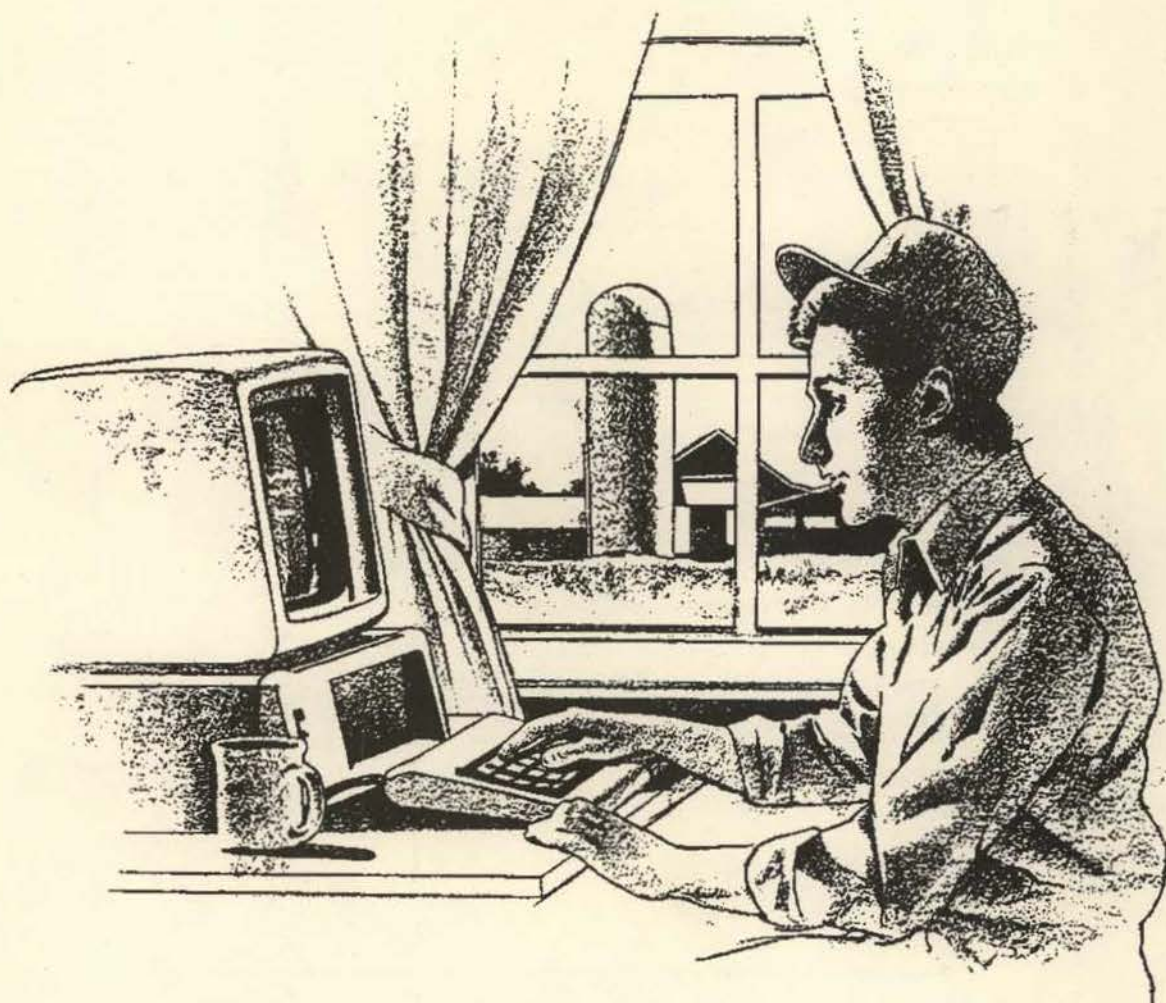


Buying a
Computer
for your
Farm or Ranch



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*College of
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Extension System

Contents

| | |
|---|----|
| Eight Steps to Buying a Farm Computer | 3 |
| What Do YOU Want the Computer to Do? | 3 |
| A Brief History Lesson | 4 |
| What About Windows? | 4 |
| Microprocessor | 5 |
| Random Access Memory | 5 |
| Expanded vs. Extended Memory | 6 |
| Math Coprocessor | 6 |
| Floppy Disk Drives | 6 |
| Hard Disks | 7 |
| Expansion Slots | 7 |
| Parallel, Serial, and Mouse Ports | 8 |
| Warranty | 8 |
| Monitor | 8 |
| Operating System | 8 |
| Mouse and Other Pointing Devices | 9 |
| Printers | 9 |
| Cables | 10 |
| Modems and Fax/Modems | 10 |
| Portable Computers | 10 |
| Power Fluctuations | 11 |
| Computer Bid Sheet | 11 |
| Manufacturers, Specifications, and Prices | 11 |
| The Authors | 12 |
| References and Useful Reading | 12 |
| Computer Bid Sheet (worksheet) | 13 |
| Glossary | 15 |

Trade names—To simplify information, trade names have been used. No endorsement of named product is implied nor criticism implied of products not mentioned.



Buying a Computer for Your Farm or Ranch

P. E. Patterson, C. W. Gray, and A. Davis

"I'm thinking of getting a computer for the farm, what kind do you think I should buy?"

Farmers and ranchers often ask Extension personnel this question. But before deciding what kind of computer to buy, the producer should thoroughly examine the issue of buying a computer. Even though computer prices have fallen substantially in recent years, not every producer should own a computer. A computer makes a very expensive paperweight, as some farmers have unfortunately found.

View the decision to buy a computer for the farm the same way you make any machinery purchase. You should ask two fundamental questions: (1) Do I really need a computer? (2) Will it pay for itself? Keep in mind that not everyone is computer compatible. Some people simply don't have the personality traits that will lead to a long and harmonious relationship with a computer.

If you have the opportunity, take an introductory computer class. These classes may be offered through vo-tech and community colleges, vo-ag programs, or your Cooperative Extension System office. This will give you a better idea what a computer can and cannot do, as well as expose you to a variety of computer hardware and software.

Be sure to take a computer application class, not a programming class. There is a big difference. While the majority of us can learn to run a computer, only a minority of people have the skills to program. Learning a specific application program like Lotus 1-2-3, Quattro Pro, Quicken, or Microsoft Word will be more beneficial than learning a programming language, such as C or BASIC. Taking a class on the disk operating system (DOS) or Windows would also be very useful. Your goal is to learn enough about computers to operate the programs that others have written. If you are willing to operate a tractor designed by John Deere, shouldn't you be willing to buy and use computer software programmed by the experts?

Eight Steps to Buying a Farm Computer

1. Determine what YOU want the computer to do.
2. Find out if your expectations are realistic by talking with software dealers, farmers with computers, vo-ag instructors, Extension personnel, or anyone else with knowledge and experience about computers and agriculture.
3. Discuss with your neighbors and friends who own computers what they did right and wrong when they bought their computers and software.
4. Determine which software is available for accomplishing your objectives.
5. Read some computer books or magazines to familiarize yourself with terminology and trends in software and hardware.
6. Visit computer stores in your area to find out which computers and software they carry. Do they carry agriculture-specific software? Do they support it?
7. Price a number of different systems and software. Be sure to research warranty and technical support, and whether it's local or phone support.
8. Select the system and the software that best fits both your needs and your budget.

What Do YOU Want the Computer to Do?

Computers do not think. They respond to user commands. The emphasis in this question should be on you, not on the computer: what do YOU want the computer to do?

Many people have unrealistic expectations about what a computer can or should do. There is virtually nothing that the computer can do that you can't do with a pencil and a piece of paper; the computer is just faster and more consistent. (Note, we did not say the computer was necessarily more accurate.)

A word of caution: while most producers acquire a computer for record keeping, owning a computer will not turn a poor record keeper into a good one. Someone must still collect the informa-

tion and enter it into the proper program. Be sure to discuss this with your spouse before you commit him/her to this task.

Many producers buy computers assuming they will save time. This is seldom the case. For the time spent, however, you will have better information on which to base production, financial, and marketing decisions. Your ability to make timely decisions also will be enhanced. After all, the right decision made too late is no better than the wrong decision made in a timely fashion.

Now that you've determined that you want the computer to keep production and financial records, the next step is to buy a half dozen different computer programs so that everything that walks, crawls, or grows on the farm can be entered into the computer. Wrong! Start with one or two computer programs. Learn them before you launch into another. Not only will this be more realistic in terms of your learning capabilities, but you won't end up with out-of-date software versions needing an upgrade before you even start using them.

This publication is limited to the PC, the IBM, or IBM clones running MS/PC DOS or Windows. We do not discuss the Macintosh system from Apple Computer. Our discussion explains computer features, whether they should be a requirement or an option, and what price ranges to expect. Price quotes throughout the publication are for reference only. Computer prices have dropped consistently since PCs were introduced in the early 1980s, and prices will likely continue to fall. Prices listed in this publication were observed in spring 1994. Most mail order vendors have 800 numbers that allow you to check for the most current price quotes. (Many computer terms are not defined; please refer to the glossary at the end of this publication.)

A Brief History Lesson

Before we discuss computer specifics, it may prove useful to review briefly the evolution of the microcomputer. The hardware and software used in today's systems have evolved substantially during the past 15 years. Modern computers are faster, more powerful, more reliable, and less expensive than their predecessors.

The different computer manufacturers used proprietary operating systems in the late 1970s and early 1980s; software had to be written specifically



for that computer's operating system. IBM's entry into the microcomputer market changed that. IBM used a version of an operating system that was available to all computer manufactures. This meant that a program written for the IBM PC would also run on a Compaq. While PC DOS used by IBM is technically different than MS DOS, the generic version of Microsoft's operating system, they are essentially identical.

Even though the MS/PC DOS operating system proved to be very successful, DOS is not a user-friendly operating environment for the computer novice. The commands used within DOS are cryptic at best and nonsensical at their worst. Learning DOS commands is akin to learning a foreign language.

Apple Computer pursued another type of operating system that relied on symbols and pictures to describe the commands. In this graphical environment the user simply selected the *icon* (or symbol) that represented what he/she wanted the computer to do. While this type of operating system proved much easier for the novice to master, the hardware requirements for the graphical user interface (GUI) technology were more expensive. Microsoft also developed a graphical user interface environment, but one that would run within DOS. WINDOWS, as Microsoft calls this operating environment, has proven to be immensely successful.

What About Windows?

Before you choose the specifics of your future computer, first consider if you will want to run the software in the Windows environment. The advantage to the Windows operating environment is the intuitive learning process. It has been well docu-

mented that the computer novice will learn to operate a graphical system sooner than a non-graphical one. For long-time DOS users, however, Windows can be frustrating and it can also reduce the overall computer performance.

Performance is of prime importance when considering Windows. Reduced performance is a particularly troublesome issue on older, less powerful PCs. You should be using at least an 80486 microprocessor if you want to run Windows without reduced performance. (RAM memory is also an important issue that will be discussed in a later section.) Much of the agriculture and other software available today was written for the DOS operating system, not for Windows. That doesn't mean that the software can't be used on a computer with Windows. But it does mean that you may have to leave the Windows operating environment to run the program. As time goes on, however, new software will be written specifically for the Windows environment.

Microprocessor

The microprocessor name indicates its relative power.

Intel, the leading microprocessor manufacturer, has simply added an additional integer. The first generation was the 8088, the next generation was the 80286. The third and fourth generations were the 80386 and 80486, respectively. Roughly speaking, the computing capability doubled with each new generation. Intel's fifth generation microprocessor called Pentium is breaking the naming tradition.

Selecting the proper processor is crucial when you purchase a computer. This is the work center of the computer. It is similar to the horsepower of a tractor; just as you don't buy a 40 hp tractor to pull a 5-bottom plow, you shouldn't expect an 80286 computer to run a sophisticated data base program.

We would recommend against buying a computer with an 8086/8088 or 80286 microprocessor. These are old technologies and lack the ability to run the new generation of software. Even buying an



80386 with an SX processing chip will impose speed restrictions on software.

The 80286 and 80386 are 8-bit and 16-bit processors, respectively, while the 80486 is a 32-bit processor. A *bit* is the smallest data component that the computer recognizes. The processor determines how much data is brought in, processed, and sent out. The bigger the data chunks, the faster the processor can accomplish a given job.

An 80386-SX is the minimum processor speed you should consider buying. Windows requires an 80386 and an 80486 is better. The microprocessor speed is measured in megahertz (Mhz). The higher the number, the faster the processor. If you have the chance to buy a 25 Mhz 80386 or an identical 33 Mhz 80386 for nearly the same money, the 33 Mhz is one-third faster so it is usually the better deal.

Many computers now allow the processor to be replaced, allowing the user to upgrade without buying a whole new system. Retrofits for the *motherboard* are priced between \$500 and \$800 and are usually machine (brand and model) specific. Since new software releases typically require more storage space, the user may well need to increase hard drive capacity at the same time. Carefully evaluating total upgrade costs and capabilities with new computer prices and capabilities is always wise.

Random Access Memory

Random Access Memory, RAM, measures the memory available for the computer to use with software programs and data. On the earlier generations of computers and software, 640 *Kilobytes* (K) or 1 *Megabyte* (MB) were considered adequate (see glossary). While many programs will still run with those limitations, the Windows operating environment and newer DOS programs will not. For someone considering Windows, 4MB is the minimum RAM you would need, but 8 is better. Windows will run with less, but overall performance will suffer. If the computer will be running DOS only, 2MB is usually sufficient. A *memory manager program* is required to access memory beyond 640K.

Just as important as the amount of RAM is the maximum the computer can take. All software does not make the same demands on the computer memory. You may later acquire a program that

exceeds your computer's capabilities. If there isn't room to add additional memory modules, you may have to replace the entire motherboard. A maximum expansion of 16MB should be adequate for most farm users, while 32 is better. So ask the vendor not only how much RAM the computer has, but the maximum it can hold as well. If you want to add memory at a later time, be sure there are free memory slots.

Expanded vs. Extended Memory

You can have three different kinds of memory installed in your computer: *conventional*, *extended*, and *expanded*. The first 640K of memory in the computer is generally referred to as conventional memory. This is all the memory that DOS is capable of using. Even with extended or expanded memory, DOS can only use 640K.

DOS was originally written for the 8088 processor, which could address only 1MB, of which 640K was memory. Even though today's processors can address up to 4 *gigabytes*, DOS is still tied to the 640K limitation. Regardless of how much extended or expanded memory your computer has, when conventional memory is fully utilized, the computer is out of memory.

A computer with 640K of RAM actually has 1MB of *addressable memory*. That is 640K plus 384K. The additional 384K memory is reserved for the system, including the video and the BIOS (Basic Input Output System). Extended memory starts after 1MB.

Expanded memory was first used in the old PCs and PC/XTs. To overcome the 640K memory limitation, expanded memory uses a technique called *bank switching*. LIM 3.2 and LIM 4.0 are two expanded memory specifications (Lotus/Intel/Microsoft memory specification.) LIM 3.2 allows 64K of memory to be banked at a given time and supports up to 8MB of expanded memory. LIM 4.0 allows up to 1MB to be banked at a time, if the expanded memory card supports it, and supports up to 32MB of expanded memory.

A *device driver* must be loaded in order to use expanded memory. Expanded memory is necessary for DOS application programs that need more than 640K, such as Lotus 1-2-3.

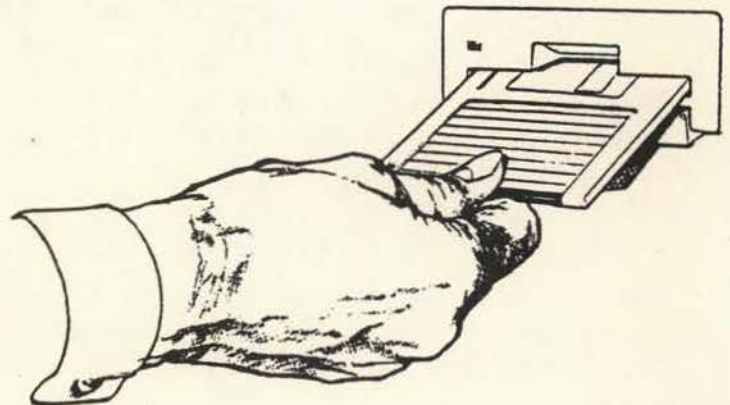
Windows requires *extended memory* to run—additional memory beyond the first 1MB. In general, it is faster and more efficient than expanded memory. To use extended memory efficiently, you should install a program called an *extended memory manager*. It prevents different programs from using the same part of extended memory at the same time. DOS 5.x and 6.x include an extended memory manager and can run in extended memory, freeing more conventional memory for user applications.

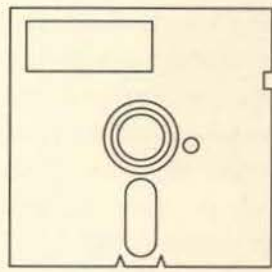
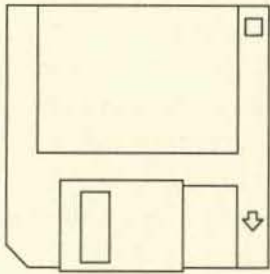
Math Coprocessor

The math coprocessor increases the computing speed for some applications that do mathematical computations. The coprocessor is of no use when you run a word processing program for instance, but it does accelerate the speed of running spreadsheet programs, graphics programs, and data processing on data base programs. Programs that do mathematical computations may not be written to take advantage of the math coprocessor. Check whether any of the programs you are considering can use or will require a math coprocessor. This can be added later if necessary. The 80486 DX processors and Pentiums have the math coprocessor incorporated into the chip, unlike all 80386 processors and the 80486 SX and SL processors, which have a separate slot and require a compatible math coprocessor.

Floppy Disk Drives

Computers include at least one internal floppy disk drive. The standard is now a 3½-inch drive, replacing 5¼-inch drives. If you are upgrading to a newer computer system, you will want to have both a 5¼- and a 3½-inch drive in the new system for greater flexibility. Most PCs are capable of handling two internal floppy drives. A combination drive that





can read both 3½- and 5¼-inch diskettes is also available. By occupying only a single drive bay, this will leave room for other devices, such as a CD-ROM drive or tape backup.

All drives of the same size are not created equal. The *density* with which the drive can read and write to a disk is as important as its physical size. Disk storage is measured in thousands of bytes capacity. There are 1,024K per MB. The standard 5¼-inch disk drive has the ability to format and read and write to a disk with 360K of storage. As technology improved, more information could be placed on the same size disk; thus came the high-density 5¼-inch drives with 1.2MB capacity. The standard 3½-inch disks first came in double density format (720K). This was later doubled to 1.44MB (double-sided high-density) and has been recently doubled again to 2.88MB. While the higher density 5¼-inch drives can read either a 360K disk or a 1.2MB disk, a 360K disk drive cannot read or write to a high-density disk. The same is true for 3½-inch drives. You should understand how to properly format these different diskettes. Formatting a double density disk to a high density format will create a disk with unreliable sectors. These disks may work fine indefinitely, but are more likely to create files that cannot be read. Occasionally, the data can be recovered or partially recovered. More often, however, the data is lost.

The newest and most sophisticated 3½-inch drive is a *density sensitive* drive. When the drive accesses the disk, it determines the type of diskette so that the prospect of ruining diskettes through improper formatting is no longer an issue.

The recommended configuration is a high density internal 3½-inch drive as well as an internal high density 5¼-inch drive.

Hard Disks

A hard disk is a necessity, not an option, because much of today's computer software will not fit on a single floppy diskette, not even on the high density diskettes. The issue is what size of hard disk you will need.

The cost of hard disks has fallen drastically in recent years, so our philosophy is to buy as big a hard disk as you can afford. The type and amount of software and the type of operating system you choose for your computer will help determine the size of hard disk you should purchase.

For someone interested only in running DOS and a limited number of programs, perhaps 100MB will suffice. If you plan on running Windows, a 200MB hard disk is the minimum you should consider purchasing.

The hard disk speed is as important as its size. Not all of them are fast. A faster hard disk means less time spent waiting for the computer to read or write data to the hard disk. If you are comparing two identical systems, one with a 28 millisecc hard disk and the other with a 17 millisecc hard disk, choose the faster 17 millisecc drive. Hard disks are also referenced by the type of *controller* used. The controller affects speed, so be careful to note the type. Slower hard disks are either MFM or RLL controlled. Newer, faster drives are either SCSI or EDI controlled. All the buyer needs to know is the type of controller to learn the speed (see glossary).

Expansion Slots

Use expansion slots primarily for adding ports to connect peripheral devices, printers, modems, FAX boards, and others. Early PCs were plain by today's standards, and owners needed a PC with a large number of expansion slots to add the necessary features. Today, three *available* expansion slots should be adequate in most circumstances. Remember, the video display card and disk drive controller often take a slot. Extra parallel or serial ports, a mouse, and internal modems may require slots as well.

Some manufacturers build mouse ports, video display adapters, and serial ports into the motherboard, while others do not. Check with the vendor for specific information.

Parallel, Serial, and Mouse Ports

Parallel and serial cables connect peripheral devices to the computer, including printers and modems. At a minimum, you should have one parallel and one serial port on your future computer. If you know you are going to use a modem, then you may want two external serial ports, unless the modem is an internal type.

The mouse connects to the computer via a mouse port. If the computer doesn't have one, you will end up connecting the mouse through a serial port or a buss card (which requires a slot). This isn't a problem unless you had planned on hooking your modem to that same serial port.

Warranty

Today's computers are extremely reliable, but a good warranty is still important. A 1-year, limited warranty is the industry standard and many manufacturers also offer a 30- or 60-day, no-fault return policy. Chances are if anything malfunctions, it will be in the first month of operating. But that also means it's advisable to set up and operate the computer immediately. In addition to warranty, you should ask what type of technical support is provided. Is it free or does it cost? Is additional support available on a subscription basis? Is an 800 number available for technical support? Be sure to ask.

Warranty policies for on- and off-site support can be purchased for both new and in-use computers.

Monitor

Standards for minimally acceptable monitor have changed considerably in recent years; computer users often view the *monochrome* (single color) monitor as unacceptable. This monitor is still a good investment, however, for users on a tight budget. The image quality of a good VGA monochrome monitor is usually superior to a color monitor selling at the same price. Cheap color monitors are a poor investment and will cause eye fatigue. If you choose a monochrome monitor, make sure it has VGA graphic capabilities.

If the software you choose uses color screens extensively, then you will want to invest in a good

color monitor; you might even consider a high-resolution monitor. If you are going to run Windows, a color monitor is almost a requirement. The image quality of a monitor depends on the number of dots or pixels per square inch. The more dots per inch, the better the resolution, and the higher the price. VGA (640 x 400 pixels) is the current color standard. Higher resolution modes are SVGA (800 x 600 pixels), XVGA (1,024 x 768 pixels) and UVGA (1,240 x 1,024 pixels). As you can see, many computer specifications are tied directly to the software. Monitor size is also important. A 14-inch diagonal monitor is the minimum for eye comfort. The 15-inch size is rapidly becoming the standard and larger ones are available.

Operating System

The operating system makes the computer function. This system is software-based, meaning it is not a permanent part of the computer's memory. The operating system software must be loaded each time the computer is turned on, or *rebooted*. The two basic types of operating systems are *non-graphical* and *graphical*. At a minimum, you will need a copy of the non-graphical operating system (DOS). Graphical operating systems are *Windows* and *OS/2*.

The standard non-graphical for IBM PCs is PC-DOS, and for the IBM clones, the generic counterpart is the Microsoft operating system MS-DOS. The version of the operating system is also identified, e.g., MS-DOS version 6.0. One thing to verify when you buy a computer is that the operating system is the latest release. In addition to the major version changes in the operating system, minor changes are referenced by a number or letter after the decimal point, e.g., version 6.1. Version 6.1 is a newer release than 6.0 and may have new features as well as correcting some deficiencies found in the earlier version.

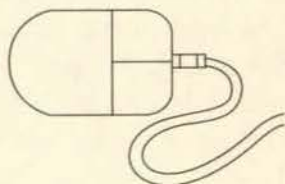
Windows is a graphical operating system. You may see it referenced as GUI, or Graphical User Interface. The OS/2 system from IBM is also a GUI. Besides being easier to use, as mentioned earlier, the GUI allows the user to run more than one application program simultaneously. For most producers, this may not be sufficient reason to choose a GUI. But a dairyman running a monthly herd summary that ties up the computer for two hours, may find this feature very useful. Windows is

not a complete substitute for DOS, as Windows runs on top of DOS. This is one reason why some DOS software has reduced performance when run as a Windows application. OS/2 does not require DOS, and neither will version 4 of Windows (due in late 1994).

Mouse and Other Pointing Devices

The *mouse* migrated to the PC marketplace from the Macintosh world several years ago. The ergonomically contoured device, about the size of a bar of soap, connects to the PC by a slender cable. It enables the user to select applications and manipulate drawings and text without keying in commands on the keyboard. Most PC mice have two buttons, some have three.

The mouse device correlates with a screen pointer or arrow. The user rolls the mouse in the direction and for the distance that he/she wants the arrow to move. Mice commands are performed through a combination of three functions: one click of a button (single click), two quick clicks of a button (double click), or holding down a button while moving the mouse (drag).



There are two types of mice: *bus* and *serial*. The bus mouse interfaces with the PC through an expansion card. The serial mouse cable connects to the PC through the serial port. You must install and initiate software driver files on the PC before using the mouse.

Because carrying a mouse is often inconvenient with a portable PC, and as the space around the portable PC may be limited, other pointing/tracking devices are becoming popular. This includes *trackballs* (think of upside-down mice), *joysticks*, *mousepen* (pen-like device with the roller ball set into the end), *Isopoint* (straw-shaped shaft set into the front of a portable computer), and the *Unmouse* (keypad-like device combining mouse and keyboard functions).

Printers

How you use what you print will dictate the type of printer you buy. For most farmers, a *9-pin dot matrix printer* will be sufficient. A step up from this

in quality are the *inkjet printers* and *24-pin dot matrix printers*. Rather than creating an image from pins in the printhead striking a ribbon, as does the dot matrix, inkjet printers spray the ink on the page. Some inkjet printers require higher quality paper, which will increase operating costs. If you will be printing checks and the checks have a carbon or carbonless copy, you will need the impact type printer. (Impact printers are noisy, however).

The type of paper feed can also be important when you choose a printer. *Tractor feed* and *friction feed* are the two basic types. The tractor feed has a pinwheel on each side of the carriage. The pins fit into perforations along the side of the paper. Friction feed printers use two rotating rollers that pull the paper through as they turn. Most printers handle both and can park the continuous forms while a single sheet is fed through.

When printing on forms, such as checks, the tractor feed is superior as it keeps the forms lined up correctly. Friction feed printers may slip, especially when using heavier paper. If you print a lot of checks, buying a dot matrix printer with a tractor feed to use only in printing checks is a good investment as you avoid the hassle of changing between paper and checks. Check with your banker to make sure the printer you're considering can print on the continuous feed checks they can supply. Newer inkjet printers use a paper tray holding 50 to 350 sheets. Checks, forms, and letterhead can be accommodated.

Between the two basic types of impact printers, 9-pin and 24-pin, the 24-pin produces a much better quality but at a higher price. For most producers, the 9-pin will be acceptable. The printer speed, measured in characters per second (cps), may be more important than slight differences in quality. Most printers have different settings of print quality, typically *draft mode* and *near letter quality (NLQ)*. You will want to know the speed in characters per second for both draft and NLQ modes.

The majority of dot matrix printers are 80 column. Like a typewriter, they can accept standard width paper of 8½ inches and print approximately 80 characters per line. Wide carriage printers, 132 columns, are useful for large forms. Most of these also have the ability to run standard width computer paper. Wide carriage printers are usually \$200 more than a comparable standard width printer.

Laserjet printers are at the top end of the quality spectrum. They are more expensive, generally starting at \$650 through mail order or discount stores. The speed of the laserjets is substantially greater than the dot matrix printers and is measured in pages per minute (ppm). Laserjet printers come with a variety of built-in fonts, giving the user a wide range in the character size and style. Many laserjets will also accommodate additional fonts on cartridges that simply plug into the printer. Most font cartridges are similar in size to an 8-track tape cartridge, for those of you over 35, or 3¹/₂ x 5¹/₂ inches. Some newer cartridges look like a credit card and slip into a slot on the printer.

Cables

To connect a peripheral device to the computer you need a cable. The two basic types of cables match the two common output ports, *parallel* and *serial*. Some peripheral devices can be connected to either a serial port or a parallel port and have both types of connectors. Others, such as modems, must use a specific type of connection. For printers that allow either parallel or serial connection, the parallel connection will be faster. But if the printer is more than 15 or 20 feet away, you'll have to use a serial cable. An external modem will require a serial cable. When you buy a peripheral device to hook to your computer, make sure you buy the proper type of cable.

Serial ports and serial cables come in both 25-pin and 9-pin configurations. The trend is toward the 9-pin connection. While they are functionally equivalent, make sure to match your serial port with the proper serial cable. Different serial devices require different pin configurations. Buying the cable at the same time as the peripheral device and from the same vendor is good insurance against mistakes.

Modems and Fax/Modems

A modem is another peripheral device that producers may want to buy. A modem allows computer-to-computer communication over a telephone line. There are a number of private and public information services you can access with a modem, called *electronic* or *remote bulletin boards*. They provide everything from weather to current commodity prices to computer programs.

Like computers, modem prices have been dropping. Also like computers, the faster the modem, the higher the price. Modem speed is measured in *bits-per-second* (bps), commonly referred to as *baud rate*. The important thing to know is that the higher the number, the faster the modem. Early modems transferred data at 300 bps, a speed considered too slow by today's standards. Twelve hundred- and 2,400-bps were the next two levels of modem speed.

Producers serious about telecommunications should not consider anything slower than 2,400. This is a rapidly changing area and older or slower technology is rapidly outdated. Buying a 9,600 bps modem is worth the extra money and a 14,400 bps modem should not be dismissed. In areas with poor quality telephone lines, which includes many rural areas, a modem with noise abatement features is a must. Poor quality telephone lines may limit data transmission to a speed below the modem's maximum. A fax/modem could also be useful as it combines a fax and a modem into a single unit. These are available in both internal (requires a slot) and external models (plugs into a cable).

Portable Computers

The user who travels frequently or needs computing power in the field may want to consider purchasing a portable computer. Portable computers fall into several categories, depending upon size, weight, and computing power. A portable computer is somewhat more expensive than a comparable desktop model.

The portable computer, or *luggable*, is the heaviest model, weighing more than 20 pounds. The earliest portable computers fall into this class. The newer laptop computers weigh 8 to 12 pounds, are about the size of a briefcase, and usually include a battery pack and AC adaptor. The smaller notebook computers conform to the 8¹/₂ inches x 11 inches form and weigh less than 3 to 7 pounds. Carrying cases are usually not necessary since the notebook computer is designed to fit within a briefcase. Computer users often view the smallest group, or *palmtop computers*, as toys, however, the latest models support limited DOS functions and are perceived as convenient, pocketable data containers.

Key features for the portable computer user are screen type and size, keyboard size, and battery life. Gas plasma screens are popular because they can be seen from any angle; however, they are also heavier than the more common LCD Supertwist screens and consume more power. Most LCD screens feature 16 shades of gray and 640 x 480 dpi resolution (see glossary). Backlighting will enhance the contrast.

While many of the laptops feature full-size keyboards and numeric keypads, the smaller notebook models require smaller keys with multiple functions. The palmtop keyboards are usually too small for touch typing.

Laptop and notebook models feature NiCads battery packs with AC adaptors. Batteries last between 1 and 4 hours, depending upon the individual PC and the user. Most allow the user to recharge the batteries while using the PC.

The computing power of the portable computer now approaches that of the desktop. The laptop models generally feature the SX processing chip, running at 25 to 33 MHz. The smaller notebook computer uses the SLC chip with an increased efficiency and ability to virtually shut off the system when not in use. Hard drives of 60 to 120MB are common with 200+ MB drives possible. This allows the user to purchase a single PC for use both in and out of the office. If you decide this best suits your situation, be sure to purchase a full-size monitor for office use. Some also provide a port for a full-sized keyboard.

Expansion has traditionally been one disadvantage of using a portable computer. The advent of the *docking station*, or expansion module, has eliminated this problem. The docking station gives laptops and notebooks the expansion slots, drives, and ports needed to function nearly as a full-featured desktop machine. In most cases, the docking station is purchased as a separate item.

Power Fluctuations

Many rural areas suffer from a lack of continuous and reliable power. Large on-farm power draws such as for electric pumps or a welder can also

cause power fluctuations. Power fluctuations can cause major problems with computer hardware. Stored data is also at risk. Some surge protection can be provided by outlet strips containing circuit breakers, which sell for \$20 to \$75. Better protection against brownouts and voltage spikes is provided by power conditioners, which sell for \$150 to \$300. The ultimate in protection is the uninterruptible power supply, UPS, which supplies a continuous level of power even during a power outage. These sell for between \$275 and \$1,200.

Computer Bid Sheet

Use the accompanying bid sheet to help you compare prices between local dealers, or to compare different systems from mail order companies. Remember, price is not the only criteria on which to base your decision. Support, especially good support from a local vendor, can be worth several hundred dollars. You may want to buy locally and support local merchants whenever possible. If you will not get good service/support for the higher price, then shop elsewhere.

Computer technology is changing every day. Should you wait for the next big technological change before you buy? No. Some significant breakthrough will always be just around the corner. Recognize the difference between technological and functional obsolescence. Before the next computer comes off the assembly line, it is technologically obsolete. Yet, computers with 8088 processors from 10 years ago work just fine in some applications. Buy a system that provides flexibility in adapting to future changes.

Manufacturers, Specifications, and Prices

Should you buy an IBM or an IBM clone? There is no correct answer. This is similar to deciding between buying a John Deere or a Case tractor. A number of very good clones are available. Some of the early clone manufacturers, such as Compaq and Dell, have themselves become mainstream PC suppliers. Just as important as computer features and reliability is the dealer's reputation for support.

The Authors

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References and Useful Reading

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- Hein, Norlin A., and M. Wilsdorf. 1984. *A Computer for Your Farm—Some Things to Think About*. North Central Regional Extension Publication No. 247. Columbia, MO: University of Missouri.
- United States Department of Agriculture. 1984. *Computers on the Farm*. Farmers' Bulletin Number 2277. Washington, D.C.

Computer Bid Sheet

Company _____
Address _____

Telephone # _____ Salesperson _____

Computer (circle the appropriate response when alternatives are listed)

Manufacturer _____ Model _____

Microprocessor:

80386-DX / 80486-SX / 80486-DX/Pentium Other _____

Speed: 25 / 33 / 40 / 50 / 66 MHz Other _____

RAM _____ K or _____ MB _____ Maximum expandable RAM _____

Maximum RAM on system board _____ MB _____ Upgradeable processor yes/no

Math coprocessor yes / no Socket Available yes / no

Disk drives: Internal floppy disk

Drive #1: 3½" : 720K / 1.44 MB / 2.88 MB or 5¼" 360K / 1.2 MB

Drive #2: 3½" : 720K / 1.44 MB / 2.88 MB or 5¼" 360K / 1.2 MB

Hard disk: Internal (specify brand, size, & speed)

Example: Seagate / 80 MB / 17 millisec

CD-ROM: brand/access time/ transfer rate/ drive card/software

Tape backup (capacity/format/software _____)

Mouse port yes / no Expansion slots _____ Parallel ports _____ Serial ports _____

Warranty _____ Price \$ _____

Monitor

Manufacturer _____ Model _____

VGA / SVGA / XVGA / UVGA Color / Monochrome Screen size _____

Pixels _____ (i.e., 640 x 400)

Warranty: _____

Price \$ _____

Operating system: Disk size should match drive A.

DOS Version _____ 3½" / 5¼" Price \$ _____

Windows Version _____ 3½" / 5¼" Price \$ _____

Printer

Manufacturer _____ Model _____

Dot matrix 9 pin / 24 pin Column width 80 / 132

Character per second draft _____ Near-letter quality _____

Warranty _____ Price \$ _____

Laser: Pages per second _____ Memory _____ # of fonts _____

Postscript yes / no

Warranty _____ Price \$ _____

Cable

Parallel / Serial length _____ Price \$ _____

Modem (in the price include cable for external)

Manufacturer _____

Baud rate _____ Internal / External

Error handling _____ Noise filter _____

Warranty _____ Price \$ _____

Other Options

Total system price \$ _____

For how long is bid good? _____ days

Date _____

Signature _____

Glossary

- A - B -

- Address**—A hexadecimal number that represents a location in storage or memory. Also used to identify communications ports.
- Addressable space**—Memory area where the computer stores program instructions and data.
- Analog**—Analog devices measure a continuous variable, such as voltage levels (contrasts with digital).
- Applications**—Software programs that perform a specific user-oriented task, such as word processing or payroll. Applications can be either purchased as a package, or custom designed by a programmer.
- Archive**—To copy information that need not be instantly accessible to a storage device that holds such files (for backup or security reasons).
- Asynchronous device**—A piece of equipment having a variable or random time interval between successive events. The transmission of information (character, word, or small block) is individually timed by the use of start and stop bits.
- AUTOEXEC.BAT**—A special batch file containing a series of commands that DOS will execute when the computer is turned on.
- Backup**—An extra copy of a disk or file made in case the original disk is lost or ruined. Make backups of all master disks immediately upon receiving or purchasing a new piece of software. Also make backups of important work disks and files.
- Bad sector**—A disk sector that cannot reliably hold data because of a media flaw or damaged format markings.
- Bank switching**—One way to extend the useful amount of RAM in a computer by switching data in banks of memory to addresses that are accessible to the microprocessor. As DOS is able to address only 640K of memory, computers with more memory use bank switching to access this additional memory.
- Batch file**—A file containing a series of DOS commands that the operating system executes when the file is processed.
- Baud**—A measure of the data transmission rate, bits per second. Typically referred to as *Baud rate* with data communications. Baud rate divided by 10 is approximately equal to characters per second (cps). Thus, 1,200 baud is about 120 cps.
- Bay**—An opening in the computer's chassis designed to hold mass storage devices, such as hard disks, floppy disks, CD-ROM drives, and tape backup units.

BIT—Binary digit. The basic element of a byte (eight bits constitute one byte). It is a type of electrical switch that is either *on* or *off*. One binary digit is usually represented by 1 or 0.

Booting up or bootstrapping—The initial loading of information that occurs when a computer is turned on, enabling it to read in or respond to further instructions. See *warm boot* and *cold boot*.

Buffer—A memory storage area that temporarily holds data during the transfer between internal and external or input/output storage.

Byte—A unit of memory capacity; a standard-length sequence of bits, usually eight, used to represent a single character.

- C - D -

Cache memory—High speed memory that contains the next most likely instruction to be executed or data block to be used.

Carriage return—A control character the computer recognizes as a signal for the end of a particular input of data.

Carrier—The reference signal on which information is superimposed for transmission or reception of data over telephone lines.

Cartridge—A font cartridge is a plug-in unit containing electronic circuitry and memory allowing the creation of entire sets of characters on a laserjet printer. Font cartridges are also referred to as *hard fonts*.

Character—A symbol, such as a letter or punctuation mark, used to represent data or operational instructions.

CD—Compact disk. The plastic, optically-read medium capable of storing massive amounts of data.

CD ROM drive—The device that reads CD-ROM disks.

Cold boot—Starting the computer after turning it completely off (see *warm boot*).

Compatibility—A computer's capability to work with other devices like printers, data storage units and with other computer models, either from the same or different manufacturers; could also refer to software and program languages.

Component—A part of a computer system, usually a specific piece of equipment.

Computer—An electronic device that is capable of number computations, data storage, and logical operation. The computer is directed by a program prepared by a human.

Computer language—A specific set of rules and symbols used to communicate with a computer. BASIC and FORTRAN are two such languages common to computer users.

Computer program—A series of instructions that guide computer activities.

Computer system—The combination of hardware (equipment) and software (programs) used for performing certain tasks.

CONFIG.SYS—A file that is read when the computer boots, which customizes the way DOS uses hardware, memory, and files.

Conventional memory—The first 640K of memory. DOS is limited to using conventional memory for running applications.

CPS—Characters per second. The operational speed of a printer or data transmission device.

CPU—Central processing unit. The brain of a microcomputer. It contains the address registers, arithmetic logic unit, and timing signal generator.

<CR>—The standard symbol for a carriage return.

CRT—see *Screen*.

Crash—A software or hardware malfunction that halts operations. Data loss can occur, especially when physical damage results, such as with a disk head crash.

Cursor—An electronically generated symbol that appears on the microcomputer screen to tell the operator where the next character will appear.

Data—The input of facts, numbers, letters, and symbols that, when processed, becomes usable information.

DBMS—Data base management system. A computer application program designed to keep records in a data base.

Default—The standard option the computer assumes if you fail to specify otherwise.

Delete—To erase data from the screen or from a disk, whether it be a character, sentence, or a whole file; similar to erase.

Density—The amount of data that can be written to a given area on a floppy disk. A double density 3 1/2-inch diskette holds 720K of information; a high density one holds 1.44MB.

Device—Hardware that allows the user to communicate with the computer (input device), or which receives information from the computer (output device).

Device driver—Software that enables a computer to communicate with a specific device or memory module.

Digital—Digital devices measure discrete values. A digital piece of information might be inches of rainfall or pounds of seed, or electronic pulses in a computer (contrast with analog).

Dip switch—A small switch block found on a circuit board used to designate the operating state of a component.

Directory—An index to the files of data and programs on diskette. Also referred to as a *catalog*.

Disk—A flat, circular, platelike device with a magnetic coating on which information can be encoded and permanently stored. Disks can be flexible and movable *floppy* diskettes, or rigid and unmovable *hard* disks. Floppy disks are classified by physical size, 5 1/4-inch or 3 1/2-inch, and storage capacity in kilobytes *K* or megabyte *MB*, while hard disks are classified as internal or external and by storage capacity in megabytes or gigabytes.

Disk drive—A piece of equipment used to store and access data on diskettes.

Documentation—A description of what a program does, how it works, its assumptions, and possible applications; an *owner's and operator's manual* for a program or piece of hardware.

DOS—Disk operating system. Any operating system that emphasizes the use of disks to store files. Commonly refers to the popular operating system developed by Microsoft, Inc. for PCs, MS-DOS, or PC-DOS.

Dot matrix—A printer type using a number of pins, 9 or 24, striking a ribbon to form characters.

Download—The process of accessing files on a remote computer and transferring them to the file system of one's own computer.

Duplex—Communication parameter that is set to allow bidirectional or unidirectional data transmission. When duplex is set incorrectly, characters will either not appear, or they will appear double. See *full duplex* and *half duplex*.

- E - G -

Electronic mail—Messages or mail that are sent and received electronically, i.e., no hardcopy exists.

Enter—Has the same meaning as input: to type information onto the screen to later be recorded, edited, deleted, etc.; not to be confused with a certain function key on some machines.

Erase—To remove information stored on a CRT, random access memory, or external storage device; same as delete.

Error message—A word or combination of words that tell the user an error occurred while the program was operating.

Execute—To carry through with program instructions, to “run” a program.

Expanded memory—Memory in addition to conventional memory, which is available through an expansion board for applications. Expanded memory requires a special program called an *expanded memory manager* that comes with the expanded memory board.

Extended memory—A seamless addition of memory beyond 1MB. Since DOS can only access the first MB of memory, extended memory is administered by a memory manager, which addresses the extended memory and prevents several programs from trying to use the same memory at once. Extended memory cannot be used on 8088 processor computers.

Fax—Facsimile terminal. The transmission of images via telephone lines for reproduction on paper.

File—A specified collection of information (data) or instructions (programs) located on a diskette or other storage medium.

File extension(s)—The three character second part of a filename identifying the type of file. For example, for CONFIG.SYS, SYS is the file extension.

File name—The first part of a file name, limited to 8 characters. Certain characters are excluded, including a space, period, comma, etc. Example: for CONFIG.SYS, CONFIG is the file name.

Floppy disk (diskette)—A flexible disk. Most common sizes are 5¼-inch and 3½-inch.

Font—A particular design, shape, and size of lettering, or of a printing typeface.

Format (formatting)—Preparing a diskette for data storage; also the structure of a file.

Full duplex—Two-way data transmission where data transfers can occur simultaneously in both directions. Characters you type are sent to the remote, which echoes them back.

Function—A specific operation, movement, control, or command performed by the computer. Example, *SIN* gives the sine of a number, while *INT* returns the integer (whole number) portion of a number.

Function keys—Additional keys on a keyboard that are used to perform user or program-definable operations; F1 through F12 on most keyboards.

Gigabyte—A unit for measuring storage: 1 gigabyte is approximately 1 billion bytes.

GIGO—Common computer acronym for garbage in, garbage out. (Output from a computer is only as good as the data input).

GUI—Graphical user interface. This is an operating environment where the user inputs commands by selecting icons, rather than by typing commands on the keyboard.

- H - J -

Half duplex—Two-way data transmission where data transfers occur alternately in both directions. Characters you type are echoed locally.

Hard copy—Information generated by a computer and printed on paper.

Hard disk—A type of mass storage computer disk that cannot be removed from its housing, consisting of a rigid metal platter with a magnetic coating. Also called a *fixed* disk.

Hardware—The physical components of a computer system.

High-level formatting—Formatting performed by the DOS FORMAT program. This process creates the root directory and the file allocation tables.

I/O—Input and/or Output. I/O devices include keyboards, floppy disk drives, CRTs, printers, or monitoring devices such as for grain temperature or rainfall. Each of these feed information into and/or works from information coming out of the CPU.

Icon—A graphical representative of various elements, such as applications, documents, and hardware.

Impact printer—A printer that strikes the paper through an inked ribbon, like a typewriter (see *Dot Matrix*).

Initialization—The process of preparing external media, such as diskettes, for computer access.

Input—The process of transferring data or program instructions into memory from a peripheral unit.

Joystick—An input device that allows control of the cursor or some part of the image on a computer screen; used extensively with video games.

Jumper—A small connector that slips over two pins protruding from a circuit board. The jumper connects the pins electrically, thus connecting the two terminals of a switch, turning the switch on.

- K - L -

Keyboard—The typewriter-like input device used to enter character information into the computer.

Kilobyte—Often referred to as *K*. A measure of computer information storage capacity or memory. (Technically, 2¹⁰ bytes, or 1,024 bytes.)

Language—A system of encoding instructions to the computer. Each language has its own rules of syntax and characteristic strength and weaknesses for particular uses. Must be decoded and translated into executable binary code by a translator. Examples include FORTRAN, BASIC, Pascal, and C.

Laptop—A small, self-contained computer designed for mobility. Usually smaller and more lightweight than a portable computer, and larger and heavier than a notebook computer.

LCD—Liquid crystal display. A type of output display (screen) in which characters are typically formed by black lines on a gray background. Commonly used on many laptop and portable computers.

Load—A programming process of retrieving programs or data from storage for processing.

Lost clusters—Clusters of information that have accidentally been marked as *unavailable* in the file allocation table, even though they belong to no file listed in a directory.

Low-level formatting—Formatting that divides tracks into sectors on the disk surfaces. Defective tracks are marked.

- M - O -

Magnetic disk—see *Disk*.

Megabyte—Often referred to as *MB* or *Meg*. A measure of storage capacity. (Technically, 2^{20} bytes, or 1,048,576 bytes).

Memory—That portion of the computer used to store information. The size of memory is measured in kilobytes or megabytes. Also see *RAM* and *ROM*.

Memory resident program—A program that remains in memory once it has been loaded. The program may be activated at any time, even during another program. Also called *Terminate and Stay Resident* (TSR).

Menu—Display of a list of options available to the user at a particular point in the execution of the program. Programs that function this way are referred to as menu driven.

MHz—Megahertz. A unit of analog frequency used to measure the speed of the computer microprocessor.

Microcomputer—A small computer utilizing a microprocessor. It has less capabilities and ability to store information than a minicomputer or mainframe computer.

Microprocessor—A silicon circuitry comprising the *brain*, or CPU, of the microcomputer.

Modem—MODulator-DEModulator. A device that permits one computer to communicate with another via telephone line by converting digital electronic signals to analog tones (sound).

Monitor—The video screen connected to the computer that displays input/output information and messages from the computer.

Motherboard—The primary circuit board used in different microcomputers. It provides power to other circuit boards via electronic circuitry, and it links the CPU, memory, and peripherals together.

Mouse—A hand-held input device that controls movement of the pointer (cursor) on the monitor screen having one to three buttons that access various features.

Multitasking—The act of running several programs simultaneously.

Offline—Equipment or devices that are not under direct CPU control.

Online—Equipment directly under the CPU control.

Operating system—A software package that manipulates files and allocates system resources to various computing functions such as copying, printing, editing, and executing files. Sometimes referred to as the *Master Control Program*. Examples include: DOS, CP/M, and UNIX.

OS/2—A multitasking operating system developed by IBM and Microsoft. Includes *Presentation Manager*, a graphical icon- and window-based software interface.

Output—Information moved from internal storage to output devices, such as printers or display screens.

- P - R -

Parallel—The simultaneous transfer of a group of binary bits by sending each bit over a separate wire; contrasts with *serial*.

Parity—A technique for adding an overhead bit to a character code to provide error-checking capability.

Park—The procedure in which disk drive heads are moved to an unused track so that they will not damage data if a head crash occurs. Heads should always be parked prior to moving a computer.

Password—A secret identification code the user must key in; the system checks the password before permitting access.

Path—The combination of disk drive letter and directory(ies) directing the user to a file within the system.

PC—Personal Computer. Any microcomputer. Also refers to personal computers sold by IBM from 1981 to 1988 using an 8088 microprocessor, or the compatibles made by others.

Peripheral—Any external piece of equipment that is an accessory of a system that receives information from or sends it to a computer, i.e., disk drives, CRTs, printers, and modems.

Permanent storage—Data retained even when the power of the computer is turned off.

Pixel—The smallest graphic unit on the screen. Also known as *picture elements*.

Port—A channel of communication between the CPU and a peripheral.

Program—A series of instructions that tells a computer in detail how to process data, normally written in a standard computer language.

Prompt—A message on your display screen requesting information and telling you which responses can be made. Also refers to the cursor.

Protocol—A standard procedure for transmitting information that allows computers to exchange data accurately over a communications link. The protocol defines message formats, devices for detecting and correcting transmission errors, and the commands and responses needed to coordinate the activities of the transmitter and receiver.

Protocol rules include the following:

Block size—Defines the amount of data sent in one continuous block. For example: X modem uses 128 byte blocks, while Y modem uses 1,024 byte (1K) blocks.

Duplex—Defines the procedure for the sequence of transmissions. Full duplex allows information to be sent both directions simultaneously, while half duplex allows information to be sent in only one direction at a time.

Handshaking—Defines the procedure for responding to information sent.

Error detection—Defines the procedure for detecting an error. Both header information and data block must be checked.

Error correction—Defines the procedure to follow if an error is detected. Generally, this involves retransmission of the entire packet (header plus data block). If the error is not correctable, the transmission will be aborted.

Public domain software—Software that can be freely copied and distributed. Authors do not claim royalties or license fees to use the program. Also referred to as *freeware*.

RAM—Random Access Memory. Memory that can be read from and read to while the computer is running. Information in RAM is lost when computer is turned off. Also called *volatile memory*.

Release—The particular version of a program. Since most programs are updated continually, one version can be significantly different from another.

ROM—Read Only Memory. This memory is permanently built into the computer and cannot be changed. It is associated with interpreting computer languages and communication between the computer and its peripherals.

Root directory—The highest directory level of any hard disk or floppy disk.

- S - U -

Save—To transfer information from the computer's volatile memory to a disk or other type of permanent storage.

Screen—The television-like display connected to, or part of, the computer. Also called a *monitor* or *CRT*.

Scroll—The vertical or horizontal movement of text on the screen. As new information is entered or displayed, previous lines or columns move up or to the side, and off the screen.

Serial—Bit transfer in sequential order, one right after the other.

Shareware—A type of software distribution, or the software itself, where the developer encourages widespread copying of the program as a means of distribution. Users are asked to register and to pay a small fee, generally less than \$100. Shareware is copyrighted and should not be confused with public domain software.

Software—The instructions contained in a program and/or the program itself.

Spreadsheet—An applications program that allows data entry into a row and column configuration and the data manipulation; includes many mathematical functions.

Storage—Memory. A device that stores data for retrieval at a later time.

Sub-directory—A directory contained within another directory.

Support—To assume the responsibility for making something in a computer system (hardware or software) operate or work properly.

Surge protector—An electronic device plugged into a computer that protects it from the harmful effects of sharp voltage surges.

- V - Z -

Telecommunications—Information sent and received by wire, radio, optic, or infrared media. Commonly refers to computerized information sent and received over the telephone lines.

Uninterruptible power supply—A device that supplies power to the computer from batteries so that power will not stop during an outage.

UNIX—An operating system originally developed by AT&T and initially used for mainframe computers and mini-computers. A version of UNIX is now used on some PCs.

Upload—The process of transferring files from one computer system to a remote computer system through a telecommunications link.

User-friendly—Term applied to both hardware and software implying that these are easy to use or learn, even for the computer novice.

Utilities—A general-purpose computer program designed to improve the operation of a computer system and accomplish a variety of housekeeping chores.

Vaccine—A program intended to counteract or eliminate a certain virus or group of viruses (see *Virus*).

Virus—A program or computer code designed to insert itself into an existing program, alter, or destroy data, and attach itself to other programs.

Warm boot—Restarting the computer by holding down the Ctrl and Alt keys while pressing and then releasing the Del key (see *Cold boot*).

Wild card—A general character that substitutes for a character or group of characters. In DOS, the asterisk (*) can be used to indicate one to eight letters that match that position in file names, and the question mark (?) substitutes for one letter.

Window—A rectangular portion of the computer screen where information is presented.

Windows—A program providing graphical user interface. The user communicates with the computer by pointing to and selecting icons, rather than by typing commands on the keyboard.

Word processor— An application *program* that formats and prints text that the user enters.