

Operating Systems and its Services

Objectives...

- To learn Basic Concepts in Operating System
- To study DOS and Working of Files and Directories
- To understand Batch Files
- To learn Types of Operating Systems

3.0 INTRODUCTION

- An operating system is the most essential system software that manages the operations of a computer. Without an operating system, it is not possible to use the computer.
- An operating system is an intermediary between a user and the computer hardware (See Fig. 3.1). The purpose of an operating system is to provide an environment in which a user may execute program.
- An Operating System (OS) is system software that manages computer resources and provides programmers with an interface used to access those resources.
- An operating system facilitates communication between users and computer hardware.

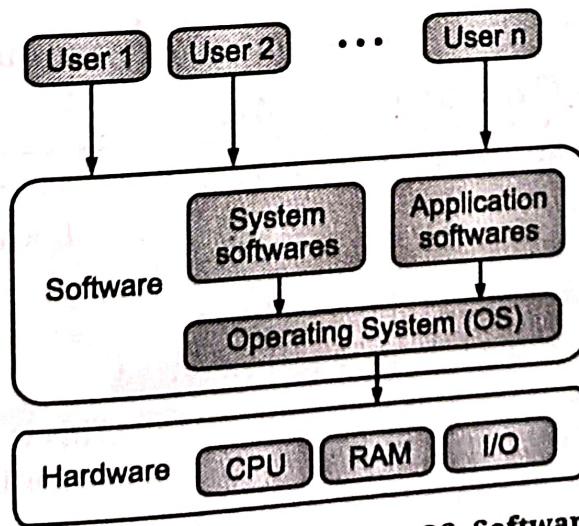


Fig. 3.1: Interaction among Hardware, OS, Software and Users

- It provides users an environment in which a user can execute programs conveniently and efficiently. Popular modern operating systems include Android, iOS, Windows, Linux, OS X, VMS, OS/400, AIX, z/OS etc.

3.1 BASIC CONCEPTS OF OPERATING SYSTEMS

- An operating system is an essential component of a computer system. An operating system is the collection of the various programs that take control over the operation of the computer system.
- An operating system is a set of programs which control all the computer's resources and provide an environment in which a user can develop application programs. It acts as an intermediary between a user and the computer hardware.
- An operating system is system software that manages computer hardware and software resources and provides common services for computer programs.

3.1.1 Definition of an Operating System

- An operating system is defined as, "the system software that helps in managing resources of a computer as well as provides a platform for the application programs running the computer".
- An operating system is, "a program that acts as an interface between the user and computer hardware and controls the execution of all kinds of programs".

Objectives of Operating System:

- To make a computer system convenient to use in an efficient manner.
- To hide the details of the hardware resources from the users.
- To provide users a convenient interface to use the computer system.
- To act as an intermediary between the hardware and its users and making it easier for the users to access and use other resources.
- To manage the resources of a computer system.
- To provide efficient and fair sharing of resources among users and programs.

3.1.2 Functions of an Operating System

- Memory Management:** OS keeps tracks of primary memory i.e. what part of memory is in use by whom, what part is not in use etc., and allocates the memory whenever a process or program requests it.
- Processor Management:** OS allocates the processor (CPU) to a process and deallocated processor when it is no longer required.
- Device Management:** It keeps track of all devices. This is also called I/O control. It decides which process gets the device, when, and for how much time.
- File Management:** It allocates and de-allocates the resources and decides who has access to what file.

5. **Security:** It prevents unauthorized access to programs and data by means of passwords and similar other techniques.
6. **Job Accounting:** OS keeps track of time and resources used by various jobs and/or users.
7. **Control Over System Performance:** OS records delays between request for a service and from the system.
8. **Co-ordination between other Software and Users:** Co-ordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.
9. **Execution of Program:** The OS is responsible for executing various programs whether user programs or system programs, i.e., special programs required for the machine functioning.
10. **Detection of Errors:** The OS is also responsible for detecting any type of error that occurs and then handling it.

3.1.3 Structure of Operating System

- Fig. 3.2 shows the basic structure of an operating system which shows various parts of an operating system and each part consists of a number of programs.
- Structure of an operating systems have a layered structure, with the bottom most layer forming the hardware part of the computer and the outer most (top most) layer forming the User Interface (UI). In between these two layers are kernel layer and shell layer.
- The kernel is the innermost layer and is the central controlling part of the operating system. The kernel is the core of the operating system and provides the basic services for all other parts of the operating system.
- The services of a kernel are requested by other parts of the operating system or by application programs through a specified set of program interfaces, sometimes known as system calls.

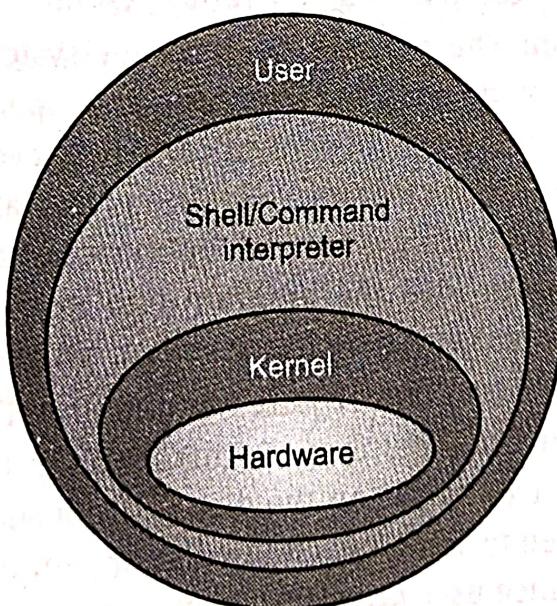


Fig. 3.2: Basic Structure of an Operating System

- A typical kernel contains programs that are used for the basic functions of operating system like process management, input/output devices management.
- The shell is the next layer to the kernel. A shell is a software that provides interface for users of an operating system access the services of a kernel.
- The shell is the layer of programming that understands and executes the commands user enters. In some systems, the shell is called a command interpreter.
- Programs in the user interface part either provide a Command Line Interface (CLI), a Graphical User Interface (GUI) to the user. These programs use facilities by shell.
- A user interacts with programs in the User Interface (UI) typically with the command interpreter to request use of resources and services provided by the system.

3.1.4 Services of an Operating System

- Fig. 3.3 shows services provided by operating system.

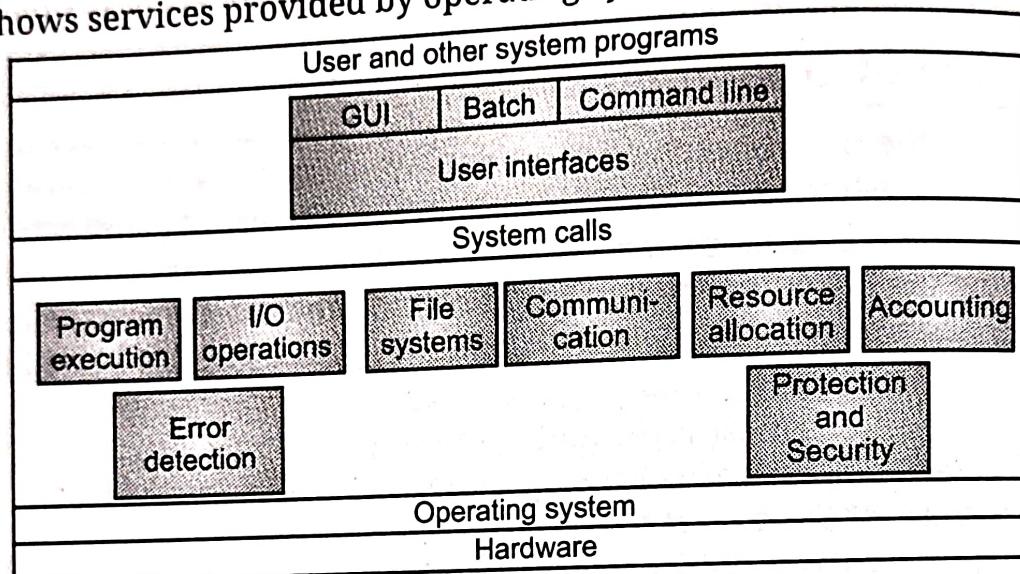


Fig. 3.3: A View of Operating System Services

- Fig. 3.3 shows following services of an operating system:
 1. **Program Execution:** The purpose of computer system is to allow the user execute programs in an efficient manner. The operating system provides environment where the user can conveniently run these programs. The user does not have to worry about the memory allocation or de-allocation or any other thing because these things are taken care of by the operating system. The operating system must be able to load the program into memory and to execute it. The program must be able to terminate its execution, either normally or abnormally.
 2. **I/O Operations:** Each program requires an input and after processing the input submitted by user it produces output. This involves the use of I/O devices. Input may be either from a file on the disk or from some other input device. Output may be written to some file on the disk or sent to some output devices such as printer, plotter. Since user programs cannot execute I/O operations directly, the operating system must provide some means to perform I/O.

3. **File System Manipulation:** While working on the computer, generally a user is required to manipulate various types of files like as opening a file, saving a file and deleting a file from the storage disk. Program needs to read a file or write a file. The operating system gives the permission to the program for operation on file. Maintain details of files or directories with their respective details. This is an important task that is also performed by the operating system.
4. **Communications:** Operating system performs the communication among various types of processes in the form of shared memory. In multitasking environment, the processes need to communicate with each other and to exchange their information. These processes are created under a hierarchical structure where the main process is known as parent process and the sub processes are known as child processes.
5. **Error Detection:** Error can occur anytime and anywhere. Error may occur in CPU, in I/O devices or in the memory hardware. Operating system deals with hardware problems. To avoid hardware problems the operating system constantly monitors the system for detecting the errors and fixing these errors (if found). The main function of operating system is to detect the errors like bad sectors on hard disk, memory overflow and errors related to I/O devices. After detecting the errors, operating system takes an appropriate action for consistent computing.
6. **Resource Allocation:** In the multitasking environment, when multiple jobs are running at a time, it is the responsibility of an operating system to allocate the required resources (like as CPU, main memory, tape drive or secondary storage etc.) to each process for its better utilization. For this purpose, various types of algorithms are implemented such as process scheduling, CPU scheduling, disk scheduling etc.
7. **Accounting:** Operating system keeps an account of all the resources accessed by each process or user. In multitasking, accounting enhances the system performance with the allocation of resources to each process ensuring the satisfaction to each process.
8. **Protection:** If a computer system has multiple users and allows the concurrent execution of multiple processes, then the various processes must be protected from one another's activities. Protection refers to mechanism or a way to control the access of programs, processes, or users to the resources defined by a computer system. Providing protection to program, data, and files and to ensure data security.
9. **User Interface:** Providing a User Interface (UI) to interact with users is essential for an operating system. This interface can be in one of the several forms. One is Command Line Interface (CLI) in which users interact with the operating system by typing commands. Another is batch interface, in which several commands and directives to control those commands are collected into files which are then executed. Another is Graphical User Interface (GUI), in which users interact with the system with a pointing device, such as a mouse.

3.2 DOS (DISK OPERATING SYSTEM)

- The Disk Operating System (DOS) is a single user operating system released by Microsoft Cor. in the early 1980's.
- DOS also known as MS-DOS, is a command line user interface, which enables users to organize data files, load and execute (run) program files and control the input and output devices attached to the computer.
- It is called DOS because, much of its work deals with managing and handling disk and disk files.
- DOS resides on a disk and is loaded into memory and executed when the computer is switched ON or reset.
- When the PC is switched ON, after performing the self checks, a command prompt character C:\> appears on the monitor. This indicates that DOS is loaded properly into the memory of the PC. The presence of any one of the prompt means that the PC is ready to execute the command given by the user.
- Fig. 3.4 shows DOS window.

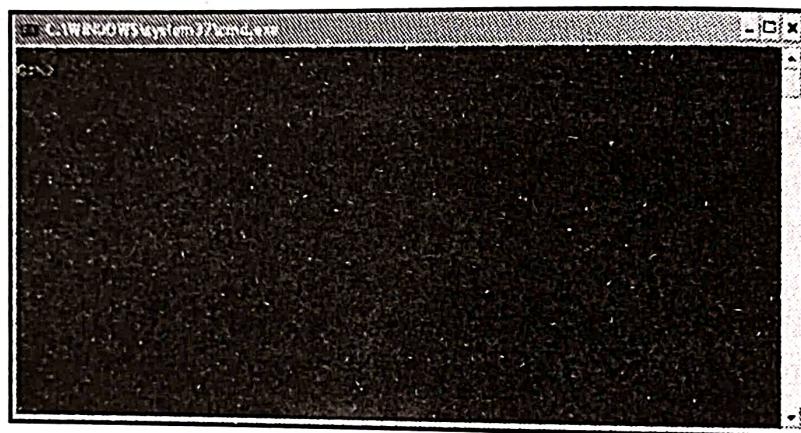


Fig. 3.4: Command Prompt of DOS

3.2.1 MS-DOS Environment (Files and Directories)

- The DOS environment gives the user a quick and direct access to the basic utilities of the computer. All tasks are accomplished by typing commands at a command prompt, i.e., at the cursor location.
- A prompt is defined as "a character or string of characters used in the command line interface to indicate that a computer is ready to accept commands from users".
- In DOS, '>' is used as a prompt, which is preceded by other information such as current drive and path of the current working directory.

Working with DOS Files and Directories:

1. File:

- A file is a primary unit of storage in computers. DOS uses a unique filename to describe the content of a file and keep track of the file so that you can use it later.

In DOS, the name of a file is divided into two parts, the filename itself and an extension. For example, the filename Emp.doc. has two parts, namely, Emp (filename) and .doc (extension). DOS uses different file extensions such as .com, .exe, .bat, .txt, etc.

DOS contains following files:

- (i) IO.SYS contains the system initialization code and built-in device drivers.
- (ii) MSDOS.SYS contains the DOS kernel.
- (iii) COMMAND.COM is the command interpreter.
- (iv) AUTOEXEC.BAT is run by the default shell to execute commands at startup.
- (v) CONFIG.SYS contains statements to configure DOS and load device drivers.

2. Directory:

- Files are organized under different directories. A directory allows users to group files under one category.
- Every disk has one basic directory called the root directory, which is created automatically when the disk is formatted.
- In addition to files, a directory can contain other directories also in itself known as sub-directories.

3. Pathname:

- To access a file in DOS, a user may have to traverse through different directories. Thus, a path-name is used to instruct the computer where to look for any particular file.
- A pathname is a sequence of directories separated by a backslash ('\\') followed by a filename.
- For example, the pathname for a file named EMP can be C:\\Employee\\Details\\Emp.doc. In this pathname, C drive contains a directory Employee in which Details is a subdirectory where the file Emp.doc is stored.
- A pathname can be either absolute or relative. An absolute pathname mentions the path to a specific file from the root directory while a relative pathname mentions the path to a specific file from the current working directory and does not begin with '\\'.

3.2 History of DOS

A DOS (Disk Operating System) is an operating system that runs from a disk drive. The term can also refer to a particular family of disk operating systems, most commonly MS-DOS, an acronym for Microsoft DOS.

First released on August 12, 1981, MS-DOS became the foundation for business computing for almost two decades. MS-DOS stood for Microsoft Disk Operating System and was often referred to simply as "DOS".

- DOS is the software that helped build Microsoft, becoming the foundation Microsoft built the Windows operating system on.
- The initial name of MS-DOS was 86-DOS and it was owned by Seattle computer products. This OS was written by an American computer programmer Tim Patterson.
- It was originally named QDOS (Quick and Dirty Operating System), but was changed 86-DOS once they began shipping in August of 1980.
- QDOS 0.11 was released in August of 1980, which is when it was renamed to 86-DOS. Microsoft ended up licensing it from SCP in December of 1980 and in May of the following year hired Tim Patterson to assist in porting it to the IBM PC.
- A month before Microsoft's new operating system was released, they purchased rights to 86-DOS from SCP for only \$50,000. After settling a lawsuit over the deal with SCP, Microsoft later ended up paying a total \$1 million.
- Microsoft took its adapted 86-DOS 1.14, created MS-DOS 1.10/1.14, and licensed it to IBM who sold by IBM under the name PC DOS 1.0.
- PC DOS versions 1.0, 1.1, 2.0, 2.1, 3.0, 3.1, 3.2, 5.0, and 6.0 were developed primarily by Microsoft, though IBM made additions of their own specific to their computers.
- MS-DOS 6.3 was the last version that was released as a stand-alone program. The next version, MS-DOS 7.0 was released as part of Windows 95.
- Both Windows 95 Revision 2 and the first release of Windows 98 were equipped with MS-DOS 7.1 running things behind the scenes.
- These were the first major versions of MS-DOS that were completely separate from DOS, whose version 7.0 was developed by IBM alone.
- The final version of MS-DOS was released as a part of Windows ME in September 2000. This was the last version of Windows that used MS-DOS as a foundation.

3.3 DOS COMMANDS

- The command generally means an instruction written in computer acceptable language that user types to execute a specific operation on the DOS prompt.
 - In an operating system, a command is defined as "a directive given to the computer to perform a specific operation".
 - In MS-DOS, commands are used to perform different operations such as copying files, deleting files, creating a directory, etc.
 - There are two types of DOS command.
 1. **Internal Commands:** These are the command which get loaded in the memory Computer automatically along with DOS at the time of booting.
- For examples:** dir, del, rename, copy, type etc.

2. **External Command:** These are the short programs or utilities which are available on floppy/hard disk and are loaded in the memory of computer when specially asked for.

For examples: format, print, chkdsk, discopy etc.

3.3.1 Internal Commands

- Internal commands are those commands that are loaded automatically in the memory when DOS is loaded into memory during booting process.
- These commands are easier to learn and use. Internal commands are permanent part of the resident portion of the memory. These commands can be used without the need of any DOS file.
- No external file is required to run these commands. These commands are used for common tasks like creating a file, typing the contents of the file, copying a file, and erasing a file etc.

1. DIR Command:

- DIR command displays the list of directories and files on the screen.
- DIR is basically used to display all files and directories on the monitor screen page wise and width wise.

Syntax: C:\>DIR\switches

Example:

```
C:\>DIR
Volume in drive B is New Volume
Volume Serial Number is PC71-B721

Directory of B:\

08/23/2014  05:15 PM    <DIR>          achart
08/23/2014  07:57 PM    <DIR>          Book1.xlsx
08/27/2014  07:28 AM    5,955,435,529     calculator II - DL LE ENG Games.lwp
08/02/2014  12:21 PM    <DIR>          desktop data
08/26/2014  04:47 PM    <DIR>          EPSON M10A B0011 P170
07/12/2014  12:00 PM    <DIR>          Images
07/29/2014  12:11 PM    <DIR>          MELE DIVISION BUSINESS
08/23/2014  07:22 AM    <DIR>          Pictures
02/25/2007  04:07 PM    5,866,827,128   MS Office 2007.msp
07/12/2014  05:13 PM    <DIR>          Music
08/18/2014  01:18 PM    9,921   New Microsoft Office Word Document.docx
08/27/2014  03:19 PM    <DIR>          pctab
08/25/2014  03:44 PM    <DIR>          pen drive
07/23/2014  02:02 PM    <DIR>          Photo & ps
07/16/2010  11:28 AM    287,259,676   photoshop CS 8.0.msp
08/21/2014  11:24 AM    <DIR>          videos
08/29/2014  01:13 PM    <DIR>          wots now
09/02/2014  12:51 PM    <DIR>          www
05/08/2004  05:25 PM    <DIR>          www
                5 File(s) 5,955,435,529 bytes
                14 Dir(s) 12,548,583,936 bytes free
```

2. CLS Command:

- CLS is a command that allows a user to clear the complete contents of the screen and leave only a prompt.

Syntax: c:\> CLS

Example:

```
C:\>echo Hello
Hello

C:\>time /t
11:41

C:\>date /t
04/06/2018

C:\>cls
```

3. DATE Command:

- This command is used for display the current system's date.

Syntax: C:\>DATE

Example:

```
C:\>date
The current date is: Tue 03/29/2011
Enter the new date: <mm-dd-yy>

C:\>date/t
Tue 03/29/2011

C:\>
```

4. TIME Command:

- This command is used for display the current system's time.

Syntax: C:\>TIME

Example:

```
C:\>time
The current time is: 13:41:53.99
Enter the new time:

C:\>time/t
01:42 PM

C:\>
```

5. COPY CON Command:

- This command is used to create a file. The file created by this command can not be modified.

Syntax: C:\>COPY CON Filename

Example:

```
D:\>copy con anan
Hello how are u
^Z
1 file(s) copied.

D:\>
```

6. TYPE Command:

- TYPE command allows the user to see the contents of a file.

Syntax: Type [drive:] [path]filename

C:\>TYPE Filename

Example:

```
D:\>type anan
Hello how are u

D:\>type d:hello hello.txt
The system cannot find the file specified.
Error occurred while processing: d:hello,
hello.txt

Hello how are u Frds...
D:\>
```

7. REN or RENAME Command:

- This command is used to rename an old filename with new filename.

Syntax: C:\>REN Oldfilename Newfilename

Example:

```
D:\>ren jandu anan
D:\>ren jandu.bat computer.txt
D:\>
```

8. DEL or DELETE Command:

- This command is used to delete a single file.

Syntax: C:\>DEL filename

Example:

```
D:\>del anan
D:\>
```

9. COPY Command:

- This command allows the user to copy one or more files to an alternate location.

Syntax: C:\>COPY source path target path

Example:

```
D:\>copy computer.txt akash
1 file(s) copied.
D:\>
```

10. MD (Make Directory) or MKDIR Command:

- This command is used to create a new directory or sub directory that is subordinate to the currently logged directory.

Syntax: C:\>MD Directory name

C:\>MD Sub Directory name

Example:

```
D:\>md testing
D:\>md folder
D:\>
```

11. CD or CHDIR Command:

- CD (Change Directory) is a command used to switch directories in MS-DOS and Windows command line.
 - This command is used to change from one directory or sub directory to another directory or sub directory.
- Syntax:** C:\>CD Directory name
C:\>CD Sub Directory name

Example:

```
cmd Command Prompt
D:\>cd aakash
D:\aakash>cd..
D:\>chdir images
D:\images>chdir..
D:\>cd www
D:\www>cd college
D:\www\college>cd sites
D:\www\college\sites>cd\
D:\>
```

12. RD (Remove Directory) or RMDIR Command:

- This command is used to remove a directory or sub directory. If user wants to remove a directory or sub directory, then first delete all the files and sub directory in it. User can remove only empty directory or subdirectory.

Syntax: C:\>RD Directory name

C:\>RD Sub Directory name

Example:

```
cmd Command Prompt
D:\>rd test
D:\>rmdir testing
D:\>rmdir notes\computer
D:\>
```

13. PATH Command:

- This command is used to provide access to files located in other directory paths other disk.
- User can access only those files that have extension them .EXE, .COM, .BAT. By setting the path to these executable files user can execute them anywhere.
- There are three options for the setting Path to executable files.
 - (a) To set the Path
 - (b) To remove the Path
 - (c) To see the Path

Syntax: C:\>PATH = Drive name:\Directory name;

Example:

1. To set the Path
C:\>PATH = C:\DOS
2. To see the Path
C:\>PATH
3. To remove the Path
C:\> PATH;

The screenshot shows a Command Prompt window with the title 'Command Prompt'. The window displays the following text:
 Microsoft Windows [Version 6.0.6001]
 Copyright © 2006 Microsoft Corporation. All rights reserved.
 C:\Users\RichB>path
 PATH=c:\Windows\system32;c:\Windows
 C:\Users\RichB>
 A callout bubble points from the word 'path' to the text '/system32 or /Windows'.

14. Prompt Command:

- This command is used to configure a DOS Prompt.
- User can ON/OFF the prompt by using this command.

Syntax: C:\>PROMPT

Example:

The screenshot shows a Command Prompt window with the title 'Command Prompt'. The window displays the following text:
 Microsoft Windows [Version 6.1.7600]
 Copyright © 2009 Microsoft Corporation. All rights reserved.
 C:\Users\raj>cd/
 C:\>prompt \$t \$d
 14:11:32.15 Sat 09/06/2014
 14:11:40.22 Sat 09/06/2014prompt \$t
 14:11:58.29prompt \$d
 Sat 09/06/2014

15. ECHO Command:

- It displays messages or turns on or off the display of commands in a batch file.

ECHO on|off

ECHO (message)

3.3.2 External Commands

- External commands are conventional program files. These files can be deleted, copied and even renamed.

1. EDIT Command:

- The MS-DOS Editor is a command line text editor that allows us to view, create, or modify any file on our computer.

Using this command user can display multiple lines and move within displayed text both vertically and horizontally.

Fundamentals of Computers

- To execute Edit command file is required.

Syntax:

C:\>EDIT Filename

or

C:\>EDIT [/B] [/H] [/R] [/S] [/<nnn>] [/?] [file(s)]

where,

/B	Forces monochrome mode.
/H	Displays the maximum number of lines possible for your hardware.
/R	Load file(s) in read-only mode.
/S	Forces the use of short filenames.
/<nnn>	Load binary file(s), wrapping lines to <nnn> characters wide.
/?	Displays this help screen.
[file]	Specifies initial files(s) to load. Wildcards and multiple file specs can be given.

Example:

C:\>EDIT Aman

or

C:\>edit c:\autoexec.bat

2. ATTRIB Command:

- This command is used to change the attribute of a file i.e. user can use ATTRIB to make a file "read only" which prevents the file from the change of contents.
- User can also hide or unhide a file. Also user can make the file in the "non readable" form. These commands provide a time saving and security during updating of file which user is updating.
 - (a) Read-only:** Allows the file to be only viewed and not written to or changed.
 - (b) Archived:** Allows Microsoft Backup and other backup programs to know what files to back up.
 - (c) Hidden:** Makes files invisible to standard users and hidden if show hidden files is enabled.
 - (d) System:** Makes the file an important system file.

Syntax:

C:\>ATTRIB Filename attributes

Examples:**Hide the file:**`C:\>ATTRIB Gill +h`**Unhide the file:**`C:\>ATTRIB Gill -h`**Read only the file:**`C:\>ATTRIB Gill +r`**SYS Command:**

3. This command is used to copy the system files from one drive to another drive, allowing that drive to be bootable.

Syntax:`C:\>SYS <Drive name>`**Example:**`C:\>SYS A:`**PRINT Command:**

- This command is used to print the files.
- The files that are to be printed must be standard text file and containing data compatible to the printer.

Syntax:`C:\>PRINT <File name>`**Example:**`C:\>PRINT testfile.txt`**SORT Command:**

- This command sorts the data in alphanumeric order which can be ascending or descending.

Syntax:`C:\>SORT <File name>`**Examples:**

```

D:\>sort test.txt
Bhan
Deep
Singh

D:\>sort /z test.txt
Invalid switch.

D:\>sort /r test.txt
Singh
Deep
Bhan

D:\>
  
```

6. BACKUP Command:

- This command is used to store the various important files from the fixed disk to floppy disk as a protect from the various damages or crashes which occurs to the hard disk due to various reasons.

Syntax:

C:\>BACKUP <Source path>/options <Target path>

Example:

C:\>BACKUP C:\DOS A:/S

7. FORMAT Command:

- This command is used to make a disk usable for operating system by dividing the disk into magnetic tracks and sectors. The number of sectors and tracks depends upon the capacity of the disk and the version of DOS.
- FORMAT command erases all the data from the target disk.

Syntax:

C:\>FORMAT <Drive name>/switches

Example:

C:\>FORMAT A:

where, /s /v /u are switches.

8. TREE Command:

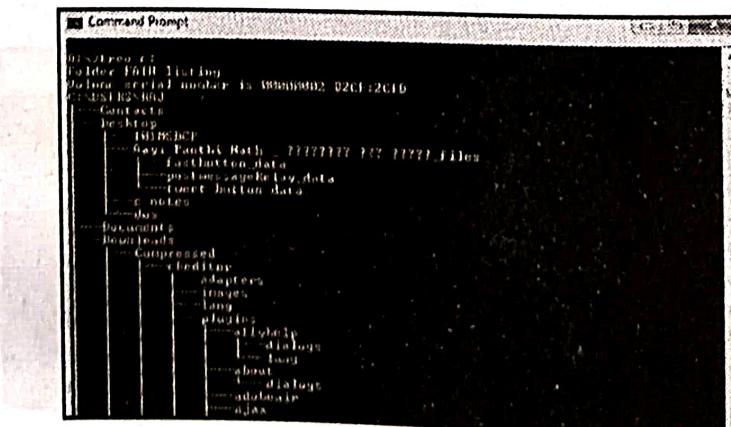
- This command displays the list of directories and files on specified path using graphically display.
- It displays directories and files like a tree.

Syntax:

C:\>TREE <Drive name>

or

C:\>TREE/Switches

Example:

9. MOVE Command:

- The MOVE command is used to move files or directories from one folder to another, or from one drive to another.

Syntax:

C:\>MOVE <Source path> <Target path>

Examples:

C:\>MOVE A:*.* C:\command

C:\>MOVE SAT GILL

10. FIND Command:

- This command is used to search files stored on the disk and data stored in the files.

Syntax:

C:\>FIND "text" <File name>

Example:

C:\>FIND "gill" Satinder

3.4 BATCH FILES

- A special batch file named as AUTOEXEC.BAT file is executed automatically when user boots the computer. A batch file is a collection of DOS commands.
- MS-DOS batch files consist of the normal operating system commands such as DIR, DEL, COPY and MKDIR together with some extra commands such as IF, FOR, GOTO, SHIFT and PAUSE that provide conditional control of execution and enable PARAMETERS to be passed so that the same batch file can be used in many different contexts.
- Batch file is the group of internal and external commands stored in a single file and all commands in batch file are executed automatically with file name only.
- Batch File has extension .BAT.
- Some commonly used batch file commands are:
 - REM: Used for comments.
 - PAUSE: To pause the execution of batch file and waits until user press a key.
 - ECHO: To on/off the text display on the screen.
 - CALL: Calls specified batch file, execute it and returns to the main file.

Example of Batch File:

C:\>EDIT SAT.BAT

3.5 TYPES OF OPERATING SYSTEMS

- OS are classified into following different types, depending on their capability of processing:
 - Single-user, Single-tasking OS:** As the name implies, this operating system is designed to manage the computer so that one user can effectively do one thing at a time. The palm OS for palm handheld computers is a good example of a modern single-user, single-task operating system. Another example includes MS-DOS and Windows 95.
 - Single-user, Multi-tasking OS:** This type of OS which allows a single user to execute two or more tasks at a time. Single-user, multi-tasking is the type of operating system most people use on their desktop and laptop computers today. Both Windows 98 and the Macintosh OS are examples of operating systems that will let a single user have several programs in operation at a time. Another example includes Windows 2000 and UNIX.
 - Multi-user, Multi-tasking OS:** A multi-user operating system allows many different users to take advantage of the computer's resources simultaneously. UNIX, Linux, VMS (Virtual Memory System) are examples of multi-user operating systems.
- Real Time Operating System (RTOS):** RTOS is managing the resources of the computer so that a particular operation executes in precisely the same amount of time every time it occurs. The response time of a real-time operating system is very quick. The operating system which guarantees the maximum time for these operations are commonly referred to as **hard real-time systems**, while operating systems that can only guarantee a maximum of the time are referred to as **soft real-time systems**. Examples of real-time OS are QNX, RTLINUX etc.
- Distributed Operating System:** Distributed means data is stored and processed on multiple locations like in the network. In a distributed operating system, the users access remote resources including both hardware and software in same manner as they do local resources. Examples of distributed operating systems includes LOCUS Distributed OS (based on UNIX), OSF/1 OS, IRIX OS, Solaris etc.
- Time Sharing OS:** In time sharing OS, a number of simultaneous users are there and each user is given a trivial amount of time (a quantum/time slice) in which he/she processes interactively or conversationally. UNIX, Windows NT and Windows XP are examples of this type of operating system.
- Multi-programming OS:** Multi-programming is a term given to a system that may have several (multiple) processes in the 'state of execution' at the same time. A Multiprogramming Operating System runs multiple programs on at a time. Windows, Linux, macOS, iOS are examples of multiprogramming operating systems.

8. **Multi-processing OS:** In a multi-processing OS, a single CPU has more than one processor. All these processors may or may not be equally powerful and may or may not prefer same operation. UNIX, LINUX, and Solaris are the most widely used multi-processing operating system.
9. **Batch-processing OS:** In this type of OS, there is no direct interaction between user and the computer. The user has to submit a job (written on cards or tape) to a computer operator. Then computer operator places a batch of several jobs on an input device. Jobs are batched together by type of languages and requirement. Then a special program, the monitor, manages the execution of each program in the batch. The monitor is always in the main memory and available for execution.
10. **Multi-tasking OS:** It allows executing more than one task at the same time. An operating system that is capable of allowing multiple software processes to run at the same time. Some examples of multi-tasking operating systems are UNIX and Windows 2000 Windows XP, Windows 7, Windows Vista etc.
11. **Multi-threading OS:** It allows different parts of a single program to run concurrently. Multithreading operating systems allow different parts of a software program to run concurrently. Operating systems that would fall into this category are Linux, UNIX and Windows 2000.
12. **Network Operating System (NOS):** A network operating system is a collection of software and associated protocols that allows a set of autonomous computers, which are interconnected by a computer network to be used together in a convenient and cost-effective manner. Examples of network operating system are BSD (Berkeley System Distribution), MS LAN Manager, Windows-NT, UNIX, Microsoft Windows Server 2003, Novell's NetWare, Microsoft Windows Server 2008 and so on.
13. **Embedded OS:** Embedded operating systems are designed to work on semiconductor memory with limited processing power. This OS is embedded in a device in the ROM. They are specific to a device and are less resource intensive. Examples of embedded operating systems includes embedded Windows XP, embedded Linux etc. They are used in appliances like microwaves, washing machines, traffic control systems etc.
14. **Real Time OS:** Real time operating system is used mainly for real-time systems. These OS used by systems where a precise timing and reliability are the first priority. Lynx OS and OS/9 are the examples of real time OS. The Air traffic control system, Railway/Air ticket booking systems, Medical imaging system, Industrial control system etc., operates on real time systems.
15. **Mobile Operating System:** A mobile operating system also called a mobile OS. It is an operating system that is specifically designed to run on mobile devices such as mobile phones, smartphones, PDAs, tablet computers and other handheld devices. Examples of mobile operating systems includes Symbian OS, Windows CE, Apple iOS, Windows Phone and Google Android.

PRACTICE QUESTIONS

Q.I Multiple Choice Questions:

1. Which is a software that manages and handles the hardware and software resources of a computer system?
 - Operating System (OS)
 - System Software
 - Application Software
 - All of the mentioned
2. DOS stand for,
 - Disk Open System
 - Disk Operating System
 - Both (a) and (b)
 - None of the mentioned
3. Internal DOS commands include,
 - DIR
 - COPY
 - DEL
 - All of the mentioned
4. A batch file is a script file in DOS with which file extension,
 - .doc
 - .pdf
 - .bat
 - .jpg
5. Which DOS command is used to list of files and directories in the current directory?
 - DIR
 - MD
 - ECHO
 - COPY
6. Which DOS command is used to create a new directory?
 - MKDIR
 - RMDIR
 - ECHO
 - COPY
7. External DOS commands include,
 - FORMAT
 - PRINT
 - EXIT
 - All of the mentioned
8. MS-DOS and Windows 95 are the example of.
 - Single-user, Multi-tasking OS
 - Single-user, Single-tasking OS
 - Multi-user, Multi-tasking OS
 - None of the mentioned
9. Mobile OS include,
 - Google Android
 - Apple iOS
 - Symbian OS
 - All of the mentioned

Answers

1. (a)	2. (b)	3. (d)	4. (c)	5. (a)	6. (a)	7. (d)	8. (b)	9. (d)
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Fill in the Blanks:

1. An Operating System (OS) is software that manages and handles the hardware and software _____ of a computer system.
2. A _____ is an operating system for x86 based personal computers.
3. In DOS the _____ command copies files from one location to another.
4. The _____ commands are the commands that are built into the command interpreter or the command prompt of the DOS operating system.
5. The _____ command is used to make a new directory.
6. A _____ file is a script file in DOS (.bat), consists of a series of commands to be executed by the command-line interpreter, stored in a plain text file.
7. DOS _____ command is used to remove a directory.
8. In DOS the users interact with the computer by typing _____ -based commands.
9. The well-known DOS batch file is AUTOEXEC.BAT that initializes DOS at system _____.
10. The _____ command in DOS deletes files.

Answers

1. resources	2. DOS	3. COPY	4. internal
5. MD	6. batch	7. RMDIR	8. text
9. startup	10. DEL		

III State True or False:

1. An Operating System (OS) provides interaction between users of computers and computer hardware
2. The clr command in DOS clears the screen.
3. A batch file is a script file in DOS consists of a series of commands to be executed by the command-line interpreter (COMMAND.COM), stored in a plain text file.
4. DOS is Command Line Interface (CLI) OS in which the users interact with the computer by typing text-based commands.
5. DOS command rm remove the directory.
6. External DOS commands are simple and essential commands that users can use to interact with the file system and execute simple tasks.
7. A batch file is a script file that stores commands to be executed in a serial order.
8. The Unix, Linux, and Solaris are the most widely used multi-processing operating system.
9. Example of NOS include Windows-NT, Windows Server 2003, Novell's NetWare, Microsoft Windows Server 2008 and so on.

Answers

1. (T)	2. (T)	3. (T)	4. (T)	5. (F)	6. (F)	7. (T)	8. (T)	9. (T)	
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Q.IV Answer the following Questions:**(A) Short Answer Questions:**

1. Define operating system.
2. What is DOS?
3. List types of operating systems.
4. List internal commands in DOS.
5. What is batch file?
6. What are the examples of mobile operating system?
7. List components of an operating system.
8. List external commands in DOS.
9. What is the purpose of CD and DEL?
10. List objectives of an operating system.
11. Give examples of multithreading operating system?

(B) Long Answer Questions:

1. What is operating system? How it works? List its components diagrammatically?
2. With the help of suitable diagram describe structure of an operating system.
3. What are the functions of an operating system, (any six).
4. Give the history of DOS in detail.
5. What is internal command in DOS? Explain CD and MKDIR with example.
6. What is the purpose of FORMAT command in DOS? Describe with example.
7. What is the purpose of batch file in DOS. List batch file commands.
8. How to create and delete files and directories in DOS?
9. Describe various types of operating systems in detail.