

CHAPTER 01

OPERATING SYSTEM

Q1. Select the best answer for the following MCQs.

i. In which operating system, same types of jobs are grouped together and executed one by one?

- a. Multiprogramming operating system
- b. Batch processing operating system
- c. Real-time operating system
- d. Time-sharing operating system

ii. In _____ operating system CPU is rapidly switched between programs so that all the programs are executed at the same time.

- a. Multiprogramming operating system
- b. Batch processing operating system
- c. Real-time operating system
- d. Time-sharing operating system

iii. Which operating system runs applications with very precise timing and provides immediate response to avoid safety hazards?

- a. Real-time operating system
- b. Multitasking operating system
- c. Multiprocessing operating system
- d. Distributed operating system

iv. _____ operating system divides task into many subtasks and processes them independently using many processors.

- a. Real-time operating system
- b. Distributed operating system
- c. Parallel processing operating system
- d. Multitasking operating system

v. Which operating system is used in home appliances?

- a. Time-sharing operating system
- b. Distributed operating system
- c. Parallel processing operating system
- d. Embedded operating system

vi. Which of the following manages allocation of computer resources during program execution?

- a. Memory management
- b. Process management
- c. I/O management
- d. File management

vii. Which of the following creates user groups and assigns privileges to them?

- a. Process management
- b. I/O management
- c. File management
- d. Network management

viii. In which state, a process is waiting to be assigned to the processor by the operating system scheduler?

- a. New state
- b. Ready state
- c. Waiting state
- d. Running state

Answer 01:

Question	i	ii	iii	iv	v	vi	vii	viii
Answer	b	a	a	c	d	b	d	b

Q2. Write short answers of the following questions.**i. What is the purpose of operating system in a computer? (FBISE)****Operating System**

An *operating system* is a program that controls the execution of application programs. It acts as an interface between the user and computer hardware. It provides the basic functionality for any device for example, desktop computer, laptop, tablet, smartphone, etc. *For example*, commonly used operating system are *DOS, Windows* and *Linux*.

ii. What is graphical user interface (GUI)?**Graphical User Interface (GUI)**

Graphical user interface provides the user-friendly environment. The user does not need to memorize commands. The commands are given through icons, menus and buttons, etc. The user does not have to memorize commands like DOS. *For example*, *Windows* and *Linux* are common examples of GUI operating system.

iii. Mention three advantages of UNIX operating system?**Advantages of UNIX**

- UNIX provides greater processing power and better security than windows.
- It is rarely affected by malware attack.
- It is available for wide range of computers from microcomputers to mainframes.

iv. Differentiate between multiprogramming and time-sharing operating systems? (FBISE)

Time-Sharing Operating System	Multiprogramming Operating System
Processor time is shared with multiple users.	It loads one or more programs in main memory and executes one program at a time.
The system works for the same or less time on each process.	The system does not take same time to work on different processes.
Time sharing operating system has fixed time slice.	Multiprogramming operating system has no fixed time slice.
<i>For example</i> , Windows NT Server operating system.	<i>For example</i> , Unix operating system.

v. Why multiprocessing operating systems have been developed?

Multiprocessing Operating System

Multiprocessing operating system has been developed to control the operations of two or more processors within a single computer system. They are used to obtain very high speed to process large amount of data. All the processors share can share the same main memory and input/output devices. *For example*, Windows NT, XP and Unix.

vi. Differentiate between single-user and multiuser operating system. (FBISE)

Single-user operating system	Multiuser operating system
They allow only one person at a time to use the computer.	They allow many users to interact with a single system at the same time.
It runs on a client computer.	It runs on a server computer.
It is a simple operating system.	It is a complex operating system.
<i>Examples</i> are Windows and Mac OS.	<i>Examples</i> are Unix and Linux.

vii. Why memory management is required in a computer?

Memory Management

Memory management controls and manages the operation of main memory. It allocates space to programs that are loaded in main memory for execution. It keeps track of freed memory when a program is closed and updates the memory status.

viii. Why protection system is required in a computer?

Protection System

Protection system is used to ensure that each resource of computer is used according to the privileges given to the user by the system administrator. It creates account for each user and gives privileges to prevent misuse of the system. It provides passwords to all the users to maintain network security.

ix. What is a thread?

Thread

A thread is a basic ordered sequence of instructions within a process that can be executed independently. The threads are made of and exist within a process; every process has at least one thread. There can be multiple threads in a process. Threads run in shared memory spaces. *For example*, each tab in a web browser to open a website act like a thread.

x. Differentiate between multiprocessing and multithreading by giving one example of each. (FBISE)

Multiprogramming	Multithreading
1. The applications of more than one program loaded in main memory is called multiprocessing.	1. In multithreading, a process is divided into several different subprocesses called <i>threads</i> .
2. It executes one process at a time.	2. It executes various components of the same processes at a time.

3. It is less efficient.	3. It is more efficient.
4. <i>For example</i> , a user loads MS Word and Notepad. First CPU executes MS Word and then Notepad.	4. <i>For example</i> , a user is typing in Microsoft Word. In background multiple threads run at a time like Grammar check, notifying spelling mistakes and so on.

Q3. Write long answers of the following questions.

i. Mention the tasks performed by operating system.

Tasks of Operating System

Operating system performs the following tasks.

- Loads and executes application and system software.
- Controls main memory and secondary storage devices.
- Manages files and folders on storage devices.
- Manages the operations of all input/output devices.
- Allows multitasking to handle multiple tasks simultaneously.
- Performs network operations to communicate users and sharing computer resources.
- Detects hardware failure.
- Provides security through username and passwords.

ii. Compare DOS and Windows operating system.

DOS

DOS stands for **Disk Operating System**. It was developed in **1970s** by Microsoft when first microcomputer was introduced. It uses command-line interface. The user enters commands to interact with the computer. It is not a user-friendly operating system.

Windows

Windows operating system was developed in mid **1980s** by Microsoft Corporation. It provides a graphical user interface (**GUI**) which is user-friendly. It allows users to give commands through icons, menus and buttons, etc. The latest version is **Windows 10**.

iii. Describe the following types of operating system.

- a. **Real-time operating system**
- b. **Parallel processing operating system**
- c. **Embedded operating system**

Real-time Operating System

Real-time operating system is used to run real-time applications that must process data as soon as it is received and give immediate response. It executes special applications within specified time with high reliability. It is used in research programs, real-time traffic control and oil refining.

Parallel Processing Operating System

Parallel Processing operating system executes programs developed in parallel programming language. It uses many processors at the same time. The task is divided into many smaller tasks

which are executed by many processors at the same time. It is used in *supercomputers* with thousands of processors.

Embedded Operating System

The embedded operating system is a built-in operating system. It is embedded in the hardware of the device. It controls the operations of devices like microwave oven, TV, camera, games, etc. It runs *automatically* when the device is turned on.

iv. Define the following terms.

- a. File management
- b. I/O management
- c. Network management
- d. Command-interpreter

File Management

File management manages files and folders on storage devices like hard disk and CD/DVD. Computer users can perform operations on files and folders like creating, copying, moving, renaming, deleting and searching. The users can also perform operations such as read, write, open and close.

I/O Management

I/O management controls all the input and output operations during program execution. It manages all I/O operations of input/output and storage devices. The efficient I/O management improves the performance of computer.

Network Management

Network operating system is used to manage a computer network. It monitors and manages network resources. It allows to create user groups and assign privileges to them. It shares the network resources among users, detects and fixes network problems.

Command-Interpreter

The command-interpreter provides an interface between the user and computer system. It is a file in operating system that reads and executes user commands entered as text through keyboard. For example, Windows uses *cmd.exe* file as command-interpreter.

v. Describe the five states of process with diagram. (FBISE)

Process States

A process passes through different states as it executes. These states may be different in different operating systems. However, the common process states are **five** states of a process which are following.

1. New state
2. Ready state
3. Running state

4. Waiting state
5. Terminated state

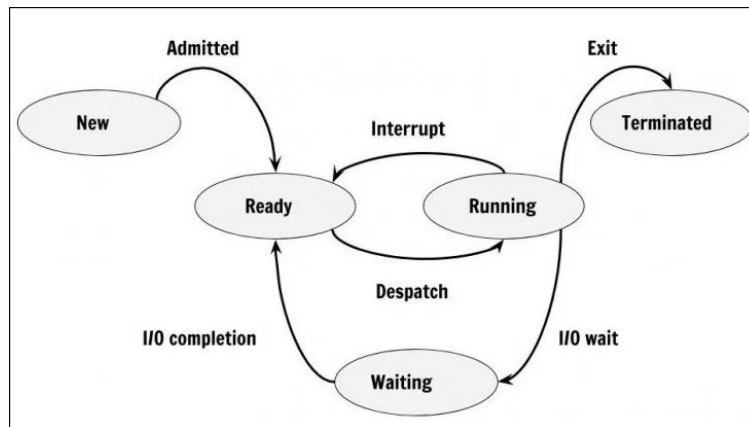


Fig. States of a Process

New State

In New state, the process is being created but it is not yet in memory. It is the first state of a process. It is any kind of new operation or service requested by a program for execution by the CPU.

Ready State

In Ready state, the process is waiting for execution by the processor but it is waiting to be assigned to the processor by the operating system. The process is loaded in main memory and it is ready to run.

Running State

A process is in running state when it is executed by the processor. The process is assigned to the processor for execution by the operating system.

Blocked/Waiting State

In blocked/waiting state, the process is not under execution. It is waiting for a resource to become free. The process enters blocked state when it requests access to I/O or needs input from the user or try to access a critical region.

Terminated State

In terminated state, the process has finished execution and is no longer in memory. The process is killed during this state.

SLO-BASED QUESTIONS FROM CHAPTER

SHORT QUESTIONS

Q1. Why DOS operating system is obsolete today? Give three reasons.

Reasons

- DOS uses commands which are difficult to memorize for a new user.
- It uses command-line interface which is not very attractive.
- It is not user friendly.

Q2. Why Windows operating system is popular? Give three reasons.

Reasons

- It has user friendly graphical interface.
- The user can enter commands through menus, icons, etc.
- It uses many kinds of data such as text, images, audio and video.

Q3. Why Mac OS is not widely used by users? Give reasons.

Reasons

- It is more expensive than other operating systems.
- It has limited application software available in the market.
- It was initially installed on only Apple computers.

Q4. What do you know about Mac OS?

Mac OS

Mac OS is a series of operating systems developed by Apple Corporation. It is mostly installed on all Apple computers. Latest version is OS X. It is 10th major release of Mac OS. It is more secure OS than windows.

Q5. What is process management? Give example.

Process Management

A *process* is a program in execution. It manages allocation of computer resources to various processes in main memory. It describes the state and resource ownership of each process.

Q6. Calculate execution time of CPU if three processes A, B and C are ready for execution. Process A needs 5 milliseconds, process B takes 2 milliseconds and process C takes 1 millisecond.

Case 1:

When the 3 processes become ready in the order of ABC, total execution time will be:

$$T = (5+7+8)/3 = 6.67 \text{ milli sec}$$

Case 2:

When the 3 processes become ready in the order of BCA, total execution time will be:

$$T = (2+3+8)/3 = 4.33 \text{ milli sec}$$

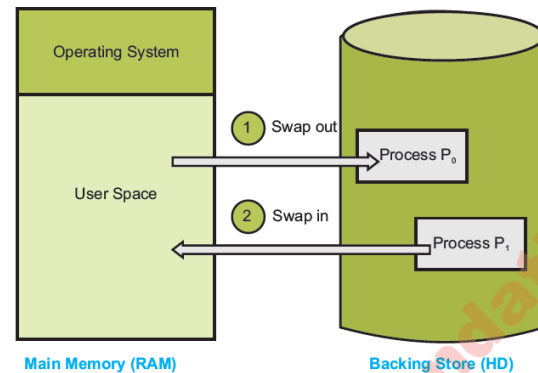
In this example, the CPU time is managed more efficiently in case 2 because the execution time in case 2 is less than case 1.

Q7. What is the purpose of swap in and swap out in memory management? Give example.

Swap in and Swap out

When a process is loaded in RAM, it is called *swap in* and when it is removed from RAM then it is called *swap out*. Swapping helps to create and use virtual memory. It also improves the utilization of main memory.

For example, a process P1 is loaded in main memory called *swap in* whereas another process P0 is removed from the memory called *swap out*.



Q8. What is secondary storage management? Give example.

Secondary Storage Management

It manages free space and storage allocation of user programs and data on secondary storage devices. **For example**, Program A is ready for storing in hard disk. The OS will look for free space in hard disk and assign a proper address. If space is not available, the OS will prompt the user to empty some space.

Q9. What is a process? Give example. (FBISE)

Process

A *process* is a program in execution. A program does not perform any action itself. A program becomes a process when it is loaded into the memory for execution. A process is an active entity while a program is a static entity. *For example*, if we load Microsoft Word in memory then it becomes a process.

Q10. Give a comparison between process and thread.

Process	Thread
An executing instance of a program is called a process.	A thread is a subset of a process.
It has its own copy of the data segment of the parent process.	It has direct access to the data segment of its process.
It runs in a separate memory.	It runs in shared memory.
It is controlled by the operating system.	It is controlled by the programmer in a program.

Q11. What is multithreading? Give examples.

Multithreading

Multithreading is the process of executing multiple threads simultaneously. It is an execution method of a program that allows a single process to run multiple threads at the same time. The *main purpose* is to provide simultaneous execution of two or more parts of a program for maximum utilization of CPU.

Examples

- A user is *typing* a paragraph in MS word but in background one or more thread is running and *checking spelling* mistakes.
- Web servers use multithreading all the time, every request is handled by a different thread.

Q12. What is multitasking? Give example.

Multitasking

Multitasking loads multiple (programs, processes, tasks, threads) in main memory and executes them at the same time by rapidly switching CPU among them. The OS keeps track of where the users are in these tasks and go from one to another without losing information. Each running task takes only a fair quantum of CPU time. *For example*, running a browser and media player at the same time.

Q13. What is multiprocessing?

Multiprocessing

Multiprocessing executes more than one processes simultaneously on a multiprocessor machine. Computer uses more than one processor at a time. It is normally used in *supercomputers* that consists of thousands of processors.

Q14. Differentiate between multitasking and multithreading.

Multitasking	Multithreading
Users are allowed to perform many tasks by the CPU.	Many threads are created from a single process.
The processes share separate memory.	Processes are allocated the same memory.
It involves multiprocessing.	It does not support multiprocessing.
It is slow in speed.	It is faster in speed.

Q15. Differentiate between multitasking and multiprogramming.

Multitasking	Multiprogramming
More than one tasks are executed at a time using a single CPU.	Many processes run concurrently at the same time on a single CPU.
it takes less time to execute the tasks or processes.	It consumes more time to execute the processes.
It allows multiple processes to run at the same time using time sharing concept.	It reduces the CPU idle time for as long as possible.

Multitasking	Multiprogramming
It increases both CPU utilization and responsiveness.	It increases only CPU utilization by organizing jobs.

LONG QUESTIONS

Q1. Explain various types of operating system.

TYPES OF OPERATING SYSTEM

The most important types of operating systems are:

- Batch processing system
- Multiprogramming operating system
- Multitasking operating system
- Time-sharing operating system
- Real-time operating system
- Multiprocessor operating system
- Parallel processing operating system
- Distributed operating system
- Embedded operating system

Batch Processing System

The batch processing system groups same type of jobs in batches and automatically execute them one by one. It performs the same type of tasks on all jobs in a batch in the *sequence* in which they appear. It is an easy and efficient way of processing same jobs. *For example*, monthly bank statement for each account holder is printed one by one.

Multiprogramming Operating System

Multiprogramming OS loads one or more programs in main memory and execute them using a single CPU. The CPU executes one program at a time while others waiting in a queue. If one program is busy with I/O operation, the CPU switches to another program. This improves the performance of computer

Multitasking Operating System

The multitasking OS executes multiple tasks at the same time by using a single CPU. The CPU executes one task at a time but rapidly switches between multiple tasks. It appears as multiple tasks running at a time.

Time-Sharing Operating system

Time-sharing OS Shares the CPU time between multiple programs. Very short time of CPU is allocated to each program called *time slice or quantum*. The switching among programs is very fast. The users think that they are using their own CPU. It is used in *minicomputers* and *mainframes*.

Real-time Operating System

Real-time OS is used to run real-time applications that must process data as soon as it is received and give immediate response. It executes special applications within specified time with high reliability. It is used in research programs, real-time traffic control and oil refining.

Multiprocessor Operating System

Multiprocessor OS is used to control the operations of multiple CPUs within a single computer. All processors share the same main memory and i/o devices. It provides high speed for processing large amount of data. It executes a single program using many processors to improve processing speed.

Parallel Processing Operating System

Parallel Processing OS executes programs developed in parallel programming language. It uses many processors at the same time. The task is divided into many smaller tasks which are executed by many processors at the same time. It is used in *supercomputers* with thousands of processors.

Distributed Operating System

Distributed OS executes application software on different computers in a network. The user programs may run on any computer in the network and access data on any other computer. The users don't know on which computer their programs are running. It automatically *balances load* on different computers in the network

Embedded Operating System

The embedded OS is a built-in operating system. It is embedded in the hardware device. It controls the operations of devices like microwave oven, TV, Camera, games, etc. It runs *automatically* when the device is turned on.

Q2. Explain functions performed by operating system in detail. (FBISE)

Operating System Functions

The functions performed by operating system are the followings.

- Process management
- Memory management
- File management
- I/O management
- Secondary storage management
- Network management
- Protection system
- Command-interpreter

Process Management

A process is a program in execution. It manages allocation of computer resources to various processes in main memory. It describes the state and resource ownership of each process.

Example

Three processes A, B and C ready for execution. The CPU will manage the CPU time as follows:

- Process A has CPU cycle ($t_a = 5$ milli sec)
- Process B has CPU cycle ($t_b = 2$ milli sec)
- Process C has CPU cycle ($t_c = 1$ milli sec)

Case 1: When the 3 processes become ready in the order of ABC, total execution time will be:

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In this example, the CPU time is managed more efficiently in case 2 because the execution time in case 2 is less than case 1.

Memory Management

Memory management controls and manages the operation of main memory. It allocates space to programs that are loaded in main memory for execution. It keeps track of free memory when a program is closed and updates the memory status.

File Management

File management manages files and folders on storage devices. Computer users can perform operations on files and folders like creating, copying, moving, renaming, deleting and searching. The users can also perform operations such as read, write, open and close.

I/O Management

I/O management controls all the input/output operations during program execution. It manages all the i/o operations of input/output and storage devices. The efficient i/o management improves the performance of computer.

For example, three programs A, B and C which are using the printer. The OS will decide which program will access the printer first. A queue will be set by the OS and each program will get in the order

Secondary Storage Management

It manages free space and storage allocation of user programs and data on secondary storage devices. *For example*, Program A is ready for storing in hard disk. The OS will look for free space in hard disk and assign a proper address. If space is not available, the OS will prompt the user to empty some space.

Network Management

Network operating system is used to manage a computer network. It monitors and manages resources of network. It allows to create user groups and assign privileges to them. It shares the network resources among users and detects as well as fixes network problems.

Protection System

The protection system ensures that each resource of computer is used according to the privileges given to the user. Privileges are assigned by the system administrator. It creates account for each user and gives privileges to prevent misuse of the system. It provides passwords to all the users to maintain network security

Command-Interpreter

The command-interpreter provides an interface between the user and computer system. It is a file in operating system that reads and executes user commands entered as text through keyboard. *For example*, Windows uses **cmd.exe** file as command-interpreter.