You'll then have your local dealer to turn to if there are problems with the extra memory. It's difficult to find a local dealer, however, who can keep dozens of different printers in stock, and that dealer might not want to carry the newest, cheapest (and smallest profit) dot-matrix model. Don't be

afraid to ask questions: what will this peripheral really do? is it the only one of its type on the market? are there better deals? Be wary of "newest state-of-the-art technology." Too often, unfortunately, users have found themselves in the position of being trouble-shooters for a product that was pushed onto the market too fast. We have been in that position, and it is not particularly pleasant.

Each peripheral should expand your computing horizons. As your computing abilities grow, you will find that using your PCjr will become more and more exciting.
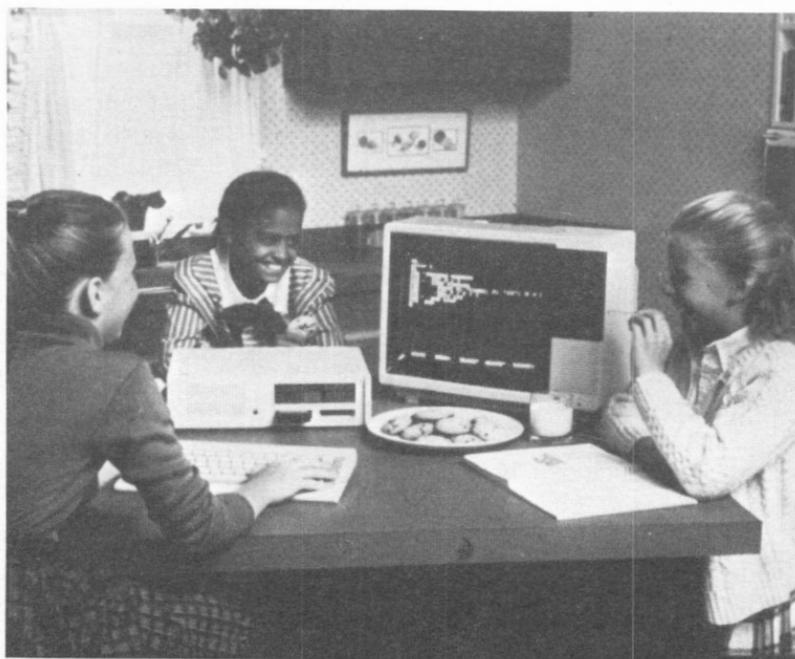
3 SOFTWARE SIGHTS

W ithout software, your PCjr would be a very large, slightly overpriced doorstop. Software refers to *programs,* a collection of instructions to tell your computer what to do. There are several ways programs can be made useful to the computer. As we've seen, some programs are built into the microchips themselves. Using a programming language like BASIC you could type in a program with your keyboard, or write your own program. By far the easiest way to get programs loaded into your PCjr is with the ROM cartridges or on a preprogrammed disk.

Although the situation will no doubt change, the vast majority of the programs available for the PCjr are on disks. The number of programs that will eventually be available for the PCjr is impressive, thanks largely to the success of the IBM Personal Computer.

The IBM-PC has become the best-supported machine in the short history of microcomputers. Consequently, programmers rushed to provide all manner of software for the PC, from the lowliest arcade game to the fanciest data base manager. New software titles are being announced on an almost daily basis, in addition to translations of almost all of the successful products written for such operating systems as CP/M.

Another way to learn more about a specific piece of software or to search for a type of software that fits your needs is with your computer itself. Some on-line services, such as Dialog's *Knowledge Index,* offer sophisticated and constantly updated software data bases. You can use your modem and communications software to call up and ask for all the particulars on any software package you're interested in!

Before we go into specific software titles, you should keep a couple of general caveats in mind:

Before you buy any software, evaluate that software based on your own needs. If you just want to balance your checkbook, you don't need double-entry accounting, no matter how "user-friendly" the program is. And don't forget to include pricing in the equation. If your only word processing need is writing letters to distant relatives, there's no sense in paying $400 for software to turn your PCjr into a dedicated word processor. After a careful and judicious selection of software, you can use the money you save to buy *Frogger.*

GAMES PCjrs PLAY

One of the biggest attractions of PCjr is its ability to play games. Computer games with funny little creatures scurrying around a video screen have changed the way we live. *Pac-Man* is a household word, and literally millions of dollars in allowances slip into quarter slots at local video game parlors. A few years ago companies like Atari and Coleco flooded the country with home video games, reaching virtually a saturation point.

One of the reasons for the success of small computers is their ability to play games that nearly duplicate the top arcade hits. Apple led the way, and the PCjr places very highly. Obviously, no small computer can deliver the color graphics of an arcade game, since those machines are designed to do nothing but create that
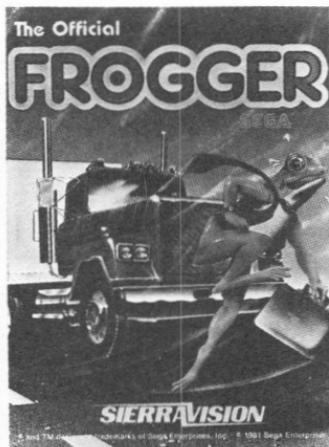
game. But the PCjr represents a new peak in video quality for game freaks, and we'll tell you how to take advantage of it.

Computer entertainment divides into two very loose categories. The first is the arcade game, which can be subdivided into "blast the hell out of 'em" games like *Asteroids* or "Run before it eats you" games like *Pac-Man*.

The first games available for the PCjr are from IBM and are provided on plug-in ROM cartridges. IBM has released four arcade-style games for Junior:

—*Mine Shaft*, originally designed by Sierra On-Line.

—*Crossfire*, also by Sierra On-Line.

—*Mouser*, designed by Gebelli Software.

—*Scubaventure*

Mine Shaft is basically a *Pac-Man* clone, only the Miner can shoot at the hostile creatures that are making his life miserable. *Crossfire* is an adaptation of a game available on disk for the PC. It's a cosmic shoot-em-up; bugs armed with zap guns try to shoot the "Exterminator." This game is hot! The action never lets up, and after a while you're going to find yourself sweating it out, clutching that joystick like there was no tomorrow. This is the best of the bunch.

The second best of the four is *Mouser*, where a hapless farmer tries to rid his house of mice. The color and graphics are excellent, and, perhaps important to some parents of young children, the mice are "trapped" rather than killed. Trapping adds an extra touch, as does nice sound.

The weakest cartridge, in our opinion, is *Scubaventure*, where a scuba diver swims upstream, catching red fish and trying to keep ahead of an alligator. The game is fairly slow, possibly making it a good addition for the very youngest member of the family. For video arcade junkies, though, there's a clear and present danger of falling asleep.

Be assured that all of the most popular games presently available for the PC will probably be translated to the PCjr very quickly, which is good. Frankly, we've always had a weakness for *Frogger*, by Sierra On-Line. There's something painfully poignant about the little frog trying to get across the highway, past all the things that want to run over or eat him, just to meet up with a lady friend. In case you've been living in the asteroid belt for the last

couple of years, the object of *Frogger* is to get the frog across a substantial highway, featuring racecars and 18-wheel trucks, past the frog-eating creatures, and across the swiftly flowing river to meet up with his croaking paramour. The action is fast, but be warned—it's not as fast as a video arcade game. Sierra On-Line also offers some good "run before it eats us" type games, including *Mouskattack.*

We consulted our PC expert, *ComputerLand*'s John Parker, for some of the newest and best fast action arcade games. His personal favorite is *Night Mission Pinball* by subLogic Corporation. In effect, *Night Mission Pinball,* with its masterful color and graphics, is an ironic full circle—the old mechanical pinball games became electronic pinball games, which were unable to compete with video games and nearly disappeared, only to be resurrected on the PC. Your PC screen becomes the board for a "Night Mission" pinball game. You have the ability to control the ball speed, the number of balls per game, the score at which you'll get a
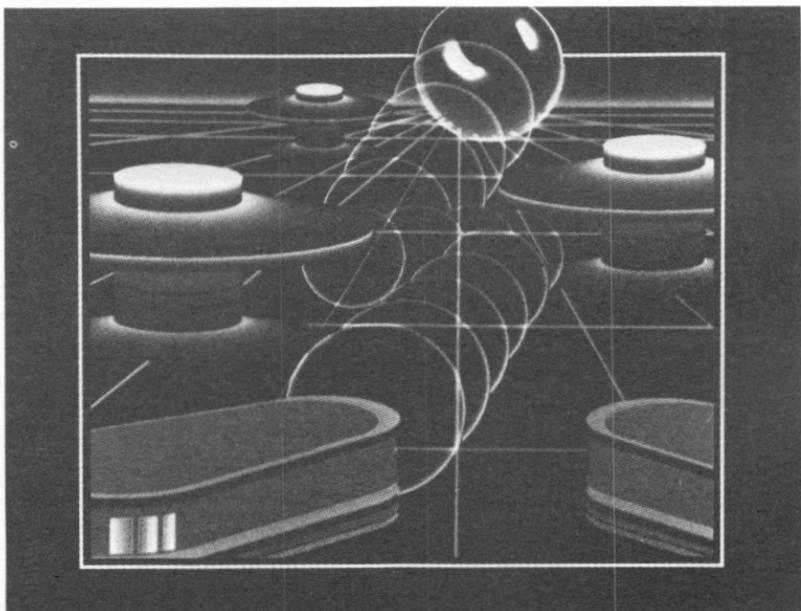
Night Mission Pinball *provides an excellent simulation*

replay—you can even "tilt" the machine by hitting the wrong key on the keyboard! There are lifelike sound effects, and up to four can play. All you need is a pinball parlor with cigarette stains on the floor and fluorescent lights on the ceiling to complete the effect.

Probably the ultimate "run..." game for the PC is Orion Software's *PC-Man,* where the little yellow PC-Man (sound familiar?) is chased by the Micro Monsters. Orion also has one of the more popular shoot-em-up games, *Paratrooper.* In *Paratrooper* the object of the game is to shoot down little paratroopers before they blow you up.

The PCjr shines in the second category of games: adventure, strategy and role-playing games which can include text, graphics or a combination of both. You can fight a war, solve a murder or fight dragons and monsters to your heart's content. But be warned in advance—this type of game is definitely habit forming. If you decide to become involved in, say, *Adventure* or *Deadline,* leave a note for your family and friends.

The grandfather of this category is *Microsoft Adventure,* distributed by IBM through its dealers. *Adventure* is an underground quest in which you are a character, similar to ones in the board game *Dungeons And Dragons.* Text adventure games are sort of like reading a television screenplay in which you happen to be one of the characters. The computer describes the scene around you. . . "It is a dark and stormy night..." and presents you with options. You tell the character which way you want your character to move, what to pick up, and what weapons to use against the various and sundry monsters. The responses you make determine which way the "plot" is going to go. Instead of one fixed game, there are hundreds of potential versions of the game. No wonder text adventure games are so all-consuming!

If you like *Adventure,* you'll love *Zork* from Infocom. *Zork* sends you through the Great Underground Empire searching for the Twenty Treasures. The most amazing thing about *Zork* is the sophistication of the program. It is all text, and you respond to the program with "spoken" commands. If fantasy isn't your forte, Infocom offers a series of state-of-the-art adventure games. You can be a police detective investigating what might be a murder (*Deadline*), an off-duty cop in the sleazy Los Angeles of 1938
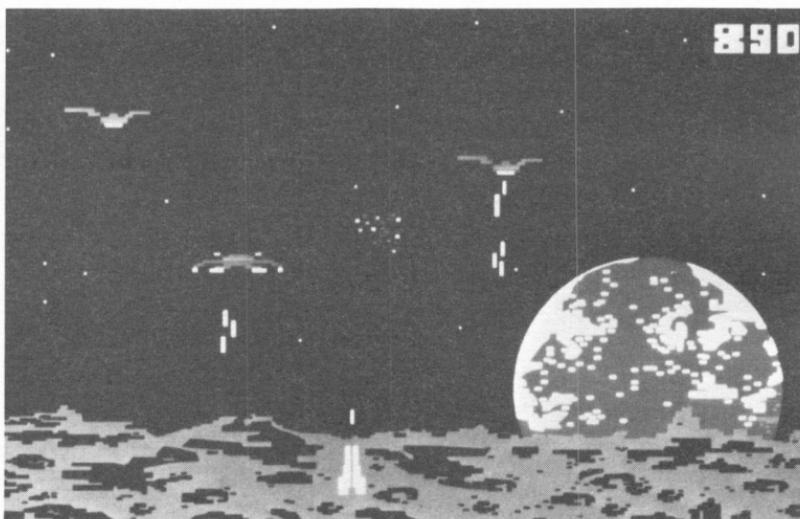
Game classics such as Demon Attack *are available for the PCjr*

(*Witness*), a person in suspended animation trying to keep an alien planet running (*Suspended*) or a starship commander exploring a mysterious alien vessel (*Starcross*). In each of these games, the relationship between you and the computer is uncanny. If you're not careful, your computer persona can find himself dead!

The most incredible thing about Infocom's games is their level of realism. Instead of bizarre computer commands, a command might be "Walk down the hall and pick up the vase." If your hands are too full, you'll drop something. If you instruct your character to turn the wrong way, you'll walk into a wall. These games are so absorbing they're spooky, and they are masterpieces of computer programming. If you buy no other game for your PC, buy one of Infocom's.

Other adventure/strategy games pit you against the stock market, force you to try to break out of a mental institution or launch you into the midst of World War Three. The success of the movie *War Games* has spawned a game titled *Global Thermonuclear War* from Starfire Games (9960 Owensmouth Ave., Suite 32, Chatsworth, CA 91311). It features full color graphics and speech synthesis with realistic sound effects. Perhaps it should

come in a lead-lined box. One text adventure game designed for the PC, *Heroism in the Modern Age,* allows you to create characters and guide them through their lives, then pit them against a series of drastic scenarios, such as a terrorist plot (Pacific Infotech Corp., 10850 Wilshire Blvd., Suite 800, Los Angeles, CA 90024). In any case, whatever your forte, the PCjr should soon have a game for it. The sky's no longer the limit these days.

THE PROCESSED WORD

Of all the uses for the personal computer, the most commonly known is word processing. Word processing is a term coined by IBM more than 20 years ago to describe how text is manipulated—and it is manipulated in many ways.

With a word processor, you'll never have to type, retype and type *again* a memo or a letter until it is perfect. Type it once into the computer, then edit it on your monitor. For home users, word processing is convenient; for business users it's nothing short of a revelation. Paperwork takes up less and less time. Work that once took two or three hours now takes less than an hour. The reason so much hoopla surrounds word processing is that it is fiercely efficient.

Most word processors have some sort of facilities for printing form letters and mailing labels, plus the ability to use spelling checkers, punctuation checkers, grammar programs, even an electronic thesaurus!

Their biggest drawback has been expense—a first-class word processing program can still cost $500. But IBM has carefully tailored word processing programs for the PCjr at several levels, opening the world of the processed word to everyone.

What does a word processor do?

Basically, a word processing program turns your PCjr into a sophisticated typewriter, allowing you to enter and correct text on your computer screen. As you type on the keyboard, the letters appear on your screen at the point of the *cursor.* The cursor is a flashing indicator on your screen. It can be a short line, a point or a highlighted box, but its purpose is always the same—to tell you where you are on the screen. There are special keys on your PCjr keyboard, called *cursor keys,* that will help you move the cursor around quickly. The keys, on the right side of the

keyboard, point in the direction they will move the cursor—up, down, right and left.

Once you know where you are in the text, you use *commands* to do whatever you want with it. Commands are keys or groups of keys that cause the program to do a specified action. For example, in one word processing program, hitting the combination CONTROL-Q—Y causes the program to erase all the characters on a single line to the right of the cursor. In another word processing program, hitting the combination CONTROL-B causes every character after that to appear in boldface. To end the boldfacing, you need to type CONTROL-B again. This type of command is known as a *toggle,* since, just as with a toggle switch, you turn it off and on.

You can add and delete characters, words and lines, move blocks of copy around like building blocks, search for and replace words or strings of characters, merge one file into another, justify the text (all text lines the same printed length) and arrange to print the text any way you want.

Word processing programs appear very complicated to use at first glance, but most are actually very easy. Commands tend to be fairly logical—B for boldface, for example—and you never need to know all the commands before you start working. The word processing program we used for this book, *WordStar,* is reputed to be one of the most complicated, yet you can operate the program by learning no more than five commands. You learn the other commands as you need them.

IBM offers two word processors for the PCjr, *Home Word* and *Easy Writer Version 1.15*

Probably the biggest news for the PCjr is the $75 *Home Word* program, developed for IBM by Sierra On-Line. It requires a disk drive, since the program is provided on disk, but it can make excellent use of a 40-column display on a television set, plus being adaptable to the 80-column display on a monitor. For a modest price *Home Word* provides most of the features of word processors costing many hundreds of dollars, plus a couple of features that many bigger word processors will envy.

Home Word makes creating, editing, and printing small documents a snap. The commands are simple and intelligent, including an overlay for the PCjr keyboard which allows you to begin editing at once. For the novice user, *Home Word* uses *icons*

Esc

Tab

Ctrl

Shift

Fn

Backspace

Enter

Shift

Del

Ins

CapsLock

Home

Pg Up

Pg Dn

End

IBM
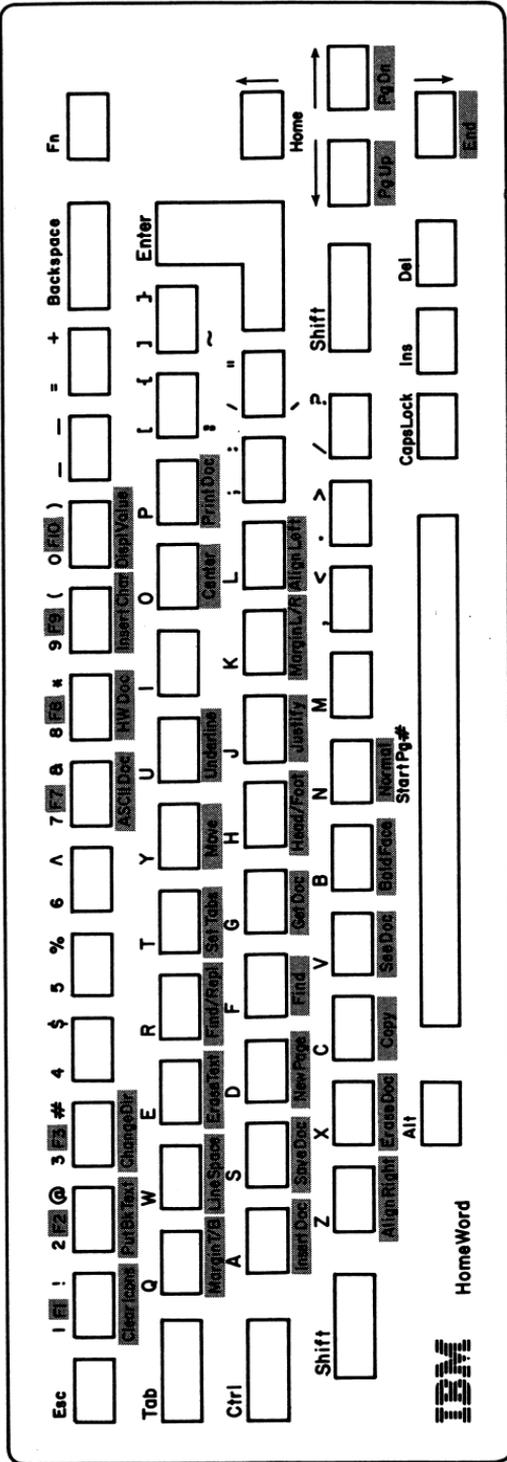
HomeWord

The Homeword Keyboard

instead of a printed menu. Instead of reading the choices on a menu, you are presented small pictures—a printer for *printing*, a page of copy for *editing*, a filing cabinet for *filing* and the like. To select your choice, you use the cursor keys (or the joystick) to move a box to enclose the appropriate icon. The advantage of icons, pioneered by Apple Computer on their Lisa computer, is that users, especially young users, can handle the program without plowing through a manual, allowing the computer to be more quickly integrated into your day-to-day activities.

IBM wisely set up *HomeWord* to allow you to turn off the icons and revert to a printed menu as you become more familiar with the program. The problem with icons is that they are slower than selecting a choice from a printed menu. Part of the problem we've found with icon-driven programs is that they tend to hinder users who know how to type, forcing them to "reprogram" their fingers to move in different sequences. With *HomeWord* , you have a choice and can see which works best for you.

One really useful feature that's absent in many higher-priced word processing programs is reformatting each paragraph as you insert copy. You can also command *HomeWord* to insert text with different margins and spacing in the final printed copy.

There's also one very handy feature that is rarely seen. In *HomeWord,* you can choose whether you'd like the program to make automatic back-up copies of your document. You will find that you very rarely need back-up copies, but when you do, you need them *really* badly. Most word processors either automatically make back-ups or don't make back-ups at all, requiring you to use the DOS COPY routine. If you're writing an important paper on *HomeWord,* you can make back-ups automatically. If you're writing letters home, it's not necessary, so not making a back-up will save you a lot of disk space.

So what's the catch?

Well, *HomeWord* can only work on a document 12 single-spaced pages long, and that's with 128K of memory. For home use such as letters or school papers, that shouldn't present any problems. But for professional use, it's a major drawback.

IBM also offers a "full-featured" word processor for the PCjr, *EasyWriter. EasyWriter* is a professional quality word processor, capable of performing almost any function you can think of. It's also more expensive, $175, and requires a disk drive, an
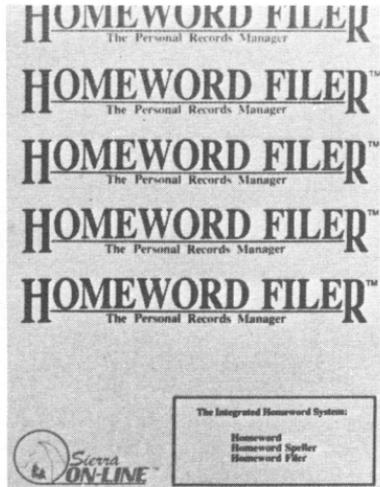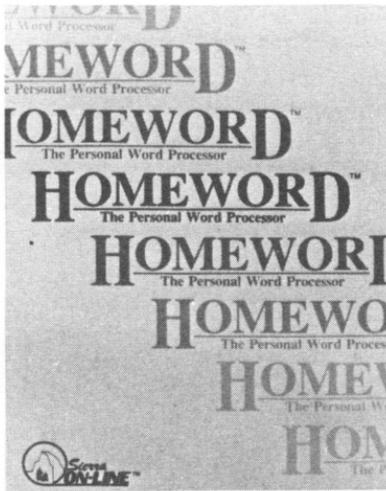
80-column display, and the 64K Memory and Display Option.

Many of the most famous word processors for the PC will undoubtedly be converted to PCjr. In fact, the maker of the second-best selling word processing program, *MultiMate,* has already announced that a special PCjr version will be available. *MultiMate* makes the PC emulate a Wang dedicated word processor, one of the best and most successful dedicated word processors. *MultiMate* would be an excellent choice for professional word processing on the PCjr.

Again, it is essential to know your own needs. Purchasing a word processing program is usually a trade-off between features and price. If all you're going to do is write love letters, you don't need *WordStar.* Many of the features touted by the authors of word processing programs come under the heading of "useful, but so what?" How many different ways are there to format a letter to Mom? A page of type? What we are saying here is to be realistic about your own needs. Don't let yourself get oversold.

Most software companies keep a file of magazine reviews of their product, so don't hesitate to write and ask for them. Explain your needs to the salesperson and ask for helpful suggestions. If you don't want to spend a fortune, say that up front. Once you get a word processor, though, you won't be able to imagine how you lived without it.

One great advantage of the computer over a typewriter is that it allows even the casual writer to—perhaps for the first time in that person's life—spell everything correctly. There are now numerous spelling checkers and even one grammar checker, and IBM has provided one for the PCjr. *Word Proof* ($60) compares all the words in your document against its 125,000-word dictionary. It cannot tell you if a word is misused in context, only that it is incorrectly spelled or mistyped, but that's a lifesaver. *Word Proof* works with *HomeWord* and probably most of the other word processors that will become available for the PCjr. The exception, perversely, is *EasyWriter.* That program is written in a language that hinders communication with other programs, essentially locking you into the *Easy* software series. This is a point to consider if you plan to keep adding to your software library and want to take advantage of more sophisticated programs as they become available.

SOFT BUSINESS

Business software is as varied as the businesses who use it. There's software aimed at specific businesses, such as law offices, and general programs such as accounting and payroll programs. Such programs are outside the scope of this book, except to say that the same rules apply to their purchase as any other program.

The PCjr's designation as a home computer will limit some of the business software made available for it, especially accounting programs and some of the more sophisticated *integrated* business programs, such as Lotus Software's *1-2-3* which includes a spreadsheet, data base and graphics in a single program.

The two most common types of business programs, though, are spreadsheets and data base management. You may recall that the introduction of the electronic spreadsheet, *VisiCalc* in 1979, triggered the boom in small computers. *VisiCalc* and similar programs are an electronic update of the large green ledger sheets that planners and accountants use to map the relationship between various aspects of a business: Income, expenses, wages, taxes, etc., all interact to define how well a business works. An electronic spreadsheet allows you to define the mathematical relationship between many items, then insert different values and see how those values effect the bottom line. What happens to our profit margin if taxes go up ten percent, if we lay off an employee, if our widget

Spreadsheet programs such as Multiplan *aid in home/business management*

becomes the next Pet Rock? The spreadsheet is a "What If?" program, and it has become invaluable to businesspeople who need its super-fast problem solving. Among the best examples of a spreadsheet is Microsoft's *Multiplan,* distributed by IBM for the PCjr. The spreadsheet of *Multiplan* is 255 rows deep by 63 columns long. Each intersection of a row and a column forms a unique point, called a "cell." Formulas or data can be placed in each cell, allowing the user to build a "model" of a business or situation.

The second major category of business-oriented software is file or data base managers. A data base is a collection of information; a file. It can be all the names and phone numbers in your address book, your Christmas card list or all the books in the Library of Congress. A data base program helps you structure that information, then sort it and retrieve it in any way you want. Take your address book, for example. If you created a data base from your address book, then wanted to know the telephone numbers of all the people you knew in Chicago, and you structured it correctly, the computer could easily produce such a list.

Or suppose you create a data base to keep track of your record collection. On screen, you draw an "input" form, maybe listing the record, its date of release, the artist, the back-up musicians,

the names of the songs on the album, and some of your comments. Suppose a friend then wants to know what Eric Clapton sounded like before he got famous. You go to your PCjr, run up the data base program and ask for a listing of CLAPTON AND BACK-UP MUSICIANS BEFORE 1965. You'll get a list of songs featuring an unknown guitar player named Eric Clapton, assuming, of course, you've got a super record collection.

The function of a data base program, then, is to sort and organize information to make it more useful to you. When you store information, say, in a filing cabinet, you can only use one *index*—alphabetical, by telephone number, or any such way. A computer can use many indices, giving it a tremendous amount of power in looking up that information.

The drawback for the PCjr is that data base management eats up memory and disk space, and many data base programs require two disks to function. That might limit some of the programs presently available for the PC.

IBM, however, offers its own data base managers, *pfs:FILE* and *pfs:REPORT* for the PCjr. The two programs work together, *pfs:REPORT* allowing you to create reports from the data generated by *pfs:FILE*. The easiest way to think of *pfs:FILE* (or any small data base management system) is as a series of index cards. The program lets you create the cards, or *input screen*, any way you want. You create a space for the different types of information you want to enter, say the names, addresses, and telephone numbers of everyone on your Christmas card list. These are called *fields*. Once you've created your card, then you just fill in the information.

When you've finished entering information, you can get it back out in a number of different ways, depending on your needs.

A second and totally different data base program available for the PCjr is called *Superfile 3000* from FYI. *Superfile 3000* is a way to organize what you've already written with your word processor. Say you've got a disk full of letters to everybody from Aunt Martha to the Internal Revenue Service. *Superfile* allows you to use all that text as your data base and to search through *every word* in those letters for any particular word or combination of words linked with AND, OR and NOT. The program's manual works as well as the program. In short, *Superfile* helps keep information from getting *lost*.

Superfile is a great program for college students with their own PCjr. *Superfile* could make writing a term paper almost fun.

You'll find that data base management is mostly a state of mind, and once you start using it you'll find more and more uses. If you really get caught up in data bases (and some people have found them as addictive as video games), we recommend the book *Everyman's DataBase Primer,* published by Ashton-Tate, authors of *dBaseII.* The book is easy to understand and use (unlike the *dBaseII* manuals), and you'll come away from it with the ability to manipulate information in ways you never believed possible.

HOME SOFT

A common use for the PCjr at home is personal finance. Personal finance programs can help you keep track of your money,
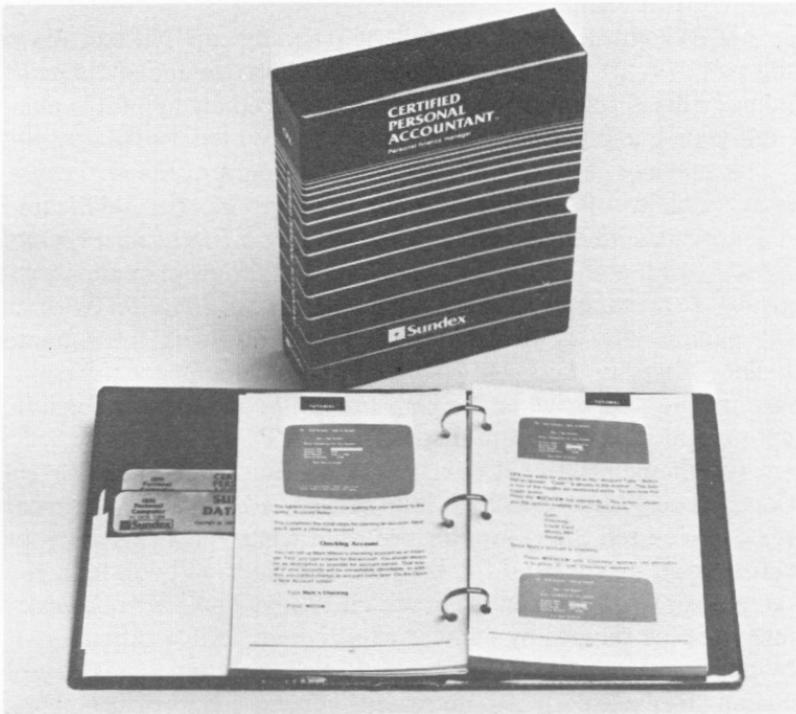
Certified Personal Accountant *is one of a series of Sundex Software's financial management software packages*

speed things up at tax time, and, on some programs, automatically pay the bills. These programs are so sophisticated and easy to use that it's a snap to manage not only home finances but those of a small business as well.

One of the best is *Home Accountant Plus* from Continental Software. *Home Accountant Plus* allows up to 100 budget categories, can flag tax deductible expenses and can print checks. The manual is well organized and easy to use, but we suggest a thorough reading before beginning to enter your financial data. Once you close one month's records, you can't go back and enter new data for that month, although you can edit existing data. *Home Accountant Plus* has an excellent search function, allowing you to search through your finances by check number, name, amount, budget category and several other fields, plus combined fields. This is extremely handy when a company asks to see a copy of your cancelled check. *Home Accountant Plus* can help you find it quickly.

The program also has excellent graphing capabilities, allowing you to chart your finances and see where the money is *really* going. This is generally depressing, but extremely helpful in planning your budget.

A fine inexpensive home accounting program, *Home Finance*, is available from Apparat ($34.95), although more sophisticated homeowners might benefit from Financier's *Financier Personal Series* with matching tax form preparation program or Best Programs' *Personal Computer Professional Finance Program* (with its companion *TaxCut* program). IBM also offers its own home finance program, *Personal Finance*, for only $45. These programs require the disk drive at the very minimum and usually the 64K option and the 80-column display for the PCjr.

One home program that's generating much interest is Virtual Combinatics' *Micro Cookbook*. The *Micro Cookbook* is exactly what it says. You tell the computer program what you've got in your refrigerator and around the kitchen, and the cookbook tells you recipes for what you can make with it. Voila! The *Micro Cookbook* lets you pick recipes by name, by ingredient, by classification or by any combination of the above. It also includes a glossary of cooking terms, calorie and nutritional information, measurements, ingredient substitutions and a food buying, storage, and cooking

guide. Coming soon is a *Micro Barmate.*

The cookbook-on-computer is an excellent example of how you can make your PC work for you at home as well as at work. Virtual Combinatics' primary concern was information management, and the information they chose to manage was food. With the *Micro Cookbook* you can enter your own recipes, change the size of portions and even have your PC make out your weekly shopping lists. If not for this program, there may be computer programmers who would starve to death.

One computer term you'll discover again and again is elegant, used to describe a piece of hardware or software. Elegant is loosely defined as a simple, almost artistic, solution to a program. Silly as it sounds, the more you work with programs, the more you'll come to understand elegant.

Superfile is an elegant program. *The Micro Cookbook* is an elegant program. Elegant programs make solving problems fun.

After you've finished blasting asteroids, doing your taxes, fixing your business, organizing your office and cooking supper, why not teach yourself to fly?

Well, almost. Microsoft's *Flight Simulator* is a high-flying experience whether you learn to fly from it or not. The *Flight Simulator* turns your PCjr into the cockpit of an airplane, a Cessna 182. When you "look out the window," you see exactly what the pilot in a small plane would see. All the controls are right in front of you, and you fly the plane from the keyboard. You can pick the degrees of difficulty and take your choice from more than 20 airports, including toughies like LAX and New York City's airports. When you fly over a city and look out the window, by the way, you see "landmarks." The color graphics are good enough to be startling, and you can spice things up by arranging to run out of fuel. If you really foul up, you crash, of course.

Included in the *Flight Simulator* is a World War One dogfight, and you're a British ace. If you've been "killed" once in the evening playing *Deadline,* you can arrange to be killed a second time by the Red Baron. Who says computers aren't fun?

EDU-SOFT

One of the PC's weakest links was educational software. Because of Apple's widespread acceptance in school systems,
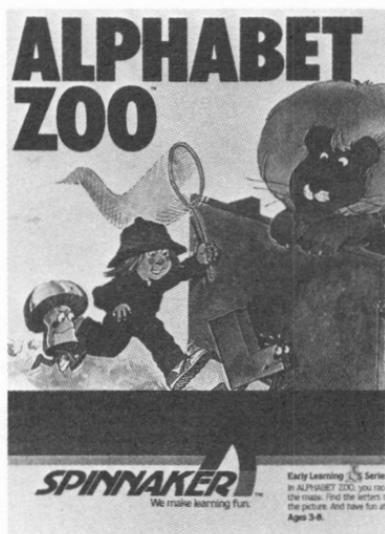
Spinnaker's Alphabet Zoo *and* Facemaker *provide early education*

most educational software was written for that computer. The PC was also a bit high priced for most beleaguered school systems. The PCjr seems destined to correct those problems. The price is right, the system has the potential and there's already educational software available.

The Learning Corporation provided IBM with three programs for young children, *Bumble Games, Juggle's Butterfly,* and *Bumble Plot.* All three of the packages make exceptional use of the PCjr's color graphics. *Juggle's Butterfly* is for kids from six to eight years old, introducing them to the computer at an early age. *Bumble Games,* for slightly older children, provides number training in the form of six simple games. The third package, *Bumble Plot,* is for children from eight to thirteen and continues on with more complicated numbers and functions.

There are three more educational programs available for the PCjr. *Adventures In Math* is a really neat idea, combining the tension of adventure games with math skills. The plot is familiar—you're wandering through a castle, looking for loot. But once you find the loot, there are math questions—addition, subtraction, multiplication, division or a combination of the four, chosen by the player—that must be answered before you get to keep it. If you make

a mistake, a spider comes and sacks your loot. Unlike the text adventure games, this one makes full—and somewhat spectacular —use of the PCjr's color graphics. In fact, *Adventures In Math* really whets our appetite for a role-playing adventure game with graphics like these.

Monster Math presents math questions with a 60-second deadline. If the child answers all the questions within the deadline, the monster on the left side of the screen disappears and the player gets points. The computer keeps a record of the highest score and displays it with the current score.

There's also *Animation Creation,* a program that allows you to draw color pictures on the PCjr's screen, store them on disk, then play them back in sequence—instant animation! If this doesn't hook your child (and you) on graphics, nothing will.

So you can see, software for the PCjr isn't going to be a problem. Software is also available through mail order channels at a substantial discount— *WordStar,* for example, was recently advertised for $259 from one large mail order house.

If you can't find the software you want locally or from mail order, which is usually only the case with a very new product, try calling or writing the manufacturer. Sometimes you can save two

Ernie's Magic Shapes *and* Big Bird's Special Delivery *make learning fun*

Compatibility

One of the biggest selling features of Junior is its compatibility to Senior, the IBM PC. The PC software base is huge, featuring some of the most sophisticated business programs available, and it's no surprise that the PCjr's ability to run these programs was a prime consideration for Junior's designers.

Compatibility means that a program designed for the PC will probably run on the PCjr. At this point, compatibility is more important for the executive who wants to run his PC programs from work at home rather than the opposite. Remember the rule of thumb for picking a computer—first pick the software, then the computer to run it. The PCjr will soon be deluged in software, and there's really no reason to buy a PCjr with the idea of purchasing exclusively PC software.

As a *very* rough rule of thumb, most PC programs that will run on DOS Version 2.1, require 64K or less of RAM and only one disk drive will run on a 128K enhanced Junior with the disk drive.

You will always be better off checking to make sure the program works *before* you buy it. Most programs that will run on both the PC and PCjr are now marked appropriately. There are some programs, such as Lotus' *1-2-3* and the *MultiMate* word processor that require so much memory that they will not run on Junior. This doesn't mean, however, that the manufacturers won't bring out a special Junior version (as *MultiMate*) or that you can't juice up your Junior (with an expansion chassis, say) to run it, if it's that important to you.

Still, that's more the exception than the rule. The PCjr has all the earmarks of becoming the *second* best supported computer in the history of the business, right after the original PC. There should be enough software available for Junior to take care of almost any application.

IBM Software for the PCjr

Program Name/Version	Operates on PCjr	Requires DOS 2.10	Requires BASIC Cartridge	Display	Disk or Cartridge	Comments
System Software						
APL (A Programming Language)/1.00	No	n/a	n/a	n/a	D	
BASIC Compiler/1.00	Yes	Yes	No	Any compatible	D	Must have sufficient storage for COMPILE and LINK.
COBOL Compiler/1.00	No	n/a	n/a	n/a	D	Compiler output will run on IBM PCjr if there is sufficient storage.
Diskette Librarian/1.00	Yes	Yes	Yes	Any compatible	D	
Fixed Disk Organizer/1.00	No	n/a	n/a	n/a	D	
IBM PCjr BASIC/1.00	Yes	No	n/a	Any compatible	C	
Logo/1.00	Yes	Yes	No	Any compatible	D	
UCSD p-System (all products)	No	n/a	n/a	n/a	D	

IBM Software for the PCjr continued

Program Name/Version	Operates on PCjr	Requires DOS 2.10	Requires BASIC Cartridge	Display	Disk or Cartridge	Comments
Applications Software						
Bumble Games/1.00	Yes	No	Yes	Any compatible	D	
Crossfire	Yes	No	No	Any compatible	C	
Dow Jones Reporter/1.00	Yes	Yes	Yes	Any compatible	D	
HomeWord/1.00	Yes	No	No	Any compatible	D	
Juggles' Butterfly/1.00	Yes	No	Yes	Any compatible	D	
VisiCalc/1.20	Yes	Yes	No	Any compatible	D	

*Some monitors, including most televisions, display only 40 columns (characters) across the screen. This program requires a monitor that supports 80 columns across the screen.

n/a = not applicable   C = cartridge   D = disk

or three weeks on getting a product by buying directly from the manufacturer.

If possible, see your software before you buy it. If you're buying it mail order, ask your local users' group if anyone there is using a similar package, if there are any problems or quirks you should know about, and if you can see it work. If it's a very expensive package, ask the manufacturer if there is a cheaper demonstration disk (this is becoming more common; a demo disk usually costs $10 and gives an excellent idea of how a program works) or whether you can return the product for a refund if it doesn't meet your needs. Find out whether the disk is copy-protected, which opens a whole new can of worms. Copy-protected disks cannot be copied, which is good for the software companies because it prevents bootlegging, but bad for the user if something should happen to the program disks—and accidents do happen. You'll have to make your own decision on whether that's important to you.

4 INFORMATION STATIONS

While word processing and financial modeling remain the best known and most used aspects of the personal computer, there's a giant lurking just around the corner with the power to bring the personal computer to its full potential.

Telecommunications, the act of one computer "talking" to another, may well prove to be the pot of gold at the end of the computer rainbow. Telecommunication is an umbrella term that encompasses a broad range of services, from electronic "bulletin boards" and swap shops to sophisticated data bases allowing you to search through millions of bits of information in a few seconds.

In fact, the options available in telecommunications are expanding at such a rapid rate that it's impossible to list them. There are more than 750 different services available on THE SOURCE, *Reader's Digest*'s huge information utility in McLean, Virginia, including business and financial analysis; financial market reports; stocks, bonds and metals news; air schedules and an on-line travel agency; discount shopping services; electronic mail and teleconferencing; movie reviews; computer games; the United Press International newswire; even the weather report!

In addition to the vendors of many services similar to THE SOURCE or CompuServe, there are smaller, more specialized electronic bulletin boards. These bulletin boards can have as many uses as their cork counterparts, from classified ads to chatting with people with similar interests. Many bulletin boards offer public domain software for "downloading" to your computer—the cheapest and fastest way of obtaining a program.

The advantage of telecommunicating is that it allows you to tailor vast amounts of information to fit your specific needs in ways that would have been impossible just a few years ago.

Let's say, for instance, that you're only interested in reading stories about your favorite football team. Instead of thumbing through the local paper day after day, you could search the United Press International sports wire, collect all the stories on your favorite team, print them out and read them at your leisure. Or you could connect to one of the data base services and search for every magazine article written on the team, then arrange to receive copies either through your computer or through the mail. You can also arrange airline flights, send mail, shop, play games, write an electronic novel and, in some areas, do your banking through your small computer.

For the businessperson, there's a staggering array of business news, from current Dow Jones quotes to detailed data on publicly held companies to the complete text of the *Wall Street Journal, Barron's* and *The Dow Jones News Service.*

In fact, there is more information now available to the individual than at any other time in history. You have more information at your fingertips than entire governments did just a few short years ago.

So what's stopping you from jumping in?

Like the Tower of Babel, there's so much talk going on that it's hard to figure out what's really happening.

The confusion stems from the fact that information utilities—which is as good a name as any to call the new services, since "utility" describes exactly what they are—are the new gold rush, growing so quickly that it's hard to keep up with what's going on. Let's take it one step at a time.

The IBM-PCjr talks to other computers through a code called ASCII, which is short for American Standard Code for Information Interchange. The ASCII code, adopted in 1968, simply uses binary numbers to represent letters, numbers and other information. The advantage of this is that large amounts of information can be represented by a series of ones and zeroes, which correspond to "off" and "on" settings on a switch. The IBM uses asynchronous transmission, which simply means that each ASCII character is transmitted individually.

The basic necessity for connecting to an information utility is either a computer or a terminal (a terminal is a video screen and keyboard engineered for just such a hook-up, sort of a computer

without a brain; in fact, communications terminals are usually referred to as "dumb" terminals). Just because you purchased a computer doesn't necessarily mean that the computer is ready to communicate, although IBM has gone to some lengths to see that the PCjr is easy to get "on-line."

For years computer manufacturers have resisted the idea of building a computer that doesn't need a million attachments to make it do something other than function as a high-tech placemat. IBM has taken a small step in the right direction with the PCjr. Unlike its big brother the PC, the PCjr comes with a built-in *serial port*. As we mentioned back in the discussion of printers, there are two ways a computer sends information, the bits in a byte, to other computers (or devices like printers). One way is the serial method, in which each byte is broken up into its individual bits and sent one bit at a time. The receiver reassembles the byte. The computer also sends some additional bits to help that reassembly, including bits that tell which are the beginning and ending bits and parity bit. The parity bit is sort of a data checker, enabling the receiving device to know whether the byte it just received and reassembled is correct. It is based on the number of binary zeros and ones in the byte, and the receiver compares the parity number with the actual byte. If they don't match, the byte has been incorrectly received.

Obviously, serial communication is a bit more complicated than parallel, where one byte at a time goes out, but serial communication requires only two wires to connect the two devices, and the devices can be located much farther apart than parallel devices.

Although IBM is to be commended for including a serial port at no extra cost, they should be chastised for not providing a standard-type plug on the back of the main unit. Instead, you must buy an IBM-supplied 3-inch cable to connect the connector on the back of a PCjr to a standard serial device. This means that sometimes things can get a little tricky in connecting a serial device like a modem or a serial printer to your PCjr.

The next step for getting on-line is the purchase of a modem, short for "modulator-demodulator." A modem is the translating device that sits between a microcomputer and the telephone system, taking information from one and converting it into infor-

mation usable by the other. A modem can be a separate device that sits alongside your computer, or it can be an electronic board placed inside the machine.

The quickest and easiest way to get on-line is with IBM's own Internal Modem for the PCjr, a $199 peripheral that plugs directly into one of the PCjr's expansion slots, then connects with its own cord to a standard (RJ-11) telephone wall socket. The PCjr's Internal Modem is fully program-controlled, which means that the software tells the modem what to do. It can dial numbers automatically using either Touch Tone or rotary dialing. It can also receive phone calls automatically. The Internal Modem has a couple of excellent advantages and one big disadvantage.

The first advantage is that the modem, made by Novation—a company with a reputation for excellent products—slips into the PCjr's case and doesn't take up any extra room on your desk.

The second advantage is that it doesn't use up the PCjr's serial port, as it connects directly to the telephone system. This is especially important if you're using the PCjr's Compact Printer, a thermal unit that connects to the serial port. There's also an intangible advantage that comes from the first two advantages. The easier a computer is to use, the more likely you are to use it once the newness wears off. One of the principal disadvantages of on-line services is the tedious procedure of logging on, and anything that makes that procedure easier is welcome. A second intangible advantage is that with the internal modem, the PCjr makes a compact, relatively light (a bit over seventeen pounds) package. If you've got a PC at the office, a PCjr with a built-in modem could make an effective "portable" computer system with the ability to send data back to your main system.

The disadvantage is that, in order to keep the price down, the modem is either a 110 or 300 baud unit. A baud is a measure of speed, defined as one bit per second. The slow 300 baud transfer rate is something of a de facto standard, mainly because until very recently there were almost no 1200 baud modems available at a reasonable price. The reason speed is important is that time is, literally, money. Information utilities charge from $5 to $25 per hour for their services; the faster you can receive information, the less it costs you. However, the fly in the ointment here is that some services and many bulletin boards are not yet equipped for

1200 baud operation, and in some cases, such as THE SOURCE, 1200 baud hook-up time is more expensive than 300 baud.

For strictly home use, 300 baud is more than sufficient. But if you're planning to use your PCjr in any kind of small business, the 1200 baud capability is going to be sorely missed.

If the baud rate seems a problem for you, the answer is an "outboard" modem, connected through the PCjr's serial port.

There are two types of outboard modems: Direct connect, which, not surprisingly, connects directly to your telephone line through a standard phone plug, and acoustically coupled, which is a complicated way of saying that you stuff the telephone receiver into rubber gaskets on the modem to make the hook-up. Each type has certain advantages.

The direct-connect modem is easiest to use, usually allows automatic phone dialing and answering and minimizes the amount of stray noise that might be sent over the line and gum up the transmission. For a home or business installation that is going to be fairly permanent, the direct-connect modem is the best way to go.

If, however, you plan to take your computer on the road with you, or if you've *designed* your PCjr for portability, you might consider an acoustic modem. Some motels do not use standard modular plugs on their phones, lest some unscrupulous visitors unplug them and carry them away with the towels and ashtrays. The only solution here is an acoustic modem. However, unless the phone has a "standard" round earpiece and microphone, an acoustic modem won't work.

A 1200 baud modem is usually about 40 percent more expensive than a 300 baud unit. It will also run at 300 baud to access local bulletin boards and the like. Also, a word to the wise—in modems, you tend to get what you pay for. Stick with such name brands as Hayes Smartmodem, Novation, and the like. Your dealer is a valuable source of information, as are local users' groups. Be sure to tell your dealer that you plan to use the modem on a PCjr rather than a PC. Remember that you're going to need the short IBM cable to convert the serial plug to the industry standard 25-pin "D" connector and a cable from the modem to the IBM cable. Look for a local custom computer cable manufacturer in your telephone Yellow Pages and save as much as 50 percent

on the cost of having a cable made.

The final necessity is software for your computer. A terminal package or communications program (which means about the same thing) tells your computer which numbers to dial, how to link up with a foreign computer, which communications parameters to use, and how to send and receive the data. Communications programs are one of the few (indeed, maybe the only) exceptions to the "get what you pay for" rule. One of the absolute best communications programs for the IBM-PC is called *PC-Talk*, and it is free for the asking (actually, you must send a formatted disk to get it).

For the PCjr, the best bet for the new user is IBM's Personal Communications Manager (PCM). For $100 you get a program
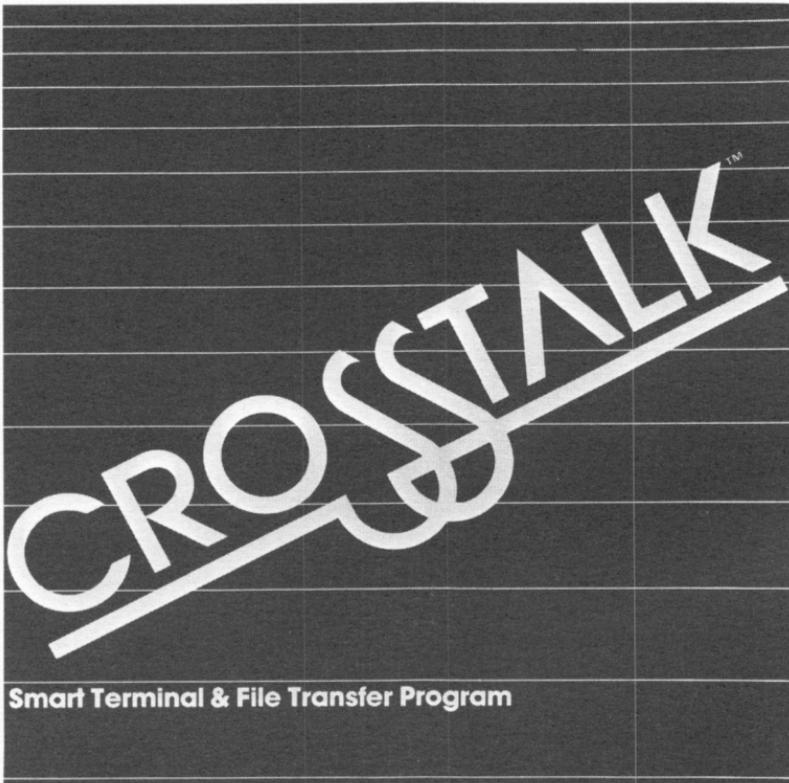
Crosstalk helps connect your computer and modem to other computers

that fully controls the Internal Modem, allows you to talk to all the information utilities like the Source or CompuServe, allows you to exchange data with other computers, whether a PCjr or another type of computer. PCM can also maintain a directory of 40 names and telephone numbers. You can instruct your PCjr to send a message to a certain person. The program will look up that person's phone number, call automatically and leave the message. It can also send messages to an individual at a specified time or send the same message to many people. The catch is that you'll need at least 64K of memory and the Display Option to make full use of PCM, as well as a disk drive.

There are several other excellent communications programs for the PC in the $100 to $150 range, including Mark of the Unicorn's *PC/Intercomm* and Microstuf's *Crosstalk,* both recommended more for the business user than the individual. Most of these programs will be modified for the PCjr if they don't already work with the Junior. By all means *avoid* the IBM *Asynchronous Communications Package,* an unwieldy, obtuse program better suited to programmers than real people.

Information utilities usually charge both an initiation or sign-up fee and by the hour for the amount of time you are connected to their service. For most personal computer services, the sign-up fee is between $35 and $100, with connect charges running from $5 an hour to $25 an hour. The connect charges usually are billed to a major credit card.

Perhaps the most difficult decision for the new user is just exactly which services to sign up for. Because telecommunication is still in its infancy, there are opportunities for users to influence what's available on-line. New information services such as Delphi constantly solicit their subscribers' input on new services, and local bulletin boards are shaped by their users.
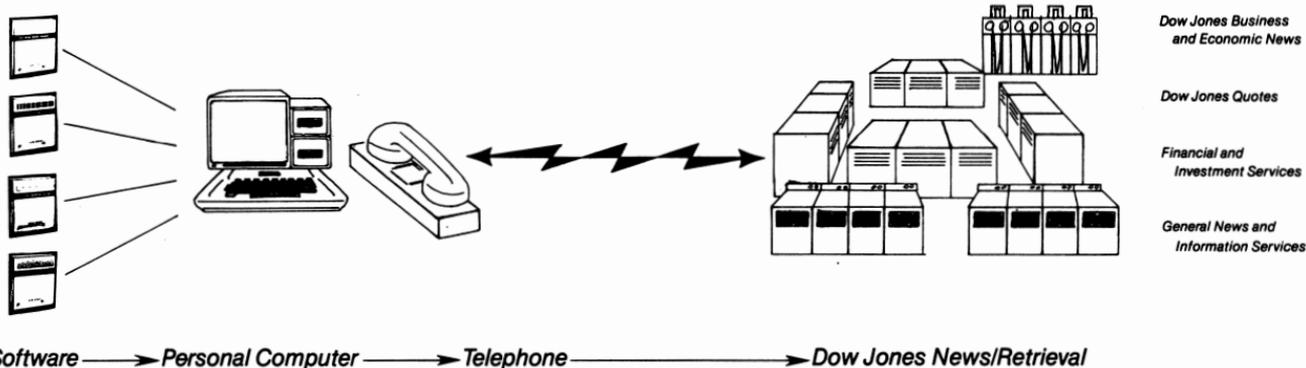
If your uses are likely to be strictly personal, look into THE SOURCE, CompuServe or Delphi. They offer the broadest range of services to their subscribers, and their variety is, at times, staggering. CompuServe remains the best buy, frequently found on sale at computer stores or included with some other packages.

For business and financial access, the Dow Jones News/Retrieval Service is hard to beat, although there are numerous specialized services. If you're going to be doing any

DOW JONES SOFTWARE™ 🤝 **DOW JONES NEWS/RETRIEVAL®**

Dow Jones Business
and Economic News

Dow Jones Quotes

Financial and
Investment Services

General News and
Information Services

Software ⟶ Personal Computer ⟶ Telephone ⟶ Dow Jones News/Retrieval

**Dow Jones Software™ allows easy access to Dow Jones News/
Retrieval®, the world's leading interactive business information
service, and facilitates detailed analysis on the financial and
investment information available through the service. A simple
telephone hookup connects you to our main data bank, giving you
access to up-to-the-minute business and economic news, current
and historical quotes, financial and investment services and
general news and information.**

heavy research, BRS After Dark and Knowledge Index offer the small computer user some of the most sophisticated research tools in the world, providing a large number of data bases on a variety of subjects.

Once you're on-line, you'll find more and more uses for telecommunicating. Electronic banking is beginning to be available in some areas. Electronic banking allows bills to be paid by touching a few keys on the computer keyboard instead of writing a check and mailing the bill in. Computer owners will be able to monitor their money more closely than ever before, keeping a running, accurate tally of their finances electronically.

Shopping by computer is already available on some of the larger services and through Comp-U-Store in Stamford, Conn. Comp-U-Store subscribers can use their computers to search the company's data base for specific items and for the best prices. The item can then be ordered through the computer and billed through a major credit card at a substantial savings.

Electronic mail and teleconferencing are two business aspects of telecommunicating that are becoming more popular as small computers proliferate. Electronic mail is exactly what the name implies—mail sent on the computer rather than through the U.S. Postal Service. Information utilities provide you with a "mailbox," an electronic address for your mail. You then connect to the service to read and send mail. MCI Mail, available in conjunction with Dow Jones, offers an alternative to traditional mail. A letter can be sent from your PCjr to MCI, which either delivers it electronically if the recipient has a computer, or delivers it by hand. They offer regular mail service, overnight service, and a special four-hour hand delivery in major metropolitan areas.

Teleconferencing allows a number of users with small computers to have a conference over the telephone. All the conference participants have a permanent record of what went on (if they choose to save it on a disk or a print-out), and the connect charges are typically less than a long-distance telephone charge. Many of the larger services provide local or toll-free phone numbers to access their services.

The best way to find out more about information utilities is to call or write the specific company and ask for a brochure. Their brochures are being constantly updated for services and price.

THE SOURCE
Source Telecomputing Corporation
A subsidiary of the Reader's Digest Association
1616 Anderson Rd.
McLean, Virginia 22102
(800) 336-3366
(703) 734-7500 in Virginia
Price: $100 initiation fee, one time only. $10 per month minimum billing, $9 of which can be credited to usage. 25-cent connect fee for each connection. Connect time charges range from $5.75 from midnight to 7 a.m. to $20.75 for peak weekday service (300 baud). 1200 baud rates range from $8.75 to $25.75.
Hours: 24 hours
Write The Source directly for a full listing of their services. A partial listing from their most recent brochure includes Astrology, Barter-Trade Network, Business and Finance, Restaurant Reviews, Compu-U-Store, Financial Market Reports, Games, Management Services, Media General Stock Analysis, Movie Reviews, Tax Information, United Press International and much more.
Also available are electronic mail and mailgrams and extensive menus outlining each Source option.

COMPUSERVE
500 Arlington Center Blvd.
P.O. Box 20212
Columbus, Ohio 43220
(614) 457-8650
Price: Subscriptions cost $19.95 and are available at Radio Shack and other computer stores. Connect time ranges from $5 per hour in the evenings to $22.50 per hour in the prime-time business hours. Another "full-service" information utility, CompuServe offers home services such as newspapers, electronic mail, bulletin boards, and special interest groups. One of CompuServe's most popular features is the Citizen's Band simulator, which allows CompuServe users to treat their computers like electronic radios and talk to whoever is on the "air." In addition, CompuServe offers a full range of business and computer services, including a software exchange.

DELPHI
General Videotex Corp.
377 Putnam Ave.
Cambridge, MA 02139
(617) 491-3393

Price: The hook-up fee is $49.95, which includes an hour of free time. On-line charges range from $5 per hour in the evening to $20 per hour prime time. Delphi is one of the newest information utilities, which gives you the opportunity to shape how the service will grow.

Delphi offers a large research library with a 20,000 entry encyclopedia, an excellent advice service on almost any topic, the ability to run subscriber polls and the usual information utility services. Delphi also features electronic banking, and extensive tutorials are planned for the near future. Delphi is also very "user-friendly," definitely an asset for new users.

KNOWLEDGE INDEX
Dialog Information Services
3460 Hillview Avenue
Palo Alto, CA 94304
(800) 528-6050

Price: A single-time connect fee of $77, plus $24 per hour on-line charges. Available M-TH, 6 p.m. to 5 a.m.; F, 6 p.m. to midnight; Sat, 8 a.m. to midnight; Sun, 3 p.m. to 5 a.m.

Dialog is one of the largest data base services in the country, and the Knowledge Index is their subset for small computers. It is a bibliographic service, searching through hundreds of thousands of magazine, newspaper, journal and book entries, then sending the specifics of that entry and an abstract back to your computer. You can order hard copies from the Knowledge Index if your library does not have the entry specified.

Data bases include: Agriculture, Books in Print, Business, Computers, Software, Standard & Poor's News, Education, Engineering, Government Publications, Magazine Index, Medicine, Pharmaceuticals, News and Newspapers, and Psychology, with other data bases being added regularly. We have used this service extensively and found it to be invaluable.

BRS AFTER DARK
BRS
1200 Rt. 7
Latham, NY 12110
(518) 783-1161

Price: A $50 subscription fee, plus on-line charges of from $6 per hour to $20 per hour, depending on the data base selected. There is a minimum fee of $12 per month, based on two hours usage a month. Available 6 p.m. to midnight. BRS is another major data base supplier, and BRS After Dark is their service for microcomputer users. In addition to extensive data bases on Education, Social Science and Humanities, Energy and Environment, Science and Medicine, and Business, BRS After Dark offers an extensive on-line encyclopedia with some of the most sophisticated searching available anywhere.

Other services for small computer users include electronic mail, and more are planned.

DOW JONES NEWS/RETRIEVAL
Dow Jones and Company Inc.
P.O. Box 300
Princeton, NJ 08540
(800) 257-5114

Price: A $50 one-time connect charge, with connect charges ranging from $.20 a minute to $1.20 a minute. Special rate plans are available. Available 22 hours per day, seven days a week, 6 a.m. to 4 a.m.

Dow Jones includes around 20 business-oriented data bases, including the Dow Jones News Service, the Wall Street Journal, the Weekly Economic Update and a vast array of financial and business information. Current market quotes are available with a 15 minute delay, and there is also historical stock information. Dow Jones also offers the Academic American Encyclopedia, with more than 28,000 entries; news, sports and weather reports; movie reviews; Comp-U-Store, and Wall Street Week Online.

Dow Jones recently began offering MCI Mail, an overnight mail service available on-line for competitive prices.
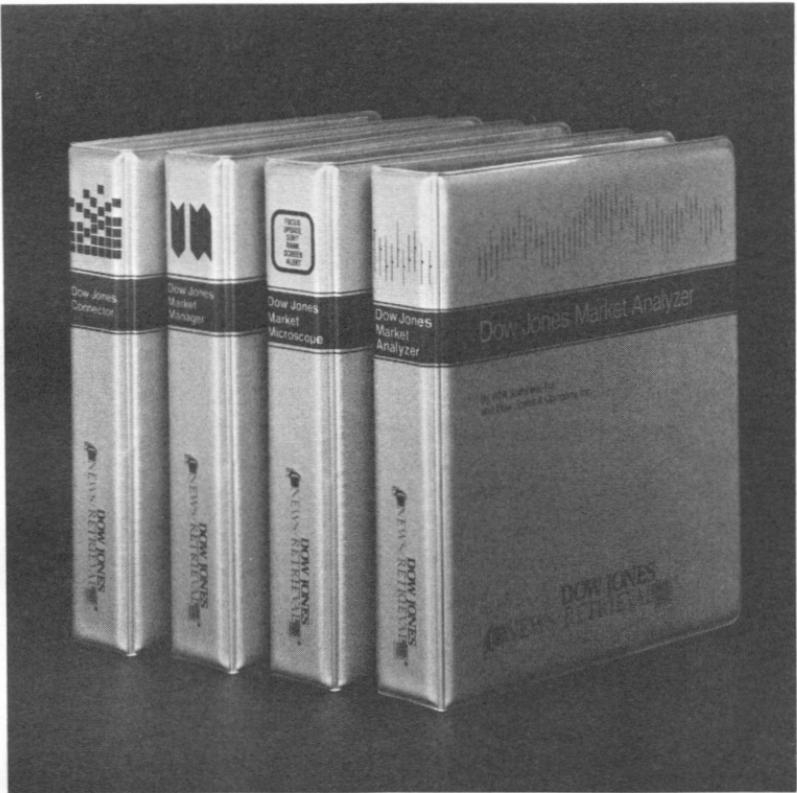
Dow Jones Software products provide a wide range of functions that are useful for investment analysis

Computer clubs are fun!

5 GROUP ENCOUNTERS

The most useful "accessory" for your new PCjr has nothing to do with either software *or* hardware and isn't attached to or inserted in the computer. Rather, it's a membership in a PCjr user group in your area.

What is a user group?

Exactly what the name says—a group of people who use the same computer. But a user group is much more than a social club; for the computer user—especially the novice—a user group incorporates all the best features of a lifeboat and a safety blanket, plus a graduate course in using your computer. Operations that seemed like a nightmare when you read them in your *Guide To Operations* don't seem nearly so bad with some experienced help and advice to guide you along.

Because your PCjr is the new machine on the block, there may not be any user groups in your area yet. You might want to consider starting your own.

What's involved with starting a user group?

It's not as complicated as you might think. The first step is rounding up new owners of PCjrs, and the best way to do this is to drop by the computer stores in your area and leave your address and telephone number. Most computer stores have a warm spot in their hearts for user groups, since the groups provide a solid service to first-time computer users, which they hope will translate into repeat customers.

While you're visiting the computer store, ask about any IBM-PC user groups in your area, then get in touch with one of the directors of that group. The PC user groups have been in place for much longer and have already been through many of the problems you're likely to encounter. It might not be a bad idea for PCjr groups in some areas to initially be subsets of a PC user group for bulk purchases or public domain software. If you live in a larger area, the PC user group might already have an electronic bulletin

board up and running, and your PCjr group might be able to make use of that board.

User group meetings can begin in your living room, but an easier alternative is a meeting room at a local community center, church, or school. Shopping malls also have rooms available for public meetings and are usually very cooperative to first-timers.

The success of your user group rests entirely on the success of your meetings. And the success of your meetings rests on how well those meetings address the needs of your members.

After your organizational meeting, try to stick to a good agenda rather than a free-form (read: boring) free-for-all. A sample agenda might be something like this:

A. 15 minutes general questions and answers

B. Guest speaker (the local PC group is a good resource here)

C. A discussion on a specific (e.g., the speaker's) topic. For instance:

Effectively using PC-DOS

Home accounting on the PCjr

Simple BASIC programming

D. A demonstration of a specific program—none of us can afford to buy every program we want to try. A demonstration period is invaluable.

As your user group grows, you might want to divide up after the guest speaker/discussion for a series of smaller meetings on specific topics. There is nothing more deadly, for example, than trying to teach programming to someone who never plans to try it.

User groups open the door to new uses for your PCjr and its application software. Most user groups feature lectures or demonstrations or even classes in some aspect of personal computing. The more active you are in a user group, the more input you'll have into shaping the group. Many memberships of the larger groups, such as the ones in Washington, D.C., and New York City, run in the hundreds or even thousands of members and they split off after the main meetings into dozens of special interest groups.

A good user group can offer several other concrete advantages to its members. Bulk purchases are possible at a good discount—we purchase our floppy disks through a user group at a savings of around 25 percent per box of ten. Bulk purchases are

also available on software and hardware packages.

Most user groups also maintain a software library of public domain software or software written by members of the group. Given the cost of high-quality software, access to such a library can be worth many dollars in savings to you. There are some programs, such as the terrific *PC-Talk* communications program, that are available free and can be included in your user group library. Be sure to ask about PCjr compatibility, since most of the free and public domain software was originally written for the PC. For more information on these programs, write:

Headlands Press

P.O. Box 862

Tiburon, CA 94920

An excellent filing program, *PC-FILE,* also originally written for the PC, can be obtained by sending a formatted disk to:

Jim Button

P.O. Box 5786

Bellevue, WA 98006

A friend of ours, after pricing several accounting programs at between $500 and $1000, obtained a non-copyrighted version of one free from his user group. That kind of savings pays a lot of dues.

Many times a computer company will rely on user group newsletters to communicate with owners of their machines, announcing updates of hardware and software of major revisions of equipment.

Finally, many user groups offer electronic bulletin boards, giving you rapid access to other people using PCs in all lines of work and play. Simply use your modem to link up and talk (or type, actually) away.

User group dues are usually low, typically in the $10 per year range. The more services a group offers, the more likely the dues are to be higher. We're listing as many of the PC user groups around the country as we can find, but user groups are springing up faster than new word processing software. If your area isn't listed here, log onto a local bulletin board and ask around. Also try calling an IBM dealer in your area and ask about user groups. Also check both THE SOURCE and CompuServe on their PCjr special interest bulletin boards.

6 READOUTS

Perhaps no other computer premier has generated the excitement of the PCjr, and an avalanche of books is on the way. One magazine, *PCjr,* from the publishers of *PC*, is already on the stands, and another is in the works. Be assured that your PCjr will become the *second* most written about computer in the world, right behind the original PC.

The purpose of this chapter is to acquaint you with many of the other books and magazines aimed at the PCjr owner. There are more PC publications coming out every day, and the same rules apply to purchasing books as purchasing peripherals.

In keeping with the whole concept of a *personal* computer, IBM has done wonders with their manuals and documentation for the PCjr. Compared to the rest of the industry, IBM's documentation has always rated excellent, if uninspired. For the PCjr, though, IBM pulled out the stops. The *Guide To Operations* is the most basic and most important document to come with the PCjr. IBM has made this wealth of information much more accessible to new users through the use of color, graphics and step-by-step tutorials.

Each PCjr comes with the *Guide To Operations* and a second volume, *Hands-On BASIC for the IBM PCjr.* This volume is a good starter book for PCjr owners who want to learn how to program their computers in BASIC, a version of which is resident in the PCjr's Read Only Memory (ROM). If you're planning on teaching your children to program, IBM offers a second, very helpful manual (which must be purchased separately), *BASIC Made Easy for the IBM PCjr.* This volume provides a simple BASIC tutorial, aimed at younger users, to make programming as painless as possible.

MAGAZINES
PCjr: The Independent Guide to the PCjr in Education, Home and Business

Just like the PC spawned the PCjr, *PC* Magazine spawned *PCjr* Magazine. The great advantage to this arrangement is that *PCjr*'s staff includes many of the grizzled veterans of *PC*, who are already wise in the ways of IBM computers and software. The emphasis on home software and educational uses looks promising indeed, essentially filling a void left by most publications aimed strictly at the PC.

If for no other reason at all, PCjr owners will revel in this magazine because of the page-after-page of ads for peripherals and software. It's no secret that the free market of software and peripheral manufacturers runs well ahead of industry pundits in coming up with things for your PCjr to do. The only problem with subscribing to *PCjr* ($14.97 a year) is that all those ads can be injurious to your budget. This is a must-have magazine.

Ziff-Davis Publishing
One Park Avenue
New York, NY 10016
(212) 725-7054

Subscription: $21.97 a year
Ziff-Davis Publishing
One Park Avenue
New York, NY 10016
(212) 725-3500

PC World: The Personal Computer Magazine for IBM PCs and Compatibles

PC's biggest competitor is *PC WORLD,* another multi-hundred page monthly about the PC, PCjr and compatibles. *PC WORLD,* formed by former staffers of *PC,* also features hardware and software reviews of a very high, although slightly more technical, quality. The main difference between the two magazines is that *PC WORLD* appeals to a more technical audience and features more articles on programming and the actual nuts and bolts of computer operation.

On the plus side, *PC WORLD* sometimes features articles on how to personalize your machine and some of the more common applications programs. Their articles on *WordStar,* for example, have proved invaluable.

Subscription: 12 issues for $24.00
PC World Communications
555 De Haro St.
San Francisco, CA 94107
(415) 861-3861

BOOKS

One interesting aspect about computer books (and one we've gone to some lengths to avoid) is that they are written with the assumption that your goal in life is to learn how to program a computer. Although this may have been true two years ago, it is emphatically no longer the case.

The revolutionary part of the small computer revolution is that computer users no longer have to know the difference between BASIC and, say, Italian. In fact, most computer experts agree that most (around 80 percent) of the new computer users today will never write a program for their machines. The reasons include the proliferation of high-quality software over-the-counter—yes, you can write your own data base program, but it's

not going to be as good or as comprehensive as dBaseII; the emphasis on computers as problem-solvers rather than hobby toys and, lastly, for many people programming has all the appeal of watching paint dry.

For people who insist on learning to program their PCjr, there are a score of books dedicated to learning BASIC. We've included a couple of books here originally aimed at the PC, but with good sections on programming in another language—Logo, for example, which is taught in many school systems—look for a book with the basics of programming in that language.

We've selected five books that can form the nucleus of an excellent PCjr library. These books, along with the one you're reading, will supplement the reference books provided by IBM, explaining and expanding a number of points. If the computer has already decimated the budget, buy them in the order they're listed.

PC-DOS: Using the IBM PC Operating System
By Ruth Ashley and Judi N. Fernandez
Wiley Press
605 Third Avenue
New York, NY 10158
Price: $14.95 softcover

One of the biggest problems new users have is understanding and using PC-DOS. You can get by with only the most cursory relationship to PC-DOS, just enough to get the machine up and running your application software, but a good, solid grounding in what the operating system does and how it works can make your life a lot easier. For example, a friend of ours who is a master at *WordStar* recently had to combine 50 small *WordStar* files into a single file. She undertook the task in *WordStar,* adding one file at a time, until, many hours later, she had a single large file. The entire operation could have been accomplished with a *single* PC-DOS command in seconds. The IBM *Guide To Operations* and the accompanying *DOS* book are great references, but lousy teaching guides.

Wiley Press' *PC -DOS* will step you through the PCjr's operating system and give you a much better understanding of how to use your IBM. The book is set up as a self-teaching guide, which is both good and bad. If you've just purchased your PC, it's

good, because you can go through the book in a couple of hours and get PC-DOS down pat. If you've had your machine for a while, you'll find yourself longing for a manual *without* all those self-teaching tests. Although *PC-DOS* is not nearly as comprehensive as Thom Hogan's *CP/M User Guide* (Osborne/McGraw-Hill), it will set you on the right path. Ironically, one of the weakest points of the book is one of PC-DOS' strongest points, batch processing (processing several DOS commands at the same time). This book, though, when used with the *Guide To Operations,* should give you a good start.

Keep in mind, however, that this book was originally written for PC-DOS Version 1.1. The PCjr's DOS Version 2.1 (again, as we've said, Version 2.1 is the only version that will work on your PCjr) offers even more features, especially in the batch processing area.

    Que On Systems: Introducing IBM PCjr
    By Chris DeVoney and Douglas Ford Cobb
    Que Corporation
    7999 Knue Road, Suite 202
    Indianapolis, IN 46250
    (317) 842-7162
    Price: $14.95 softcover

Que On Systems is a series of books describing various computer systems, and their book on the PCjr was the first on the scene. It's an excellent first addition to your library, mainly because it is a good overview of the entire system. It gives a technical breakdown of the PCjr and how each part of the system interconnects. There are also some excellent explanations of PC-DOS Ver. 2.1 operating system for the PCjr, plus evaluations of some of the software for the PC, including *Home Word* and *Easy Writer Version 1.15,* two good home-oriented word processing programs and IBM's communications program, *Personal Communications Manager.*

The book is extremely easy to read, keeping with the style and concepts of the operating manuals designed by IBM for the PCjr. It provides a good grounding on how a computer works in general, and how the PCjr in particular carries out its tasks. One drawback is that because it was the first book on the market, the information on software and peripherals, especially, is a little

sketchy, although *Que* will certainly rectify that in an upcoming revision.

Introducing the IBM PCjr
Andrew M. Seybold
Howard W. Sams & Co. Inc.
4300 West 62nd. St.
Indianapolis, IN 46268
Price: $12.95 softcover

The Howard W. Sams Company has for years specialized in books for computer users. Their book on the PCjr offers a good, if sketchy, overview of the system, with especially good chapters on BASIC and computer telecommunications.

IBM PC Expansion and Software Guide
Que Corporation
7960 Castleway Drive
Indianapolis, IN 46250
(317) 842-7162
Price: $16.95 softcover

Que also produces and updates this guide to IBM expansion products and software. Every IBM owner should have some kind of reference guide (*PC* Magazine also produces one), especially for software. Keep in mind, though, that any reference guide is outdated by the time it is published. The *Que* guide offers bimonthly updates for $3.95 each, which helps make the guide more valuable.

IBM Personal Computer: An Introduction to Programming and Applications
By Larry Joel Goldstein and Martin Goldstein
Robert J. Brady/Prentice-Hall
Bowie, Maryland 20715
Price: $14.95 softcover

If you do happen to be interested in programming in BASIC, the Goldstein/Goldstein book is an excellent introduction, especially if you're starting from zero. The book begins with a good but short explanation of what a computer is and does, then quickly gets into writing a simple program:

```
10 PRINT 5 + 7
20 END
```

It progresses into data files and even a simple word processor.

With all the hoopla about computers and computer programming, we haven't found a computer owner yet who wasn't at least a little curious about how programming worked. This book is not only a good introduction, but a good investment for the person who would like to know a little more about programming without diving in too deep. We highly recommend this book to PCjr owners with a yen to try it themselves.

Your IBM PC: A Guide To The IBM Personal Computer
By Lyle J. Graham
Osborne/McGraw-Hill
630 Bancroft Way
Berkeley, CA 94710
(415) 548-2805
Price: $17.95

Osborne/McGraw-Hill produces good computer books, and their introduction to the PC is no exception. Although a little heavy on BASIC, the book gives a good, encyclopedia-like coverage of the PC, including an easy-to-understand section on batch processing under DOS and a long chapter on CP/M-86, the PC's alternative operating system. There's also a comprehensive appendix of commands, error messages, and ASCII codes, plus a super-comprehensive index.
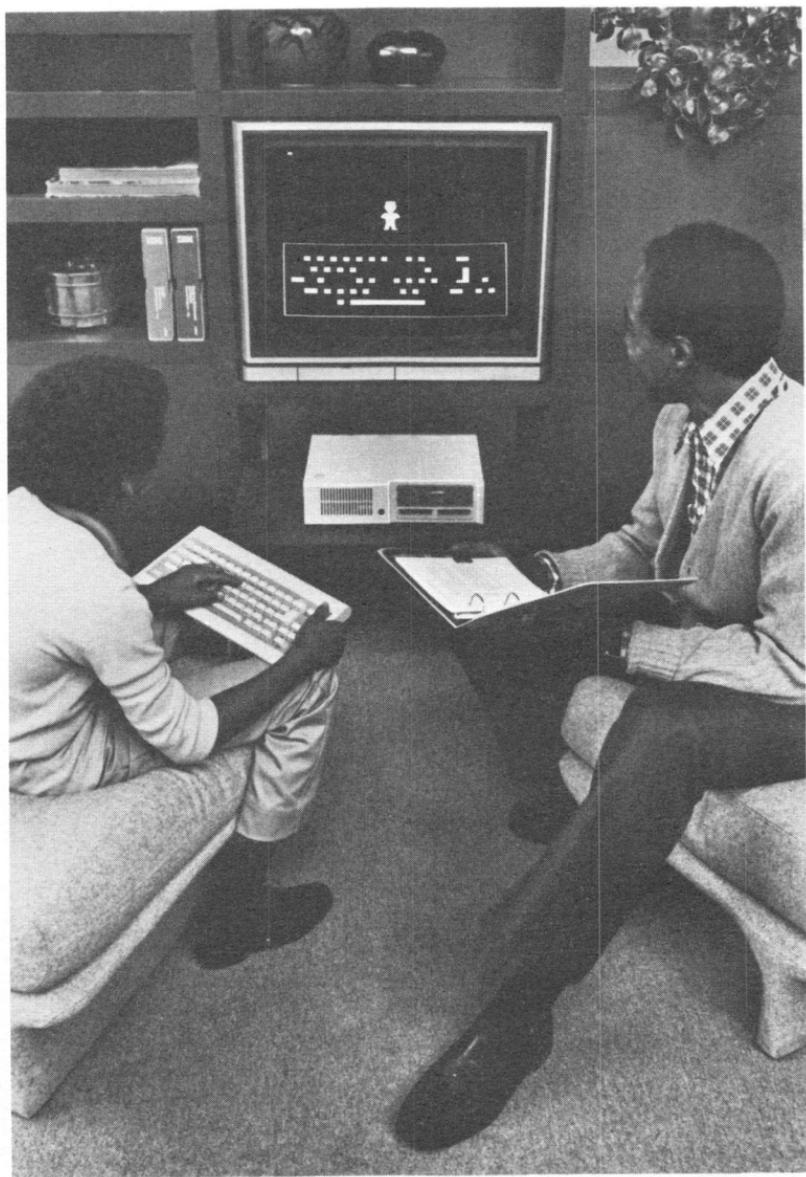
7 SMALL BYTES

A very popular book on repairing your home computer has this title: "Don't!" That is pretty good advice, too. Your IBM-PCjr is not like a 1956 Dodge, you can't tinker a little here, tune a little there, and get it to run faster.

The basic philosophy behind computer repair is that if it no longer works, replace it. Microchips don't wear out in the conventional sense—they either work or they don't. Unless they're assaulted by static electricity, voltage surges or some other physical attack, the microchips in your PCjr will probably outlast you. The common wisdom is that the new computer owner should hook the new machine up and let it run for 24 hours, the theory being that most electronic circuitry, if it is going to fail, will fail in that timespan, and you'll be able to get things going again quickly. This is actually a pretty good idea. Even if you don't turn it on and leave it running, use your PCjr extensively as soon as you get it home and unpacked. IBM has already run the machine for four hours (the "burn-in" period) before you purchased it, so don't be afraid that you're going to wear it out.

We mentioned earlier that the PCjr performs its own self-test each time you turn it on. The little "beep" that you hear means that everything is fine. If it doesn't beep, remember the advice from the British radio series "Hitchhiker's Guide To The Galaxy:" Don't Panic! A series of numbers will appear on your screen, sometimes only briefly. Write these numbers down, since the PCjr is telling you what's wrong with it. A repair person can quickly replace the failed component and you're back in business.

Chapter 4 of your *Guide To Operations* contains all the information you'll need for determining which part of your PCjr isn't functioning properly. By using this section of the *Guide*, you can determine which part of the computer needs to be carried in to be fixed, which is considerably more convenient than carting everything.

This chapter also details usage of the diagnostic disk provided by IBM. The disk is a continuation of the written chapter, helping you isolate the problem. Simply insert the disk and boot it (CONTROL-ALTERNATE-DELETE) like you would any other, then follow the screen instructions step by step.

Whenever you have a problem with your PCjr, you want to isolate that problem as much as possible. The first step is eliminating the obvious. We recently received a near-hysterical phone call from a fellow PCjr owner whose printer had passed on. She had tried everything, but the printer would not work. Our first suggestion was to check to see if it was cabled correctly. She sheepishly called back to say that the printer had been unplugged for cleaning, then plugged into the wrong port.

Are your cables correctly attached?

Is your PCjr plugged in? (We wholeheartedly suggest *unplugging* your PCjr during thunderstorms. Yes, your voltage suppressor will probably save the computer if lightning hits nearby, but do you want to gamble? Also, a tiny flutter in the power could cause you to lose all your data in memory.)

Does your PCjr give its happy "beep" self-test after about less than thirty seconds?

If all your hardware checks out, look at your disks. Disks are fragile. If you've been tossing them around like frisbees, your problem might be in the disks. We routinely make a new back-up copy of a program on a new disk when there seems to be a problem in booting or running a program, then use that new copy to try again.

If this is the first time you've run a particular program, consider that the program itself might be flawed. This happens much more than it should. Do not hesitate to call either the retailer or the program manufacturer with your question.

If your machine is under warranty, all you need to do is take it in and get it fixed. The PCjr comes with a 90-day warranty. Some non-IBM peripherals and boards offer warranties of up to two years. You can also purchase a maintenance contract—essentially an extended warranty—for an average of 10 percent per year for the overall cost of the sytem. If your system cost $5000, an annual maintenance contract might cost $500. This is a touchy subject. There are people who won't turn their PCjr on without

some kind of coverage, and others who dismiss the extended warranty as a waste of money. It's a decision you'll have to make, but keep these things in mind. Repair costs are high, anywhere from $35 to $100 an hour, although repair usually doesn't take that long. Also, some maintenance contracts cover labor, but not parts. This is okay if we're talking about cheap microchips, but not as good when we're discussing expensive monitors. Frankly, we tend to shy away from maintenance agreements, and so far we have not been proven wrong.

The small computer revolution has also generated a revolution in small computer repair. Businesses which once handled only mainframes or their own brands are now doing repair work on many different brands of micros. Xerox is a good example. Their repair centers now repair a number of small computers and peripherals (although not yet IBM). Check your phonebook for listings.

The largest repairers of IBM-PCjrs are the two largest dealers, IBM itself, through its Product Centers, and Computer-Land. IBM service is legendary; it is also very expensive.

The best way to avoid expensive repairs is to use your common sense, which is what IBM suggests. Dust and heat are the two major enemies of small computers. As we stated earlier, keep your PCjr away from heat and clean it frequently. Avoid pouring your morning coffee on the keyboard—silly or not, this is a major problem.

If you have disk drives, consider purchasing a head-cleaning kit such as *Datalife* by Verbatim, the floppy disk manufacturer. Disk drives work just like tape recorders, and just like tape recorders the heads get dirty. If the heads get too dirty, you could lose important data. A head cleaning kit includes a disk and special solvent for cleaning the heads (or, in the case of *Datalife*, a special disk already impregnated with solvent). Simply insert the disk and run the drive for a few seconds. Do this every 10 to 50 hours of disk operation.

Keep your PCjr away from direct heat or sunlight.

Try to keep your personal pet from walking across the keyboard.

Unless you happen to be an electrical engineer, resist any impulse to tinker with your PCjr.

Be aware of your machine—the cooling fan hums; if it's not humming, it's not working. If it's not working, your machine could be frying. Get it fixed. Each disk drive makes its own peculiar noise (each different operating system makes its own peculiar noise, for that matter). If your disk drive sounds like a couple of ounces of nuts and bolts in a blender, shut the machine off and get it checked.

Once you've set your computer up in one place, don't go moving it around a lot. The alignment of disk drives is critical, and the disks in the PCjr are not designed to be carted hither and yon.

Keep any magnet or magnetized material away from your PCjr. The way you erase a disk is to run a magnet over it. The presence of a strong magnetic field near your computer can cause it to do odd things, such as losing information or refusing to load a program.

Beware of static electricity. If you work in a carpeted room, you might consider purchasing an anti-static mat from an office supply store. Think of static electricity as a voltage surge, which it is, only it comes through your body instead of the power line.

Finally, take the above advice to heart, but don't worry. Common sense will keep your PCjr running for years.

COMING TO GRIPS WITH THE DREADED POINTED FINGER

The "dreaded pointed finger" has become such a cliché in computer circles that one large software distributor uses it as part of their advertising campaign: "Beware the dreaded finger pointers!"

And they are truly something to dread. It works like this. One afternoon your computer coughs, belches, and stops working. Fraught with fear, you call the hardware manufacturer, who points his finger at the printer. You call the guy who sold you the Boomslang 2001 printer from the back of his pickup truck, who, without even having the grace to look embarrassed, points at the software. "That's the problem," he says assuredly. A quick call to the software author gets you connected to a pious young man who sounds as if he just escaped from L.L. Bean. Nope, he intones sanctimoniously, it's the hardware. And you're back where you started with a computer that still doesn't work.

Amazingly, the "dreaded pointed finger" comes not only from fly-by-night computer companies, but from some of the biggest operations in the land. We recently got caught in a "pointed finger" loop that went on for a month. Luckily, we were able to localize the piece of equipment which failed (harder than you might think) and the manner in which it failed. With that in hand, we contacted an assistant to the President of the company, a multinational conglomerate whose name is a household word— not IBM, folks. After a couple of brief telephone calls, we got a new machine specially designed for the PC, an apology from on high, and the satisfaction of knowing that the dealer with the quick index finger came close to losing his franchise.

What are the steps in beating the dreaded pointed finger?

Find out what's wrong. Simple, right? Wrong. Suppose your new printer doesn't print—is it the fault of the printer, the printer interface in your computer, the connecting cable or the software itself?

You must become a detective, ferreting out the problem. Sometimes it really will be simple—the dog pulled the plug out of the wall. Sometimes it will be complicated enough to drive you back to stamp collecting. Approach it as if you were Sherlock Holmes—Logic, my dear Watson, Logic:

1. First check for operator, i.e., your, error. Turn everything off, then turn it back on and try to do the same thing again. It's amazing how many times this will clear up the problem. While writing this book, in the wee hours of the morning, we had the screen suddenly freeze, as if the computer had suddenly become tired of computing and was looking for simpler work. We fiddled around for an hour or so, trying this and trying that, until, since it was late at night and we were tired, we decided to follow our own advice. Shut down, restart. The problem cleared up and never came back. We still don't know exactly *what* happened, but we do know *who* caused it.

2. Check your power plugs and cables. Is it plugged in? Are all the cables connected to the right places. Remember our friend with the defunct printer, which had been disconnected, then reconnected the incorrect way. If you've connected a peripheral for the first time, are you sure you have the correct cable? If you're not, call the dealer and ask, just to be sure. Make sure everything

is plugged in properly. If you're using the PCjr's cordless keyboard, remember that extremely bright light, such as direct sunlight or a nearby fluorescent light, will cause problems (If there is a keyboard problem you'll get the "B" error message on your screen).

3. Still doesn't work? It's time to fret about the software. Floppy disks are notoriously fragile little buggers. A magnetized paper clip, dust, that *tiny* drop of spilt coffee, cat and dog hair, a ringing telephone, even a small nuclear explosion nearby will do irreparable damage to whatever is on the disk. If you are not keeping your disks safe in their special non-static folders, in some sort of protective box, preferably plastic, or one of those "flip files," you are asking for all kinds of trouble. We recently visited a friend who runs his whole business with a PC-XT. We were shocked to see disks all over the place, covered with dust and ashes. One was even slightly underneath the telephone—the magnetic field created when the phone rings is enough to erase a floppy! We were shocked, but not as shocked as he'll be when he tries to load something from his floppy to his hard disk drive.

If you suspect software trouble, go back to your master program disk and make a new working copy on a new disk, as if you just purchased the program. If you have data files, copy them onto a clean, new floppy as well. Now try it.

It's worth mentioning here that not all programs are perfect. We recently came across an accounting program that wouldn't subtract. Nonsense, said the program's distributors when we called. However, they quickly sent us a new"updated" program that subtracted like a champ. Be especially suspicious when you're dealing with a relatively new system like the PCjr. Remember, a detective suspects everyone.

If you're using one of the PCjr's ROM cartridges, make sure that the electrical contacts are clean and that the cartridge seats firmly into its slot on the front panel. Make sure you're inserting the cartridge LABEL-SIDE UP. When you've turned the machine on and inserted a cartridge, it should perform a system reset, just as if you hit the CONTROL-ALTERNATE-DELETE keys on the keyboard. The screen should clear, and the cartridge program screen should appear. If this doesn't happen, try another cartridge to determine whether it's the cartridge or the PCjr. If it's the

Junior, it's time to head for your nearby service department.

4. If it still isn't working, it's time to ask the hardware to start testing itself. Luckily, the PCjr has one of the simplest test routines of any home computer. Just turn your PCjr on, and when you get your standard screen, press CONTROL and ALTERNATE, then INS. The PCjr will then begin running a long series of tests to help you determine where the problem is. Eventually you will test your disk drive, the TV and 80 column display, the 80 column display, the light pen, the IBM joystick, sound, keyboard, modem and printer. This is much simpler than the routines on most computers, which involve special software to find the glitch.

Many higher-priced peripherals, like letter quality printers, have their own test procedures. Take it one step at a time. First test the computer, then the peripherals, one at a time.

Ideally, at some point in this sequence, you will have shouted "Eureka," or something similar, then been able to call your trusty computer store and tell them exactly what is the matter. It's much harder for them to point a finger at someone else if you say, "My screen interface board is not working properly," as opposed to, "It broke."

If you're still having problems, there are a few sneaky things you need to check:

1. Environment. You took your PCjr to the beach with you. It's 110 degrees and you have no air conditioner. Why is the screen acting funny? Answer: It's too hot, you're frying your computer. Conversely, you decided to backpack with Junior and a big battery to the Yukon. It's 30 below zero and your disk drives sound like arthritic joints. What's wrong? Answer: It's too cold. Computers are adversely effected by heat over 85 degrees and cold below 30 degrees. At 95 degrees with no air conditioning, it takes our PC three or four times as long to do anything, and you can almost hear the little chips screaming for relief.

2. Fluctuations in line voltage. You bought a surge suppressor, didn't you? Still, suppose your computer sporadically does weird things, for which you can find no logical reason. Is any other major appliance plugged into the same line as the computer? Strange things happen to the line voltage when an air conditioner or a refrigerator compressor kicks on. Even stranger things hap-

pen to a computer that happens to be running at the same time.

3. Static. You walk across your rug, touch a piece of metal, and WHAMMO, your own personal lightning bolt. You walk across the rug, touch your computer, and WHAMMO, your own personal disaster area, microchips dying by the thousands and computer repair people everywhere licking their chops in anticipation. STATIC ELECTRICITY IS DEATH TO COMPUTERS AND FLOPPY DISKS! If you live in an area where static electricity is a problem, you had better take steps to head off disaster at the pass. Get an anti-static mat from any office supply store. They're expensive, around $150, but it's cheaper than a new computer. The mat covers your rug or floor and saves your computer.

A final word of warning: For some reason, otherwise sane people have an overwhelming urge to take the cover off their computer and "see how it works." People who wouldn't think of tearing into their Sony color television sets with a pair of pliers and a rubber mallet will rip into their computers like they knew what they were doing.

A computer is not like a '62 Chevy; there's not a lot to see in there. Before you go poking around, consider that chips are super-sensitive to even the smallest amount of static.

Also keep in mind that you're in the same position as the bull in the china shop—you break it, you bought it. While *MOST* retailers will not void your warranty for home tinkering, they also won't clean up your mistakes, either. You are responsible for what you break.

Unless you are very sure of what you're doing, keep out!

8 WORDS FOR THE WISE

If the strange words have scared you off from computers, this section is for you. First of all, you're not alone. The new technology has brought with it an entirely new language to learn. But you can become more comfortable and knowledgeable just by taking note of the necessary fundamental vocabulary and terms you'll encounter as we become a more computerized society. Below are your building blocks of computer literacy.

Access. To read or get information, often from memory.

Access time. The time between calling for and receiving information from storage.

Acoustic coupler. A device that allows a computer to send and receive information through a telephone's handset.

Address. An exact place in a computer's memory that stores information, represented by a name, a label or a number.

Alphanumeric characters. Symbols including alphabet letters, numbers, punctuation marks and mathematical symbols.

Applications software. Programs designed to perform specific tasks, such as games, educational programs, payroll programs or spreadsheets.

Arithmetic/logic unit (ALU). A microprocessor register that performs arithmetic and logical operations.

Back up. To copy data, such as a file, onto another storage medium in case the original is lost or damaged.

Bank switching. A method of moving data back and forth between a computer's memory and an external memory bank.

BASIC. An acronym for Beginner's All-purpose Symbolic Instruction Code, a high-level computer language designed for beginners. Because of its simplicity, BASIC quickly became the most common microcomputer language.

Baud rate. The rate of speed at which information is transferred from one device to another. For instance, a 300 baud rate is 300 bits per second.

Binary. Relating to a number system that uses only two digits, 0 and 1, to express all numeric values. See *digital computer*.

Bit. A contraction of *binary digit*, a basic unit of computer memory. A bit can have a value of either 1 or 0.

Block. A group of records treated as a unit because of their positions next to each other in memory.

Bootstrap. A process where built-in instructions are used to load other programs.

Breakpoint. A point at which computer programming can be stopped manually and checked.

Bubble memory. A solid-state memory capable of storing large amounts of information in an extremely small area.

Buffer. A temporary storage area for computer data. A buffer is often used to compensate for differing speeds between devices—for example, between a computer and a printer.

Bug. A problem that prevents the computer from performing correctly, or at all.

Bus. See *address bus* and *control bus.*

Byte. A group of eight bits (or a memory cell that can store eight bits) usually treated as a unit. It takes one byte to store each letter of information. For instance, the four-letter word *love* requires four bytes of memory.

CAI. Computer-aided instruction.

Calling sequence. Instructions linking data going to and from program subroutines.

Canned software. A program or a series of programs ready to run without having to be altered. Many of these programs include coded instructions to prevent copying, so changes are extremely difficult if not impossible to make.

Carrier wave. A broadcast wave that carries a radio or television signal.

Cartridge. A plastic box that contains ROM software such as BASIC. Cartridges are commonly used for home video game machines.

Cassette drive. A standard tape recorder used to store programs or data.

Cassette. A standard tape cassette.

Cathode-ray tube (CRT). A vacuum tube used to reproduce an image in a television receiver, radar set, or computer terminal.

Cell. A place for a single unit of information in memory, usually one character or byte.

Central processing unit (CPU). The heart of the computer, containing the circuits that control the interpretation and execution of instructions.

Chip. A very thin slice of silicon treated to accommodate thousands of electrical circuits to form an integrated circuit.

Clock. A circuit in a computer that produces precisely timed electronic signals to ensure proper timing of the operations of all other circuits.

COBOL. An acronym for Common Business Oriented Language, a language used widely on mainframe computers.

Code. Any system used to represent symbols (such as alphanumeric characters) with binary numbers.

Compiler. A program designed to translate a high-level language (such as BASIC) into machine language (1's and 0's) prior to execution of the program by the computer. This eliminates the need for translation each time the program is run.

Computer. An electronic device for juggling information, in either numeric or verbal form. A computer can receive and follow instructions to perform calculations or compile, select or correlate data. The primary differences between a computer and a calculator are that a computer can manipulate text, display graphics and make decisions.

Computer-aided instruction (CAI). Using computers in an educational process.

Concatenation. The connecting of two or more text strings to form a single longer string.

Console computer. A desktop computer with its own video screen.

Control bus. A communication line along which control data flows.

Control information. Information that controls functions of devices.

CP/M. Control Program for Microprocessors.

CPU. Central processing unit.

CRT. Cathode-ray tube.

Cursor. The flashing square or bar on a video monitor that indicates where the next character will be displayed.

Cursor tracking. The manipulation of a cursor on a screen using a stylus and graphics tablet.

Cycle time. The time needed by a microprocessor to complete a certain function in a program.

Daisy wheel. A print element used in some printers that resembles a wheel with "spokes" having a letter on each end.

Data. Any and all items of information—numbers, letters, symbols, facts, statements—which can be processed or generated by computer.

Data base. An entire collection of data in a computer system that can be accessed at one time.

Data bus. A communication line that transports program data.

Debugger program. A program that helps a user locate and correct programming errors. The debugger program stops an execution at breakpoints preselected by the user. This makes inspection for errors more efficient, as the program can be tested a portion at a time.

Decoder. A program that translates coded signals.

Degausser (bulk eraser). A device used to demagnetize a magnetic tape.

Demodulator. A device that separates a TV signal from its carrier wave

so that a TV picture can be produced. Demodulators are used in TV sets, but are not needed in computer monitors, since monitors don't receive broadcast signals.

Digital. A number system that uses 0 and 1, or on and off, to represent variables involved in calculation. This means that information can be represented by a series of bits.

Digital computer. A computer that uses a series of electronic offs and ons to represent information. These offs and ons are converted to (or from) binary numbers. Microcomputers are digital computers.

Directory. Information on a floppy disk that tells the computer where on the disk a program is located. Directories also give the user easy reference to files. The command DIR will display the directory on the disk in the main disk drive.

Disk. A flat rotating circular sheet that's used to store bits of information.

Diskette. A flexible disk made of a plastic-like magnetizable material that's either 5¼ or 8 inches in diameter (about the size of a 45 RPM record).

Disk drive. An electromechanical device that stores information on or recalls information from a disk.

Disk operating system (DOS). An operating system that must be present when disk storage is used. The functions of a DOS include keeping track of files, controlling space allocation, and saving and retrieving files.

Documentation. All of the available information about a particular computer, computer program or set of programs. It should include operating instructions, troubleshooting warnings, and labeling. The term usually refers to the printed form of this information in books or pamphlets.

DOS. An acronym for disk operating system.

Dot-matrix printer. A printer that forms symbols by the use of dots in a pattern. Letters are of poorer quality than those of letter quality printers but are typed faster, and the unit is less expensive.

Double-density disk. A disk that can store twice as much information as an ordinary disk because of increased storage density.

Double-sided floppy disk. A floppy disk with two usable sides to increase storage capacity.

Driver. Instructions controlling peripherals and their connections with the CPU (central processing unit).

Dual disk drive. A floppy disk system using two drive mechanisms and recording heads, which yields such advantages as increased storage capacity.

Dumb terminal. A monitor-and-keyboard module that looks much like a microcomputer, but can be operated only when connected to a mainframe computer, since it cannot perform computer functions by itself.

Dumb terminals are most commonly used to retrieve and receive information stored in a data base that is often located at a different location.

Editor program. A standard program (in ROM or external storage) that lets users enter corrections, insert or delete information, as well as move text, while inputting programs.

Electronic mail. Personal or business messages generated on a computer and transmitted via phone lines to another computer at a different location.

Electronic printer. A printer in which dry ink is melted onto an electrostatic charge placed on paper to form characters.

Embedded command. Text characters that do not appear on the screen or printout, but instead instruct a computer to perform some task. Embedded commands are used in word processing and other applications. For example, the instruction may be to begin a new page.

External memory. Mass storage.

Field. One or more characters treated as a data unit.

Field gap. A space used at the end of a file to indicate to a computer system where the file ends.

Firmware. Unalterable, permanent programs or data stored in ROM.

Fixed-head disk system. A disk system that uses one head for each track of information on a disk. The positions of the heads are therefore fixed.

Floating-point representation. A system used for translating decimal numbers into binary numbers so they can be processed by a computer.

Floppy disk. A flexible plastic disk coated with magnetic recording material on which computer data may be stored; a diskette.

Flowchart. A programming aid that illustrates problem-solving procedures (algorithms) step by step. Standard flowcharts use geometrical shapes such as rectangles (for operations) or diamonds (for testing conditions), along with arrows to illustrate procedures clearly.

Formatting. The preparation of a disk to accept information or preparing text for printout. This process includes putting down data tracks on a disk; or setting margins, line and character spacing, and page length for printing.

FORTRAN. An acronym for *For*mula *Tran*slation.

Full duplex. In telecommunications, a two-way transmission mode.

Glitch. An undesirable variation in an electrical flow that can cause errors in a program or other failures in a computer system.

Graphics. The ability of a computer to show pictures, line drawings, and special characters on a video monitor or printer.

Graphics tablet. An electronic writing tablet used to convert shapes and drawings into the digital form needed for computer storage. As a special stylus is moved across the tablet (to trace drawings, for example), the

shape shows up on a display screen and is entered into the system.

Green phosphor. The chemical giving the characters their green color on the background of video monitors.

Half duplex. In telecommunications, a one-way transmission mode.

Handshaking. A brief interruption in a program's execution so that a computer can perform some other task.

Hard copy. A copy of the computer's output printed on paper.

Hard disk. A rotating mass-storage device that uses a rigid disk made of a hard plastic-like material. It has many times the storage capacity of a floppy disk.

Hardware. All of the various physical components of a computer system: the computer itself, the printer, the monitor, etc.

Head. A device to magnetically read records or erase data on a disk, a tape or other magnetic medium.

Heuristic. A trial-and-error method of solving a problem.

High-level language. A computer language that uses simple English words to represent computer commands. For instance, the command RUN in BASIC tells the computer to run a program. Compare with low-level language.

High resolution. The extent of detail offered in the graphics of a printer or video display.

Horizontal scrolling. The moving of text or data horizontally on a display screen so more of it can be seen than what fits within the screen's width at any one time.

Idle time. An interval during which some or all of a system isn't being used.

Impact printer. A printer whereby characters are put onto paper by striking through an inked ribbon, as in a typewriter.

Input. To transfer data from the keyboard, a diskette or a cassette to RAM.

Input/output (I/O). The process of entering data into a computer or taking it out.

Interface. A place where two systems meet and act upon each other.

Interpreter. A program that translates high-level language instructions into machine readable form.

Iteration. The repetition of a part of a program.

K. An abbreviation for kilo.

Keyboard. An input device, normally comprised of a standard set of keys like that on a typewriter and various special keys.

Keypad. An input device, usually consisting of keys for the numbers 0-9 and a period.

Key stations. The number of input terminals in a multiple-user system.

Keyword. In a computer language, a word that has a specific meaning and therefore cannot be used as a variable name.

Kilo (K). A prefix meaning 1000. For computers, used as a handy approximation of 2^{10} or 1024.

Kilobyte. 1024 bytes. Thus 4K of memory is about 4000 bytes of memory. (It's actually 4×2^{10} or 4096 bytes, but 4K is a convenient way to keep track of it.)

Language. The form of communication used between a computer programmer and computer. Examples of some computer languages are BASIC, COBOL, FORTRAN, LOGO, PASCAL, and PILOT.

Laser writer. A printer in which electrostatically charged paper attracts dry ink powder to form images that are baked onto the paper. This method offers excellent quality and high speed.

Letter-quality printer. A printer producing a complete character with each stroke, using a ball, daisy wheel or thimble element. The same as "line-quality" printer.

Light pen. A pen-shaped instrument that allows the user to "draw" on a display screen. The photosensitivity of the pen allows various coordinates to be inputted.

Line feed. A command that moves the printout onto the next line. Also, *line break.*

LOGO. A complete language simple enough for beginners yet sophisticated enough for advanced programming. Originally designed to teach programming to children, it focuses on drawing shapes using simple commands.

Loop. The repeating of a sequence of instructions in a program a given number of times.

Low-level language. A computer language at the machine-language level (a pattern of pure binary coding) or somewhat higher. (Compare with *high-level language.)*

Machine-dependent. Capable of being used only on a particular machine.

Machine language. The lowest level language comprising a pattern of binary coding that tells the computer what to do.

Magnetic media. Devices that store data in the form of magnetic impulses, such as disks and tapes.

Mainframe computer. A large computer generally used for data processing in large corporations, laboratories and government installations. Originally, the term referred to the extensive array of large rack and panel cabinets that held the extensive bulk of the early computers.

Main memory. Memory that is immediately accessible for programs and data storage; includes ROM and RAM.

Mass storage. Large capacity, secondary storage systems, such as recording tape and magnetic disks; external memory.

Megabyte. One million bytes.

Memory. The internal hardware in the computer that stores information for further use.

Menu. A list of commands appearing on the screen, from which a person can choose. Programs using menus to present all their main commands and operations are called menu-driven programs.

Microcomputer. A fully operational small computer that uses a microprocessor as its central processing unit (CPU).

Microprocessor. A central processing unit contained on a single chip.

Minicomputer. A small computer based on large-computer technology.

Modem. An acronym for *mo*dulator *dem*odulator; a device that enables computers to communicate over telephone lines.

Modulation. The altering of a signal to allow it to be broadcast. For example, a TV signal is modulated by being combined with a carrier wave.

Module. A plastic housing holding one or more memory chips which can be connected to a computer.

Monitor. A television receiver or CRT device used to display computer output.

Monitor program. A program that controls simple, frequently performed tasks such as inspecting or changing the contents of locations in memory, loading or storing programs, etc.

Monochrome monitor. A video monitor with a single-color display.

Mouse. A device that rolls on wheels and is used to move a cursor on a screen.

Multiple key rollover protection. A keyboard feature that stores typed characters temporarily when several keys are pressed almost simultaneously on a keyboard. Then, when a pause is detected, the characters can be printed. This technique prevents loss of data.

Multiprocessor. A computer with more than one microprocessor chip.

Nesting. Using programming instructions that are usually in subroutines.

Network. Computers, peripherals or terminals that are interconnected to communicate with each other. One type is a data-communications network, which basically supplies information to subscribers.

Nibble. Four bits, or half a byte.

Nonacoustic coupler. A device that is similar in concept to an acoustic coupler, but connects the computer directly to a telephone line without using the telephone headset.

Object program. The machine-language program that corresponds to a program written in a high-level language.

On-line. Designating a system and its peripherals that are directly com-

municating with the central processing unit (CPU).

Operating system. A set of computer programs devoted to the operation of the computer itself, which must be present in the computer before applications programs can be loaded or expected to work.

Operation code. A command that identifies a specific operation to be carried out, such as MUL (meaning "multiply").

OS. Operating system.

Output. Information or data transferred from the internal memory of the computer to some external device, such as a CRT, printer.

Overflow. A number, produced through an arithmetic operation, that is too large for the computer's register.

Overlay. A technique used to utilize programs that are too large for a system's memory. One part of the program is executed, and additional routines are brought in later, taking the place of the program segment that is no longer needed.

Packaged software. Canned software.

Parallel interface. A connection over which several bits move at the same time over different wires.

Parallel processing. An operation that runs two programs simultaneously with more than one central processing unit (CPU).

PASCAL. A powerful high-level computer language with modular structure, intended for business and general use. Named for French mathematician and philosopher Blaise Pascal (1623-62).

PC. Personal computer.

Peripheral. Any input/output device such as a printer.

PILOT. An easy-to-learn, high-level language designed for use by novice computer users. Primarily intended for educational settings.

Pin feed. The pin apparatus of a printer which guides fanfold paper by its holes.

Pixel. A shortened form of *pic*ture *el*ement, rectangular element used in combinations to form images on video display terminal screens. The more pixels, the sharper the picture.

PLATO. An educational system using computer timesharing, where students interact with the computer on an individual basis.

Plotter. A peripheral that draws and produces output, such as drawings and blueprints, in permanent form.

Port. The connection for input/output between interfacing computers and peripherals.

Printed circuit board. An insulating board which contains a circuit and has transistors, resistors, diodes and other electrical components mounted on it.

Printer. A device for producing hard copy of the data output by a computer.

Program. An organized group of instructions that tells the computer what to do. The program must be in a language (such as BASIC or PASCAL) that the computer understands.

Program counter. A memory register in a central processing unit that stores the sequence of a program's instructions as they are executed.

Program development cycle. A definite sequence of steps involved in writing a program.

PROM (Programmable read-only memory). A memory circuit that can be programmed (unlike ROM) with an inexpensive programmer. It cannot be changed after being programmed.

Prompt. A message given by the computer to the operator to tell him there's an error or something he should do.

Proportional spacing. Compensation by a printer for the varying widths of letters, giving a better overall appearance.

Public domain software. Software with no copyright, allowing for free copying and exchanging.

Random-access memory (RAM). Read-write memory available for use in the computer. Through random access memory the computer can retrieve or deposit information instantly at any memory address. RAM is the computer's working memory area and its size (64K or 128K) largely determines the sophistication of the programs the computer can handle.

Raster. The horizontal lines on a video screen which are scanned and illuminated by the electron beam.

Read. The act of taking data from a storage device, such as a diskette, and putting it in computer memory.

Read-only memory (ROM). A random-access memory device that has permanently stored information. The contents of this memory are set during manufacture.

Read-write memory. Memory that can be read or written to.

Refreshing. The constant regenerating of the information that decays or fades when left idle, such as the phosphor on a video screen. The image would fade if not for the electron beam.

Register. A memory location in a microprocessor in which information is processed.

RF modulator (Radio Frequency Modulator). A device that allows a computer-output signal to be viewed on a television screen.

RGB monitor. An ultra-high-resolution color video monitor with separate inputs for red, green and blue video signals.

RPG (Report Program Generator). A high-level language designed for business applications.

Search and replace. A word-processing program's ability to find and replace a given piece of information wherever it appears in the text.

Sector. Individual portion of a circular track on a disk, providing easy retrieval of information by locating sector and track number. A typical sector contains 128 bytes.

Serial access. The searching for data by going through information in the order it is stored on the disk. The slowest of all access methods. Also, *sequential access.*

Serial interface. A connection over which one bit moves after the other over the same wire.

Smart terminal. A peripheral, usually consisting of a combined video screen and keyboard, that has its own microprocessor and can therefore perform some computer functions. Its main role, however, is interfacing with a computer.

Software. The programs and data used to control a computer.

Static memory elements. Memory devices that retain their contents indefinitely (without refreshing) as long as power is provided.

String. A sequence of letters, numerals and other characters. String length refers to the number of characters a string contains.

Structured programming. A method of programming, using modules, that simplifies much of the aspects of programming computers.

Subroutines. A group of instructions within a program that are used several times, whenever needed.

Synchronous transmission. A method of sending and receiving information in which careful timing is needed for characters to be decoded. This method provides high speed but requires expensive equipment.

System. All of the various hardware components that make the computer usable, such as the printer, modem, disk drive, etc.

Terminal. A keyboard and CRT combined in one package, for both input and output. A printer that incorporates a typewriter-style keyboard is also a terminal when used with a computer, or a teleprinter when used or considered by itself.

Thermal printer. A device that uses heat and heat-sensitive paper to form characters. Advantages: low initial cost, ease in combining alphanumerics and graphics. Disadvantages: slow, average reproduction quality, high cost of paper.

Timesharing. An arrangement where a central processing system serves several users over phone lines.

Touch terminal. A terminal into which the user writes information by touching his fingers to a screen, rather than by using a keyboard.

Track. A circle of bits on a diskette.

Turtle graphics. Line drawings created in the LOGO programming language by moving the cursor. The term "turtle" is derived from the triangular cursor used.

Typewriter interfaces. Devices that allow a computer to employ a standard electric or electronic typewriter as a printer.

User-friendly. Designating systems that are easily learned and operated by computer owners.

User group. An organized club or group of people who share hardware and software information for a particular brand of computer.

Utility functions. Programs for frequently used applications, such as file-to-file conversion, printing, etc.

Vertical scrolling. The moving of text up or down on the display screen.

VLSI (Very Large Scale Integration). A chip that contains the equivalent of thousands of semiconductors (five times more than the 20,000 or so on a large-scale integrated chip, or LSI).

Volatile memory. Computer memory requiring current to retain information, such as random-access memory (RAM). The contents of RAM disappear when the power is turned off.

Wafer. A piece of silicon from which integrated circuits are made. The wafer is later cut into individual chips.

Wait state. The state a microprocessor is in when it is not processing data, i.e. when it has idle time.

Warm start. Returning the computer to its initial condition, without stopping the power. Data is cleared from memory when this is done.

Winchester disk. A hard disk with higher storage capacity and much shorter access time than a floppy disk.

Window. A portion of a file shown on a CRT.

Word processing. A special feature of a computer that allows you to manipulate text.

Word processor. A special computer program that helps a person manipulate text. A person can write a document, insert or change words, paragraphs or pages, and then print the document letter-perfect.

Word size. The basic unit of information. Word size is equal to a specific number of bits, and varies with the system used.

Word wrap. The automatic placement by a word-processing system of a word on the next line if it doesn't fit within one line.

Write: To store data on external media such as disk or cassette. The expression *write to diskette* means that the information stored in the computer's memory is sent to the diskette, where it is stored.

Write-protection. A technique used to prevent the accidental erasure of information by writing over data on a disk or other storage medium. In write-protection of a floppy disk, a user attaches a special tab to the jacket that covers a notch in the jacket.

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THE IBM PCjr USER'S GUIDE

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