

# OPERATING SYSTEM

## 1) What is an operating system?

The operating system is a software program that facilitates computer hardware to communicate and operate with the computer software. It is the most important part of a computer system without it computer is just like a box.

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## 2) What is the main purpose of an operating system?

There are two main purposes of an operating system:

- It is designed to make sure that a computer system performs well by managing its computational activities.
  - It provides an environment for the development and execution of programs.
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## 3) What are the different operating systems?

- Batched operating systems
  - Distributed operating systems
  - Timesharing operating systems
  - Multi-programmed operating systems
  - Real-time operating systems
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## 4) What is a socket?

A socket is used to make connection between two applications. Endpoints of the connection are called socket.

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## 5) What is a real-time system?

Real-time system is used in the case when rigid-time requirements have been placed on the operation of a processor. It contains a well defined and fixed time constraints.

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## 6) What is kernel?

Kernel is the core and most important part of a computer operating system which provides basic services for all parts of the OS.

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## 7) What is monolithic kernel?

A monolithic kernel is a kernel which includes all operating system code in a single executable image.

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## 8) What do you mean by a process?

An executing program is known as process. There are two types of processes:

- Operating System Processes
  - User Processes
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## 9) What are the different states of a process?

A list of different states of process:

- New Process
  - Running Process
  - Waiting Process
  - Ready Process
  - Terminated Process
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## 10) What is the difference between micro kernel and macro kernel?

**Micro kernel:** micro kernel is the kernel which runs minimal performance affecting services for operating system. In micro kernel operating system all other operations are performed by processor.

**Macro Kernel:** Macro Kernel is a combination of micro and monolithic kernel.

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## 11) What is the concept of reentrancy?

It is a very useful memory saving technique that is used for multi-programmed time sharing systems. It provides functionality that multiple users can share a single copy of program during the same period.

It has two key aspects:

- The program code cannot modify itself.
- The local data for each user process must be stored separately.

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## 12) What is the difference between process and program?

A program while running or executing is known as a process.

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## 13) What is the use of paging in operating system?

Paging is used to solve the external fragmentation problem in operating system. This technique ensures that the data you need is available as quickly as possible.

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## 14) What is the concept of demand paging?

Demand paging specifies that if an area of memory is not currently being used, it is swapped to disk to make room for an application's need.

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## 15) What is the advantage of a multiprocessor system?

As many as processors are increased, you will get the considerable increment in throughput. It is cost effective also because they can share resources. So, the overall reliability increases.

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## 16) What is virtual memory?

Virtual memory is a very useful memory management technique which enables processes to execute outside of memory. This technique is especially used when an executing program cannot fit in the physical memory.

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## 17) What is thrashing?

Thrashing is a phenomenon in virtual memory scheme when the processor spends most of its time in swapping pages, rather than executing instructions.

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## 18) What are the four necessary and sufficient conditions behind the deadlock?

These are the 4 conditions:

- 1) **Mutual Exclusion Condition**: It specifies that the resources involved are non-sharable.
  - 2) **Hold and Wait Condition**: It specifies that there must be a process that is holding a resource already allocated to it while waiting for additional resource that are currently being held by other processes.
  - 3) **No-Preemptive Condition**: Resources cannot be taken away while they are being used by processes.
  - 4) **Circular Wait Condition**: It is an explanation of the second condition. It specifies that the processes in the system form a circular list or a chain where each process in the chain is waiting for a resource held by next process in the chain.
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## 19) What is a thread?

A thread is a basic unit of CPU utilization. It consists of a thread ID, program counter, register set and a stack.

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## 20) What is FCFS?

FCFS stands for First Come, First Served. It is a type of scheduling algorithm. In this scheme, if a process requests the CPU first, it is allocated to the CPU first. Its implementation is managed by a FIFO queue.

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## 21) What is SMP?

SMP stands for Symmetric MultiProcessing. It is the most common type of multiple processor system. In SMP, each processor runs an identical copy of the operating system, and these copies communicate with one another when required.

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## 22) What is RAID? What are the different RAID levels?

RAID stands for Redundant Array of Independent Disks. It is used to store the same data redundantly to improve the overall performance.

Following are the different RAID levels:

RAID 0 - Striped Disk Array without fault tolerance

RAID 1 - Mirroring and duplexing

RAID 2 - Memory-style error-correcting codes

RAID 3 - Bit-interleaved Parity

RAID 4 - Block-interleaved Parity

RAID 5 - Block-interleaved distributed Parity

RAID 6 - P+Q Redundancy

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## 23) What is deadlock? Explain.

Deadlock is a specific situation or condition where two processes are waiting for each other to complete so that they can start. But this situation causes hang for both of them.

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## 24) Which are the necessary conditions to achieve a deadlock?

There are 4 necessary conditions to achieve a deadlock:

- **Mutual Exclusion:** At least one resource must be held in a non-sharable mode. If any other process requests this resource, then that process must wait for the resource to be released.
- **Hold and Wait:** A process must be simultaneously holding at least one resource and waiting for at least one resource that is currently being held by some other process.
- **No preemption:** Once a process is holding a resource (i.e. once its request has been granted), then that resource cannot be taken away from that process until the process voluntarily releases it.
- **Circular Wait:** A set of processes  $\{P_0, P_1, P_2, \dots, P_N\}$  must exist such that every  $P[i]$  is waiting for  $P[(i + 1) \% (N + 1)]$

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## 25) What is Banker's algorithm?

Banker's algorithm is used to avoid deadlock. It is the one of deadlock-avoidance method. It is named as Banker's algorithm on the banking system where bank never allocates available cash in such a manner that it can no longer satisfy the requirements of all of its customers.

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## 26) What is the difference between logical address space and physical address space?

Logical address space specifies the address that is generated by CPU. On the other hand physical address space specifies the address that is seen by the memory unit.

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## 27) What is fragmentation?

Fragmentation is a phenomenon of memory wastage. It reduces the capacity and performance because space is used inefficiently.

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## 28) How many types of fragmentation occur in Operating System?

There are two types of fragmentation:

- **Internal fragmentation:** It is occurred when we deal with the systems that have fixed size allocation units.
  - **External fragmentation:** It is occurred when we deal with systems that have variable-size allocation units.
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## 29) What is spooling?

Spooling is a process in which data is temporarily gathered to be used and executed by a device, program or the system. It is associated with printing. When different applications send output to the printer at the same time, spooling keeps these all jobs into a disk file and queues them accordingly to the printer.

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## 30) What is the difference between internal commands and external commands?

Internal commands are the built-in part of the operating system while external commands are the separate file programs that are stored in a separate folder or directory.

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### 31) What is semaphore?

Semaphore is a protected variable or abstract data type that is used to lock the resource being used. The value of the semaphore indicates the status of a common resource.

There are two types of semaphore:

- Binary semaphores
  - Counting semaphores
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### 32) What is a binary Semaphore?

Binary semaphore takes only 0 and 1 as value and used to implement mutual exclusion and synchronize concurrent processes.

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### 33) What is Belady's Anomaly?

Belady's Anomaly is also called FIFO anomaly. Usually, on increasing the number of frames allocated to a process virtual memory, the process execution is faster, because fewer page faults occur. Sometimes, the reverse happens, i.e., the execution time increases even when more frames are allocated to the process. This is Belady's Anomaly. This is true for certain page reference patterns.

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### 34) What is starvation in Operating System?

Starvation is Resource management problem. In this problem, a waiting process does not get the resources it needs for a long time because the resources are being allocated to other processes.

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### 35) What is aging in Operating System?

Aging is a technique used to avoid the starvation in resource scheduling system.

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### 36) What are the advantages of multithreaded programming?

A list of advantages of multithreaded programming:

- Enhance the responsiveness to the users.
  - Resource sharing within the process.
  - Economical
  - Completely utilize the multiprocessing architecture.
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### 37) What is the difference between logical and physical address space?

Logical address specifies the address which is generated by the CPU whereas physical address specifies to the address which is seen by the memory unit.

After fragmentation

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### 38) What are overlays?

Overlays makes a process to be larger than the amount of memory allocated to it. It ensures that only important instructions and data at any given time are kept in memory.

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### 39) When does trashing occur?

Thrashing specifies an instance of high paging activity. This happens when it is spending more time paging instead of executing.

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### Q. What is a process and process table? What are different states of process?

A process is an instance of program in execution. For example a Web Browser is a process, a shell (or command prompt) is a process.

The operating system is responsible for managing all the processes that are running on a computer and allocated each process a certain amount of time to use the processor. In addition, the operating system also allocates various other resources that processes will need such as computer memory or disks. To keep track of the state of all the processes, the operating system maintains a table known as the process table. Inside this table, every process is listed along with the resources the processes is using and the current state of the process.



**Processes can be in one of three states: running, ready, or waiting.** The running state means that the process has all the resources it need for execution and it has been given permission by the operating system to use the processor. Only one process can be in the running state at any given time. The remaining processes are either in a waiting state (i.e., waiting for some external event to occur such as user input or a disk access) or a ready state (i.e., waiting for permission to use the processor). In a real operating system, the waiting and ready states are implemented as queues which hold the processes in these states. The animation below shows a simple representation of the life cycle of a process.

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## Q. What is a Thread? What are the differences between process and thread?

A thread is a single sequence stream within in a process. Because threads have some of the properties of processes, they are sometimes called lightweight processes. Threads are popular way to improve application through parallelism. For example, in a browser, multiple tabs can be different threads. MS word uses multiple threads, one thread to format the text, other thread to process inputs, etc.

A thread has its own program counter (PC), a register set, and a stack space. Threads are not independent of one other like processes as a result threads shares with other threads their code section, data section and OS resources like open files and signals.

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## Q. What are the benefits of multithreaded programming?

It makes the system more responsive and enables resource sharing. It leads to the use of multiprocess architecture. It is more economical and preferred.

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## Q. What are the different scheduling algorithms?

1. First-Come, First-Served (FCFS) Scheduling.
  2. Shortest-Job-Next (SJN) Scheduling.
  3. Priority Scheduling.
  4. Shortest Remaining Time.
  5. Round Robin(RR) Scheduling.
  6. Multiple-Level Queues Scheduling.
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## Q. What is deadlock?

Deadlock is a situation when two or more processes wait for each other to finish and none of them ever finish. Consider an example when two trains are coming toward each

other on same track and there is only one track, none of the trains can move once they are in front of each other. Similar situation occurs in operating systems when there are two or more processes hold some resources and wait for resources held by other(s).

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## Q. What are the necessary conditions for deadlock?

**Mutual Exclusion:** There is a resource that cannot be shared.

**Hold and Wait:** A process is holding at least one resource and waiting for another resource which is with some other process.

**No Preemption:** The operating system is not allowed to take a resource back from a process until process gives it back.

**Circular Wait:** A set of processes are waiting for each other in circular form.

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## Q. What is Virtual Memory? How is it implemented?

Virtual memory creates an illusion that each user has one or more contiguous address spaces, each beginning at address zero. The sizes of such virtual address spaces is generally very high.

The idea of virtual memory is to use disk space to extend the RAM. Running processes don't need to care whether the memory is from RAM or disk. The illusion of such a large amount of memory is created by subdividing the virtual memory into smaller pieces, which can be loaded into physical memory whenever they are needed by a process.

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## Q. What is Thrashing?

Thrashing is a situation when the performance of a computer degrades or collapses. Thrashing occurs when a system spends more time processing page faults than executing transactions. While processing page faults is necessary in order to appreciate the benefits of virtual memory, thrashing has a negative affect on the system. As the page fault rate increases, more transactions need processing from the paging device. The queue at the paging device increases, resulting in increased service time for a page fault.

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## Q. What is Belady's Anomaly?

Belady's anomaly is an anomaly with some page replacement policies where increasing the number of page frames results in an increase in the number of page faults. It occurs with First in First Out page replacement is used.

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## Q. What is Banker's algorithm?

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