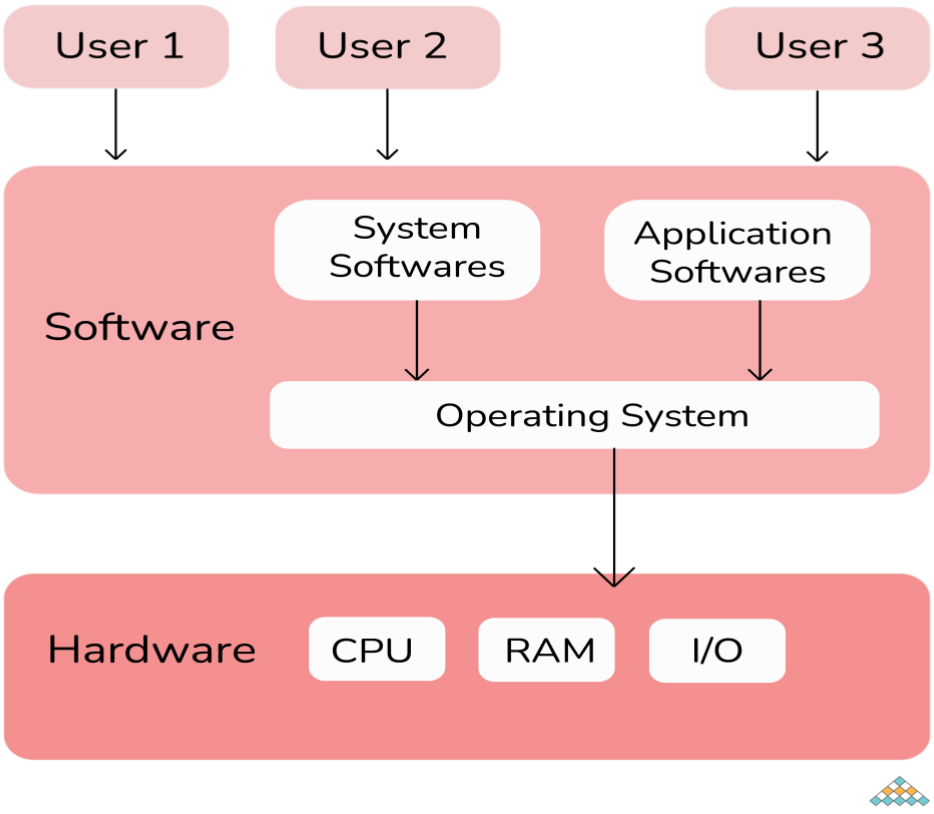
# INTERVIEW QUESTIONS ON OPERATING SYSTEMS

**What do you mean by an operating system? What are its basic functions?**

Operating System (OS) is basically a software program that manages and handles all resources of a computer such as hardware and software. The first OS was introduced in the early 1950s known as GMOs. An OS is responsible for managing, handling, and coordinating overall activities and sharing of computer resources. It acts as an intermediary among users of computer and computer hardware.




**Functions of OS:**
There are many functions of the OS. Some of the important functions of OS are given below:

- Memory and Processor Management
- Providing user interface to users
- File Management and Device Management
- Scheduling of resources and jobs
- Error Detection
- Security

**1. Why is the operating system important?**

OS is the most essential and vital part of a computer without which it is considered useless. It enables an interface or acts like a link for interaction between computer software that is installed on OS and users. It also helps to communicate with hardware and also maintains balance among hardware and CPU. It also provides services to users and a platform for programs to run on. It performs all common tasks applications require.

**2. What's the main purpose of an OS? What are the different types of OS?**

The main purpose of an OS is to execute user programs and make it easier for users to understand and interact with computers as well as run applications. It is specially designed to ensure that the computer system performs better by managing all computational activities. It also manages computer memory, processes, and operation of all hardware and software.

**Types of OS:**

- Batched OS (Example: Payroll System, Transactions Process, etc.)
- Multi-Programmed OS (Example: Windows O/S, UNIX O/S, etc.)
- Timesharing OS (Example: Multics, etc.)
- Distributed OS (LOCUS, etc.)
- Real-Time OS (PSOS, VRTX, etc.)

**3. What are the benefits of a multiprocessor system?**

A Multiprocessor system is a type of system that includes two or more CPUs. It involves the processing of different computer programs at the same time mostly by a computer system with two or more CPUs that are sharing single memory.

**Benefits:**

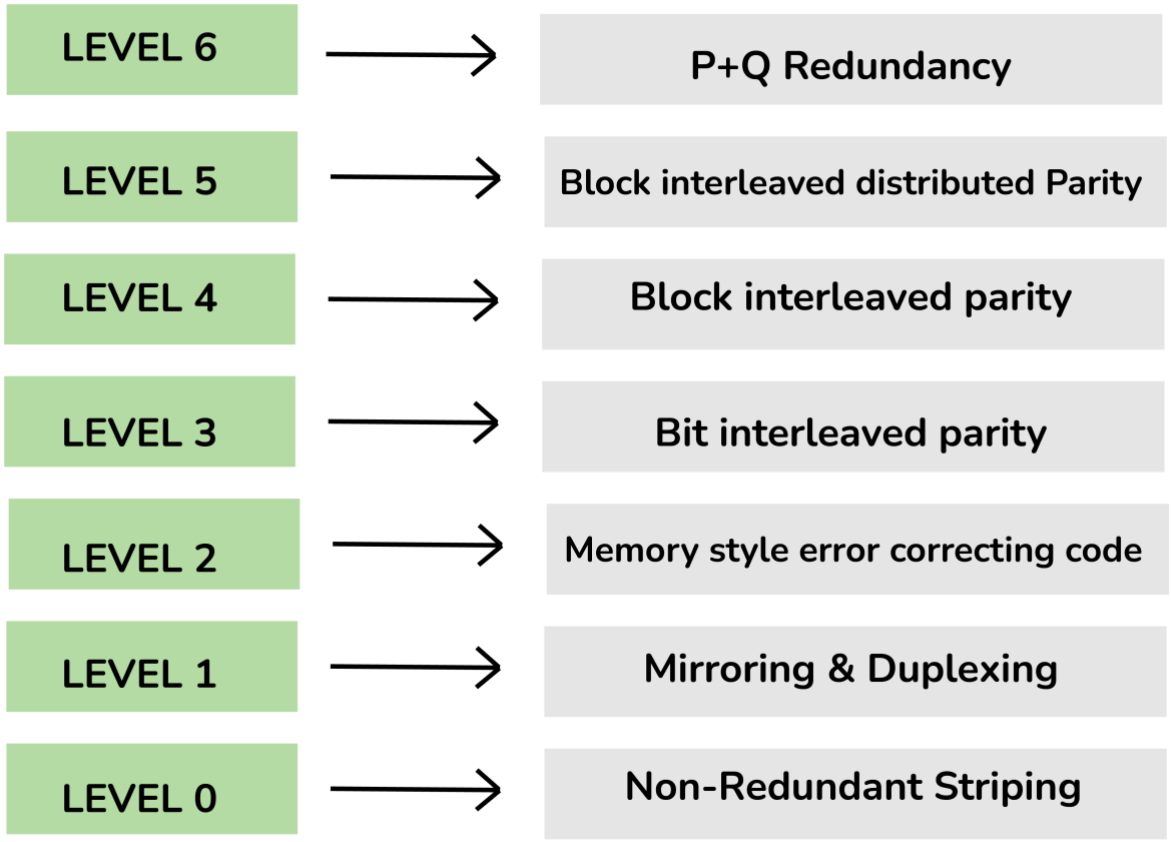
- Such systems are used widely nowadays to improve performance in systems that are running multiple programs concurrently.
- By increasing the number of processors, a greater number of tasks can be completed in unit time.
- One also gets a considerable increase in throughput and is cost-effective also as all processors share the same resources.
- It simply improves the reliability of the computer system.

**4. What is RAID structure in OS? What are the different levels of RAID configuration?**

RAID (Redundant Arrays of Independent Disks) is a method used to store data on Multiple hard disks therefore it is considered as data storage virtualization technology that combines multiple hard disks. It simply balances data protection, system performance, storage space, etc. It is used to improve the overall performance and reliability of data storage. It also increases the storage capacity of the system and its main purpose is to achieve data redundancy to reduce data loss.

**Different levels of RAID**

Nowadays, RAID is available in various schemes or RAID level as given below:




- RAID 0 - Non-redundant striping: This level is used to increase the performance of the server.
- RAID 1 - Mirroring and duplexing: This level is also known as disk mirroring and is considered the simplest way to implement fault tolerance.

- RAID 2 - Memory-style error-correcting codes: This level generally uses dedicated hamming code parity I.e., a liner form of error correction code.
- RAID 3 - Bit-interleaved Parity: This level requires a dedicated parity drive to store parity information.
- RAID 4 - Block-interleaved Parity: This level is similar to RAID 5 but the only difference is that this level confines all parity data to a single drive.
- RAID 5 - Block-interleaved distributed Parity: This level provides far better performance than disk mirroring and fault tolerance.
- RAID 6 - P+Q Redundancy: This level generally provides fault tolerance for two drive failures.

**5. What is GUI?**

GUI (Graphical User Interface) is basically a type of user interface that allows users to use graphics to interact with OS. GUI is created because it is more user-friendly, less complex, and easier to understand rather than a command-line interface. Its main goal is to increase efficiency and ease of use. Instead of having to memorize commands, users can just click on a button to simply execute the procedure. Examples of GUI include Microsoft Windows, macOS, Apple's iOS, etc.

**6. What is a Pipe and when it is used?**

The pipe is generally a connection among two or more processes that are interrelated to each other. It is a mechanism that is used for inter-process communication using message passing. One can easily send information such as the output of one program process to another program process using a pipe. It can be used when two processes want to communicate one-way i.e., inter-process communication (IPC).

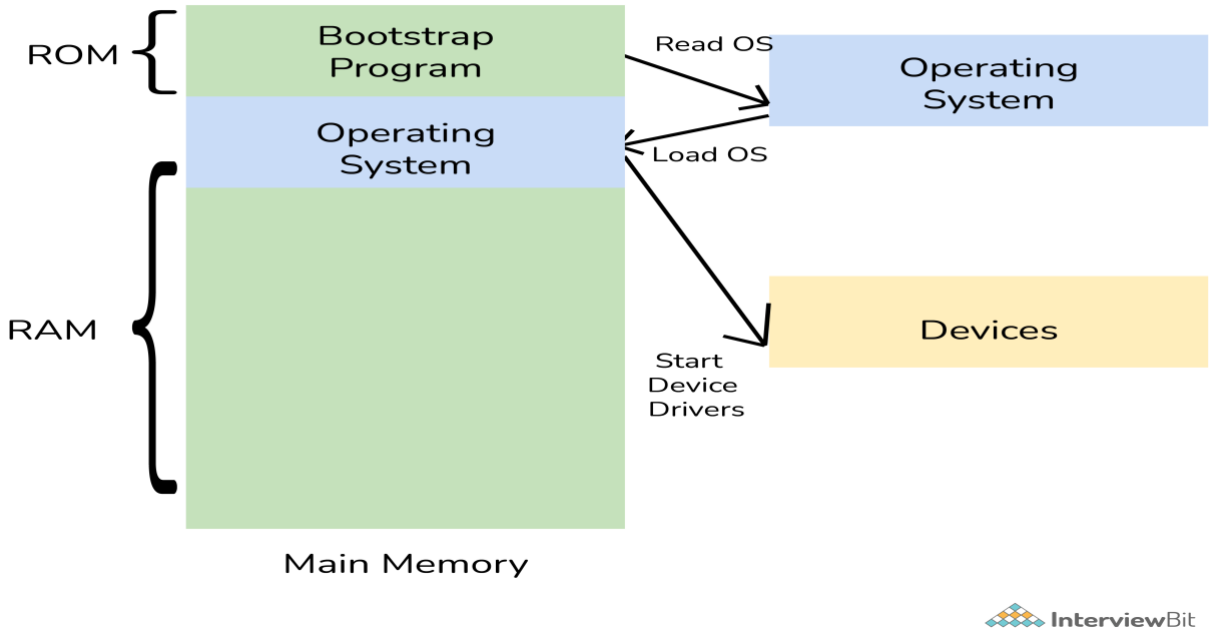
**7. What are the different kinds of operations that are possible on semaphore?**

There are basically two atomic operations that are possible:

- Wait()
- Signal()

**8. What is a bootstrap program in OS?**

It is generally a program that initializes OS during startup i.e., first code that is executed whenever computer system startups. OS is loaded through a bootstrapping process or program commonly known as booting. Overall OS only depends on the bootstrap program to perform and work correctly. It is fully stored in boot blocks at a fixed location on the disk. It also locates the kernel and loads it into the main memory after which the program starts its execution.




**9. Explain demand paging?**

Demand paging is a method that loads pages into memory on demand. This method is mostly used in virtual memory. In this, a page is only brought into memory when a location on that particular page is referenced during execution. The following steps are generally followed:

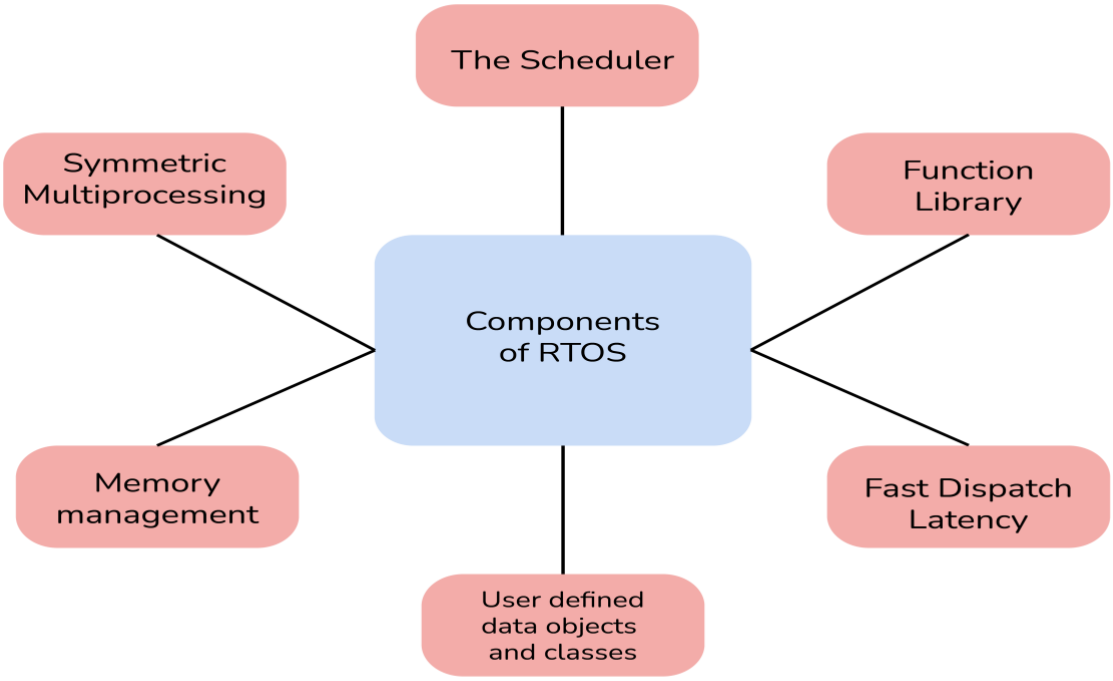
- Attempt to access the page.
- If the page is valid (in memory) then continue processing instructions as normal.
- If a page is invalid then a **page-fault trap** occurs.
- Check if the memory reference is a valid reference to a location on secondary memory. If not, the process is terminated (**illegal memory access**). Otherwise, we have to **page in** the required page.
- Schedule disk operation to read the desired page into main memory.
- Restart the instruction that was interrupted by the operating system trap.

**10. What do you mean by RTOS?**

Real Time Operating System (RTOS) is an operating system that is used for real-time applications i.e., for those applications where data processing should be done in a fixed and small measure of time. It performs much better on tasks that are needed to be executed within a short time. It also takes care of execution, monitoring, and all-controlling processes. It also occupies less memory and consumes fewer resources.

**Types of RTOS:**

- Hard Real-Time
- Firm Real-Time
- Soft Real-Time




InterviewBit

RTOS is used in Air traffic control systems, Anti-lock Brake Systems, and Heart pacemakers.

**11. What do you mean by process synchronization?**

Process synchronization is basically a way to coordinate processes that use shared resources or data. It is very much essential to ensure synchronized execution of cooperating processes so that will maintain data consistency. Its main purpose is to share resources without any interference using mutual exclusion. There are two types of process synchronization:

- Independent Process
- Cooperative Process

### 12. What is IPC? What are the different IPC mechanisms?

IPC (Interprocess Communication) is a mechanism that requires the use of resources like a memory that is shared between processes or threads. With IPC, OS allows different processes to communicate with each other. It is simply used for exchanging data between multiple threads in one or more programs or processes. In this mechanism, different processes can communicate with each other with the approval of the OS.

**Different IPC Mechanisms:**

- Pipes
- Message Queuing
- Semaphores
- Socket
- Shared Memory
- Signals

### 13. What is different between main memory and secondary memory.

**Main memory:** Main memory in a computer is RAM (Random Access Memory). It is also known as primary memory or read-write memory or internal memory. The programs and data that the CPU requires during the execution of a program are stored in this memory.
**Secondary memory:** Secondary memory in a computer are storage devices that can store data and programs. It is also known as external memory or additional memory or backup memory or auxiliary memory. Such storage devices are capable of storing high-volume data. Storage devices can be hard drives, USB flash drives, CDs, etc.

| Primary Memory | Secondary Memory |
|---|---|
| Data can be directly accessed by the processing unit. | Firstly, data is transferred to primary memory and after then routed to the processing unit. |
| It can be both volatile and non-volatile in nature. | It is non-volatile in nature. |
| It is more costly than secondary memory. | It is more cost-effective or less costly than primary memory. |
| It is temporary because data is stored temporarily. | It is permanent because data is stored permanently. |

| Primary Memory | Secondary Memory |
|---|---|
| In this memory, data can be lost whenever there is a power failure. | In this memory, data is stored permanently and therefore cannot be lost even in case of power failure. |
| It is much faster than secondary memory and saves data that is currently used by the computer. | It is slower as compared to primary memory and saves different kinds of data in different formats. |
| It can be accessed by data. | It can be accessed by I/O channels. |

**14. What do you mean by overlays in OS?**

Overlays is basically a programming method that divides processes into pieces so that instructions that are important and need can be saved in memory. It does not need any type of support from the OS. It can run programs that are bigger in size than physical memory by only keeping only important data and instructions that can be needed at any given time.

**15. Write top 10 examples of OS?**

Some of the top OS's that are used mostly are given below:

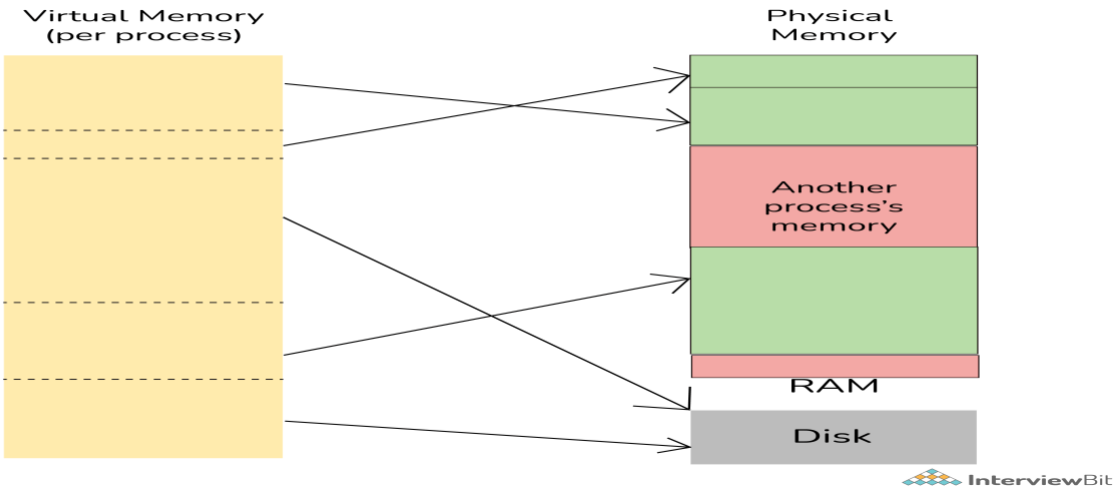
- MS-Windows
- Ubuntu
- Mac OS
- Fedora
- Solaris
- Free BSD
- Chrome OS
- CentOS
- Debian
- Android

**Intermediate OS Interview Questions**

**16. What is virtual memory?**

It is a memory management technique feature of OS that creates the illusion to users of a very large (main) memory. It is simply space where a greater number of programs can be stored by themselves in the form of pages. It enables us to increase the use of physical memory by using a disk and also allows us to have memory protection. It can

be managed in two common ways by OS i.e., paging and segmentation. It acts as temporary storage that can be used along with RAM for computer processes.

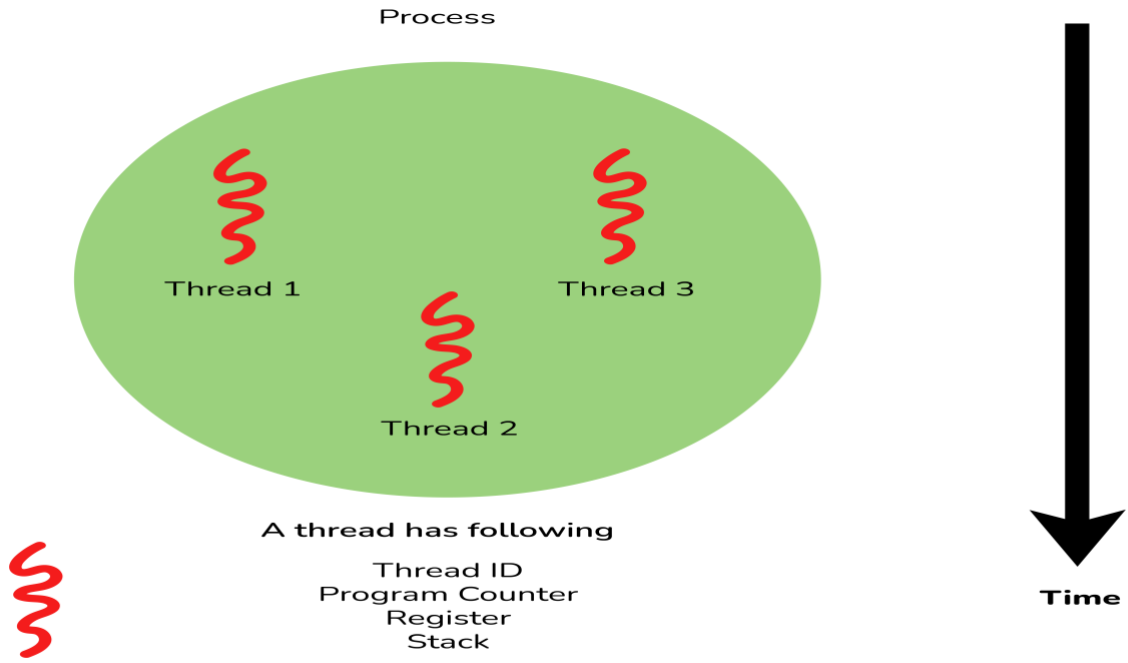



### 17. What is thread in OS?

Thread is a path of execution that is composed of a program counter, thread id, stack, and set of registers within the process. It is a basic unit of CPU utilization that makes communication more effective and efficient, enables utilization of multiprocessor architectures to a greater scale and greater efficiency, and reduces the time required in context switching. It simply provides a way to improve and increase the performance of applications through parallelism. Threads are sometimes called **lightweight processes** because they have their own stack but can access shared data.

Multiple threads running in a process share: Address space, Heap, Static data, Code segments, File descriptors, Global variables, Child processes, Pending alarms, Signals, and signal handlers.

Each thread has its own: Program counter, Registers, Stack, and State.



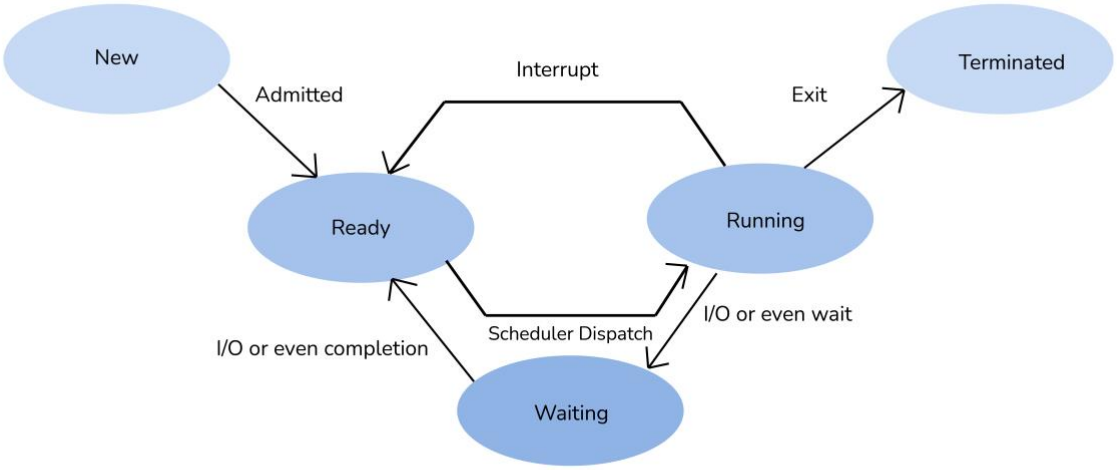

Thread In OS

InterviewBit

**18. What is a process? What are the different states of a process?**

The process is basically a program that is currently under execution. The main function of an OS is to manage and handle all of these processes. When a program is loaded into the memory and it becomes a process, it can be divided into four sections ─ stack, heap, text, and data. There are two types of processes:

1. Operating System Processes
2. User Processes




Proccess State

InterviewBit

**States of Process:**

Different states of the process through which process goes are given below:

- **New State**: In this state, a process is just created.
- **Running:** In this state, the CPU starts working on the process's instructions.
- **Waiting:** In this state, the process cannot run because it just waits for some event to occur
- **Ready:** In this state, the process has all resources available that are required to run but it waits to get assigned to a processor because CPUs are not working currently on instructions passed by the process.
- **Terminate:** In this state, the process is completed I.e., the process has finished execution.

**19. What do you mean by FCFS?**

**FCFS** (First Come First Serve) is a type of OS scheduling algorithm that executes processes in the same order in which processes arrive. In simple words, the process that arrives first will be executed first. It is non-preemptive in nature. FCFS scheduling may cause the problem of starvation if the burst time of the first process is the longest among all the jobs. Burst time here means the time that is required in milliseconds by the process for its execution. It is also considered the easiest and simplest OS scheduling algorithm as compared to others. Implementation of FCFS is generally managed with help of the FIFO (First In First Out) queue.

**20. What is Reentrancy?**

Reentrant is simply a function in which various clients can use and shares a single copy of a program during a similar period. This concept is generally associated with OS code and does not deal with concurrency. It has two major functions:

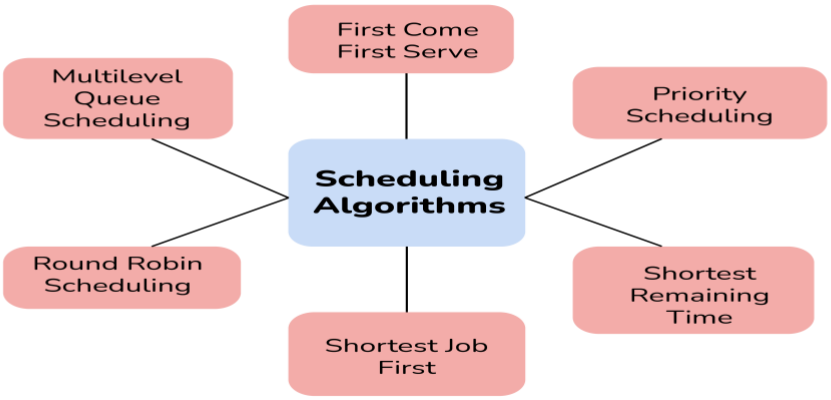
- Program code cannot change or modify itself.
- Local data for every client process needs to be stored in different disks.

**21. What is a Scheduling Algorithm? Name different types of scheduling algorithms.**

A scheduling algorithm is a process that is used to improve efficiency by utilizing maximum CPU and providing minimum waiting time to tasks. It simply deals with the problem of deciding which of outstanding requests is to be allocated resources. Its main aim is to reduce resource starvation and to ensure fairness amongst parties that are utilizing the resources. In simple words, it is used to allocate resources among various competing tasks.

## Types of Scheduling Algorithm

There are different types of scheduling algorithms as given below:




InterviewBit

### 22. What is the difference between paging and segmentation?

**Paging:** It is generally a memory management technique that allows OS to retrieve processes from secondary storage into main memory. It is a non-contiguous allocation technique that divides each process in the form of pages.
**Segmentation:** It is generally a memory management technique that divides processes into modules and parts of different sizes. These parts and modules are known as segments that can be allocated to process.

| Paging | Segmentation |
|---|---|
| It is invisible to a programmer. | It is visible to a programmer. |
| In this, the size of pages is fixed. | In this, the size of segments is not fixed. |
| Procedures and data cannot be separated in paging. | Procedures and data can be separated in segmentation. |
| It allows a cumulative total of virtual address spaces to cross physical main memory. | It allows all programs, data, and codes to break up into independent address spaces. |
| It is mostly available on CPUs and MMU chips. | It is mostly available on Windows servers that may support backward compatibility, while Linux has limited support. |
| It is faster for memory access as compared to segmentation. | It is slower as compared to paging. |

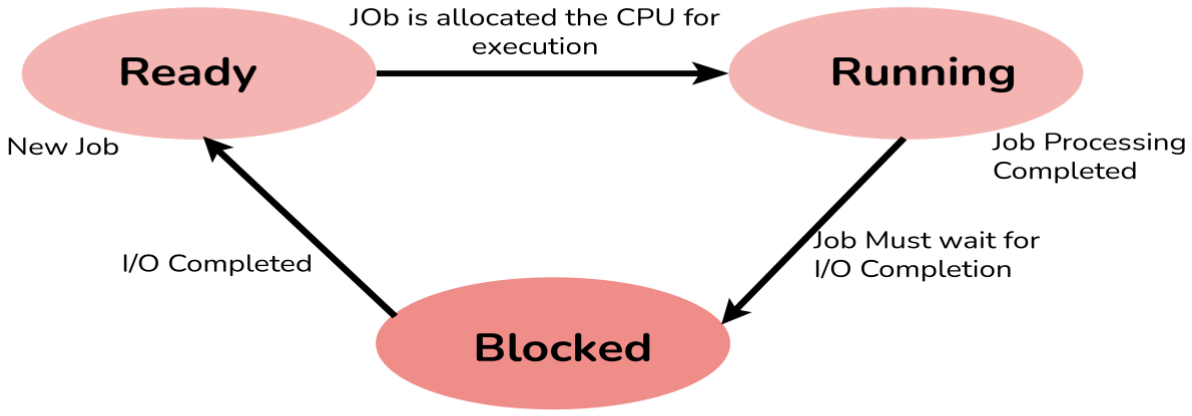
| Paging | Segmentation |
|---|---|
| In this, OS needs to maintain a free frame. | In this, OS needs to maintain a list of holes in the main memory. |
| In paging, the type of fragmentation is internal. | In segmentation, the type of fragmentation is external. |
| The size of the page is determined by available memory. | The size of the page is determined by the user. |

**23. What is thrashing in OS?**

It is generally a situation where the CPU performs less productive work and more swapping or paging work. It spends more time swapping or paging activities rather than its execution. By evaluating the level of CPU utilization, a system can detect thrashing. It occurs when the process does not have enough pages due to which the page-fault rate is increased. It inhibits much application-level processing that causes computer performance to degrade or collapse.

**24. What is the main objective of multiprogramming?**

It refers to the ability to execute or perform more than one program on a single processor machine. This technique was introduced to overcome the problem of underutilization of CPU and main memory. In simple words, it is the coordination of execution of various programs simultaneously on a single processor (CPU). The main objective of multiprogramming is to have at least some processes running at all times. It simply improves the utilization of the CPU as it organizes many jobs where the CPU always has one to execute.

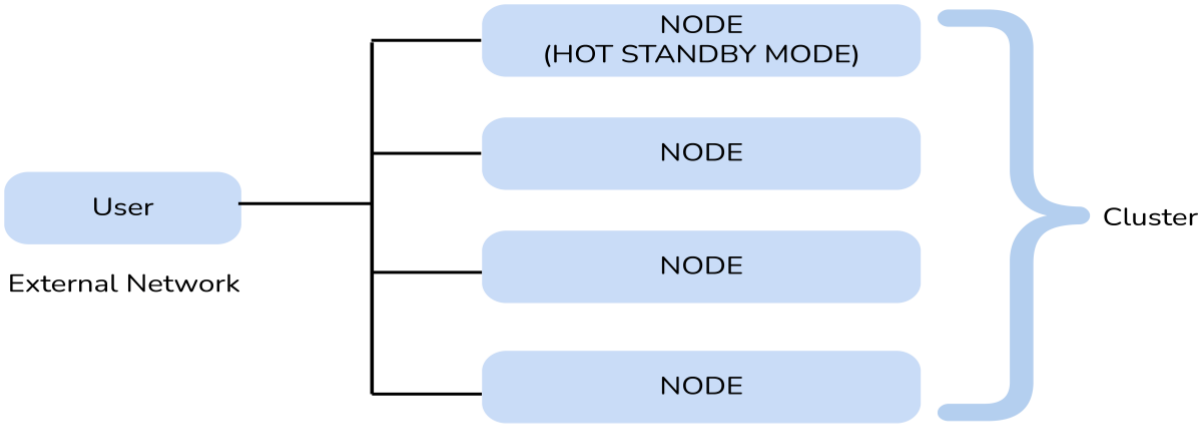



Three Different Stages Of Job

---

**25. What do you mean by asymmetric clustering?**

Asymmetric Clustering is generally a system in which one of the nodes among all nodes is in hot standby mode whereas the rest of all nodes run different applications. It simply uses whole or entire hardware resources therefore it is considered a more reliable system as compared to others.

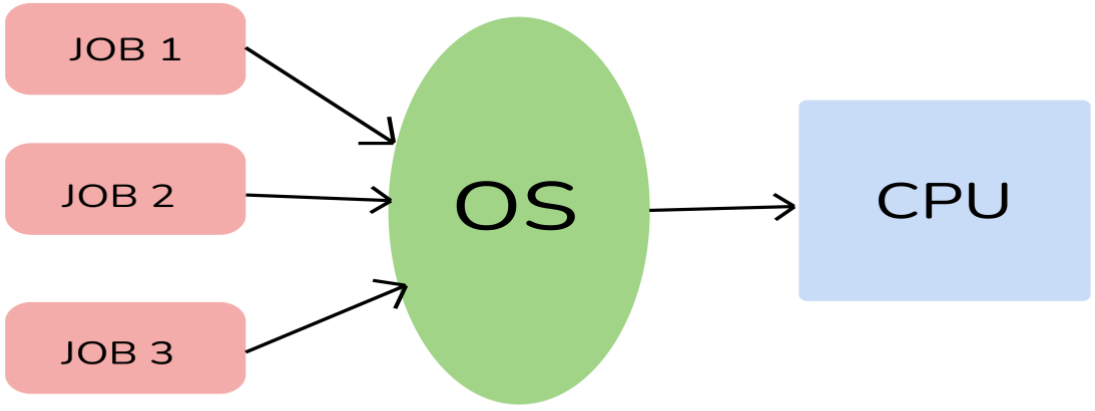



Asymmetric Clustering System

InterviewBit

**26. What is the difference between multitasking and multiprocessing OS?**

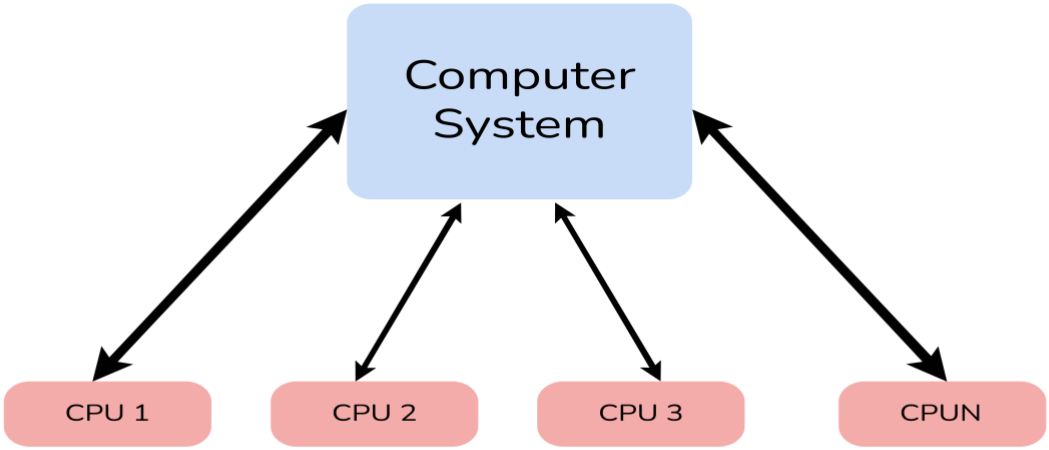
**Multitasking:** It is a system that allows more efficient use of computer hardware. This system works on more than one task at one time by rapidly switching between various tasks. These systems are also known as time-sharing systems.




Multitasking

InterviewBit

**Multiprocessing:** It is a system that allows multiple or various processors in a computer to process two or more different portions of the same program simultaneously. It is used to complete more work in a shorter period of time.




Multiprocessing

InterviewBit

| Multitasking | Multiprocessing |
|---|---|
| It performs more than one task at a time using a single processor. | It performs more than one task at a time using multiple processors. |
| In this, the number of CPUs is only one. | In this, the number of CPUs is more than one. |
| It is more economical. | It is less economical. |
| It is less efficient than multiprocessing. | It is more efficient than multitasking. |
| It allows fast switching among various tasks. | It allows smooth processing of multiple tasks at once. |
| It requires more time to execute tasks as compared to multiprocessing. | It requires less time for job processing as compared to multitasking. |

### 27. What do you mean by Sockets in OS?

The socket in OS is generally referred to as an endpoint for IPC (Interprocess Communication). Here, the endpoint is referred to as a combination of an IP address and port number. Sockets are used to make it easy for software developers to create network-enabled programs. It also allows communication or exchange of information between two different processes on the same or different machines. It is mostly used in client-server-based systems.

**Types of Sockets**

There are basically four types of sockets as given below:

- Stream Sockets
- Datagram Sockets
- Sequenced Packet Sockets
- Raw Sockets

### 28. Explain zombie process?

Zombie process, referred to as a defunct process, is basically a process that is terminated or completed but the whole process control block is not cleaned up from the main memory because it still has an entry in the process table to report to its parent process. It does not consume any of the resources and is dead, but it still exists. It also shows that resources are held by process and are not free.

### 29. What do you mean by cascading termination?

Cascading termination is a process termination in which if the parent process is exiting or terminating then the children process will also get terminated. It does not allow the child to continue processing as its parent process terminates. It is generally initiated by OS.

### 30. What is starvation and aging in OS?

When we use Priority Scheduling or Shortest Job First Scheduling, Starvation can happen, This algorithm is mostly used in CPU schedulers

**Starvation:** It is generally a problem that usually occurs when a process has not been able to get the required resources it needs for progress with its execution for a long period of time. In this condition, low priority processes get blocked and only high priority processes proceed towards completion because of which low priority processes suffer from lack of resources.

**Aging:** It is a technique that is used to overcome the situation or problem of starvation. It simply increases the priority of processes that wait in the system for resources for a long period of time. It is considered the best technique to resolve the problem of starvation as it adds an aging factor to the priority of each and every request by various

processes for resources. It also ensures that low-level queue jobs or processes complete their execution.

### 31. What do you mean by Semaphore in OS? Why is it used?

Semaphore is a signaling mechanism. It only holds one positive integer value. It is simply used to solve the problem or issue of critical sections in the synchronization process by using two atomic operations i.e., wait() and signal().

**Types of Semaphore**

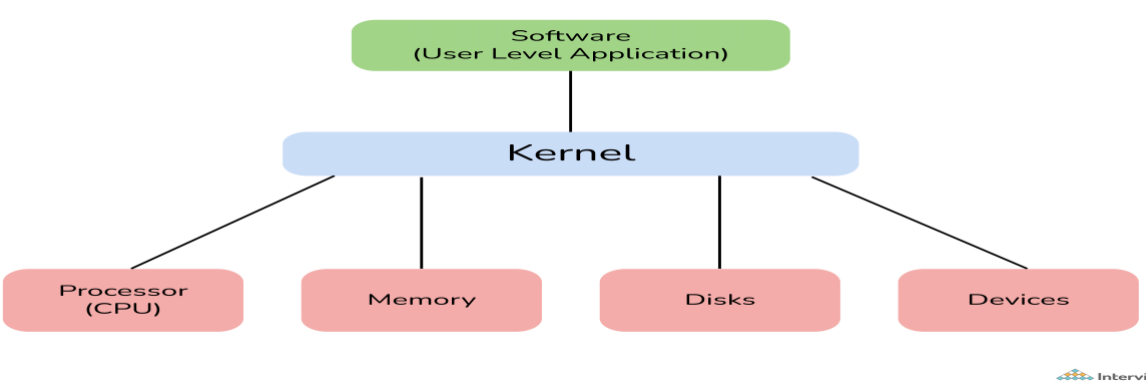
There are usually two types of semaphores as given below:

- Binary Semaphore
- Counting Semaphore

| Binary Semaphore | Mutex |
|---|---|
| It allows various process threads to get the finite instance of the resource until resources are available. | It allows various process threads to get single shared resource only at a time. |
| Its functions are based upon signaling mechanisms. | Its functions are based upon a locking mechanism. |
| Binary semaphores are much faster as compared to Mutex. | Mutex is slower as compared to binary semaphores. |
| It is basically an integer. | It is basically an object. |

### 32. What is Kernel and write its main functions?

The kernel is basically a computer program usually considered as a central component or module of OS. It is responsible for handling, managing, and controlling all operations of computer systems and hardware. Whenever the system starts, the kernel is loaded first and remains in the main memory. It also acts as an interface between user applications and hardware.



**Functions of Kernel:**

- It is responsible for managing all computer resources such as CPU, memory, files, processes, etc.
- It facilitates or initiates the interaction between components of hardware and software.
- It manages RAM memory so that all running processes and programs can work effectively and efficiently.
- It also controls and manages all primary tasks of the OS as well as manages access and use of various peripherals connected to the computer.
- It schedules the work done by the CPU so that the work of each user is executed as efficiently as possible.

**33. What are different types of Kernel?**

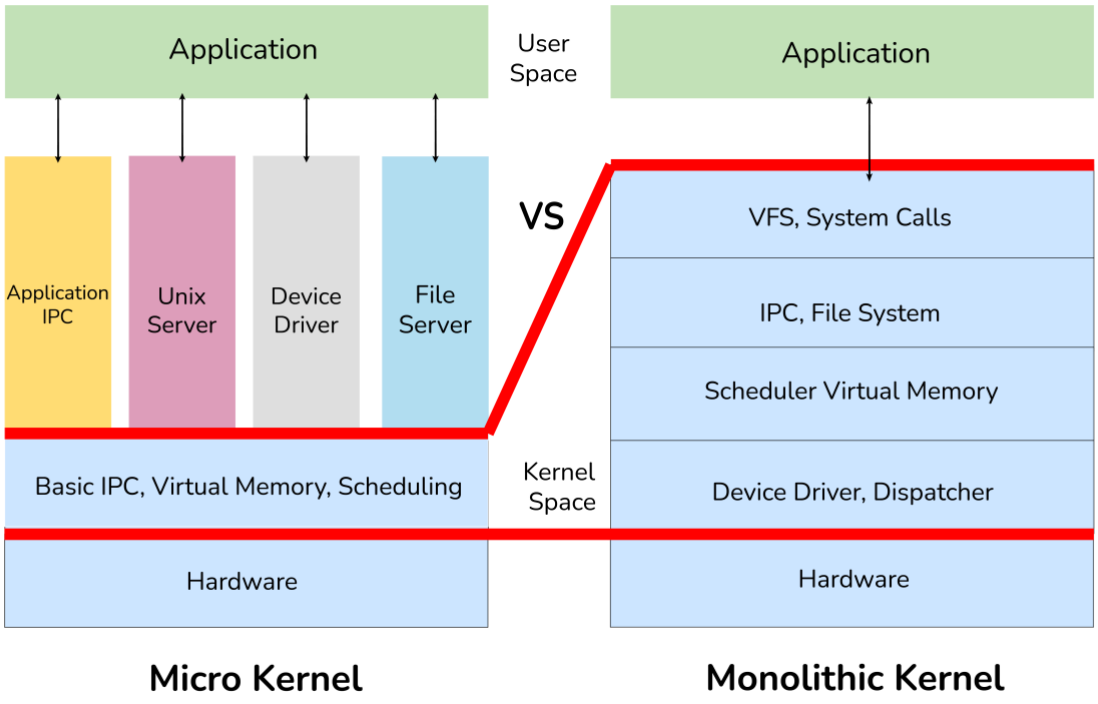
There are basically five types of Kernels as given below:

- Monolithic Kernel
- MicroKernel
- Hybrid Kernel
- Nano Kernel
- Exo Kernel

**34. Write difference between micro kernel and monolithic kernel?**

**MicroKernel**: It is a minimal OS that executes only important functions of OS. It only contains a near-minimum number of features and functions that are required to implement OS.
Example: QNX, Mac OS X, K42, etc.

**Monolithic Kernel:** It is an OS architecture that supports all basic features of computer components such as resource management, memory, file, etc.
Example: Solaris, DOS, OpenVMS, Linux, etc.



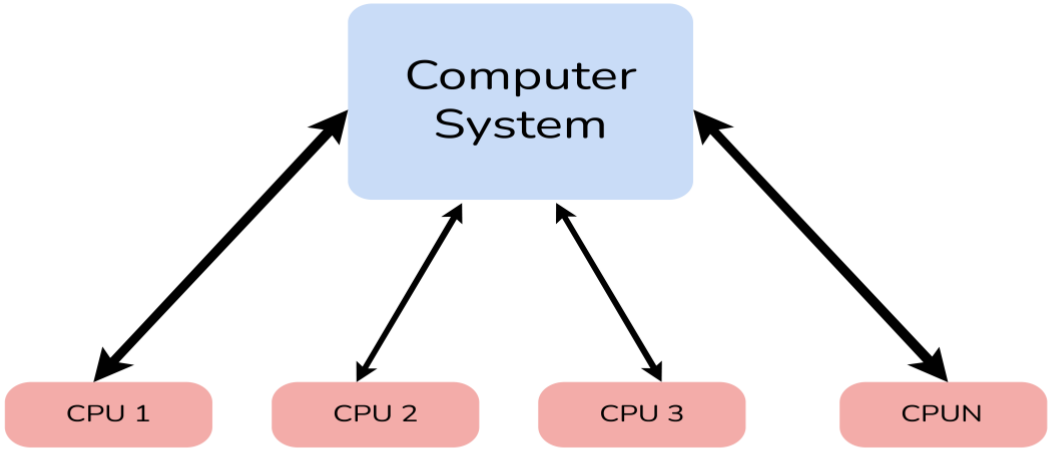

| MicroKernel | Monolithic Kernel |
|---|---|
| In this software or program, kernel services and user services are present in different address spaces. | In this software or program, kernel services and user services are usually present in the same address space. |
| It is smaller in size as compared to the monolithic kernel. | It is larger in size as compared to a microkernel. |
| It is easily extendible as compared to a monolithic kernel. | It is hard to as extend as compared to a microkernel. |
| If a service crashes, it does affect on working of the microkernel. | If a service crashes, the whole system crashes in a monolithic kernel. |
| It uses message queues to achieve inter-process communication. | It uses signals and sockets to achieve inter-process communication. |

### 35. What is SMP (Symmetric Multiprocessing)?

SMP is generally referred to as computer architecture in which the processing of programs is done by multiple processors that share a common OS and memory. SMP is very much required if you want to take advantage of multiprocessor hardware. It simply enables any processor to work on any of the tasks no matter where data or resources for that particular task are located in memory. These systems are more reliable than single-processor systems.

### 36. What is a time-sharing system?

It is a system that allows more than one user to access the resources of a particular system in many locations. In simple words, it performs multiple tasks on a single processor or CPU. As the name suggests, it means to share time into multiple slots in several processes. It also allows different users from different locations to use a particular computer system at the same time therefore it is considered one of the important types of OS.




Multiprocessing

InterviewBit

### 37. What is Context Switching?

Context switching is basically a process of saving the context of one process and loading the context of another process. It is one of the cost-effective and time-saving measures executed by CPU the because it allows multiple processes to share a single CPU. Therefore, it is considered an important part of a modern OS. This technique is used by OS to switch a process from one state to another i.e., from running state to ready state. It also allows a single CPU to handle and control various different processes or threads without even the need for additional resources.

### 38. What is difference between Kernel and OS?

**Kernel:** Kernel is a system program that controls all programs running on the computer. The kernel is basically a bridge between the software and hardware of the system.

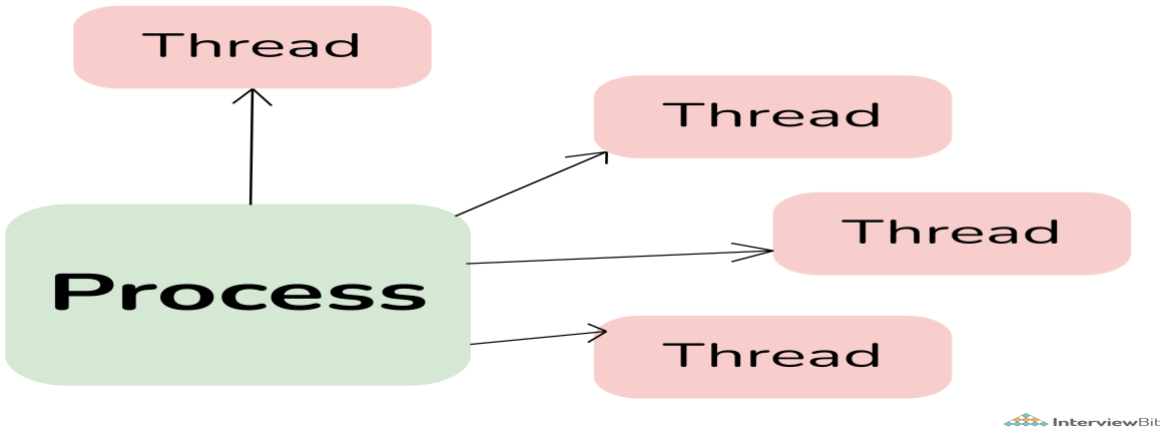
**Operating System:** Operating system is a system program that runs on the computer to provide an interface to the computer user so that they can easily operate on the computer.

| Kernel | OS |
|---|---|
| It is considered a central component of OS | It is considered system software. |
| It is generally responsible for converting user commands into machine-level commands. | It is generally responsible for managing the resources of system. |
| It simply acts as an interface between hardware and applications. | It simply acts as an interface between hardware and user. |
| It also performs functions like process management, file management, device management, I/O communication, etc. | It also performs functions like providing security to data and files in the the system, providing access controls to users, maintaining the system privacy, etc. |
| Its type includes Microkernel, Monolithic kernel, etc. | Its type includes Single and Multiprogramming batch systems, Distributed OS, Real-time OS. |

**39. What is difference between process and thread?**

**Process:** It is basically a program that is currently under execution by one or more threads. It is a very important part of the modern-day OS.

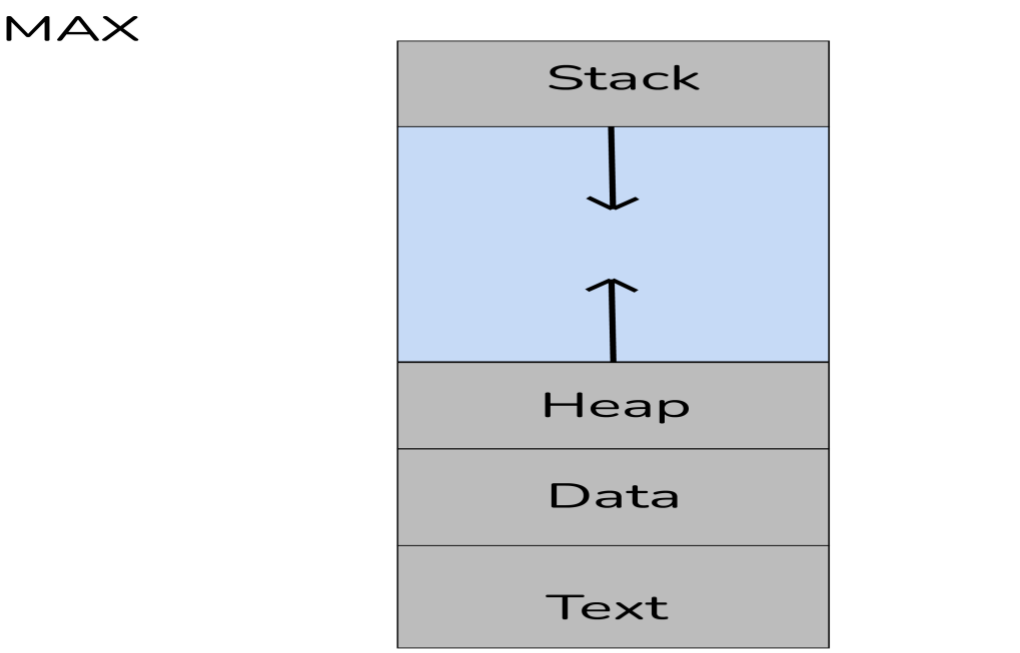
**Thread:** It is a path of execution that is composed of the program counter, thread id, stack, and set of registers within the process.




| Process | Thread |
|---|---|
| It is a computer program that is under execution. | It is the component or entity of the process that is the smallest execution unit. |
| These are heavy-weight operators. | These are lightweight operators. |
| It has its own memory space. | It uses the memory of the process they belong to. |
| It is more difficult to create a process as compared to creating a thread. | It is easier to create a thread as compared to creating a process. |
| It requires more resources as compared to thread. | It requires fewer resources as compared to processes. |
| It takes more time to create and terminate a process as compared to a thread. | It takes less time to create and terminate a thread as compared to a process. |
| It usually run-in separate memory space. | It usually run-in shared memory space. |
| It does not share data. | It shares data with each other. |
| It can be divided into multiple threads. | It can’t be further subdivided. |

**40. What are various sections of the process?**

There are basically four sections in the process as given below:




A Process In Memory

InterviewBit

- **Stack:** It is used for local variables and returns addresses.
- **Heap:** It is used for dynamic memory allocation.
- **Data**: It stores global and static variables.
- **Code or text:** It comprises compiled program code.

**41. What is a deadlock in OS? What are the necessary conditions for a deadlock?**

Deadlock is generally a situation where a set of processes are blocked as each process is holding resources and waits to acquire resources held by another process. In this situation, two or more processes simply try to execute simultaneously and wait for each to finish their execution because they are dependent on each other. We can see a hand problem in our system whenever a deadlock occurs in a program. It is one of the common problems you can see in multiprocessing.

**Necessary Conditions for Deadlock**

There are basically four necessary conditions for deadlock as given below:

- Mutual Exclusion

- Hold and Wait
- No Pre-emption
- Circular Wait or Resource Wait

**42. What do you mean by Belady's Anomaly?**

In the Operating System, process data is loaded in fixed-sized chunks and each chunk is referred to as a page. The processor loads these pages in the fixed-sized chunks of memory called frames. Belady's Anomaly is a phenomenon in which if we increase the number of frames in memory, then the number of page faults also increases. It is generally experienced when we use FIFO (First in First out) page replacement algorithm.

**43. What is spooling in OS?**

Spooling simply stands for Simultaneous peripheral operations online. It is referred to as putting data of various I/O jobs in a buffer. Here, buffer means a special area in memory or hard disk that can be accessible to an I/O device. It is used for mediation between a computer application and a slow peripheral. It is very useful and important because devices access or acquire data at different rates. This operation also uses disk as a very large buffer and is capable of overlapping I/O operations for one task with processor

**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.

**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.

**3) What are the different operating systems?**

- Batched operating systems
- Distributed operating systems
- Timesharing operating systems
- Multi-programmed operating systems
- Real-time operating systems

**4) What is a socket?**

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

**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.

**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.

**7) What is monolithic kernel?**

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

**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

**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

**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.

**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.

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

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

**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.

**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.

**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.

**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.

**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.

**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.

**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.

**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.

**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.

**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 - Stripped 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

**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.

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 { P0, P1, P2, . . ., PN } must exist such that every P[ i ] is waiting for P[ ( i + 1 ) % ( N + 1 ) ].

***Note: This condition implies the hold-and-wait condition, but it is easier to deal with the conditions if the four are considered separately.***

**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.

**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.

**27) What is fragmentation?**

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

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.

**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.

**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.

**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

**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.

**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.

**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.

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

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

**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.

**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

**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.

**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.

operations for another task.

**1) Explain the main purpose of an operating system?**

Operating systems exist for two main purposes. One is that it is designed to make sure a computer system performs well by managing its computational activities. Another is that it provides an environment for the development and execution of programs.

**2) What is demand paging?**

Demand paging is referred when not all of a process's pages are in the RAM, then the OS brings the missing(and required) pages from the disk into the RAM.

**3) What are the advantages of a multiprocessor system?**

With an increased number of processors, there is a considerable increase in throughput. It can also save more money because they can share resources. Finally, overall reliability is increased as well.

**4) What is kernel?**

A kernel is the core of every operating system. It connects applications to the actual processing of data. It also manages all communications between software and hardware components to ensure usability and reliability.

**5) What are real-time systems?**

Real-time systems are used when rigid time requirements have been placed on the operation of a processor. It has well defined and fixed time constraints.

**6) What is a virtual memory?**

Virtual memory is a memory management technique for letting processes execute outside of memory. This is very useful especially is an executing program cannot fit in the physical memory.

**7) Describe the objective of multiprogramming.**

The main objective of multiprogramming is to have a process running at all times. With this design, CPU utilization is said to be maximized.

**8 ) What is time- sharing system?**

In a Time-sharing system, the CPU executes multiple jobs by switching among them, also known as multitasking. This process happens so fast that users can interact with each program while it is running.

**9) What is SMP?**

SMP is a short form of Symmetric Multi-Processing. It is the most common type of multiple-processor systems. In this system, each processor runs an identical copy of the operating system, and these copies communicate with one another as needed.

**10) How are server systems classified?**

Server systems can be classified as either computer-server systems or file server systems. In the first case, an interface is made available for clients to send requests to perform an action. In the second case, provisions are available for clients to create, access and update files.

**11) What is asymmetric clustering?**

In asymmetric clustering, a machine is in a state known as hot standby mode where it does nothing but to monitor the active server. That machine takes the active server's role should the server fails.

**12) What is a thread?**

A thread is a basic unit of CPU utilization. In general, a thread is composed of a thread ID, program counter, register set, and the stack.

**13) Give some benefits of multithreaded programming.**

– there is increased responsiveness to the user
– resource sharing within the process
– economy
– utilization of multiprocessing architecture

**14) Briefly explain FCFS.**

FCFS stands for First-come, first-served. It is one type of scheduling algorithm. In this scheme, the process that requests the CPU first is allocated the CPU first. Implementation is managed by a FIFO queue.

**15) What is RR scheduling algorithm?**

RR (round-robin) scheduling algorithm is primarily aimed for time-sharing systems. A circular queue is a setup in such a way that the CPU scheduler goes around that queue, allocating CPU to each process for a time interval of up to around 10 to 100 milliseconds.

**16) What are necessary conditions which can lead to a deadlock situation in a system?**

Deadlock situations occur when four conditions occur simultaneously in a system: Mutual exclusion; Hold and Wait; No preemption; and Circular wait.

**17) Enumerate the different RAID levels.**

RAID 0 – Non-redundant striping
RAID 1 – Mirrored Disks
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

**18) Describe Banker's algorithm**

Bankers Algorithm

Banker's algorithm is one form of deadlock-avoidance in a system. It gets its name from a banking system wherein the bank never allocates available cash in such a way that it can no longer satisfy the needs of all of its customers.

**19) What factors determine whether a detection-algorithm must be utilized in a deadlock avoidance system?**

One is that it depends on how often a deadlock is likely to occur under the implementation of this algorithm. The other has to do with how many processes will be affected by deadlock when this algorithm is applied.

**20) State the main difference between logical from physical address space.**

Logical address refers to the address that is generated by the CPU. On the other hand, physical address refers to the address that is seen by the memory unit.

**21) How does dynamic loading aid in better memory space utilization?**

With dynamic loading, a routine is not loaded until it is called. This method is especially useful when large amounts of code are needed in order to handle infrequently occurring cases such as error routines.

**22) What are overlays?**

Overlays are used to enable a process to be larger than the amount of memory allocated to it. The basic idea of this is that only instructions and data that are needed at any given time are kept in memory.

**23) What is the basic function of paging?**

Paging is a memory management scheme that permits the physical address space of a process to be noncontiguous. It avoids the considerable problem of having to fit varied sized memory chunks onto the backing store.

**24) What is fragmentation?**

Fragmentation is memory wasted. It can be internal if we are dealing with systems that have fixed-sized allocation units, or external if we are dealing with systems that have variable-sized allocation units.

**25) How does swapping result in better memory management?**

During regular intervals that are set by the operating system, processes can be copied from main memory to a backing store, and then copied back later. Swapping allows more operations to be run that can fit into memory at one time.

**26) Give an example of a Process State.**

– New State – means a process is being created
– Running – means instructions are being executed
– Waiting – means a process is waiting for certain conditions or events to occur
– Ready – means a process is waiting for an instruction from the main processor
– Terminate – means a process is stopped abruptly

**27) What is a socket?**

A socket provides a connection between two applications. Each endpoint of a communication is a socket.

**28) What is Direct Access Method?**

Direct Access method is based on a disk model of a file, such that it is viewed as a numbered sequence of blocks or records. It allows arbitrary blocks to be read or written. Direct access is advantageous when accessing large amounts of information.

**29) When does thrashing occur?**

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

**30) What is the best page size when designing an operating system?**

The best paging size varies from system to system, so there is no single best when it comes to page size. There are different factors to consider in order to come up with a suitable page size, such as page table, paging time, and its effect on the overall efficiency of the operating system.

**31) When designing the file structure for an operating system, what attributes are considered?**

Typically, the different attributes for a file structure are naming, identifier, supported file types, and location for the files, size, and level of protection.

**32) What is root partition?**

Root partition is where the operating system kernel is located. It also contains other potentially important system files that are mounted during boot time.

**33) What are device drivers?**

Device drivers provide a standard means of representing I/O devices that maybe manufactured by different companies. This prevents conflicts whenever such devices are incorporated in a systems unit.

**34) What are the primary functions of VFS?**

VFS, or Virtual File System, separate file system generic operations from their implementation by defining a clean VFS interface. It is based on a file-representation structure known as vnode, which contains a numerical designator needed to support network file systems.

**35) What are the different types of CPU registers in a typical operating system design?**

– Accumulators
– Index Registers
– Stack Pointer
– General Purpose Registers

**36) What is the purpose of an I/O status information?**

I/O status information provides information about which I/O devices are to be allocated for a particular process. It also shows which files are opened, and other I/O device state.

**37) What is multitasking?**

Multitasking is the process within an operating system that allows the user to run several applications at the same time. However, only one application is active at a time for user interaction, although some applications can run "behind the scene".

**38) Explain pros and cons of a command line interface?**

A command line interface allows the user to type in commands that can immediately provide results. Many seasoned computer users are well accustomed to using the command line because they find it quicker and simpler.

However, the main problem with a command line interface is that users have to be familiar with the commands, including the switches and parameters that come with it. This is a downside for people who are not fond of memorizing commands.

**39) What is caching?**

Caching is the processing of utilizing a region of fast memory for a limited data and process. A cache memory is usually much efficient because of its high access speed.

**40) What is spooling?**

Spooling is normally associated with printing. When different applications want to send an output to the printer at the same time, spooling takes all of these print jobs into a disk file and queues them accordingly to the printer.

**41) What is an Assembler?**

An assembler acts as a translator for low-level language. Assembly codes written using mnemonic commands are translated by the Assembler into machine language.

**42) What are interrupts?**

Interrupts are part of a hardware mechanism that sends a notification to the CPU when it wants to gain access to a particular resource. An interrupt handler receives this interrupt signal and "tells" the processor to take action based on the interrupt request.

**44) What is preemptive multitasking?**

Preemptive multitasking allows an operating system to switch between software programs. This, in turn, allows multiple programs to run without necessarily taking complete control over the processor and resulting in system crashes.

**45) Why partitioning and formatting is a prerequisite to installing an operating system?**

Partitioning and formatting create a preparatory environment on the drive so that the operating system can be copied and installed properly. This includes allocating space on the drive, designating a drive name, determining and creating the appropriate file system and structure.

**46) What is plumbing/piping?**

It is the process of using the output of one program as an input to another. For example, instead of sending the listing of a folder or drive to the main screen, it can be piped and sent to a file, or sent to the printer to produce a hard copy.

**47) What is NOS?**

NOS is short for Network Operating System. It is a specialized software that will allow a computer to communicate with other devices over the network, including file/folder sharing.

**48) Differentiate internal commands from external commands.**

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

**49) Under DOS, what command will you type when you want to list down the files in a directory, and at the same time pause after every screen output?**
**a) dir /w**
**b) dir /p**
**c) dir /s**
**d) dir /w /p**

Answer: d) dir /w /p

**50) How would a file name EXAMPLEFILE.TXT appear when viewed under the DOS command console operating in Windows 98?**

The filename would appear as EXAMPL~1.TXT . The reason behind this is that filenames under this operating system are limited to 8 characters when working under DOS environment.

**51) What is a folder in Ubuntu?**

There is no concept of Folder in Ubuntu. Everything included in your hardware is a FILE.

**52) Explain why Ubuntu is safe and not affected by viruses?**

- It does not support malicious e-mails and contents, and before any e-mail is opened by users it will go through many security checks
- Ubuntu uses Linux, which is a super secure O.S system
- Unlike other O.S, countless Linux users can see the code at any time and can fix the problem if there is any
- Malware and viruses are coded to take advantage of the weakness in Windows

**53) Explain what is Unity in Ubuntu? How can you add new entries to the launcher?**

In Ubuntu, Unity is the default graphical shell. On the left side of the Ubuntu, it introduces the launcher and Dash to start programs.

In order to add new entries to the launcher, you can create a file name like **.desktop** and then drag the file on the launcher.

**54) Explain the purpose of using a libaio package in Ubuntu?**

Libaio is Linux Kernel Asynchronous I/O (A/O). A/O allows even a single application thread to overlap I/O operations with other processing, by providing an interface for submitting one or more I/O requests in one system call without waiting for completion. And a separate interface to reap completed I/O operations associated with a given completion group.

**55) What is the use of behavior tab in Ubuntu?**

Through behaviors tab, you can make many changes on the appearance of the desktop

- Auto-hide the launcher: You can use this option to reveal the launcher when moving the pointer to the defined hot spot.
- Enable workspaces: By checking this option, you can enable workspace
- Add show desktop icon to the launcher: This option is used to display the desktop icon on the launcher

**56) What is the meaning of "export" command in Ubuntu?**

Export is a command in Bash shell language. When you try to set a variable, it is visible or exported to any subprocess started from that instance of bash. The variable will not exist in the sub-process without the export command.

**57) Explain how you can reset Unity Configuration?**

To reset the unity configuration the simplest way to do is to hit open a Terminal or hit Atl-F2 and run the command # unity –reset

**58) Explain how to access Terminal?**

To access terminal, you have to go under Application **Menu -> Accessories -> Terminal.**

**What are the functions of operating system?**

The operating system controls and coordinates the use of hardware among the different processes and appli
various functionalities to the users. The following are the main job of operating system.

- Resource utilization
- Resource allocation
- Process management
- Memory management
- File management
- I/O management
- Device management

**Describe system calls and its type**

System calls works as a mediator between user program and service provided by operating system. In actua
make up an API (application program interface) typically invoke the actual system calls on behalf of the ap

**Types of System Call**

System calls can be grouped roughly into five major categories:

| Sr No. | | Example |
|---|---|---|
| 1 | Process control | Create process, terminate process,end,allocate and free memory etc |
| 2 | File manipulation | Create file, delete file, open file, close file, read, write. |
| 3 | Device manipulation | request device, release device, read, write, reposition, get device attributes, set device attributes etc. |
| 4 | Information maintenance | get or set process, file, or device attributes |
| 5 | Communications | Send, receive messages, transfer status information |

**Explain Booting the system and Bootstrap program in operating system.**

The procedure of starting a computer by loading the kernel is known as booting the system.

When a user first turn on or booted the computer, it needs some initial program to run. This initial program is known as Bootstrap Program. It is stored in read-only memory (ROM) or electrically erasable programmable read-only memory (EEPROM). Bootstrap program locates the kernel and loads it into main memory and starts its execution.

**Describe Main memory and Secondary memory storage in brief.**

Main memory is also called random access memory (RAM). CPU can access Main memory directly. Data access from main memory is much faster than Secondary memory. It is implemented in a

semiconductor technology, called dynamic random-access memory (DRAM).

Main memory is usually too small to store all needed programs. It is a volatile storage device that loses its contents when power is turned off. Secondary memory can stores large amount of data and programs permanently. Magnetic disk is the most common secondary storage device. If a user wants to execute any program it should come from secondary memory to main memory because CPU can access main memory directly.

**What are the advantages of multiprocessor system?**

Systems which have more than one processor are called multiprocessor system. These systems are Also known as parallel systems or tightly coupled systems.

**Multiprocessor systems have the following advantages.**

- **Increased Throughput:** Multiprocessor systems have better performance than single processor systems. It has shorter response time and higher throughput. User gets more work in less time.

- **Reduced Cost:** Multiprocessor systems can cost less than equivalent multiple single processor systems. They can share resources such as memory, peripherals etc.

- **Increased reliability:** Multiprocessor systems have more than one processor, so if one processor fails, complete system will not stop. In these systems, functions are divided among the different processors.

Is it possible to have a deadlock involving only one process? Explain your answer.

Deadlock with one process is not possible. Here is the explanation.

A deadlock situation can arise if the following four conditions hold simultaneously in a system.

- Mutual Exclusion.
- Hold and Wait.
- No Preemption.
- Circular-wait.

It is not possible to have circular wait with only one process, thus failing a necessary condition for Circular wait. There is no second process to form a circle with the first one. So it is not possible to have a deadlock involving only one process.

**What is an operating system?**

An operating system is a collection of software programs which control the allocation and usage of various hardware resources in the system. It is the first program to be loaded in the computer and it runs in the memory till the system is shut down.

Some of the popular Operating Systems are DOS, Windows, Ubuntu, Solaris etc.

**What are its main functions?**

**The main functions of an OS are:**

a. Process Management
b. Memory Management
c. Input/ Output Management
d. Storage/ File system management

**What is a Kernel?**

- Kernel is the part of OS which handles all details of sharing resources and device handling.
- It can be considered as the core of OS which manages the core features of an OS.
- Its purpose is to handle the communication between software and hardware
- Its services are used through system calls.
- A layer of software called shell wraps around the Kernel.

**What are the main functions of a Kernel?**

The main functions of a Kernel are:
- Process management
- Device management
- Memory management
- Interrupt handling

- I/O communication
- File system management

**What are the different types of Kernel?**

**Kernels are basically of two types:**

a. **Monolithic Kernels** - In this architecture of kernel, all the system services were packaged into a single system module which lead to poor maintainability and huge size of kernel.
b. **Microkernels** - They follow the modular approach of architecture. Maintainability became easier with this model as only the concerned module is to be altered and loaded for every function. This model also keeps a tab on the ever growing code size of the kernel.

**What are the disadvantages of Microkernels?**

Following are the main disadvantages of Microkernels. Usually these disadvantages are situation based.

a. Larger running memory footprint
b. Performance loss due to the requirement of more software for interfacing.
c. Difficulty in fixing the messaging bugs.
d. Complicated process management.

**What is a command interpreter?**

It is a program that interprets the command input through keyboard or command batch file. It helps the user to interact with the OS and trigger the required system programs or execute some user application.

**Command interpreter is also referred to as:**

- Control card interpreter
- Command line interpreter
- Console command processor
- Shell

**Explain Process.**

A process is a program that is running and under execution. On batch systems, it is called as a "job" while is called as a "task".

**Explain the basic functions of process management.**

Important functions of process management are:
- Creation and deletion of system processes.
- Creation and deletion of users.
- CPU scheduling.
- Process communication and synchronization.

**What do you know about interrupt?**

- Interrupt can be understood as a signal from a device causing context switch.
- To handle the interrupts, interrupt handlers or service routines are required.
- The address of each Interrupt service routine is provided in a list which is maintained in interrupt vector.

**What is a daemon?**

- Daemon - Disk and execution monitor, is a process that runs in the background without user's

interaction. They usually start at the booting time and terminate when the system is shut down.

**How would you identify daemons in Unix?**

- The name of daemons usually end with 'd' at the end in Unix.
- For e.g. httpd, named, lpd.

**What do you mean by a zombie process?**

- These are dead processes which are not yet removed from the process table.
- It happens when the parent process has terminated while the child process is still running.

This child process now stays as a zombie.

**What do you know about a Pipe? When is it used?**

- It is an IPC mechanism used for one way communication between two processes which are related.
- A single process doesn't need to use pipe. It is used when two process wish to communicate one-way.

**What is a named pipe?**

- A traditional pipe is unnamed and can be used only for the communication of related process.

If unrelated processes are required to communicate - named pipes are required.

- It is a pipe whose access point is a file available on the file system. When this file is opened for reading,

a process is granted access to the reading end of the pipe. Similarly, when the file is opened for writing,

the process is granted access to writing end of the pipe.

- A named pipe is also referred to as FIFO or named FIFO.

**What are the various IPC mechanisms?**

IPC - Inter Process Communication.

**Various IPC mechanisms are:**

a. Sockets
b. Pipes
c. Shared memory
d. Signals
e. Message Queues

**What is a semaphore?**

- A semaphore is a hardware or a software tag variable whose value indicates the status of a common

resource.

- Its purpose is to lock the common resource being used. A process which needs the resource will check

the semaphore to determine the status of the resource followed by the decision for proceeding.

- In multitasking operating systems, the activities are synchronized by using the semaphore techniques.

**What kind of operations are possible on a semaphore?**

Two kind of operations are possible on a semaphore - 'wait' and 'signal'.

**What is context switching?**

- Context is associated with each process encompassing all the information describing the current

execution state of the process

- When the OS saves the context of program that is currently running and restores the context of the

next ready to run process, it is called as context switching.
- It is important for multitasking OS.

**Tell us something about Mutex.**

- Mutex - 'Mutual Exclusion Lock' is a lock which protects access to shared data resource.
- Threads can create and initialize a mutex to be used later.
- Before entering a critical region the mutex is locked. It is unlocked after exiting the critical region. If any mutex during this time, it can't do so.

**What is a critical section?**

It is a section of code which can be executed only by one process at a time.

**What is synchronization? What are the different synchronization mechanisms?**

Synchronization means controlling access to a resource that is available to two or more threads or process. mechanisms are:
- Mutex
- Semaphores
- Monitors
- Condition variables
- Critical regions
- Read/ Write locks

**What is the basic difference between pre-emptive and non-pre-emptive scheduling.**

Pre-emptive scheduling allows interruption of a process while it is executing and taking the CPU to another process while non-pre-emptive scheduling ensures that a process keeps the CPU under control until

**Is non-pre-emptive scheduling frequently used in a computer? Why?**

No, it is rarely used for the reasons mentioned below:

- It can not ensure that each user gets a share of CPU regularly.
- The idle time with this increases reducing the efficiency and overall performance of the system.
- It allows program to run indefinitely which means that other processes have to wait for very long.

**Explain condition variable.**

- These are synchronization objects which help threads wait for particular conditions to occur.
- Without condition variable, the thread has to continuously check the condition which is very costly on the resources.
- Condition variable allows the thread to sleep and wait for the condition variable to give it a signal.

**What are read-write locks?**

- Read - write locks provide simultaneous read access to many threads while the write access stays with one thread at a time. They are especially useful in protecting the data that is not frequently written but read simultaneously by many threads.
- They are slower than mutexes.

**What is a deadlock?**

- It is a condition where a group of two or more waiting for the resources currently in use by other processes of the same group.
- In this situation every process is waiting for an event to be triggered by another process of the group.
- Since no thread can free up the resource a deadlock occurs and the application hangs.

**What are the necessary conditions for deadlock to occur?**

a. At least one resource should be occupied in a non-sharable condition.
b. A process holding at least one resource is waiting for more resources currently in use by ot
b. processes.
c. It is not possible to pre-empt the resource.
d. There exists a circular wait for processes.

**Name the functions constituting the OS's memory management.**

- Memory allocation and de-allocation
- Integrity maintenance
- Swapping
- Virtual memory

**Name the different types of memory?**

a. Main memory also called primary memory or RAM
b. Secondary memory or backing storage

c. Cache
d. Internal process memory

**Throw some light on Internal Process Memory.**

- This memory consists of a set of high-speed registers. They work as temporary storage for instructions and data.

**Explain compaction.**

During the process of loading and removal of process into and out of the memory, the free memory gets broken into smaller pieces. These pieces lie scattered in the memory. Compaction means movement of these pieces close to each other to form a larger chunk of memory which works as a resource to run larger processes.

**What are page frames?**

Page frames are the fixed size contiguous areas into which the main memory is divided by the virtual mem

**What are pages?**

- Pages are same sized pieces of logical memory of a program. Usually they range from 4 KB to 8 KB depending on the addressing hardware of the machine.
- Pages improve the overall system performance and reduces requirement of physical storage as the data is read in 'page' units.

**Differentiate between logical and physical address.**

- Physical addresses are actual addresses used for fetching and storing data in main memory when the process is under execution.
- Logical addresses are generated by user programs. During process loading, they are converted by the loader into physical address.

**When does page fault error occur?**

- It occurs when a page that has not been brought into main memory is accessed.

**Explain thrashing.**

- In virtual memory system, thrashing is a high page fault scenario. It occurs due to under-allocation of pages required by a process.
- The system becomes extremely slow due to thrashing leading to poor performance.

**What are the basic functions of file management in OS?**

- Creation and deletion of files/ directories.
- Support of primitives for files/ directories manipulation.
- Backing up of files on storage media.
- Mapping of files onto secondary storage.

Explain thread.

- It is an independent flow of control within a process.
- It consists of a context and a sequence of instructions for execution.

**What are the advantage of using threads?**

The main advantages of using threads are:

a.) No special communication mechanism is required.
b.) Readability and simplicity of program structure increases with threads.
c.) System becomes more efficient with less requirement of system resources.

**What are the disadvantages of using threads?**

The main disadvantages of using threads are:

- Threads can not be re-used as they exist within a single process.
- They corrupt the address space of their process.
- They need synchronization for concurrent read-write access to memory.

**What is a compiler?**

A compiler is a program that takes a source code as an input and converts it into an object code. During t source code goes through lexical analysis, parsing and intermediate code generation which is then optimize object code.

**What is a library?**

It is a file which contains object code for subroutines and data to be used by the other program.

**What are the advantages of distributed system?**

Advantages of distributed system are:

- Resources get shared
- Load gets shared
- Reliability is improved
- Provide a support for inter-process communication

**What are the different types of scheduling algorithms?**

The scheduling algorithms decide which processes in the ready queue are to be allocated to the CPU for ex
algorithms can be broadly classified on the basis of:

- Preemptive algorithms
- Round Robin Scheduling
- Shortest Job First Scheduling (can be both)
- Priority Scheduling (can be both)
- Non-preemptive algorithms
- First Come First Served Scheduling

**Non-Preemptive algorithms**: In this type of scheduling once a CPU has been allocated to a process it would not release the CPU till a request for termination or switching to waiting state occurs.

**Preemptive algorithms**: In this type of scheduling a process maybe interrupted during execution and the CPU maybe allocated to another process.

**Why is round robin algorithm considered better than first come first served algorithm?**

The first come first served algorithm is the simplest scheduling algorithm known. The processes are assigned to the CPU on the basis of their arrival time in the ready queue. Since, it is non-preemptive once a process is assigned to the CPU, it will run till completion. Since a process takes the CPU till

it is executed it is not very good in providing good response times. It can make other important processes

On the other hand, the round robin algorithm works on the concept of time slice or also known as quantum. In this algorithm, every process is given a predefined amount of time to complete the process. In case, a process is not completed in its predefined time then it is assigned to the next process waiting in queue. In this way, a continuous execution of processes is maintained which would not have been possible in case of FCFS algorithm

**Explain how a copying garbage collector works. How can it be implemented using semispaces?**

The copying garbage collector basically works by going through live objects and copying them into a specific region in the memory. This collector traces through all the live objects one by one. This entire process is performed in a single pass. Any object that is not copied in memory is garbage.

The copying garbage collector can be implemented using semispaces by splitting the heap into two halves. Each half is a contiguous memory region. All the allocations are made from a single half of the heap only. When the specified heap is half full, the collector is immediately invoked and it copies the live objects into the other half of the heap. In this way, the first half of the heap then only contains garbage and eventually is overwritten in the next pass.

**How does reference counting manage memory allocated objects? When can it fail to reclaim objects?**

Reference counting augments every object with a count of the number of times an object has been referenced. This count is incremented every time a reference to that object is made. Also every time a reference is destroyed the reference is decremented. This process is repeated till the reference count becomes zero. Once the reference count of an object reaches zero the object can be reclaimed. In this way, reference counting systems can perform automatic memory management by keeping a count in every object. Any object that does not have a reference count can be considered to be dead and that memory can be reclaimed.

The reference counting method can fail to reclaim objects in case of cyclic references. There are no

concrete ways to avoid this problem and it is always suggested to create an architecture that does not use a

**What differences are there between a semaphore wait signal and a condition variable wait signal?**

**Semaphore wait signal:**

- They can be used anywhere except in a monitor.
- The wait() function does not always blocks its caller.
- The signal() function increments the semaphore counter and can release a process.
- If the signal() releases a process, the released and the caller both continue.

**Condition Variable wait signal:**

- It can only be used in monitors.
- The wait() function always blocks its caller.
- The signal() can either release a process or it is lost as if it never occurred.
- On signal() releasing a process either the caller or the released continues but not both at the same time.

For a deadlock to occur what are the necessary conditions

**In order for deadlocks to occur there are four necessary conditions:**

- **Mutual Exclusion:** The resources available are not sharable. This implies that the resources used must be mutually exclusive.

- **Hold and Wait:** Any process requires some resources in order to be executed. In case of insufficient availability of resources a process can take the available resources, hold them and wait for more resources to be available.

- **No Preemption:** The resources that a process has on hold can only be released by the process itself volun cannot be preempted by the system.

- **Circular Waiting:** A special type of waiting in which one process is waiting for the resources held by a second process. The second process is in turn waiting for the resources held by the first process.

**Why is the context switch overhead of a user-level threading as compared to the overhead for proces**

**Explain.**

This is due to the reason that a context switch implementation is done by the kernel. During this process the state information is copied between the processor and the PCB (process control block) or the TCB (thread control block). Since the kernel does not know anything about user-level threads, technically it is not possible for it to be a user level thread context switch. The user level scheduler can do some limited state copying on the behalf of a thread prior to the control being handed to that thread. But this copying of state information is smaller compared to that of a kernel-level process. Also the process does not involve going into the kernel mode with the help of a syste

**State the advantages of segmented paging over pure segmentation?**

In broad terms paging is a memory management technique that allows a physical address space of a process to be non-contiguous.

**Segmented paging has a certain set of advantages over pure segmentation such as:**

- Segmented paging does not have any source of external fragmentation.
- Since a segment existence is not restricted to a contiguous memory range it can be easily grown and does not have to adjust into a physical memory medium.
- With segmented paging the addition of an offset and a base is simpler as it is only an append operation instead of it being a full addition operation.

**When does the Belady's anomaly occur?**

The Belady's anomaly is a situation in which the number of page faults increases when additional physical memory is added to a system. This anomaly arises in some algorithms that implement virtual memory. The virtual memory allows programs larger than the physical memory space to execute. An algorithm suffers from this problem when it cannot guarantee that a page will be kept when a small number of frames are available. An optimal algorithm would not suffer from this

problem as it replaces the page not to be used for the longest time. The anomaly occurs when the page replacement algorithm will remove a page that will be needed in the immediate future. An optimal algorithm will not select such a page that will be required immediately. This anomaly is also stated to be unbounded.

**What complications does concurrent processing add to an operating system?**

**There are various complications of concurrent processing such as:**

- A time sharing method must be implemented to allow multiple processes to have an access to the system. This will involve the preemption of processes that do not give up CPU on their own i.e. more than one process may be executing kernel code simultaneously.

- The amount of resources that a process can use and the operations that it may perform must be limited. The system resources and the processes must be protected from each other.

- Kernel must be designed to prevent deadlocks between the various processes, i.e. Cyclic waiting or hold and waiting must not occur.

- Effective memory management techniques must be used to better utilize the limited resources.

**How can a VFS layer allow multiple file systems support?**

The VFS layer also known as the virtual file system functions in many ways similar to object oriented programming techniques. It acts like an abstraction layer on top of a more specific file system. The VFS layer enables the OS to make system calls independent of the file system type used. Any file system that is used gives its function calls used and the data structures to the layer of VFS. The VFS layer translates a system call into the correct specific functions for the targeted file system. The program that is used for calling does not have a file system specific code also the system call structures used in upper levels are file system independent. The VFS layer translation translates the non-file system specific calls into a file system specific operation.

**What are the pros and cons of using circuit switching?**

The primary **advantage** of using circuit switching is that it ensures the availability of resources. That is it reserves the network resources required for a specific transfer prior to the transmission taking place. By doing so it ensures that no packet would be dropped and the required quality of service is met.

The **disadvantage** of using circuit switching is that it requires a round trip message to setup a reservation. By doing so as it provisions the resources ahead of the transmission it might lead to the suboptimal use of resources.

**Circuit switching can be implemented for applications that have constant demand for network resources for long periods of time.**

What problems are faced during the implementation of a network-transparent system?

**A designer primarily faces two major problems while implementing a network-transparent system. They are as follows:**

- The primary problem is to make all the processors and storage devices to appear transparent on the netwo distributed system should appear as a single centralized system to the users using the network.

**There are two solutions to it:**

- The Andrews files system
- The NFS system.

- Both these file systems (distributed) appear as a single file system to the user whereas in reality it may be network.

- The secondary issue is regarding the user mobility. The designer would want any user to connect to the er than to a particular machine.

**Explain the layers of a Windows XP system.**

The layers of Windows XP system boot-up is as follows:

- A situation of operating system portability is created by the **hardware abstraction layer** by hiding hardware differences from the operating systems upper layers. A virtual machine interface is provided by the hardware abstraction layer to be used by the kernel dispatcher and the device drivers.

- The foundation provided by the **kernel layer** is used by the executive functions and the user mode sub systems. The kernel would always remain in memory and cannot be preempted. The functions of the kernel are thread scheduling, interrupt and exception handling etc.

- The **executive layer** is responsible for providing services to be used by all subsystems. These can be object manager, process manager, i/o manager etc.

Explain the booting process of a Windows XP system.

**The steps involved are as follows:**

- As the computer is powered on, the BIOS begins execution from ROM, it loads and executes the bootstrap loader.
- The NTLDR program is loaded from the root directory of the system disk and determines which boot disk contains the operating system.
- NTLDR loads the HAL library, kernel and system hive. The system hive indicates the required boot drivers and loads them one by one.
- Kernel execution begins by initializing the system and creating two processes: the system process containing all internal worker threads and the first user-mode initialization process: SMSS.
- SMSS further initializes the system by establishing paging files and loading device drivers.
- SMSS creates two processes: WINLOGON, which brings up the rest of the system and CSRSS, the Win32 subsystem process.

**How are data structures handled by NTFS and how does it recover from a crash?**

In an NTFS file system inside the transactions all the data structure updates are performed. Prior to the alteration of a data structure a transaction creates log record containing information on redo and undo f transaction is completed commit record information is stored in the logs.

An NTFS system recovers from a crash by accessing information from the created log records. The first step is to redo operations of committed transactions and undoing those transactions which could not be successfully committed. Although the NTFS file system after recovering from a crash might not reflect the same user data prior to a crash but it can guarantee the file data structures are undamaged. It restores the structure to a pre-crash and consistent state.

**What are the benefits and losses of placing the functionality in a device controller rather than in placing it in the kernel?**

The benefits of placing functionality in the device controller are:

- System crasher due to the occurrence of a bug is greatly reduced.
- By the utilization of dedicated hardware and algorithms that are hard coded the performance can be improved greatly.
- Since the algorithms are hard coded the kernel gets simplified.

**The banes of placing functionality in the controller rather than the kernel are:**

- Once a bug occurs they are difficult to fix, a new firmware or revision may be required.
- For performance improvement of algorithms hardware upgrades are required rather than a device driver update.

**What are merits and demerits of systems supporting multiple file structure and systems supporting a stream of bytes?**

The main advantage of having a system that supports multiple file structures is that the support for it is provided by the system itself no other individual application is required to provide the multiple

structure support. Since the support is provided by the system itself the implementation is much more efficient as compared to application level.

A demerit of such kind of implementation is that it can increase the overall size of the system. Also, since the support is provided by the system, for an application that requires a different file type may not be executable on such a system.

A good alternative for this is that the OS does not define any support for file structures instead all files are of bytes. By doing so the support for file systems is simplified as the OS does not have to specify the different structures for the file systems. It allows the applications to define the file structures. This kind of implementation can be found in UNIX.

**What do you understand by transaction atomicity?**

The transaction process can be considered to be a series of read and write operations upon some data which is followed by a commit operation. By transaction atomicity it means that if a transaction is not completed successfully then the transaction must be aborted and any changes that the transactions did while execution must be roll backed. It means that a transaction must appear as a single operation that cannot be divided. This ensures that integrity of the data that is being updated is maintained. If the concept of atomicity in transaction is not used any transaction that is aborted midway may result in data to be inconsistent as there might be a possibility two transactions may be sharing the same data value.

**Why is a single serial port managed with a single interrupt-driven I/O but a front-end processor is managed using a polling I/O, such as a terminal concentrator?**

When the I/O is frequent and of very short durations polling is considered to be more efficient than an interrupt driven I/O. Although, a serial port individually can have fairly infrequent number of I/O and hence should ideally use interrupts the case of serial ports in a terminal concentrator is different.

A terminal concentrator consists of multiple serial ports and this can lead to the creation of multiple short

I/O instances this can create un-necessary load on the system in case of interrupts usage.

Instead, if a polling loop is used it can greatly reduce the amount of load on the system by looping through without the requirement of I/O.

Due to this reason interrupts are used for single ports as the frequency of I/O on such a port is less and can be managed effectively, whereas we use polling for multiple ports as the frequency of I/O increases and which suits polling.

**What is graceful degradation?**

- It is the ability to continue providing service proportional to level of hardware.
- Systems designed for graceful degradation are called fault tolerant.
- If we have several processors connected together, then failure of one would not stop the system.
- Then the entire system runs only 10% slower.
- This leads to increased reliability of the system.

**What are loosely coupled systems?**

- These systems are also called as the distributed systems.
- It consist of collection of processors that do not share memory or clock.
- The processors communicate through high speed buses or telephone lines.
- It can be a centralized system where the server responds to client requests.
- It can also be a peer to peer system.

**Explain SMP.**

- It is called as symmetric multiprocessing which is multiprocessor system.
- In it each processor runs an identical copy of the operating system.
- These copies communicate with one another as needed.
- These processor systems lead to increased throughput.
- These systems are also called parallel systems or tightly coupled systems.

**What is DLM?**

- It is the service called as distributed lock manager.
- In cluster systems to avoid file sharing the distributed systems must provide the access control and file lo

- This ensures that no conflicting operations occur in the system.
- Here the distributed file systems are not general purpose therefore it requires locking.

**Explain the handheld systems. List the issues related to the handheld system.**

- Handheld devices are palm tops and cellular telephones with connectivity to a network.
- These devices are of limited size which leads to limited applications.
- They use a memory 512KB to 16MB as a result the operating system and applications must use the memory efficiently.
- The speed of the processors is only a fraction of speed of the PC processors and for faster processors larger battery is required.
- These devices use very small display screens so reading mails and browsing must be condensed to smaller displays.

**Why is interrupt vector used in operating systems?**

- The operating system these days are interrupt driven and this requires the interrupt vector.
- This interrupt vector contains the addresses of the interrupt service routines for various devices.
- Here the interrupts can be indirectly called through the table with no intermediate routine needed.
- This leads to interrupt handling at a faster rate.
- Operating systems like MS DOS and UNIX are using the interrupt vector.

**What is the need of device status table?**

- This table gives the device type, its address and status.
- It is required to keep a track of many input output requests at the same time.
- The state of the device can be functioning, idle or busy.
- If a device is busy, type of request and other parameters are stored in the table entry.
- If more than one processor issues request for the same device then a wait queue is maintained.

**How can the speed of interrupt driven input output systems be improved?**

- Direct memory access is used to enhance the speed of the input output systems.
- Here, buffers, counters and pointers are set for the devices.
- The device controller transfers the block of data directly from own buffer storage to memory.
- The data is not given to the CPU for further transfer between CPU and input output devices or CPU

and memory.
- Only one interrupt is generated per block than one interrupt per byte which enhances the speed.

**Explain the execution cycle for a von Neumann architecture.**

- Initially the system will fetch the instruction and stores it in instruction register.
- Instruction is then decoded and may cause operands to be fetched from memory.
- After execution the result is stored in the memory.
- Here the memory unit sees only the memory addresses irrespective of how they are generated.
- Memory unit is also unaware of what addresses are for.

**Explain the positioning time for a disk.**

- It is also called as the random access time used by a disk to perform operations.
- It consists of time to move the disk arm to the desired cylinder called the seek time.
- The time required for the desired sector to rotate to the disk head is called rotational latency.
- Typical disks can transfer megabytes of data per second.
- Seek time and rotational latency is always in milliseconds.

**What is EIDE?**

- EIDE is a bus called enhanced integrated drive electronics.
- The input output devices are attached to the computer by a set of wires called the bus.
- The data transfer on a bus are carried out by electronic processes called controllers.
- The host controller sends messages to device controller and device controller performs the operations.
- These device controllers consist of built in cache so that data transfer occurs at faster speed.

**Differentiate between the user mode and monitor mode.**

- User mode and monitor mode are distinguished by a bit called the mode bit.
- User mode uses bit 1 and monitor mode uses bit 0.
- At the boot time hardware starts with the monitor mode.
- Also, at the time of interrupt user mode is shifted to the transfer mode.
- System always switches to the user mode before passing control to the user program.
- Whenever system gains control of the computer it works in monitor mode otherwise in user mode.

**What is time slice?**

- The timer in CPU is set to interrupt every N milliseconds where this N is called the time slice.
- It is the time each user gets to execute before control is given to next user.

- At the end of each time slice the value of N is incremented and the record is maintained.
- It also maintains the record of the total time user program has executed thus far.
- This method helps in time sharing among the various users.

**What are the activities related to the Time Shared User Program Management?**

- An Operating System is responsible for the creation and deletion of both user and system processes.
- It also provides mechanism for the process synchronization.
- Suspending and resuming of windows is done by the operating system itself.
- Program needs resources like CPU time, memory, files, input output devices to complete the task which i operating system.
- Mechanisms are also provided for deadlock handling.

**When an input file is opened, what are the possible errors that may occur?**

- 1st condition may be that the file is protected against access, here it terminates abruptly.
- 2nd condition may be that file exists, then we need to create the output file.
- If file with the same name exists then it may be deleted or program may be aborted.
- In another case the system may ask the user to replace the existing file or abort the program.

**Explain PCB.**

- PCB, process control block, is also called as the task control block.
- It contains information about the process state like new, ready, running, waiting and halt.
- It also includes the information regarding the process priority and pointers to scheduling queues .
- Its counter indicates the address of the next instruction to be executed for the process.
- It basically serves as the storage for any information that may vary from process to process.

**What is context switching ?**

- It is the process of switching the CPU from one process to another.
- This requires to save the state of the old process and loading the saved state for the new process.
- The context of the process is represented in the process control block.
- During switching the system does no useful work.
- How the address space is preserved and what amount of work is needed depends on the memory management.

**What is cascading termination?**

- If one process is terminated, its related processes are also terminated abnormally then it is called cascade
- It occurs in the case of parent child process.
- If the parent process is terminated normally or abnormally then all its child processes must be terminated.
- The parent is existing and the operating system does not allow a child to continue if its parent terminates.
- This child process is the new process created by the process called the parent process.

**Explain IPC.**

- It is called as the inter process communication.
- The scheme requires that processes share a common buffer pool and code for implementing the buffer.
- It allows processes to communicate and to synchronize their actions.
- Example : chat program used on the world wide web.
- It is useful in distributed computer systems where communicating processes reside on different computers network.

**What are sockets?**

- A socket is defined as endpoint for communication, a pair of sockets is used by the pair of processes
- It is made of IP address chained with a port number.
- They use the client server architecture.
- Server waits for incoming client requests by listening to specified port.
- On reception of request, server accepts connection from client socket to complete the connection.

**Explain the meaning of Kernal.**

- The kernel is the essential center of a computer operating system, the core that provides basic services for all other parts of the operating system.

- As a basic component of an operating system, a kernel provides the lowest-level abstraction layer for the resources.

- The kernel's primary purpose is to manage the computer's resources and allow other programs to run and use the resources like the CPU, memory and the I/O devices in the computer.

**The facilities provides by the kernel are :**

a. **Memory management** - The kernel has full access to the system's memory and must allow processes to access safely this memory as they require it.

b. **Device management** - To perform useful functions, processes need access to the peripherals connected to the computer, which are controlled by the kernel through device drivers
c. **System calls** - To actually perform useful work, a process must be able to access the services provided by the kernel.

**Types of Kernel:**

a. **Monolithic kernels**

Every part which is to be accessed by most programs which cannot be put in a library is in the kernel space:
- Device drivers
- Scheduler
- Memory handling
- File systems
- Network stacks

b. **Microkernels**

In Microkernels, parts which really require to be in a privileged mode are in kernel space:
- Inter-Process Communication,
- Basic scheduling
- Basic memory handling
- Basic I/O primitives

**Due to this, some critical parts like below run in user space:**

a. The complete scheduler
b. Memory handling
c. File systems
d. Network stacks

**Ques 1. Why is the operating system important?**

OS is the heart of a system without which it cannot function and is useless. It is an essential component as it acts as a link between computer software and users. It helps communicate with the system hardware and acts as a resource manager. It provides services to a user and performs all application tasks.

**Ques 2. State the main purpose of an OS and types of OS?**

An OS executes user programs so that users can understand and interact with computer systems easily. It also improves system performance by managing all computational

activities in the system. Apart from this, it also manages processes, the operation of all hardware and software, and computer memory.

Following are the five main types of OS:

- Batch Operating System
- Time-sharing operating System
- Distributed operating System
- Network operating system
- Real-time operating system

**Ques 3. State the benefits of a multiprocessor system?**

As the name suggests, this OS consists of multiple processors that share a common physical memory and that operate under a single OS. The system divides a task into subtasks that execute parallely in different processors whose working is transparent to the users.

Following are the benefits of a multiprocessor system:

- It improves the performance of systems that concurrently run multiple programs.
- Increased system throughput and speed and high computing power.
- Multiple processors help complete a larger number of tasks in less time.
- It is cost-effective.
- It improves system reliability.

**Ques 4. What is the importance of Kernel in an OS?**

Kernel helps the OS manage the operations of the computer system and hardware, basically the memory and CPU time. It uses inter-process communication and system calls to act as a bridge between applications and data processing performed at the hardware level.

It handles disk management, task management, and memory management and decides which process to allocate to the CPU for execution. It also manages communication between the software and hardware.

**Ques 5. Explain the kinds of operations that are possible on a semaphore in detail.**

The two atomic operations possible on a semaphore are:

- **Wait():** The wait (sleep or down) operation decrements the value of an argument. No operation occurs if the argument is negative or zero.
- **Signal():** The signal (wake-up or up) operation increases the value of an argument.

**Ques 6. Define Scheduling Algorithms and name different types of scheduling algorithms.**

Scheduling algorithm schedules processes on the processor in an efficient and effective manner. A Process Scheduler performs scheduling. It maximizes CPU utilization by increasing throughput.

Following are the types of process 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
7. Multilevel Feedback Queues Scheduling
8. Highest Response Ratio Next

**Ques 7. What is demand paging and how can the user perform demand paging in a system?**

Demand paging loads pages into system memory on demand. We use this method in virtual memory. A page enters into the memory when the OS references a location on that particular page during execution.

Following are the steps to perform demand paging:

- Make an attempt to access the page.
- Continue processing instructions as normal if the page is present in the memory.
- If the page is unavailable, then a situation of page-fault trap occurs.
- Make sure that the memory reference is a valid reference to a location on secondary memory in order to page in the required page. If it is not, then the process terminates due to illegal memory access.
- We need to schedule disk operation so that the desired page can be read into the main memory.
- Now, the interrupted instruction can restart.

**Ques 8. Can you relate the microprocessor to the OS?**

The OS controls a microprocessor and an OS with a microprocessor is known as a micro-controller.

**Ques 9. How is a hard deadline different from a soft deadline?**

A hard deadline system is very strict with deadlines and does not miss a single deadline. If it misses a deadline then the system fails. Whereas a soft deadline system is more lenient and the user can have some misses. We can fix the miss number and frequency with the help of algorithms. The system fails if these conditions fail.

**Ques 10. What is process synchronization?**

Process Synchronization means coordinating the execution of processes such that no two processes access the same shared resources and data. It is required in a multi-process system where multiple processes run together, and more than one process tries to gain access to the same shared resource or data at the same time. Process synchronization has two types, namely, Independent Process and Cooperative Process.

***Intermediate Operating System Interview Questions Answers***

**Ques 11. What is IPC? Name the different IPC mechanisms?**

IPC stands for Interprocess Communication. It helps exchange data between multiple threads in one (or more) processes or programs. It doesn't matter whether the process is running on single or multiple computers (connected by a network). It allows coordination of activities among various program processes running concurrently in an OS.

Following are the different IPC Mechanisms:

- Pipes
- Message Queuing
- Semaphores
- Socket
- Shared Memory
- Signals

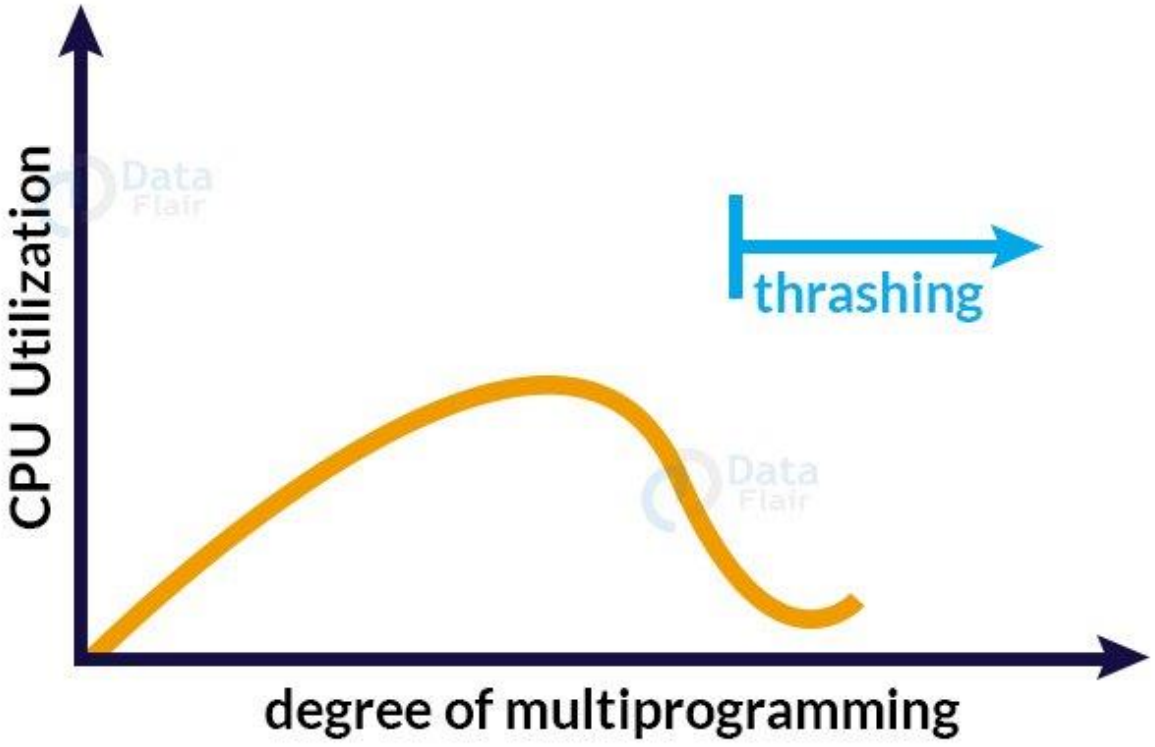
**Ques 12. What are overlays in the OS?**

A programming method divides processes into multiple pieces in order to save the important instructions in memory. This method is known as an overlay and needs no support from the OS. Programs bigger in size than physical memory can also be run using this as it stores the important data and instructions only.

**Ques 13. Define thrashing in OS?**

In thrashing, the CPU performs more swapping or paging work as compared to productive work. When the process does not have enough pages, the page-fault rate increases, degrading or collapsing the system performance. Thrashing reduces CPU utilization and multiprogramming.

A high degree of Multiprogramming, unequal number of frames and processes requirement, and more swapping of processes when CPU utilization is low are some causes of thrashing.




**Ques 14. What do you understand by the term daemon?**

A computer program running as a background process, instead of being under the direct control of an interactive user is known as a daemon. The process names of a daemon end with ‘d’ so that the user can differentiate between a daemon and a normal computer program.

**Ques 15. What do you mean by a thread?**

A thread is the basic unit of the process code and is called a lightweight process within a process that cannot exist outside a process. It has its own program counter. Threads share information like code segments, open files, and data segments with each other. If there is any change in the information of one thread all the other threads can see that.

A thread keeps track of:

- instructions to execute next.
- system registers that have the current working variables of a process.
- a stack containing the execution history.

**Ques 16. Define a process and its different states.**

The program that the OS is currently executing is known as a process. It is the basic unit of work that the OS implements in the system and it takes place in a sequence. A program during execution becomes a process and performs all the tasks for the user. A process has four sections. These sections are as follows: Stack, Heap, Text, and Data.

The different states of a process are: Start, Ready, Running, Waiting, and Terminated or Exit.

**Ques 17. What do you mean by the First-Come-First-Serve scheduling algorithm?**

FCFS is an OS scheduling algorithm that executes requests and processes automatically. The OS stores these processes in the form of a queue in order of their arrival. Processes requesting the CPU first, get the CPU allocation first in this easy and simple algorithm with the help of a FIFO queue.

After entering the ready queue, the PCB of a process links itself with the tail of the queue. Thus, when the CPU becomes free, it is assigned to the process that is at the beginning of the queue. The process that has the least arrival time receives the processor first.

**Ques 18. What is a bootstrap program in OS?**

An OS initializes a bootstrap program during startup i.e., it is the first code that executes when a system starts. Booting is a bootstrapping process or program that loads the OS and ensures the correct working of the OS. Boot blocks store the OS at a fixed location on the disk where the OS locates the kernel and loads it into the main memory. After this process performs, the program starts its execution.

**Ques 19. State the difference between paging and segmentation?**

The following table states the differences between paging and segmentation:

| Paging | Segmentation |
|---|---|
| Fix sized pages | Variable sized segments |
| Internal fragmentation | No internal fragmentation |
| Hardware decides the page size | The user decides the segment size |
| Faster memory access | Memory access is slower as compared to the paging |
| Page table stores data | Segmentation table stores data |
| Sharing of procedures is not allowed | Sharing of procedures is allowed |
| Cannot distinguish and secure procedures and data | Can separate and secure procedures and data |

| | |
|---|---|
| 1-D address space | Multiple independent address spaces |
| A single integer address is divided into page numbers and offset by the hardware | The user divides address in segment number and offset |

**Ques 20. What is the main objective of multiprogramming?**

In this, the multiple tasks are stored in the system memory that is acquired from the job pool and the OS picks one task and starts executing it. The OS fetches another job from the memory when the current job requires an I/O. In the case of multiple jobs in a ready state, which job to choose is decided through the process of CPU Scheduling. It never leaves a CPU idle and maximizes CPU usage.

Advanced Interview Questions on Operating System

**Ques 21. What is RAID configuration in an OS? Also, state the different levels of RAID.**

RAID stands for Redundant Arrays of Independent Disks. It is a method that helps store data on multiple hard disks and helps achieve data redundancy that reduces data loss. It is a data storage virtualization technology that balances data protection, storage space, system performance, etc. It also improves the overall performance and reliability of data storage and increases the storage capacity of a system.

Following are the different levels of RAID:

RAID 0: Non-redundant striping: Increase server performance.
RAID 1: Mirroring and duplexing: Performs disk mirroring and helps implement fault tolerance in a simple manner.
RAID 2: Memory-style error-correcting codes: Uses dedicated hamming code parity.
RAID 3: Bit-interleaved Parity: Stores parity information using a dedicated parity drive.
RAID 4: Block-interleaved Parity: Similar to RAID 5, just confines all the parity data to a single drive.
RAID 5: Block-interleaved distributed Parity: Provides better performance as compared to RAID 1.
RAID 6: P+Q Redundancy: Provides fault tolerance for two drive failures.

**Que 22. What is a Pipe? When is a pipe used?**

The pipe is used for inter-process communication. This half-duplex method allows communication between two related processes. A half-duplex method allows the first process to communicate with the second process. In order to achieve a full-duplex, we need to add another pipe.

**Ques 23. What do you mean by Reentrancy?**

A function in which various clients use and share a single copy of a program at the same time is known as Reentrancy. It doesn't deal with concurrency and has two major functions:
Program code is unable to change or modify itself.
Different disks store local data for every client process.

**Ques 24. State the differences between Multitasking and Multiprocessing.**

The following table states the differences between Multitasking and Multiprocessing:

| Multitasking | Multiprocessing |
|---|---|
| Performs multiple tasks at the same time using a single processor | Performs multiple tasks at the same time using multiple processors |
| Only one CPU | More than one processes |
| More economical | Less economical |
| Less efficient | More efficient |
| Fast switching among tasks | Smooth processing of multiple tasks at a time |
| More time for execution | Less time for job processing |

**Ques 25. Define Sockets in OS.**

A socket, used in client-server-based systems is the endpoint for IPC i.e., a combination of an IP address and port number. They make the creation of network-enabled programs easy and allow communication between two processes on the same or different machines. There are four types of sockets namely, Stream Sockets, Datagram Sockets, Sequenced Packet Sockets, and Raw Sockets.

**Ques 26. What is a zombie process?**

A defunct process that terminates or completes but the PCB is still present in the main memory as there is still an entry in the process table to report to its parent process. This process is known as a zombie process. In a way, it is dead as it doesn't consume any resources, but it exists too as it shows that resources are in possession of the process.

**Ques 27. What is cascading termination?**

When a process creates a new process, the identity of the child process passes onto the parent process. When the OS initiates the termination of the parent process or if the parent process exits the child process also needs to terminate.

**Ques 28. What is swap space?**

Swap space specifies the space that Linux uses to hold concurrent running processes temporarily. The user uses it when the RAM doesn't have enough space to hold all the executing programs.

**Ques 29. How does a system call works?**

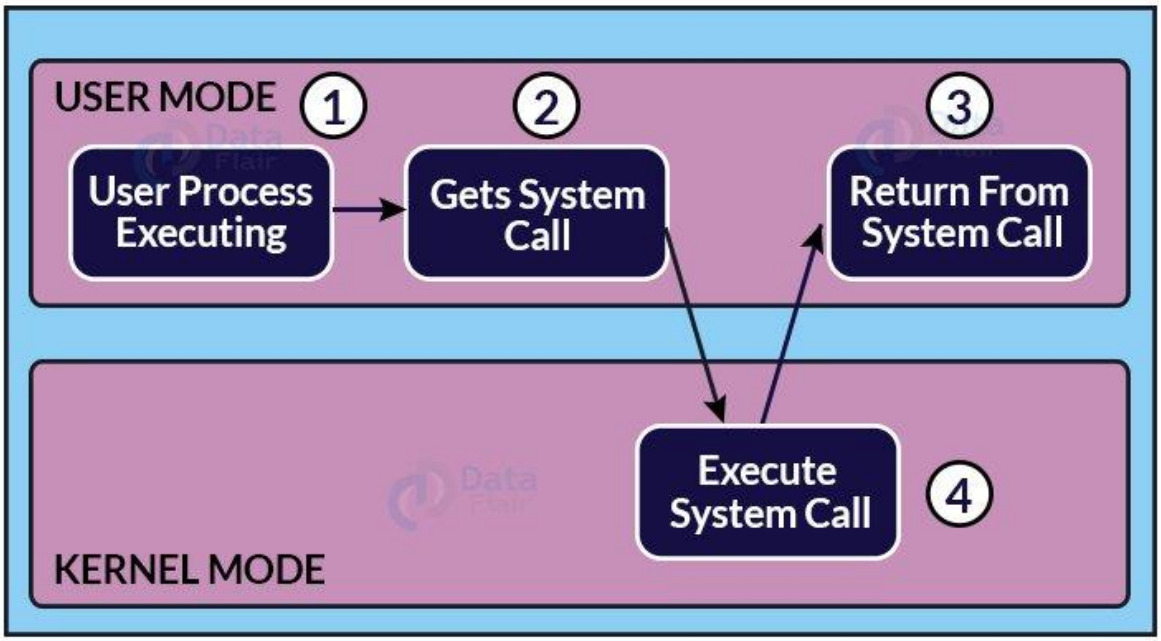
Following are the steps on how a System Call works:

Step 1: The processor executes a process in the user mode until a system call interrupts it.

Step 2: Then on a priority basis, the system call is executed in the kernel mode.

Step 3: After the completion of system call execution, control returns to user mode.,

Step 4: The execution resumes in Kernel mode.




**Ques 30. What happens during a remote procedure call?**

There are two activities that take place during a Remote Procedure Call(RPC):

1. The OS suspends and transfers the calling environment and procedure parameters respectively, across the network and to the environment where the procedure executes.

2. The OS transfers back the result produced by a procedure to the calling environment. Execution also resumes just like a regular procedure call.

1. **What do you mean by SMP?**

SMP refers to Symmetric Multi-Processing. It is the most ordinary kind of multiple-processor systems. In this system, each computer runs an equal copy of the operating system, and these copies converse with one another as desired.

1. **Define thread?**

A thread is an essential component of CPU utilization. In broad, a thread is collected of a thread ID, program answer, register set, and the pile.

1. **Name some benefits of multithread programming?**

Benefits of multithread processing are:

- Economy
- Operation of multiprocessing architecture
- Resource distribution within the method
- There is enlarged responsiveness to the user

1. **Define Banker's algorithm?**

Banker's algorithm is one shape of deadlock-evasion in a system. It gets its forename from a banking system wherein the bank never allocates obtainable cash in such a move that it can no longer gratify the needs of all of its customers.

1. **Define overlays?**

Overlays are used to allow a development to be better than the amount of memory billed to it. The basic design of this is that only commands and data that are desirable at any given time are kept in recollection.

1. **Explain Fragmentation?**

Fragmentation is recollection wasted. It can be interior if we are selling with systems that have fixed-sized portion units. If dealing with systems that have changeable sized allocation units.

1. **Define socket?**

A socket provides a link between two applications. Each endpoint of a statement is a socket.

1. **Name the various operating systems?**

The various operating systems are:

- Real-time operating systems

- Batched operating systems
- Time-sharing operating systems
- Multiprogramming operating systems

1. **Explain kernel?**

The kernel is the centre and most significant part of a computer operating system which provides essential services for all parts of the OS.

1. **What is the process?**

An executing plan is known as a process. There are two sorts of processes:

- User Processes
- Operating System Processes

1. **Define virtual memory?**

Virtual memory is a very helpful memory management method which enables processes to carry out outside of memory. This method is particularly used when an executing plan cannot fit in the corporeal memory.

1. **Define deadlock?**

Deadlock is a detailed situation where two processes are waiting for each other to total so that they can begin. But this situation causes droop for both of them.

1. **Define GUI?**

It provides users with a boundary wherein actions can be performed by interacting with icons and graphical symbols. People find it easier to interrelate with the computer when in a GUI, particularly when using the mouse. Instead of having to memorize and sort commands, users click on buttons to execute a procedure.

1. **Explain NOS?**

NOS is short for Network Operating System. It is dedicated software that will permit a computer to converse with other devices over the complex, including folder sharing.

1. **Tell me the way to access Terminal?**

To contact terminal, you have to go below Application Menu -> Accessories -> Terminal.

1. **What is the piping?**

It is the procedure of using the output of one plan as an input to another. For example, in its place of sending the catalogue of a folder or constrain to the key screen, it can be piped and sent to a file to create a hard copy.

**What do you mean by preemptive multitasking?**

Preemptive multitasking permits a working system to control between software programs. This, in turn, allows numerous programs to run without unavoidably taking whole control over the computer and ensuing in system crashes.

1. **Define Assembler?**

An assembler act as translators for low-level words. The Assembler translates assembly codes written using mnemonic authorities into mechanism language.

1. **Define spooling?**

Spooling is generally linked with printing. When diverse applications want to send an output to the laser printer at the same time, spooling takes all of these produce jobs into a disk file and queues them consequently to the printer.

**Question: What is an operating system?**
**Answer:** It is a program that provides an interface between the software and hardware of a computer. In other words, an OS offers an environment for the user to execute software using hardware.

**Question: Name some functions of the operating system.**
**Answer:**

- Memory management
- Processor management
- Device management
- File management
- Security
- Job accounting
- Control over system performance
- Error detection
- Communicate between user and software
- Communication between software and hardware.

**Question: Name the different operating systems.**
**Answer:**

- Batched operating system.
- Interactive operating system
- Multi-processing operating system

- Multitasking operating system
- Distributed operating system
- Multi-programmed operating system
- Real-Time operating system
- Timesharing operating system

**Question: List the basic functions of OS file management.**

**Answer:**

- Create and delete directories and files.
- Use secondary storage for creating backup files.
- Map file in secondary storage.
- Give support to file modification.

**Question: What is booting?**

**Answer:** It is a procedure of turning on the computer by loading the kernel.

**Question: What is the bootstrap program?**
**Answer:** It is a program that resides in the kernel of an operating system, and when we boot the system, it is the first program that executes and stores the read-only memory (ROM).

**Question: What is the use of an operating system?**
**Answer:** An operating system acts as a management system between the system software and hardware, and guides hardware to act according to the provided software. It also controls the flow of the program and provides an environment so the software can communicate with system hardware.

**Question: Define a multi-programming system.**
**Answer:** In the multi-programming system, the system keeps different programs in different parts of the main memory simultaneously, and executes each of those concurrently.

**Question: Define multitasking systems.**
**Answer:** In a multitasking system, programs are kept in the main memory so the system can execute them simultaneously.

**Question: What are the time-sharing systems?**
**Answer:** In time-sharing systems, multiple users can use a specific program from different terminals at the same time.

**Question: Give the advantages of a multiprocessor system.**
**Answer:** Multi-processor, as the name suggests, uses more than one processor. With an increase in the processor count, the processing capability of the system increases too.

**Question: What is virtual memory?**
**Answer:** Virtual memory is a memory management method that helps to execute a process using primary and secondary memories. Though the program gets executed using the main memory, the resources and pages load from the secondary memory.

**Question: What is a kernel in an operating system?**
**Answer:** It is an essential part of the operating system, also known as the core of the OS. It is present in the main memory of the system and loads before any other part of the operating system. Every OS consists of a kernel. For example, the Linux kernel is one of the famous kernels, and Android also uses this kernel.

**Question: What are the main functions of a kernel in an operating system?**
**Answer:**

- Process management
- Resource management
- Disk management
- Memory management
- Device management
- Facilitate communication between hardware and software.

**Question: Define the 2 most popular types of kernels.**

**Answer:** Though there are many types of kernels, only 2 of them are the most popular:

1. Monolithic Kernel
2. MicroKernel

**Monolithic Kernel:** In this type of OS kernel, all the user services and kernel services reside in the same memory space. Old operating systems would use this type of kernel. Some examples are Windows 95, 98, and Unix. Linux also uses it.

**MicroKernel:** This type of kernel is small in size, and all the user and kernel services reside in different memory addresses. Operating systems like macOS and Windows use microkernels.

**Question: Give some disadvantages of Microkernel.**
**Answer:**

- Complex process management.
- Debugging the messaging is complex.
- Loss in performance because of the requirement of more software.

**Question: What is SMP?**
**Answer:** It stands for Symmetric Multiprocessing (SMP), and it is an architecture that contains multiple processors to complete the process. All the processors share a single memory.

**Question: What is asymmetric clustering?**
**Answer:** Asymmetric clustering occurs when the server running the application finds some kind of cluster. In asymmetric clustering, one server tries to run the server application while others remain on standby mode.

**Question: Explain a thread?**
**Answer:** It is a flow of execution through the process code. A thread deals with the instruction to be executed.

**Question: What is demanding paging?**
**Answer:** Demanding pages is a concept used by the virtual machine. Only a part of the process needs to be present in the main memory to execute some process, which means that only a few pages will only be present in the main memory at any time, and the rest will be kept in the secondary memory.

**Question: What is a process?**
**Answer:** A program in execution is known as a process.

**Question: Name all the states of a Process.**
**Answer:**

- New
- Running
- Waiting
- Ready
- Terminate

**Question: How is a thread different from a process?**
**Answer:**

- The process is independent, whereas a thread is not.
- A thread can assist other threads, whereas the process can not.
- If one thread stops, the next thread starts executing, but this is not the case with a process.

**Question: What is a deadlock?**
**Answer:** When 2 processes are trying to execute simultaneously, and they are waiting for each other to finish the execution, as they are dependent on each other, this halt in execution is known as a deadlock. When the deadlock occurs in the program, the system usually freezes.

**Question: What are the necessary conditions for a deadlock?**
**Answer:**

- Mutual Exclusion
- Hold and wait
- No preemption
- Circular wait

**Question: What is starvation?**

**Answer:** When a program is in process, and it does not get all the resources to execute, because other processes are using the same resources then this problem of not getting all needed resources is known as starvation.

**Question: What is the difference between multitasking and multi-processing operating systems?**

**Answer:**

| **Multi-Tasking** | **Multi-Processing** |
|---|---|
| The operating system executes more than one task simultaneously using a single processor. | The operating system executes more than one task using multiple processors. |
| Only one processor executes the tasks. | More than one processor executes tasks. |
| It takes a moderate amount of time to execute all the tasks. | It generally takes very little time to execute all tasks. |

| | |
|---|---|
| The processor shifts from one task to another, which makes it look like it is executing multiple tasks simultaneously, but, actually, here we only have one processor for task execution. | Here, we have more than one processor. So multiple processes can be executed at the same time. |

**Question: Differentiate between paging and segmentation.**

**Answer:**

| **Paging** | **Segmentation** |
|---|---|
| Divides the virtual memory into physical memory. | Divides the physical memory to the logical memory. |
| Paging divides the memory into fixed length. | Segmentation divides the memory into arbitrary memory length. |
| Only loads information about the process. | Loads the full logical portion of the page. |
| Pages are smaller than segments. | Segments are generally larger. |
| It’s the hardware that divides the paging memory. | The software divides the segmentation memory. |

**Question: What is a command interpreter?**

**Answer:** It is a text field I/O interface between the user and the operating system. In the command interpreter, the user gives input through the keyboard using CLI commands. Command Prompt in Windows and Terminal in Linux and macOS are examples of the command interpreter.

**Question: What is a daemon?**
**Answer:** It stands for **D**isk **a**nd **E**xecution **mon**itor, and it is a long-running background process that acts on the request. The life cycle of the daemon commences with the system booting and continues until the system shuts down.

**Question: From where does the daemon originate and how do we classify it?**
**Answer:** The term daemon originated with UNIX. In UNIX, the daemon conventionally ends with 'd', for example 'inetd', 'nfsd', httpd', and 'lpd'.

**Question: What is the race condition?**
**Answer:** It is a situation that occurs when different operations are performed on the same data simultaneously, and the outcome of the execution depends on the order of the operations performed on the data. Evidently, the race condition can provide an undesirable outcome.

**Question: What is process synchronization?**
**Answer:** When the race condition occurs, it can lead to an undesirable outcome. So to prevent the race condition, we follow a process known as synchronization. Here, we ensure that only one process executes at a time.

**Question: Explain PCB?**

**Answer:** PCB stands for Process Control Block, and it an operating system data structure, which can collect and store information about the processes. It is also known as the process descriptor.

As soon as a process gets created, the OS creates a corresponding PCB to store the process status and information. With each transition, OS updates the PCB data structure.

**Question: What is Semaphore?**
**Answer:** It is a variable that is used to create a synchronized process. There are 2 types of semaphores:

1. Counting semaphore.
2. Binary semaphore.

Counting semaphore can have positive integer values, and Binary semaphore can only have 1 and 0 as variables.

**Question: Explain FCFS and the main problem it causes.**

**Answer:** It stands for First Come First Serve (FCFS), and it is a scheduling algorithm. According to this algorithm, the CPU serves that process first, which approaches it first. FCFS can cause the starvation problem in which the process does not get the proper resources.

**Question: Name the different RAID levels.**
**Answer:** 0 – Non-redundant striping

- 1 – Mirrored Disks
- 2 – Memory-style error-correcting codes
- 3 – Bit-interleaved Parity
- 4 – Block-interleaved Parity
- 5 – Block-interleaved distributed Parity
- 6 – P+Q Redundancy

**Question: What is cache memory?**
**Answer:** It is a volatile computer memory directly attached to the register, which provides high-speed data access to the processor.

**Question: What is IPC?**
**Answer:** IPC stands for Inter-Process Communication, and it is a mechanism, in which various processes can communicate with each other with the approval of the OS.

**Question: Name the Various IPC mechanisms.**

- Sockets
- Pipe
- Shared Memory
- Signals
- Message Queues

**Question: What is a context switch?**
**Answer:** Context can be referred to as the data in the register. A context switch is a procedure in which the CPU changes from one task to another task.

**Question: Give the difference between compiler and Interpreter.**
**Answer:** A compiler first reads all the code at once and then tries to execute it, whereas an interpreter reads the code line by line and simultaneously executes it. To know a detailed comparison visit our blog post.

**Question: What are sockets?**

**Answer:** Sockets are the Inter-process Communication mechanisms that are used to provide point-to-point communication between 2 processes.

Sockets are often utilized in client-server applications because many protocols, such as FTP, SMTP, and POP3 use sockets to implement the connection between server and client.

**Question: What do you understand by the main memory and secondary memory?**

**Answer:** Main memory is directly connected to the computer processor, and it acts as a bridge between computer processors and secondary memory. The main objective of the main memory is to get the data from the secondary memory and feed it to the processor so that the appropriate actions could be performed.

RAM and ROM are the 2 main memories used by the system, whereas hard disk and other large-sized memories form the secondary memory.

As compared to the secondary memory, the main memory is straightforward and it is fast to access data from the main memory. That's why processors directly communicate with the main memory.

Generally, the main memory does not store data permanently. Instead, it only holds data for a specific time and tries to give it to the processor for the further execution process.

**Question: Can there be a deadlock situation with a single process?**

**Answer:** No, to occur a deadlock situation, we need at least 2 dependent processes. A deadlock situation can only arise when these 4 conditions coincide:

- Hold and Wait
- No Preemption
- Mutual Exclusion
- Circular wait.

**Question: What are interrupts?**

**Answer:** These are the signals generated by the external input devices to stop the ongoing active process of the CPU. Interrupts use context switching so the CPU can switch between the current process and the new signal generated by the external device. Interrupts help in prioritizing the process execution of the CPU.

**Question: What are zombie processes?**

**Answer:** Formally, these processes are known as **defunct** processes. If a child's process is still in the process table even after the parent process has been executed, this scenario could cause a zombie process.

Even the kill commands do not have any effect on these processes. If the **Wait System Call** reads the exit status of the process, then the zombie process would remove from the process table.

**Question: Explain pipe in OS?**

**Answer:** Pipe is the method for exchanging information between processes. Generally, pipe forms a one-way communication, which means by using a pipe, a process can only send information, such as output or other parameters of the process to another process.

For setting a two-way communication between 2 processes, we require 2 pipes for both directions.

**Question: What is the limitation of pipes for two-way communication between 2 processes?**

**Answer:** If both the processes are the child process of the same parent, then only two-way pipe communication could be set between the processes.

**Question: What do you know about the named pipe?**

**Answer:** Generally, we use the un-named pipe to set communication between the related process, but if we want to communicate unrelated processes, then we need to use named pipes. Like a traditional unnamed pipe, named pipe is also a part of IPC (Interprocess Communication), and its life remains until the system is on.

**OS Interview Questions for Advanced Programmers**

**Question: Name the operations which are possible on a semaphore.**

**Answer:** We can only perform 2 operations on a semaphore:

1. Wait, and
2. Signal.

**Question: What do you know about mutex?**

**Answer:** It is an abbreviation for **Mut**ual **Ex**clusion. It is a userspace program object that helps multiple threads to access the same resource, but not simultaneously. The sole purpose of a mutex is to lock a thread with a resource so the other threads can not use the same resource until the first thread finish executing.

**Question: What is a critical section?**

**Answer:** The program will behave oddly if program parts perform concurrent access to the shared resources. So to protect the shared resources of a program, we create a protected section, which is known as the critical section or critical region.

A critical section can only execute one process at a time, and this eliminates the problems that can be caused by concurrent accessing resources.

**Question: What is process scheduling?**

**Answer:** It is a routine followed by the process manager of the system. In this, the process manager can use different methods and strategies to remove a particular running process or select another process for the CPU.

**Question: What is the difference between preemptive and non-preemptive scheduling?**

**Answer:** Scheduling is divided into 2 categories; preemptive scheduling and non-preemptive scheduling.

| **Preemptive Scheduling** | **Non-Preemptive Scheduling** |
|---|---|
| Processes are allocated to the CPU for a limited period. | A process remains in the CPU till it gets entirely executed. |
| If there is a new process that comes with high priority, then the ongoing CPU process has to stop. | Here the priority of the process does not matter. The new process has to wait until the first process finishes execution. |
| There is a continuous switching between the running and ready states of the processes. | This is not the case in non-preemptive scheduling. |
| Preemptive schedules the process on the basis of their priority. | Non-preemptive uses the process burst time. |
| There is a high probability that the process with less priority will starve. | Here process with less burst time will starve. |

**Question: Name the various scheduling algorithms.**

**Answer:**

- First Come First Serve (FCFS).
- Shortest Job First (SJF).
- Priority Scheduling
- Round Robin Scheduling

**First Come First Serve:** It follows the non-preemptive scheduling, and here the process requesting first gets the CPU.

**Shortest Job First:** It could be preemptive or non-preemptive. In this algorithm, that process gets the CPU that is closest to its execution. Here, CPU gives priority to those jobs which have a low execution time.

**Priority Based Scheduling:** It is also a preemptive algorithm, and here CPU is allocated to those processes first that have a high priority.

**Round Robin Scheduling:** It is a preemptive scheduling algorithm, and here each process gets equal time for execution.

**Question: What are condition variables?**

**Answer:** These are the synchronization objects, which can set some conditions for threads, and if the condition occurs then only the appropriate operations can be performed by the threads.

If the situation does not arise, then the threads have to wait for further execution. A condition variable is often used with critical sections and slim readers, where they help in binding and holding the threads.

**Question: What is the reader-writer lock?**

**Answer:** Reader-writer lock is used to prevent data integrity. This lock allows concurrent access to read operation, which means multiple threads can read data simultaneously.

But it does not allow concurrent write, and if one thread wants to modify data via writing, then all the other threads will be blocked from reading or writing data.

**Question: What are the different types of memory used by the system?**

**Answer:**

- Main memory, such as RAM and ROM.
- Secondary memory, such as hard disk and e-drives.
- Cache.
- Internal process memory, such as registers.

**Question: What is compaction?**

**Answer:** The free memory of the system gets split into smaller pieces when a process loads or is removed from the memory. Compaction helps in accumulating these small loose pieces of memory into one substantial chunk so that more memory can be allocated to other processes.

**Question: What is a page in OS?**

**Answer:** A page can be defined as the smallest unit of data, and it is a fixed-length contiguous block of virtual memory.

**Question: Explain page frames.**

**Answer:** When a page is transferred from the secondary memory to the main memory, then it requires a fixed length of a continuous physical memory block, known as a page frame. It is the job of the operating system to map the pages in the page frames.

**Question: What is the difference between logical and physical addresses?**

**Answer:**

| **Logical Address** | **Physical Address** |
|---|---|
| The CPU generates it. | It is the real address of the program in the memory. |
| A user can access the logical address of the program. | The physical address can be accessed directly. |
| CPU generates a logical address at the execution time. | It is generated by the Memory Management Unit(MMU) at the creation time. |

**Question: What is the page fault?**

**Answer:** It is an error that occurs when the CPU tries to access a specific block of memory address that is not present in the physical memory (RAM).

**Question: What is thrashing?**

**Answer:** It is a scenario when continuous page fault and paging activities occur. Thrashing could lead to a program collapse and degraded CPU performance.

**Question: What do you know about the library?**

**Answer:** A library is a collection of files that contains subroutines, data, and other objects that can be used by other programs.

**Question: What is the difference between a program and a process?**

**Answer:**

| **Program** | **Process** |
|---|---|
| It is a set of instructions that are written in a specific programming language. | It is an instance of a program that is about to be executed by one or many threads. |
| A program is static in nature that is present in the file. | Processes are dynamic and generated during execution time. |
| Programs are generally stored in secondary memory, which makes them portable. | Processes are not portable and they reside in the main memory. |
| The program can live in the main memory for eternity. | A process time period is limited and it either executes or fails. |
| Programs are passive entities. | Processes are active entities. |

**Question: What are APIs?**

**Answer:** API stands for Application Program Interface, and it is a collection of libraries and subprograms. APIs are used to set communication between 2 programs i.e. API provides a general way of sending and receiving data between applications.

**Question: What is Belady's anomaly?**

**Answer:** It is a situation that occurs in the OS when there is an increase in page faults by the CPU because additional memory has been introduced to the system, which results in increasing page frames.

**Question: What do you know about cascading termination?**

**Answer:** When a process finishes execution, then the OS terminates the process via the exit system call. Only the parent process can cause the termination of its child processes, so when the parent process gets entirely executed and terminated, then its child process also gets terminated automatically.

This phenomenon of a process triggering termination of another process is known as cascading termination.

1. **Question 1. Explain The Main Purpose Of An Operating System?**

   Operating systems exist for two main purposes. One is that it is designed to make sure a computer system performs well by managing its computational activities. Another is that it provides an environment for the development and execution of programs.

2. **Question 2. What Is Demand Paging?**

   Demand paging is referred when not all of a process's pages are in the RAM, then the OS brings the missing(and required) pages from the disk into the RAM.

3. **Question 3. What Are The Advantages Of A Multiprocessor System?**

   With an increased number of processors, there is considerable increase in throughput. It can also save more money because they can share resources. Finally, overall reliability is increased as well.

4. **Question 4. What Is Kernel?**

   Kernel is the core of every operating system. It connects applications to the actual processing of data. It also manages all communications between software and hardware components to ensure usability and reliability.

5. **Question 5. What Are Real-time Systems?**

   Real-time systems are used when rigid time requirements have been placed on the operation of a processor. It has well defined and fixed time constraints.

6. **Question 6. What Is Virtual Memory?**

   Virtual memory is a memory management technique for letting processes execute outside of memory. This is very useful especially is an executing program cannot fit in the physical memory.

7. **Question 7. Describe The Objective Of Multi Programming.?**

   The main objective of multiprogramming is to have process running at all times. With this design, CPU utilization is said to be maximized.

8. **Question 8. What Are Time Sharing Systems?**

   In a Time sharing system, the CPU executes multiple jobs by switching among them, also known as multitasking. This process happens so fast that users can actually interact with each program while it is running.

9. **Question 9. What Is Smp?**

   SMP is short for Symmetric MultiProcessing, and is the most common type of multiple-processor systems. In this system, each processor runs an identical copy of the operating system, and these copies communicate with one another as needed.

10. **Question 10. How Are Server Systems Classified?**

    Server systems can be classified as either computer-server systems or file server systems. In the first case, an interface is made available for clients to send requests to perform an action. In the second case, provisions are available for clients to create, access and update files.

11. **Question 11. What Is Asymmetric Clustering?**

    In asymmetric clustering, a machine is in a state known as hot standby mode where it does nothing but to monitor the active server. That machine takes the active server's role should the server fails.

12. **Question 12. What Is A Thread?**

    A thread is a basic unit of CPU utilization. In general, a thread is composed of a thread ID, program counter, register set and the stack.

13. **Question 13. Give Some Benefits Of Multi Threaded Programming.?**
    - there is an increased responsiveness to the user
    - resource sharing within the process
    - economy
    - utilization of multiprocessing architecture
14. **Question 14. Briefly Explain Fcfs.**

    FCFS is short for First-come, first-served, and is one type of scheduling algorithm. In this scheme, the process that requests the CPU first is allocated the CPU first. Implementation is managed by a FIFO queue.
15. **Question 15. What Is Rr Scheduling Algorithm?**

    RR (round-robin) scheduling algorithm is primarily aimed for time-sharing systems. A circular queue is setup in such a way that the CPU scheduler goes around that queue, allocating CPU to each process for a time interval of up to around 10 to 100 milliseconds.
16. **Question 16. What Necessary Conditions Can Lead To A Deadlock Situation In A System?**

    Deadlock situations occur when four conditions occur simultaneously in a system: Mutual exclusion; Hold and Wait; No preemption; and Circular wait.
17. **Question 17. Enumerate The Different Raid Levels.**
    - RAID 0 – Non-redundant striping
    - RAID 1 – Mirrored Disks
    - 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

18. **Question 18. What Factors Determine Whether A Detection-algorithm Must Be Utilized In A Deadlock Avoidance System?**

    One is that it depends on how often a deadlock is likely to occur under the implementation of this algorithm. The other has to do with how many processes will be affected by deadlock when this algorithm is applied.

19. **Question 19. Differentiate Logical From Physical Address Space.?**

    Logical address refers to the address that is generated by the CPU. On the other hand, physical address refers to the address that is seen by the memory unit.

20. **Question 20. How Does Dynamic Loading Aid In Better Memory Space Utilization?**

    With dynamic loading, a routine is not loaded until it is called. This method is especially useful when large amounts of code are needed in order to handle infrequently occurring cases such as error routines.

21. **Question 21. What Are Overlays?**

    Overlays are used to enable a process to be larger than the amount of memory allocated to it. The basic idea of this is that only instructions and data that are needed at any given time are kept in memory.

22. **Question 22. What Is The Basic Function Of Paging?**

    Paging is a memory management scheme that permits the physical-address space of a process to be noncontiguous. It avoids the considerable problem of having to fit varied sized memory chunks onto the backing store.

23. **Question 23. What Is Fragmentation?**

    Fragmentation is memory wasted. It can be internal if we are dealing with systems that have fixed-sized allocation units, or external if we are dealing with systems that have variable-sized allocation units.

24. **Question 24. How Does Swapping Result In Better Memory Management?**

During regular intervals that are set by the operating system, processes can be copied from main memory to a backing store, and then copied back later. Swapping allows more processes to be run that can fit into memory at one time.

25. **Question 25. Give An Example Of A Process State.**

    **New State** – means a process is being created

    **Running** – means instructions are being executed

    **Waiting** – means a process is waiting for certain conditions or events to occur

    **Ready** – means a process is waiting for an instruction from the main processor

    **Terminate** – means a process is done executing

26. **Question 26. What Is A Socket?**

    A socket provides a connection between two applications. Each endpoint of a communication is a socket.

27. **Question 27. What Is Direct Access Method?**

    Direct Access method is based on a disk model of a file, such that it is viewed as a numbered sequence of blocks or records. It allows arbitrary blocks to be read or written. Direct access is advantageous when accessing large amounts of information.

28. **Question 28. When Does Thrashing Occur?**

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

29. **Question 29. What Is The Best Page Size When Designing An Operating System?**

    The best paging size varies from system to system, so there is no single best when it comes to page size. There are different factors to consider in order to come up with a suitable page size, such as page table, paging time, and its effect on the overall efficiency of the operating system.

30. **Question 30. When Designing The File Structure For An Operating System, What Attributes Are Considered?**

    Typically, the different attributes for a file structure are naming, identifier, supported file types, and location for the files, size, and level of protection.

31. **Question 31. What Is Root Partition?**

    Root partition is where the operating system kernel is located. It also contains other potentially important system files that are mounted during boot time.

32. **Question 32. What Are Device Drivers?**

    Device drivers provides a standard means of representing I/O devices that maybe manufactured by different companies. This prevents conflicts whenever such devices are incorporated in a systems unit.

33. **Question 33. What Are The Primary Functions Of Vfs?**

    VFS, or Virtual File System, separates file system generic operations from their implementation by defining a clean VFS interface. It is also based on a file-representation structure known as vnode, which contains a numerical designator needed to support network file systems.

34. **Question 34. What Are The Different Types Of Cpu Registers In A Typical Operating System Design?**

    - Accumulators
    - Index Registers
    - Stack Pointer
    - General Purpose Registers

35. **Question 35. What Is The Purpose Of An I/o Status Information?**

    I/O status information provides info about which I/O devices are to be allocated for a particular process. It also shows which files are opened, and other I/O device state.

36. **Question 36. What Is Multitasking?**

Multitasking is the process within an operating system that allows the user to run several applications at the same time. However, only one application is active at a time for user interaction, although some applications can run "behind the scene".

37. **Question 37. What Are Some Pros And Cons Of A Command Line Interface?**

    A command line interface allows the user to type in commands that can immediately provide results. Many seasoned computer users are well accustomed to using the command line because they find it quicker and simpler. The main problem with a command line interface is that users have to be familiar with the commands, including the switches and parameters that come with it. This is a downside for people who are not fond of memorizing commands.

38. **Question 38. What Is Caching?**

    Caching is the processing of utilizing a region of fast memory for a limited data and process. A cache memory is usually much efficient because of its high access speed.

39. **Question 39. What Is Spooling?**

    Spooling is normally associated with printing. When different applications want to send an output to the printer at the same time, spooling takes all of these print jobs into a disk file and queues them accordingly to the printer.

40. **Question 40. What Is An Assembler?**

    An assembler acts as a translator for low level language. Assembly codes, written using mnemonic commands are translated by the Assembler into machine language.

41. **Question 41. What Are Interrupts?**

    Interrupts are part of a hardware mechanism that sends a notification to the CPU when it wants to gain access to a particular resource. An interrupt

handler receives this interrupt signal and “tells” the processor to take action based on the interrupt request.

42. **Question 42. What Is Gui?**

    GUI is short for Graphical User Interface. It provides users with an interface wherein actions can be performed by interacting with icons and graphical symbols. People find it easier to interact with the computer when in a GUI especially when using the mouse. Instead of having to remember and type commands, users just click on buttons to perform a process.

43. **Question 43. What Is Preemptive Multitasking?**

    Preemptive multitasking allows an operating system to switch between software programs. This in turn allows multiple programs to run without necessarily taking complete control over the processor and resulting in system crashes.

44. **Question 44. Why Is Partitioning And Formatting A Prerequisite To Installing An Operating System?**

    Partitioning and formatting creates a preparatory environment on the drive so that the operating system can be copied and installed properly. This includes allocating space on the drive, designating a drive name, determining and creating the appropriate file system structure.

45. **Question 45. What Is Plumbing / Piping?**

    It is the process of using the output of one program as an input to another. For example, instead of sending the listing of a folder or drive to the main screen, it can be piped and sent to a file, or sent to the printer to produce a hard copy.

46. **Question 46. What Is Nos?**

    NOS is short for Network Operating System. It is a specialized software that will allow a computer to communicate with other devices over the network, including file/folder sharing.

47. **Question 47. Differentiate Internal Commands From External Commands.**

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

48. **Question 48. How Would A File Named Examplefile.txt Appear When Viewed Under The Dos Command Console Operating In Windows 98?**

    The filename would appear as EXAMPL~1.TXT . The reason behind this is that filenames under this operating system is limited to 8 characters when working under DOS environment.

49. **Question 49. What Is A Folder In Ubuntu ?**

    There is no concept of Folder in Ubuntu. Everything including your hardware is a FILE.

50. **Question 50. Explain What Is The Meaning Of "export" Command In Ubuntu?**

    Export is a command in Bash shell language, when you try to set a variable, it is visible or exported to any subprocess started from that instance of bash. The variable will not exist in the sub-process without the export command.

51. **Question 51. Explain How You Can Reset Unity Configuration?**

    To reset the unity configuration the simplest way to do is to hit open a Terminal or hit Atl-F2 and run the command # unity –reset.

52. **Question 52. Explain How To Access Terminal?**

    To access terminal , you have to go under Application Menu -> Accessories -> Terminal .

53. **Question 53. What Are Turnaround Time And Response Time?**

    Turnaround time is the interval between the submission of a job and its completion. Response time is the interval between submission of a request, and the first response to that request.

54. **Question 54. What Are The Typical Elements Of A Process Image?**

**User data:** Modifiable part of user space. May include program data, user stack area, and programs that may be modified.

**User program:** The instructions to be executed.

**System Stack:** Each process has one or more LIFO stacks associated with it. Used to store parameters and calling addresses for procedure and system calls.

**Process control Block (PCB):** Info needed by the OS to control processes.

55. **Question 55. What Is The Translation Lookaside Buffer (tlb)?**

In a cached system, the base addresses of the last few referenced pages is maintained in registers called the TLB that aids in faster lookup. TLB contains those page-table entries that have been most recently used. Normally, each virtual memory reference causes 2 physical memory accesses- one to fetch appropriate page-table entry, and one to fetch the desired data. Using TLB in-between, this is reduced to just one physical memory access in cases of TLB-hit.

56. **Question 56. What Is The Resident Set And Working Set Of A Process?**

Resident set is that portion of the process image that is actually in real-memory at a particular instant. Working set is that subset of resident set that is actually needed for execution. (Relate this to the variable-window size method for swapping techniques.)

57. **Question 57. When Is A System In Safe State?**

The set of dispatchable processes is in a safe state if there exists at least one temporal order in which all processes can be run to completion without resulting in a deadlock.

58. **Question 58. What Is Cycle Stealing?**

We encounter cycle stealing in the context of Direct Memory Access (DMA). Either the DMA controller can use the data bus when the CPU does not need it, or it may force the CPU to temporarily suspend operation. The latter

technique is called cycle stealing. Note that cycle stealing can be done only at specific break points in an instruction cycle.

59. **Question 59. When Does The Condition 'rendezvous' Arise?**

    In message passing, it is the condition in which, both, the sender and receiver are blocked until the message is delivered.

60. **Question 60. What Is A Trap And Trapdoor?**

    Trapdoor is a secret undocumented entry point into a program used to grant access without normal methods of access authentication. A trap is a software interrupt, usually the result of an error condition.