Indiana University
Multi-campus Modular
Computing Curriculum

Introduction to Computing

Module # 6: Operating Systems

Goals

- Students will understand what an operating system does
- Students will become familiar with several different operating systems
- Students will learn about the important features of an operating system, including the file management system
- Students will practice using the features of several operating systems to locate and copy files, format disks, and other skills
- Students will recognize the difference between literal and symbolic directory management schemes.
- Students will be able to manipulate the directory structure of even completely unfamiliar systems through file management utilities
- Students will place and retrieve files accurately in a complex file structure using the save and load commands of unfamiliar software

Prerequisite Skills

- Comfort with the keyboard and mouse
- Experience with the STAIR process
- Background in Essentials of Computing

1 Historical Perspective

Prior to the 1950's, computers such as the ENIAC, or Electronic Numerical Integrator and Computer, had no operating system as such. In order to run a program on the ENIAC, many people were required in order to manually connect wires and set switches so the program would run properly. It might take a week or longer to perform all these operations for a program that took a few minutes or hours to run.

In 1981 IBM began selling its personal computer, the PC and MS-DOS (Microsoft Disk Operating System) was chosen as the standard for this computer. Before this, each type, or brand of computer had its own particular operating system. Since programs are specific to an operating system, software that would work on one computer would not work on another. With the development of MS-DOS, there was at least a standard operating system for the so-called PC compatible systems. Most machines based on the Intel chips used DOS as the standard operating system, although computers based on different CPUs (like the Apple lines) used their own unique operating system.

Q. 1

Why was that a problem for computer users?

(Answer on page 6-34.)

In 1983 Apple introduced the first publicly available microcomputer with a graphical user interface, the Apple Lisa. The reason most people have not heard about the Apple Lisa is because it did not sell well due to its prohibitive selling price of $10,000. Then in 1984 Apple released the Macintosh at a cost of $2,500. The high sales of this computer showed the industry that people really wanted to have computers, but they wanted them to be easier to use, and wanted GUIs (Graphical User Interfaces). The DOS world stayed away from the GUI approach until the advent of Windows.

UNIX , another popular operating system, was created in 1969 at Bell Laboratories, which was the research facility of AT&T. It was born of a need for a less expensive and more friendly programming environment. It retains its aura of higher - end computing.

2 Operating Systems in General

2.1 What They Do

The operating system controls the input, output, and processing activities for a computer. You might say it is the "boss" of what happens in the software, in the hardware, and between the hardware and software. A high quality operating system can make your computer more effective and efficient, and so make you a more productive user.

2.1.1 The Operating System as a Traffic Cop

Another important thing the operating system does is to control the resources of the computer. These resources include computer memory, file storage space, and the computer processor. One of the most valuable of these resources is the computer processor, or CPU. The CPU, or central processing unit handles one instruction at a time. Modern computers, the ones manufactured in about the last five years for example, will do multitasking, which means they can run more than one program at a time. If the CPU only does one thing at a time, how can the computer run more than one program? Well, the operating system helps the CPU budget its processing time so computers can do multitasking. The processor works so quickly doing each task, that to us it seems as if things are happening at the same time. However, even multitasking computers have their limits; you can only run so many programs at the same time.

Parents understand the concept of multitasking only too well. If you are trying to answer the phone, catch up on some work, getting ready for soccer practice, and cooking dinner all at the same time, you are multitasking. As you know, when you do this, your performance at each job may suffer. If you have too many jobs to do at once, you will just break down into screaming fits of anguish. The computer will do the equivalent if you give it too much to do at once.

Q. 2

Why is there a limit to the number of programs a multitasking computer can run at the same time?

(Answer on page 6-34.)

2.1.2 The Operating System as a Communication System

The operating system helps all the hardware components communicate with each other. For example, if the processor needs to talk to the programs, or the program needs to communicate with the printer, the operating system helps them do that. The operating system also works to maximize the speed at which everything happens, so for example, you don't have to go get a cup of coffee while you wait for your computer to copy a file.

2.1.3 The Operating System as a Box of Tools

There are utility programs contained within operating systems that help you do things like move files around, create directories, copy files, format disks, and so on. We will be looking at some examples of these utility programs for operating systems such as Windows 95 and Macintosh System 7.5.

2.1.4 The Operating System as a Self-Starter

Loading the operating system into the computer's memory is called booting. (No, it doesn't mean you have to "kick" the computer, even though sometimes you would probably like to.) The term "boot" comes from the concept of pulling yourself up by the bootstraps. As the computer turns on, some instructions in ROM tell the computer how to 'wake up', find the peripherals, and load the operating system into memory.

If the computer is turned on from the off position, it is called a hard boot. If the computer is reset while it is on it is called a soft boot. Most computers now have reset keys which allow you to soft boot the computer; with older computers the standard way to soft boot was to use the ctr-alt-del keys.

Q. 3 When might you want to soft boot your computer?

(Answer on page 6-34.)

2.2 Command Lines and GUIs

2.2.1 Command Line Interfaces

An operating system is a software program that helps the user interact with a computer. The operating system gives you an interface, or what comes between you and the computer. When you look at your computer screen and all you see is a letter with some funny symbols along with it, such as: `c:\>`, you are using a command line interface. A command line interface means you must type in what you want your computer to do, (what we call the command), and you must type it correctly. DOS and UNIX are both command line operating systems. (although they do both have graphical interfaces avaialable). Command line operating systems are very efficient in the hands of a skilled user, but they are utterly bewildering to a novice. When you are faced with a command line, you have to know what you want to do, exactly what to type, and you may even have to have special training to understand what it tells you back! Command line operating systems are easy to create, and do not require much from the computer. Earlier machines had command line systems, but as you might guess, not everyone enjoyed them.

2.2.2 Graphic User Interfaces

Fortunately, a new kind of operating system came along. If you see some nice little pictures with descriptive words underneath them, you are probably using a GUI (pronounced gooey, if you can believe that) or graphical user interface. A GUI lets you click with the mouse to start a program or do other computer tasks such as copying a file. The biggest advantage of a GUI is that little pictures are drawn on the screen to make the concepts easier to understand. In a GUI, you might be able to move a file by clicking on a picture of that file and dragging it to another part of the screen. In a comand line system, you would have no happy little pictures. You would have to know the exact command required to move the file.

2.3 Examples

2.3.1 DOS

MS-DOS which stands for Microsoft Disk Operating System was purchased by Bill Gates from a small company; he then refined it and sold it to IBM to be used by them as the standard operating system on the Personal Computer in 1981. MS-DOS is a command line operating system, which means you must type in commands for the things you want the computer to do. The syntax (the way you enter the commands) must be correct or you get some obscure error message like: bad command or file name. Needless to say, this created irritation and frustration for people just learning the computer and some people gave up in disgust. For the people who persevered and learned how to work effectively in DOS, working in this operating system can be elegant and fast. Of course, this meant they had to memorize many commands or look them up every time they were used.

2.3.2 UNIX

UNIX is the most popular operating system for multi-user computers. It is also a command line interface and just to make it REALLY confusing, it is also case sensitive. To be case sensitive means the operating system recognizes a difference between upper case characters and lower case characters. For example, typing in ls (the UNIX command for listing your files) will give you a listing of your files, but if you type LS, you will get the message "command not found". Commands in UNIX are usually in lower case and most UNIX users will use lower case for file names to make this aspect of UNIX a little easier to handle. In fact, people who work both in a Windows environment and a UNIX environment find it easier to always use lower case, no matter where they are working. There are graphical shells to UNIX which make it act like a GUI. In this class, we will think of UNIX as mainly a command line operating system.

2.3.3 Windows 3.1

Windows 3.1 is an operating system that was developed by Microsoft for IBM type computers. Windows 3.1 provides the user with a GUI environment. GUI is graphical user interface and this means there are point and click options available with which to work on the computer. We use the mouse to point and click on an icon to open program groups, launch programs and complete other tasks. The icons in Windows 3.1 are the small picture representations of a "doorway" to a task or program. The advantages of having a graphical user interface are obvious, it is much easier to move the pointer with the mouse and then click to do what we want with the computer than to remember obscure and sometimes complicated commands. Windows 3.1 gives you, the user a file management program called (with the usual brilliance and imagination of computer scientists) file manager, that is easy to understand and use. Windows 3.1 requires MS-DOS for installation. The main program in Windows 3.1 is Program Manager. If you close Program Manager, you close Windows 3.1.

2.3.4 Windows 95

Windows 95 is the operating system developed by Microsoft and released in August of 1995. It is an upgrade to Windows 3.1, and interestingly it does not require MS-DOS for installation. MS-DOS, however, is included as part of the operating system. It incorporates many of the successful design features of Windows 3.1 with a few additions.

Q. 4 Any ideas why Microsoft include DOS with Windows 95?

(Answer on page 6-34.)

2.3.5 Mac System 7.0

System 7.0 and other versions such as System 7.5 and System 8.0, is the operating system for Macintosh computers. This operating system also has a GUI environment. The main working area of the Macintosh computer that is provided by the System 7.0 operating system is called the desktop. On the desktop there are icons that allow you point and click access to programs and computer functions, and pull-down menus that let you open folders and start programs.

Q. 5 What is a "pull-down" menu?

(Answer on page 6-34.)

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3 Problems Operating Systems are Good at Solving

As you have seen, computers have gotten very complex. One computer might have hundreds of programs stored on the hard drive. Each program might be able to read hundreds of documents. A program might also have all kinds of fancy devices attached to it like scanners, printers, and sound cards. How is this stuff organized? Is there some kind of central control?

Here are some more specific problems....

- How do I find my word processing program?
- Where should I save the letter I just wrote?
- I just bought a new printer and hooked it up. How do I access its fancy features
- How can I organize all the programs and documents I need to work efficiently?

As you can see, the central problems that operating systems are there to solve are problems of **organization.** Mainly, operating systems help you to organize all the stuff on your disk drives. Operating systems are also invaluable in giving your computer an interface, or 'look and feel' that you can interact with efficiently. Also, operating systems help all the parts of your system communicate with each other.

3.1 Literal Disk organization

How things are organized in an operating system is important both to the computer and the user. Whether you are working in a command line system, like MS-DOS or a GUI environment like System 7, how things are organized follow the same basic ideas. That is a good thing for those of use who work in several different platforms!

3.1.1 The "Tree"

You can think of the file structure in an operating system much like that of a "tree". At the bottom of the tree are the roots, and for our purposes, the root directory. Branches can then be followed to the next level which are the directories. From the directories further branches can be followed to the subdirectories, and so on until you reach the files. This structure is valid whether you are working in a command line interface, or a GUI. Also, in much the same way you would have to back down a tree to the root to climb to a different branch, to reach a file that is in a different directory, you must go back to the root directory and then go down the other branches to the file you want. This is true no matter where you are working, but it is more easily to accomplish in a GUI environment. If you are working in DOS or UNIX, getting to a file in a different directory can involve major amounts of typing!

3.1.2 The Drive

Operating systems are very concerned with how things are stored on drives. The typical computer system has a number of different drives attached. The hard drive, any floppy drives, cd-ROMs, or network drives might be be attached to your machine. You might think of each drive as a seperate tree. Disk drives usually have names. In the DOS/Windows world, drives have boring names like A: (The main floppy drive) and C: (The main hard drive.) Newer operating systems allow more colorful names for drives like "my hard drive" or "Anita's floppy"

In GUI type environments like Windows and Macintosh System 7, the file and directory structure works in the same way it does in a command line operating system, but getting around to find what you want is much easier. Instead of typing a: at the C prompt to change to A: drive, you click the mouse on a PICTURE of the drive you want to move to. For example, in the File Manager program of Windows 3.1, to change the drive you click on a different drive box. The program then changes the focus to the drive you want with the directories and subdirectories showing on the left side of the screen and the files showing on the right. Not only is this system more user-friendly, but you can see more of the directories and files you have at the same time. Some operating systems and file management programs limit you to looking at a small part of the directories, subdirectories, and files residing on your computer. For example, if you are in the WINDOWS directory, you can look at all the subdirectories and files DIRECTLY under this directory, but you can't look at the files in the WORD subdirectory unless you change to that subdirectory. Also, once you change to that subdirectory, you can see all the files and subdirectories under the WORD subdirectory, but you can no longer see anything else directory under WINDOWS. If you are sitting on the branch of a tree and can see all the leaves and branches leaving from your particular branch, but you can't see the rest of the tree.

3.1.3 The Root

The root directory is a general starting place on each drive. If you have a computer that is MS-DOS only, when you turn on this computer you see something that looks like `C:\>`. This, as we have noted previously, is called the C prompt. The backward slash with no words after it tells you your location in the computer's organized filing system is at the root directory of drive C. By typing a: and hitting the enter key you would see the prompt change to `A:\>`. This would indicate you are at the root directory of A drive.

Q. 6

Notice that a: was typed at the C prompt instead of A: in order to change the drive location. Was this a mistake? If not, why not?

(Answer on page 6-34.)

The root is important because you always know where it is. Which instructions make more sense?

Go into the third house on the right.

or

Start at the corner of 4th and Main. Face the water tower. Go into the third house on the right.

3.1.4 Directories

The directories are the next level after the root directory. The programs you install on your computer usually create their own directories, or you may create a directory to keep all your personal files in one place.

In the old days when floppy disks had only a few kilobytes worth of storage, and hard drives had not been invented, the root directory was all that anyone needed to know about. In those days, you could rarely fit more than a few files in a disk. All of your organization of files was based on which floppy disk you had in the drive when you saved a file. With advances like larger floppies and hard drives, the number of files that could be stored on one disk became much larger. It became much more difficult to work with files, because a hard drive might contain hundreds or even thousands of files! It became evident that some way of subdividing a large drive was necessary, so that all like files could be placed together in some way.

To move to a different directory in MS-DOS you would have to type the name of the directory at the prompt and hit the enter key. For example, you want to see how many subdirectories and files that are in the Windows directory. At the C prompt you type CD (for change directory) windows and hit the enter key. (Remember, MS-DOS is not case sensitive.) The next thing you will see on your screen is:

```
C:\WINDOWS>
```

This means you are now in the WINDOWS directory. Typing DIR at this prompt will show you the subdirectories and files under the WINDOWS directory. In a GUI system like Windows 3.1 you could change to the WINDOWS directory by clicking on the yellow folder beside the word windows. This opens the windows directory. What you see on the right of the screen are the subdirectories and files contained in windows.

Q. 7

You notice while looking at the windows directory that the word windows is in lower case characters. Does this mean that Windows 3.1 is case sensitive?

(Answer on page 6-34.)

3.1.5 Example

Let's say you have a computer with MS-DOS only on it and there are a lot of programs out there which require Windows 3.1 or Windows 95 to operate. You decide to upgrade your computer with Windows 3.1 because your computer is older and not quite powerful enough to run Windows 95. You install Windows 3.1 without any problem and after its done installing you check to make sure its on C drive by typing DIR at the C prompt. You notice there is a new directory called WINDOWS and sure enough, after changing to that directory and typing DIR again, lots of files fly by on the screen. Obviously, Windows 3.1 is a large program with many files. Creating its own directory keeps the subdirectories and files of Windows 3.1 organized and helps you, as the user find what you need.

3.1.6 Subdirectories

Subdirectories are the next level in the file management system after directories. In fact, there may be several levels of subdirectories under one directory before you get to any files.

3.1.7 Example

Let's say you are looking for the Clipart files on your computer. You wish to see what pictures are available so you can use one or two in a document for a class where you really want to impress your instructor. Since your computer has Windows 95 it should be easy to find these files, after all you can click on the different yellow folders to see what is contained in those folders. Under the Windows directory you find the subdirectory, Msoffice. Under this subdirectory there are several subdirectories, including Word. Under the Word subdirectory, there are several more subdirectories, along with some files. One of these subdirectories is the Clipart subdirectory. Oh, good, this is just what you were looking for. You click on the Clipart subdirectory folder and find the Clipart files which your computer has.

Q. 8 You can create your own directories, and subdirectories on the hard drive of your computer, can they be created on a diskette?

(Answer on page 6-34.)

Q. 9

Just because you can create directories and subdirectories on a diskette; does that mean you should do it?

(Answer on page 6-34.)

3.1.8 Files

A file may be considered an organized collection of computer information. Files are stored on the computer with the help of the operating system. Each operating system has its own convention for naming files; the requirements for UNIX are different than those of Windows 95 for example. Both MS-DOS and Windows 3.1 limit the number of characters used in a filename to eight before the period and three after the period, and spaces and punctuation (besides the period) are not allowed in these operating systems.

Like: Myfile.doc Yourfile.xls Herfile.txt

Although there is a limit of eight characters before the period, it is acceptable to use fewer than eight. Windows 95 allows more than eight characters for filenames, along with spaces. That is helpful as it allows the user to more completely describe a particular file. In fact, Windows 95 will allow up to 255 characters for a filename. Be careful using these features with too much abandon, however. Sometimes the spaces and longer names can get you in trouble. Experienced computer users often stick with the 8.3 naming convention regardless of the operating system they are using, because they know it will always work.

Q. 10

If you create a file while you are in Windows 95 and it has a long file name, what happens when you go switch to a computer using Windows 3.1?

(Answer on page 6-34.)

3.2 Tools Operating Systems Give You

3.2.1 User Interface

The user interface is what is present between you and your computer. As mentioned above, there are two main types of user interface, the command line, and the GUI. Both the UNIX and DOS operating systems use a command line interface. What the user sees on the screen when they boot up a computer with a command line operating system is called a prompt. The graphics, color scheme, buttons, mouse cursor, and many of the other things you might see on your screen are the user interface. Programs that are written for your machine depend on the user interface as well, so they all might have certain things in common. For example, in modern programs, the loading and saving mechanisms look very common among all the programs in an operating system. Loading a file in Windows 95 looks pretty much the same, whether you are loading a word processor file, a spreadsheet, or a graphic. These programs all look similar because they inherited the interface and file handling capabilities from the operating system.

3.2.2 Management Tools

The operating system also gives you and your programs a series of tools to help you manage files. Much of what the operating system does is not obvious to the user. Almost all programs interact with the operating system, but the user does not usually need to know when that is happening. Whenever you deal with the directory structure, you are dealing with the operating system, even if you are in another program. In addition to the things operating systems do for other programs, they have some special programs that help you control your system directly.

3.3 Handling Multitasking

3.3.1 Overview of multitasking

The concept of multitasking is critical to modern operating systems. Users depend on the ability to run more than one program at a time. This ability requires some extra work on the part of the operating system. Any operating system needs to have a way to keep track of which programs are currently open (meaning loaded into memory) and which one is ACTIVE. Only one program at a time is active. The active program is the one that is currently getting your attention. Usually the active program looks like it is in front of the others on the screen. It might overlap other programs that are visible in the background. An active program usually also has a different colored caption than other programs. Any program that is visible is open, but may not be the active program. Any multitasking operating system will have ways to switch between active programs and some way of determining which programs are active and which are open.

3.3.2 Multitasking in Windows 3.1

Open programs in Win 3.1 are usually visible on the desktop. If your active program is maximized, it is hard to see minimized open programs. Your best bet is to minimize everything that is running. In this operating system, all minimized programs are on the desktop. NOTE: This is NOT the way the desktop works in Win 95 and Mac. Double - Click on a minimized program to make it the active program. You can also use the control-tab or control - esc keys to look at the programs that are open.

3.3.3 Multitasking in Windows 95

Windows 95 added the taskbar to make multitasking a little easier. This bar, which is usually along the bottom of the screen, shows all the programs that are currently open. The icon for the active program looks like it is pushed in. You can switch to another open program by clicking on its icon in the taskbar.

3.3.4 Multitasking in Macintosh

The Macintosh system 7.0 and later handles multitasking pretty much the same way that the other operating systems do. There are a couple of key differences. In the Windows world, each window can have its own menu visible. If you have three windows on the screen, you could see three menus. In the Mac world, there is only one menu, and it is always on the top of the screen. It is conceivable to have a program showing on the screen and the menu from a completely different (!) program at the top of the screen. This happens quite a lot to beginners. The key to multitasking in the Mac environment is the programs menu., on the upper right hand corner of the screen. This menu shows a little icon representing the currently active program. If you open the menu, you can see all the other open (inactive) programs. If you use this menu to hide programs, the only way you can get back to them is through the programs menu again. If you get in trouble on a Macintosh, the first thing to do is check to see if you are using the program you think you are using.

4 File Management Programs - for Exploring the Disk

One major kind of operating system utility is called a file management program. It can be completely integrated into the operating system (as in Mac System 7+) or a separate program (like the Windows 3.1 file manager). Regardless of how you get to it, any file management program works pretty much the same way, and has the same things to offer you.

4.1 Things you can find in any file manager program

4.1.1 An indicator of the current drive

Most file management systems insist on thinking of one drive at a time. Somewhere on the screen you should see some kind of indicator telling you which drive you are on. Make sure you know this! People often get very lost looking for something to find out they were not even looking on the right drive!

4.1.2 A way to change drives

Often there will be some kind of pictures or descriptions of the different drives available in the system. You can usually change drives by clicking on the picture of the drive you want. If clicking doesn't do what you want, try double - clicking, or right - clicking. You never know.

4.1.3 A picture of the tree structure

Most file management utilities have some kind of graphic representation of the tree structure. Often this representation looks like a tree or an outline. Many times part of the screen will be dedicated to this picture of the overall structure of the current drive. Since there may be more subdirectories than can be shown on one screen, there will probably be ways to scroll among the branches of the tree. You may also have the option to look only at certain levels of the structure. This is handy when you are interested in gaining a 'big picture' of how the drive is organized

4.1.4 An indicator of the current directory

There should be some way of determining where you are in the directory structure. There may be some scary looking path, like

`C:\users\cs100\examples`

or you may just have to rely on the directory listing to know where you are.

4.1.5 A list of subdirectories on the current directory

You should be able to find a list of the subdirectories that your current directory has access to. Sometimes you will see this as part of the picture of the tree structure. Sometimes subdirectories will look like little folders. Sometimes subdirectories will be listed in the same place as files! You can usually tell the difference, because the subdirectories will often have an icon like a folder to indicate they are not simply files but directories. Note that there might not be any sudirectories in a specific directory.

4.1.6 A way to change directories

The list of directories is often clickable. If you see a subdirectory that looks interesting, you may be able to click on it to change. As always, try clicking. If that doesn't work, try double - clicking or right - clicking.

4.1.7 A list of files on the current directory

Of course the reason to have directories and subdirectories is so they can contain files. You will usually see a list of the files in a directory. You might just see the names of the files, or you might see the names with little icons that represent what kind of information the files contain. Often if you double-click on a file, something will happen. If the file is a program, it will run. If it is a document, the operating system will try to open the proper program for viewing or editing the file. For example, if I have a program called "Letter.doc" on my drive somewhere, I might navigate my way to that file and double - click on it. When I do so, my operating system recognizes by the ".DOC" extension that this is a program for Word, and it runs word with my letter loaded up and ready to edit. Cool!

4.1.8 A way to back up to the previous directory

Sometimes you will see .. (two dots) listed as a directory. That is a special name for the PARENT of the current directory. Select this to "back up" a level towards the root directory. When you first look at a disk, check to see if you are looking at the root directory. If not, it is a really good idea to start navigating by going to the root. Just keep backing up until you are at the root.

4.2 Common File Management Programs

4.2.1 File Manager (Windows 3.1)

File Manager is the file management program provided by Windows 3.1. It helps you do things like copy files, delete files and format a disk. When File Manager is open you will notice on the left side of your screen a bunch of yellow folders with words written beside each yellow folder. On the right side of the screen may be some more yellow folders, and other pictures with words beside them. In File Manager language, the left side of the screen is called the "Tree" and the right side is called the "Directory". The Tree side shows the root directory along with the directories and subdirectories of the drive in which you are focused. Its easy to change the drive focus by clicking on a different drive box. Of course it is necessary to have a diskette in drive a: or b: before clicking on either of those drive boxes. (Why?) In File Manager the File menu lets you do things like copy files, rename files and run programs. The Disk menu makes it easy to format or copy a disk.

4.2.2 Explorer (Windows 95)

Windows 95 Explorer shows the drives, directories and subdirectories that are on your computer on the left side of the screen. If the drive or directory is closed you see a plus sign beside it; if it is open there is a minus sign. On the right side of the screen are the directories and/or files. In Windows 95 Explorer the view of the files on the right side (how they look) can be changed depending on the preference of the user; if you like large icons the files can look like large icons; if you like lists the files and directories can be listed. Explorer will help you find, copy, rename, and delete files.d

4.2.3 My Computer (Windows 95)

My Computer in Windows 95 allows you to search for directories and files on every drive on your computer, copy files, and format diskettes. The My Computer icon is always on the desktop and may be opened by double clicking on it. The view of folders and files may also be changed to a list or icons, depending on the preference of the user, just as in Windows Explorer. One of the main differences between the two file management programs is that in Windows Explorer you work in one window, and in My Computer you work in successive windows as you open folders to look at files.

My Computer can be set up to look at only one window at a time. My Computer may be the most comfortable approach for those who are used to the Macintosh operating system.

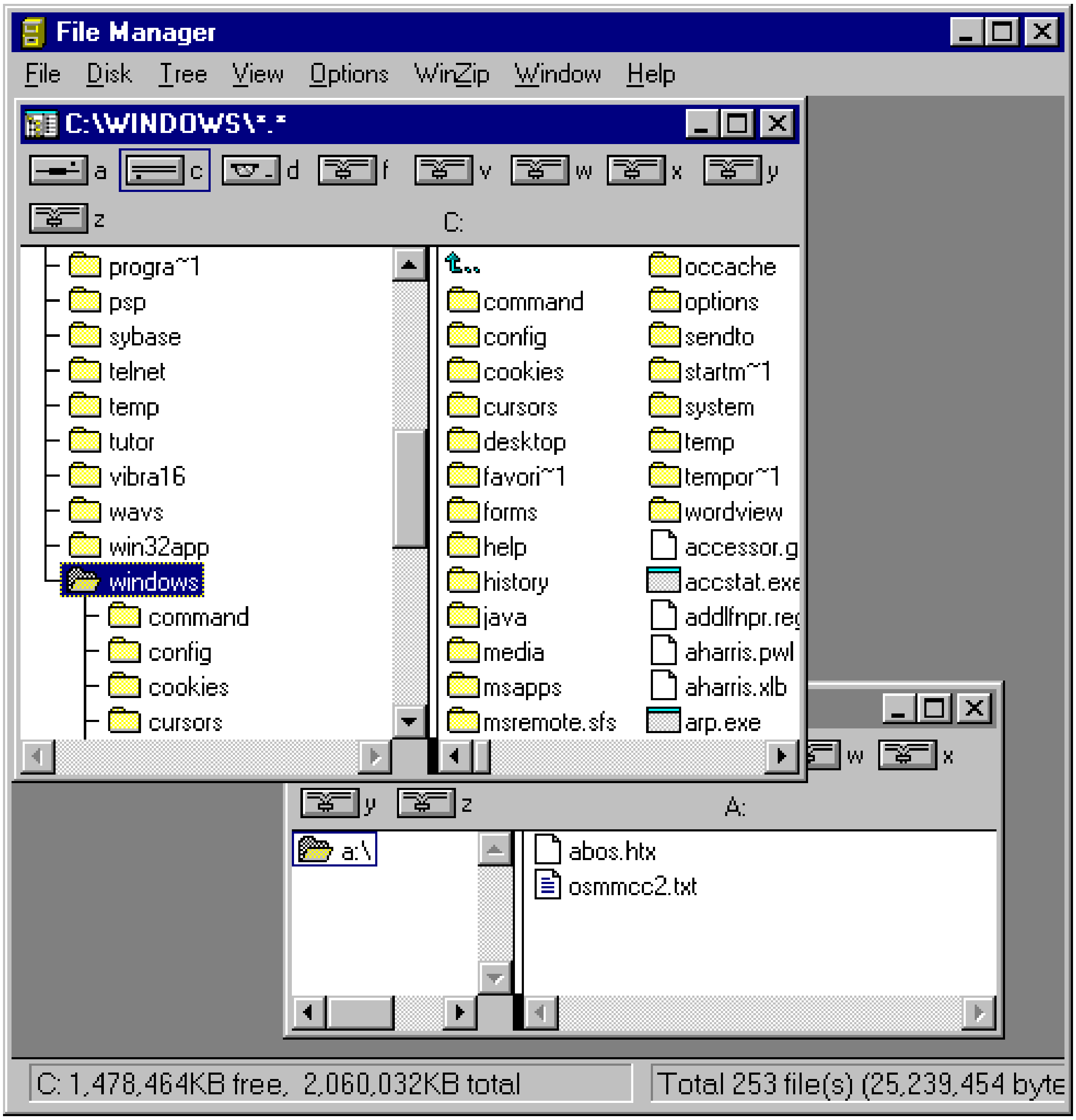

Figure 1: The File Manager

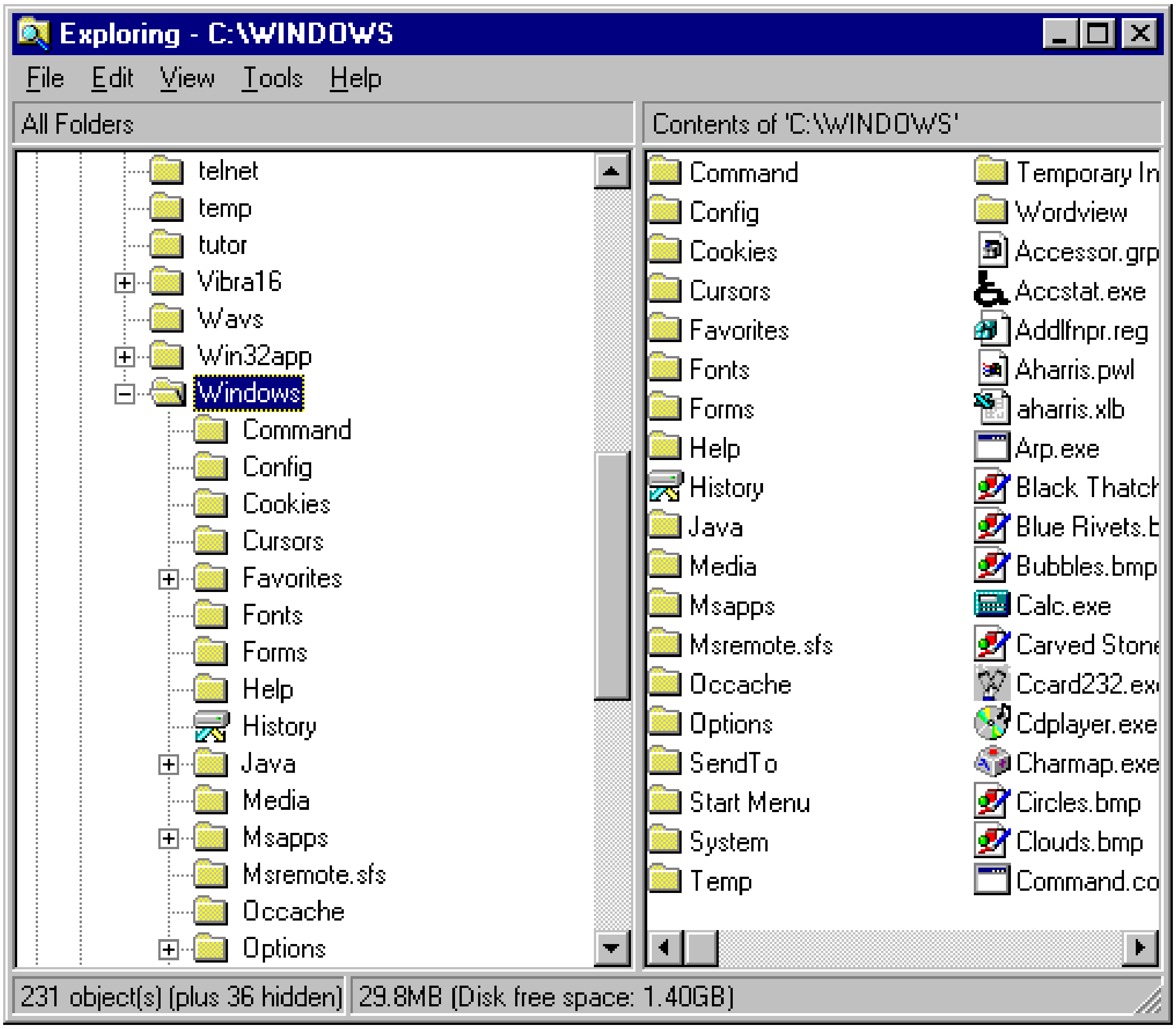

Figure 2: Windows (95) Explorer

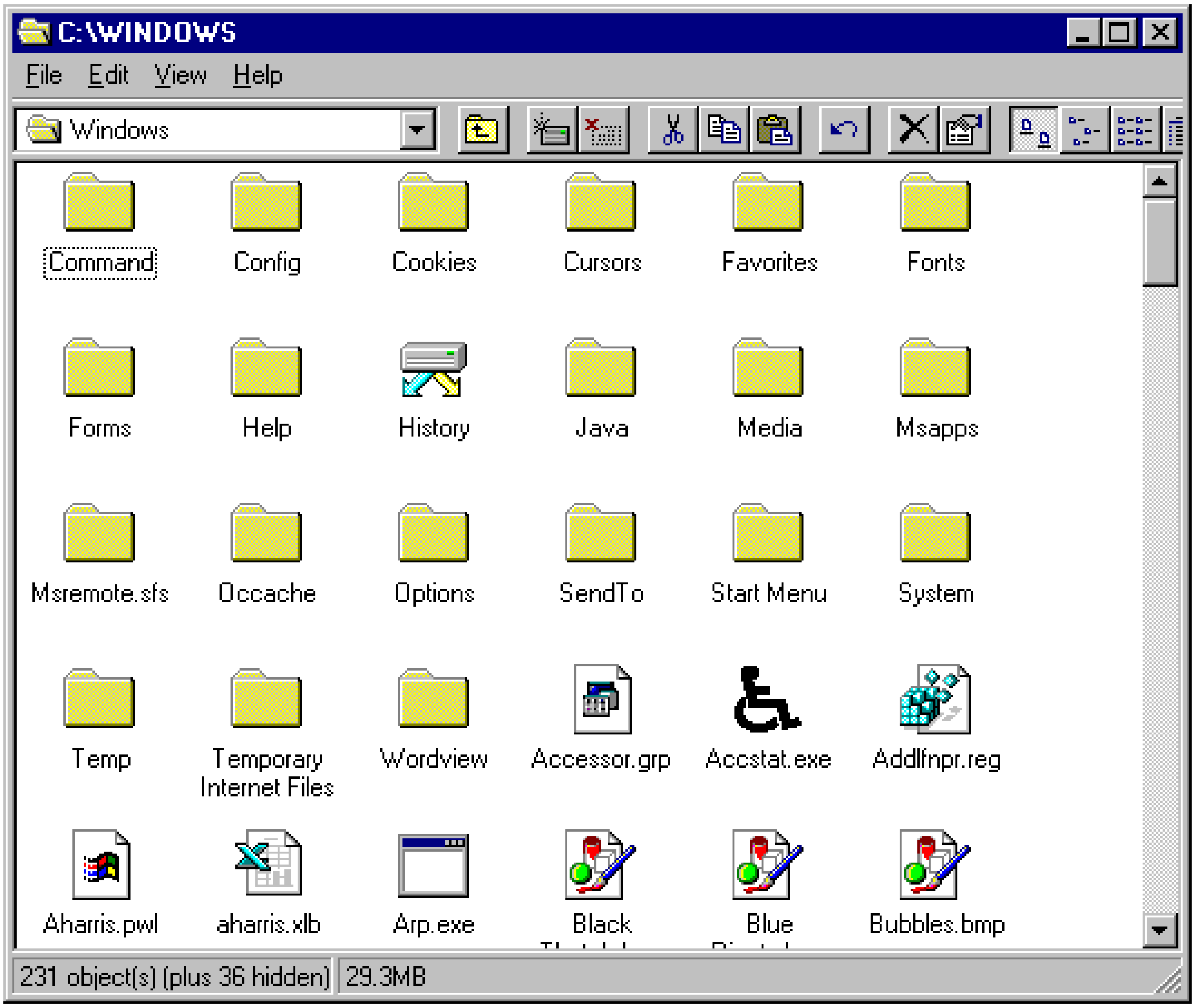

Figure 3: “My Computer”

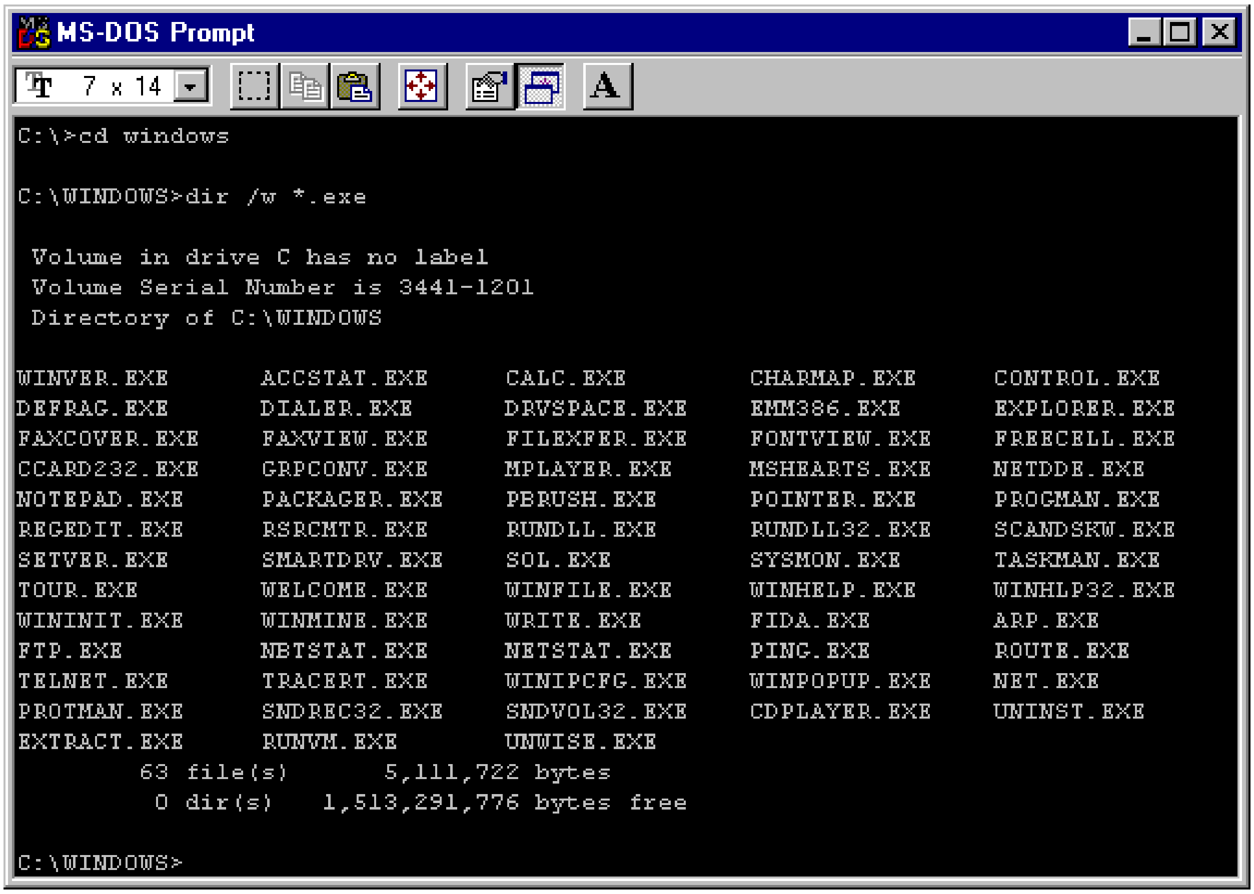

Figure 4: Command line `dir` command

4.2.4 The Mac Desktop (Macintosh)

In Macintosh computers the Desktop is where you launch and store programs, copy files, make alterations in the way your computer works, etc. The icons that appear on the desktop may be for drives, applications, folders, or documents. Applications, or programs are used to create documents and folders are to help organize programs and documents. (Does this sound familiar?) Just as in other operating systems, in System 7+ there are several ways to do things. For example, on the Desktop, there are several ways to start a program. You can click once on the icon and then choose open from the File menu. The program can also be started by clicking twice on the icon or by using a keyboard shortcut; the command key plus the letter O. These choices let you decide what works best and is the most comfortable for you.

4.2.5 File Management in a command line system

There are file management programs in command line systems, but most file management is done by interacting directly with the operating system. To do this, you have to know the commands and syntax. Below, you will see a picture that illustrates changing to the windows directory and looking at the files in that directory using DOS.

4.3 Problems File Management Systems can Help You Solve

4.3.1 Organizing Your Disk

File management programs help you organize directories, subdirectories, and files so their location makes sense and you can find files when you need them. Most computers have several different drives, including c: or the hard drive, the diskette drives, a: and/or b: and d: which is usually the CD-ROM drive. Organizing the many directories and the hundreds of files can be very challenging, especially to the uninitiated. The good news is however, that file management programs are very good at helping solve this problem and the organization of directories, subdirectories and files is very similar no matter which operating system you have.

Q. 11

What is the file and directory structure like in any operating system?

(Answer on page 6-35.)

4.3.2 Finding Where Things Are

All though the details for finding things in your directory structure can vary greatly depending on what your computer configuration is like, what operating system you are using, and which tools you use, there are some strategies you can use to help find files efficiently.

Your program may have a searching tool. The start menu in Win 95 has such a tool. You can also access such a tool in Macintosh by hitting the command key with the F key. Search tools usually ask you which drive you want to start on. They also may ask which directory of the drive you want to access.

If you can't find a searching tool, or you just want to browse, use some sort of file management tool. Use that tool to follow the following algorithm:

- Guess which drive contains the file you are looking for. Choose that drive.
- Go to the root directory of the drive. You would be amazed how often people miss this step and get totally baffled.
- look at the files in this directory. Do you see the file you want? If so, activate it. You're done!
- If you don't see the file you were looking for, look at the subdirectories of this directory. Choose the most likely subdirectory and go there. Repeat the last three steps until you find the file or reach a dead end. If you reach a dead end, back up until you find another likely path, then keep searching. How you apply this technique depends entirely on the operating system and file management program you are using. In the lab, you will find the same file using different commands in different programs, but the algorithm never changes.

4.3.3 Manipulating Files (Copying, Deleting, etc.)

File management programs give you the tools you need to copy files, delete files, and rename them. Again, depending on the operating system, the way you accomplish these tasks is a little different. In command line systems like MS-DOS the commands to copy, delete, etc. must be typed in. To copy a file in MS-DOS you would type something like the following at the prompt.

```
c:\>copy myfile.doc a:
```

What this command would do is copy the file called myfile.doc from c: drive to a: drive (the diskette drive). In Windows 3.1,Windows 95, or System 7+ operating systems files may be copied by using the mouse to "drag and drop" the icon which represents the file. Of course, there are several ways to accomplish these tasks; pull-down menus may be used to copy, delete, or rename files for example.

4.3.4 Manipulating Directories (Making New Ones and Naming Them)

There are times when you want to create new directories and subdirectories in order to improve the organization of your computer. This is easily accomplished in GUI systems by using pull-down menus and choosing a command that says something like create directory for example. Its a little more difficult in command line systems; in UNIX you would type the command mkdir at the prompt followed by the name of the directory you wish to create. In MS-DOS the command is: MD new directory.

4.4 Tools File Management Programs Give You

4.4.1 Visual Representation of Directory Structure

Graphical interface systems give you a visual representation of directory structure. Whether you are working in Windows 3.1, Windows 95 or System 7+ the directories and subdirectories are represented by yellow folders.

4.4.2 Drag and Drop Features

In GUI systems copying files is easy because of the drag and drop capabilities in these systems.

4.4.3 Graphic Representation of Files and Directories

Files and Directories are represented by icons in GUI systems. Copying, deleting, and moving files or directories is easy with a mouse and the drag and drop feature.

4.4.4 File and Directory Manipulation Tools (Menus & Toolbars)

These GUI operating systems give you ways to handle directories and files other than manipulating the icons which represent them. There are pull-down menus and toolbars with menu choices and tools to help you perform the tasks of copying, moving, and deleting files.

4.4.5 Example

Dave is an FBI agent working on a complex case involving many computers and several operating systems. He has learned that there is a specific person who has vital information on her computer the FBI needs to make their case. He manages to get into her office, but Dave only has ten minutes to download the information onto a diskette he just happens to have in his pocket. He has never used her computer before, but because he understands how operating system file management systems work, he feels confident he can get the information he needs in less than ten minutes.

He sits behind the computer and since it is already on he feels lucky, he won't have to wait for the computer to boot up. He moves the mouse to remove the screen saver and sees that this particular computer has a Windows 95 operating system. Although Dave has used MS-DOS and UNIX operating systems, he is glad that this computer has a Windows 95 operating system because he won't have to take the time to type commands.

The file he is looking for is called test information.txt. Dave knows by the extension that the file is a text file that was created by a word processor. The first thing he does is start Windows Explorer by clicking on the start button on the task bar at the bottom of the screen. This gives Dave a pull-up menu with several menu choices including programs. He clicks on programs and then chooses Windows Explorer. He then repeats this process to open Windows Explorer again. As soon as they are both open he places his diskette into drive a:. He then changes the focus of one window to a: drive. He moves his mouse to a blank place on the taskbar and clicks the right mouse button. He has some more choices, including Tile Horizontally which he clicks. The two windows then line up nicely on the screen.

Dave then takes a look at the window which is focused on c: drive. There are many directories and subdirectories, but Dave only has seven minutes left, so he doesn't have time to search every subdirectory for the file he wants. He clicks on the various menus to see what choices there are and he is in luck! In the Tools menu there is a command called Find. He clicks on this command and a dialog box appears. This dialog box gives Dave a place to type in the name of the file, along with a place to enter the drive where the file lives. He enters the name of the file and the location, then clicks on Find Now. He waits about one minute while the program looks for the file then it is located. Dave then uses the click and drag feature to click on the file icon and drag it to the a: drive window. He waits the few seconds this procedure takes; closes both copies of Windows Explorer and removes his diskette. He leaves the office with two minutes to spare!

Figure 5: The Program Manager

5 Symbolic Representation Schemes

5.1 Common Programs

5.1.1 Program Manager - Windows 3.1

Program Manager is the main program in Windows 3.1. What you see when you look at Program Manager are various program group icons. If you double click on these program group icons the program groups are opened and other icons are visible. These various icons are symbolic because they do not really represent files or directories; they are pathways to files, programs or directories. These icons may be deleted without deleting the file itself. If the icon is deleted, the program is still in your computer. The icons may also be copied into several program groups for the convenience of the user. For example, file manager is used so frequently, the icon (which is usually a yellow file cabinet) is copied from the main program group to other program groups such as accessories.

5.1.2 Start Button - Windows 95

The Start Button on the taskbar in Windows 95 also uses a symbolic representation scheme. The menu choices on the Start Button may be added or deleted as the user wishes, without effecting the files and programs themselves.

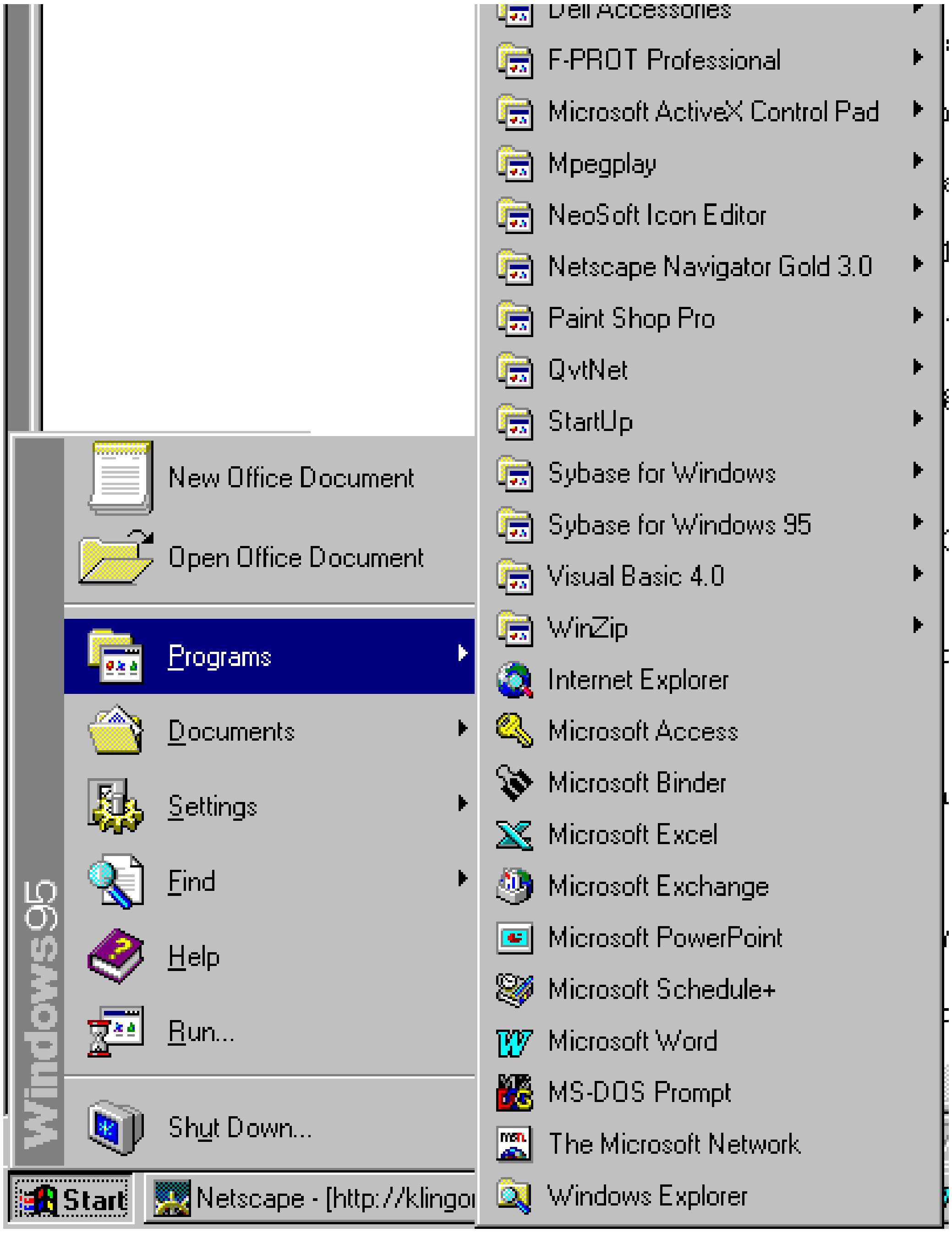

Figure 6: The "Start" Button

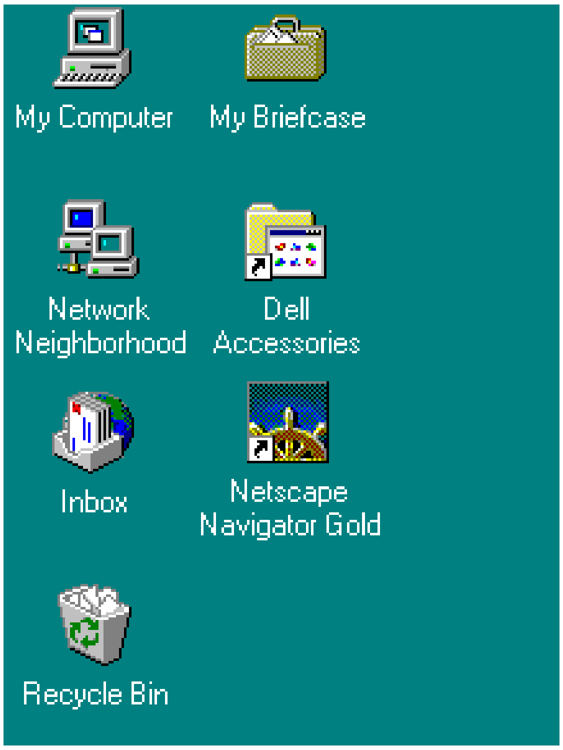

Figure 7: The Windows 95 Desktop

5.1.3 Desktop - Windows 95

The Desktop in Windows 95 contains icons which are shortcuts to launch programs. These icons are also symbolic representations; deleting, creating, or moving them does not affect the files or programs themselves. Desktop shortcuts are very handy to launch programs and are very easy to create. However there is probably a maximum number of shortcut icons you should have on the desktop. (Why?)

5.1.4 Apple Menu - Mac System 7+

The Apple Menu on System 7+ works in very much the same way the pull-up menu from the Start Button in Windows 95 works. Just as in Windows 95, the Apple Menu gives you menu choices that are symbolic. You will notice that some of these menu choices have arrows pointing to the right. If these items are highlighted other menus appear with other choices. As these items are symbolic representations of directories, subdirectories, and files, deleting or copying does not affect the underlying files, just as is the case with other symbolic representation schemes.

5.2 Problems Symbolic Schemes are Good at Solving

5.2.1 A Custom File System

One theme of the GUI revolution is the ability to custimize your computer to the way you think and work. The tools we have talked about so far are great at dealing with the physical structure of files and directories on your disk, but the way your disk is organized may not be the way you want to think about your files. For example, most modern program install themselves, and put themselves in directories they create. If you don't like the way the program is stored on the disk, you could change it, but that would be a lot of work. Also, you may have all the word processor files in one directory, all the spreadsheets in another, and so on. This may be convenient sometimes, but you may want to organize things differently, by project, for example. You might have a project that uses some word processor files, some spreadsheet files, and some other programs. You might want to have copies of all these programs organized together. You might also want to have copies of common programs available in a number of ways. One solution would be to actually copy these files over through a file management system, but such a solution would be difficult, prone to errors, and tedious. Wouldn't it be great if there were some way you could make little shortcuts to programs and files that could be easily manipulated?

5.2.2 Virtual Files, Virtual Directories

Most operating systems have some features that give you exactly that flexibility without requiring you to change the physical locations of things on the hard drives. You can use such a system to place the programs and files you need most frequently in special areas that are easy to access. In your symbolic structure you have some way of creating groups of programs or files. These groups might be in a menu (like Mac System 7 or Win 95 start menu), they may be in folders, or they might be something else! The icons you create in a symbolic structure are generally POINTERS to files, rather than the actual files. The advantage of this approach is that you can comfortably delete a symbolic link to a file without deleting the actual location of the file.

5.2.3 Example

Mitch teaches a computer science introductory class. He has people work on word processing, spreadsheets, databases, and internet programs. All these programs have already been installed on his computer. He wants to put them in a group together, but he doesn't want to change where they are on the disk. Since he is using Windows 3.1, he knows that the program manager is the main symbolic management program in the system. He goes to Program manager, and surfs the menus until he finds an item called "new program group." He selects that option, and gets a prompt for the name of his group. He decides to call it CS100. When he looks at program manager again, it has a number of groups available. One of the icons says CS100. He double clicks on it, and finds it is empty. He isn't too concerned about this, because he wants to put stuff in it. He opens file manager to find the files and programs that he wants in this CS100 group. (because Windows 3.1 can handle multitasking, it is no problem to have two different programs open at once) He finds his word processing program in file manager, and drags it to the CS100 group window in program manager. An icon for his word processing program magically appears in the CS100 group! This is just a SHORTCUT to the word processing program. The file has not moved at all. It is still where he found it in file manager. He repeats this process with all the other applications and files that he wants.

Q. 12

What if Mitch changes word processors? If he deletes the word processing icon in Program manager, will his program be deleted from the disk?

(Answer on page 6-35.)

When Mitch moves on to Windows 95 (Get with the times, Mitch!) he can do similar work. Windows 95 still has program manager, but most people prefer to use the start menu or desktop. Common files can be dragged to either of these things and will become part of that symbolic structure.

5.2.4 Example

Sally's computer has Windows 3.1 and she wants to take advantage of the symbolic representation scheme available in Windows 3.1 to organize some files for an important project she is developing for her job as a teacher. She spends a lot of time working on this project and she would like to be able to find all the files related to this project quickly and easily. Sally works on several different computers, including the one she has at home, and having all the files in one places makes it very convenient to copy the files to a diskette and transport them.

Her word processor which is Microsoft Word has been installed in its own directory, called Word. The spreadsheet program she has chosen for this project is Microsoft Excel, and it has been installed in the Excel directory. Because she is going to present this project to a group of teachers she has developed a presentation in Microsoft Powerpoint which is a graphics program which has been installed in the Powerpoint directory on her computer. Sally decides to create a program group in Program Manager called Sally's Project. She doesn't remember how to create a program group because this isn't a task she does very often. She clicks on the help menu and then chooses search from the toolbar. She types in create program group and the help window tells her what she has to do to create a program group. She follows the instructions and creates her Sally's Project program group.

Sally then opens this empty program group and goes back to the help menu to see how to create icons for all her project files. The help file tells her she can create icons from the files in File Manager, so she opens the File Manager program and follows the help instructions to create the icons she wants. Sally then has symbolic representations for all the files involved in her project.

6 Laboratory Assignment

BE SURE to follow along with your instructor. If you move ahead and get lost, we won't help you return. Don't worry about the THOUSANDS of details you will learn today. Concentrate on the strategies. They are what you really need, anyway. The specific commands will change. The underlying strategies will not. Learn HOW to do things, not just WHAT to do.

Pay close attention to your instructors. This lab will be a little different in every computer laboratory, so your instructions might vary. You may or may not be able to do all the parts of this lab assignment. Check with your instructor.

6.1 Getting to a Program Symbolically

You have already done this a couple of times, but let's find a program you have never found before!

Your job is to find an ACCESSORY program called Paint (or Paintbrush). Use a symbolic representation scheme (Start menu on Windows 95 or Program Manager on Win 3.1) to find the Accessories.

If you are using Macintoshes, your instructor will tell you how to find a paint program through the Apple window.

Fumble around a little bit! It's ok to be lost. You CAN find it. Run the program.

6.2 Doing Windows

GUI environments put all programs in entities called windows. (Thus, the name of the operating system!). It is possible and often necessary to manipulate a window.

6.2.1 Maximizing

There are buttons on the upper right corner of many windows that allow you to do some manipulations with the window. Play with these buttons in the paint window and see if you can figure out their purpose. You should find a button that makes the window fill up the entire screen. This is called maximizing. It is often a good idea to maximize a program if you are doing a lot of work on it. This helps you concentrate on the project at hand, and keeps other programs out of the way. It also gives your current program all the screen real estate.

6.2.2 Minimizing

You will find another button on the upper right that makes the program seem to disappear. It is NOT really gone! This behavior is called minimizing. If you look carefully, you will see that the program icon is still visible somewhere. If you are in Windows 3.1, you will see an icon for the program on the desktop. In Windows 95, you will see an icon for the program in the bottom row of the screen. Double click on the icon, and the program comes back.

Q. 13

Why on earth would you want to do this?

(Answer on page 6-35.)

Note that Macintosh does not currently have a way to minimize a window. The closest equivalent would be hiding the program in the programs menu.

6.2.3 Resizable Windows

You may also find an icon that allows you to have a window that is neither minimized or maximized. You can make this window just about any size you want by dragging the sides or corners. Play around with this feature in your paint program until you are confident you can make it any size you want.

You can also move a resizable window. Usually this is done by dragging the TITLE BAR (often it is a dark color, and it usually has the name of the program or the file). Try moving your paintbrush picture around as well.

The resizing and moving options are useful when you have more than one program running at a time.

Many operating systems also have a tile command available on the menus that automatically give each program you have open the same amount of space on the screen. This can be a very handy feature.

6.3 The Picture of Success

Use your painting program to draw a lovely picture. Or use it to draw an ugly picture. You have a time limit. It's ok if you don't know exactly how to do things. Experimentation is good. Everything you need is available through icons, menus, and online help.

6.4 Saving

When you are satisfied with your masterpiece, we are going to save it to your disk. You should have no problem finding a save command. Stop for a second when you get to it.

You will find something that might look like Figure 8.

If you look carefully, you will notice that this dialog box is a miniature file management program (!) Right now, it is pointed at some strange directory. (Yours will be different than mine, I'm sure) The important thing to know is that the box shows you a directory structure and some files. This probably isn't where you want to save your painting. (Remember, we wanted to save it to our floppy disk, which is called A) Try to back up to something you recognize. You will eventually encounter something like Figure 9.

You can see that we now have a pointer to the A: drive. Cool! Click on it to go there. (Make sure you have your disk in the drive first!!!) Right now, we have never saved the file, so the program doesn't know what to call it. Let's give it a name. MyPaint would be a good name. If you're in Win 95 or the Mac system, you could use a more elaborate name with spaces and a longer more descriptive title, but MyPaint seems fine. If you want, you can put the .bmp part on (making the name MyPaint.bmp) but if you don't add the extension, most programs will add the right

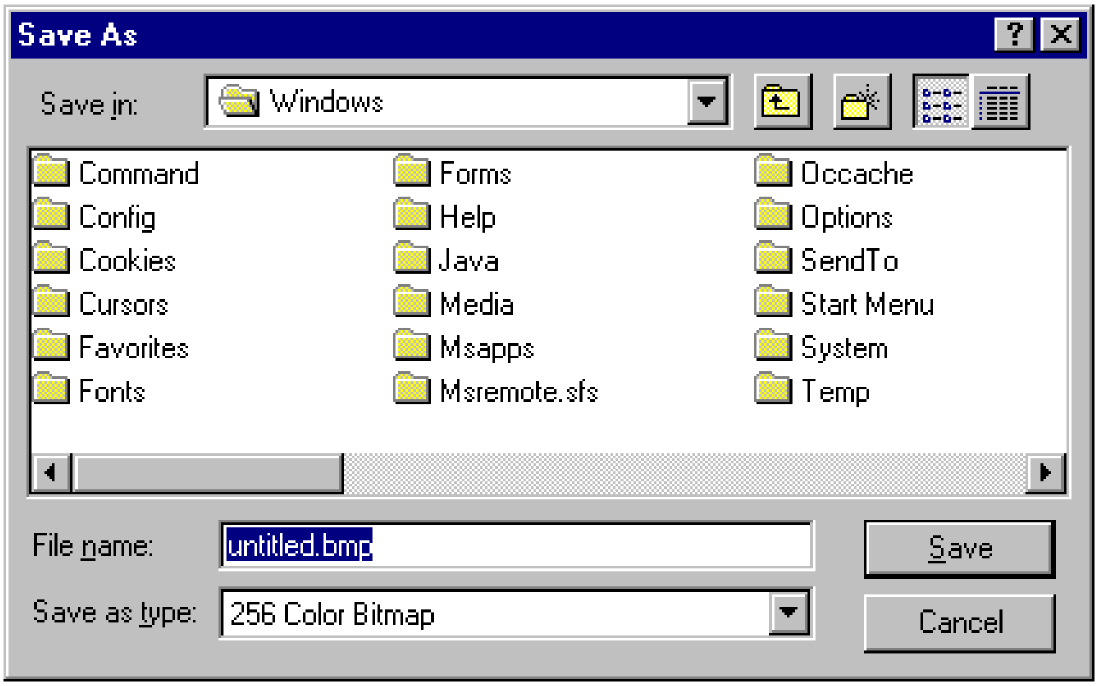

Figure 8: Save dialog 1

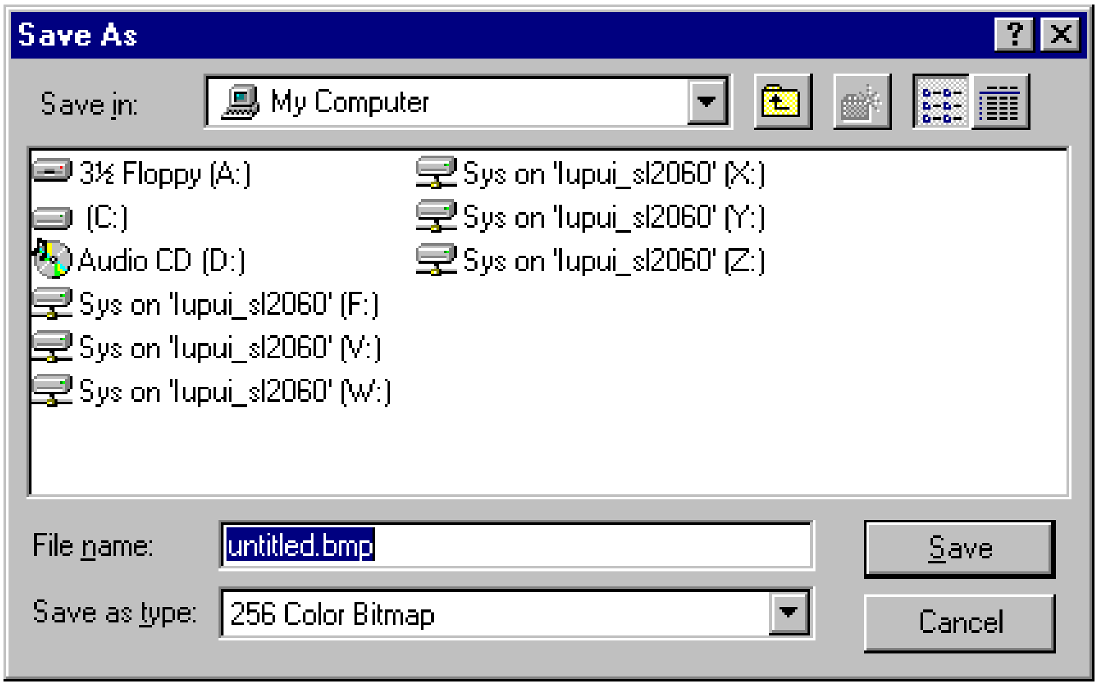

Figure 9: Save dialog 2

extension for you. It's a bad idea to change the extension to anything but .bmp, because the extension is what the operating system uses to know the file was created in paintbrush. Type the name in the Filename box, or whatever facsimile you see.

Hit the Save button. Wheeeeee! You should see the light on the A: drive light up. Close the Paint program. (Close it all the way. Don't just minimize it)

Re-open the paint program. Choose Open File from the file menu. Note that we will once again have to look for the A: drive.

Try to load up your file.

Close Paint one more time.

6.5 File Handling

6.5.1 Using A File Manager

Use a file manager to locate your file again. If you are in windows 3.1, find the file manager icon (a file cabinet) with Program Manager

If you are in Win 95, find windows explorer from the start menu On the Macintosh, you are already in a file manager when the computer is turned on. (wow!)

Once you get into the file manager, look at the floppy disk. You are clever. You don't need the details!

Double click on the icon that represents your painting. There it is!!!

Minimize (don't completely close) your paint program.

6.5.2 Multitasking

Notice that the file manager program was already open, but selecting your painting caused your paint program to open as well. Two programs are open at the same time! This is an example of multitasking. There are some key concepts here you need to be aware of.

- More than one program can be open at a time. (but you figured that out.)
- Only one program at a time is active.
- The active program looks like it is in the front of the screen (nothing overlaps it), and it usually has a darker caption bar than the other programs.
- You can often see programs that are NOT the active program in the background. If you click on one of these programs, it will become active.

Try it now. Make sure your paint program is sizable so you can see the file manager in the background. Click on the file manager. Look what happens! Go back to the paintbrush program if you can by clicking on it. Different operating systems handle multitasking differently, but all have ways of showing you what the open programs are.

6.5.3 Creating a new subdirectory

Get back to your file management program.

Go to your main hard drive root directory Create a new subdirectory from the root called MYTEMP. (If there's already a MYTEMP, call yours something else. It doesn't matter what.)

You may have to look on menus for the command to create a new directory. Explore! Be bold!

Copy your file from your disk to the new directory. There are a number of ways to do this. Compare your method with what your classmates discover.

Delete your subdirectory. Note that you have to delete your file first. It's OK. You still have a copy on your floppy disk.

6.5.4 Try it again with another file manager

Try to repeat the process above with another file manager, like Windows Explorer, or Win 3.1 file manager. The commands may be different, but the concept is the same.

6.5.5 Demonstration of DOS

Your lab instructor will demonstrate how exactly the same project can be done in a command line. Note that there are commands to type, but the principle is the same. If time allows, you may also see a demonstration of UNIX.

6.5.6 Running Tutorials

Most modern operating systems have very nice tutorials that explain how to use the system. Run a tutorial and go through the steps. If you are in Windows 95 choose help from the start menu. If you are in Windows 3.1, choose Help With Windows from the program manager help menu. In the Macintosh world, find a file like "Getting started with Macintosh". Your instructor will help you find the correct tutorial. (To a point.... You are pretty clever at this stuff now!)

6.6 Your assignment

Your instructor has hidden a special file somewhere in the lab network. She or he will give you some hints about how to find that file. Your mission is to find the file and copy it to your floppy. You will need to turn in your floppy to the lab instructor. You will be graded on the presence of this special treasure and your painting. Don't worry, we won't grade you on your artistic abilities!

7 Vocabulary/Important Concepts

Operating System An operating system is a special computer program that controls and monitors the hardware and software within a computer system.

Directory A directory is a main branch in a file management system. The root directory is where the directories are located.

Subdirectory A subdirectory is a directory which is located on levels below the directory level. For example, if you see `C:\WINDOWS\WORD>` in your file management system, WORD is the subdirectory.

File A file is a collection of data that exists at the end of the directory structure; below the last subdirectory branch. The three character extension in a file name helps you tell where the file was created.

Icon A small picture you may click on to do things on a computer.

Interface The interface helps you interact with the computer; it is what comes between you and the hardware and software.

GUI Graphic User Interface. This interface allows you to point and click on an icon to perform computer operations. Windows 3.1 and Windows 95 are examples of operating systems that have graphical user interfaces.

Command Line Interface An interface in which you must type all the commands which are to be executed by the computer. MS-DOS and UNIX are examples of this type of interface.

Case Sensitive An operating system that responds differently to lower case characters and upper case characters. UNIX is an example of this kind of operating system.

Booting Loading the operating system into memory, i.e. turning on your computer. This expression originated with the idea that the computer is becoming active by "pulling itself up by its bootstraps".

Formatting Preparing a disk drive to receive information. Disks must be formatted for the specific operating system they are to be used on.

File Manager The file handling system in Windows 3.1. This system allows you to move files, copy or delete files, create directories, etc..

Drive Box Drive boxes let you click on them to choose different drive views in the File Manager program of Windows 3.1.

Task Bar The bar in Windows 95 which is usually at the bottom of the screen. The task bar has the start button, and holds icons for minimized programs.

Prompt In command line interface operating systems the prompt is what appears when your computer is booted up. It "prompts" you to type in commands.

Path The path includes the directories and subdirectories you must go through to find a particular file; i.e. in a command line operating system, what you must type and in what order to locate a file.

Syntax The exact way a command must be entered or typed in order to work correctly.

Windows 3.1 An operating system developed by Microsoft with a GUI interface.

Windows 95 Windows 95 is an upgrade to Windows 3.1 which was released in August of 1995. It is also a GUI operating system.

MS-DOS Microsoft Disk Operating System. Sold to IBM by Bill Gates for use with their PC in 1981, MS-DOS became the industry standard for IBM and IBM type computers.

UNIX UNIX is a command line interface operating system which is the most commonly used operating system for multiple computers.

System 7+ System 7+ is the operating system developed by Apple Computer for its Macintosh computer. It is a GUI operating system

Multitasking Running more than one program at the same time on a computer, i.e., having more than one program open.

8 Summary

Operating systems control the memory and files of the computer. Operating systems set up the user interface which helps you as the user interact effectively with your computer.The two kinds of interfaces available are GUI which is graphical user interface, and command line interface. Operating systems also have file management programs to help you copy, move, delete and organize directories, subdirectories, and files. Operating systems also have symbolic representation schemes to further help the user interact with files and programs.

9 Review Questions

Q. 14 What is a GUI?

(Answer on page 6-35.)

Q. 15 What is a command line interface?

(Answer on page 6-35.)

Q. 16

Describe how you would copy a file from the hard drive to your diskette while working in Windows 95.

There are several ways to accomplish this task, including opening two copies of Windows Explorer and dragging and dropping the file from c: drive to a: drive.

Answers to Questions

1. Having software that was specific to a certain computer limited the kind and number of computer programs you could have for your computer. For personal computer users there are now two major platform choices, the IBM type, or the Apple Macintosh computer.

2. Because the programs share time on the CPU, the more programs that are running and the more they must share the CPU time, the less CPU time each program will have. So, there is a maximum limit to this number, much like there are only so many things you can do at once.

3. If your computer "locks up" or refuses to do anything for you, this is a time when you might want to perform a soft boot. Also, some programs require you to soft boot the computer during installation in order to activate changes in some particular computer files.

4. Microsoft included MS-DOS with the Windows 95 operating system so people who still used programs that required DOS in order to run would be able to run those programs. Windows 95 was designed to be a user-friendly environment with lots of different ways to perform the same tasks. For example, it has been estimated that there are eleven ways to start a program in Windows 95.

5. When you click on a pull-down menu, another menu will drop down and give you choices which allow you to do things that are related to the first command (the word you clicked on to drop down the menu). If you look closely at the items on the pull-down menu you will notice some of them have symbols with letters to the right of the word. Those are called shortcut keys; they allow you to do the same things as clicking on the words in the pull-down menu without having to use the menu. For the Macintosh computer, most shortcut keys start with a symbol that looks like a cloverleaf and a letter. For example, to open a file, you hold down the cloverleaf key and then press O. The cloverleaf key is called the command key.

6. DOS is an operating system which is NOT case sensitive. This means we may type either a: or A: in order to change the drive. DOS sees both of these characters as the same thing.

7. No, neither Windows 3.1 nor the new operating system, Windows 95 are case sensitive.

8. Yes they can, and this is done in exactly the same way you would create new directories and subdirectories for the hard drive. In DOS you type the command MD (for make directory) or if you are working in UNIX you enter the command mkdir. In Windows you would use menus or icons to help you create new directories and subdirectories.

9. That depends on what files you have on your diskette. For example, if you are taking several classes, you may want a separate directory for each class. Why?

10. There shouldn't be any problem using the file in Windows 3.1, however Windows 3.1 will shorten the file name to the required 8.3 characters, so you would need to keep that in mind when you are trying to locate your file.

11. File and directory structure is very much like a tree. It starts at the root and goes down the branches to the next level which are the directories, then to the next level which are the subdirectories, with the last level being files.

12. NOPE. Program manager is SYMBOLIC. All he is messing with is symbols.

13. Remember, it is possible to have a number of programs open at the same time. Let's imagine you find some great information on the web, and you want to copy it and place it in a word processing document (with, of course proper citation of the source). You can copy the information in your web browser and paste it in your word processor. When you copy the information, you are temporarily done with the web browser. You might not want to completely exit the program however, because you might want to go back to it immediately. You can MINIMIZE the web browser to keep it open, but put it out of the way temporarily, so you can get to it again without waiting for it to load up another time.

14. Graphical user interface. A GUI gives the user pictorial representations of files and programs with point and click access.

15. A command line interface such as used in MS-DOS or UNIX requires the user to type in commands in order to complete tasks such as copying a file.