Operating System Interview Questions:

Basic Questions:

1. **What is an Operating System?**

   o An OS is software that manages hardware and software resources on a computer and provides services for computer programs.

2. **What are the types of Operating Systems?**

   o **Batch OS**, **Time-Sharing OS**, **Distributed OS**, **Network OS**, **Real-Time OS**, and **Embedded OS**.

3. **What is the role of the kernel in an OS?**

   o The kernel manages system resources, including the CPU, memory, and hardware devices. It provides essential services like process management and memory management.

4. **What is a process in an OS?**

   o A process is a program in execution. It has its own memory space and system resources.

5. **What is the difference between a process and a thread?**

   o A **process** is an independent program with its own memory space, while a **thread** is a smaller unit of a process that shares memory and resources with other threads in the same process.

6. **What is multitasking?**

   o Multitasking is the ability of an OS to execute multiple tasks or processes concurrently.

7. **What is a deadlock?**

   o A deadlock occurs when two or more processes are unable to proceed because each is waiting for the other to release resources.

8. **What are the four necessary conditions for a deadlock?**

   o **Mutual Exclusion**, **Hold and Wait**, **No Preemption**, and **Circular Wait**.

9. **What is process scheduling?**

   o Process scheduling is the method by which the OS decides which process runs at a given time.

10. **What are the types of process scheduling algorithms?**

- First-Come, First-Served (FCFS), Shortest Job Next (SJN), Round Robin (RR), Priority Scheduling, and Multilevel Queue Scheduling.

11. **What is virtual memory?**

   o Virtual memory allows programs to access more memory than physically available by using disk space as an extension of RAM.

12. **What is a page fault?**

   o A page fault occurs when a program accesses a page that is not currently in memory.

13. **What is paging in OS?**

   o Paging is a memory management scheme that eliminates the need for contiguous allocation of physical memory.

14. **What is segmentation in OS?**

   o Segmentation divides memory into segments based on logical divisions like functions, arrays, etc.

15. **What is thrashing?**

   o Thrashing occurs when the OS spends most of its time swapping data between memory and disk, leading to a significant performance slowdown.

Intermediate Questions:

16. **What is a file system?**

   o A file system is a method of storing and organizing files on a storage device like a hard disk or SSD.

17. **What are the types of file systems?**

   o **FAT**, **NTFS**, **ext4**, **HFS**, **APFS**, and **exFAT**.

18. **What is the difference between FAT32 and NTFS?**

   o **FAT32** is older and has limitations like 4GB file size limit, while **NTFS** supports larger files, better security, and more features.

19. **What is a system call?**

   o A system call is a request made by a program to the kernel for a service like file manipulation, process control, or communication.

20. **What is the difference between a hard link and a soft link?**

   o A **hard link** points to the same inode, while a **soft link** (symlink) is a pointer to the file name.

21. **What is a semaphore?**

   o A semaphore is a synchronization primitive used to control access to shared resources in a concurrent system.

22. **What is the difference between binary and counting semaphores?**

    o   A **binary semaphore** can only have values 0 or 1, while a **counting semaphore** can have a range of values.

23. **What is a mutex?**

    o   A mutex (mutual exclusion) is a locking mechanism used to ensure that only one thread can access a resource at a time.

24. **What is a context switch?**

    o   A context switch occurs when the OS switches from one process or thread to another, saving the state of the current process and loading the state of the next.

25. **What is a shell in an OS?**

    o   A shell is a user interface that allows interaction with the OS through commands, typically either command-line or graphical.

26. **What is an inode in Linux?**

    o   An inode is a data structure in the filesystem that stores information about a file, such as its size, permissions, and location on disk.

27. **What is memory management?**

    o   Memory management is the process of managing the computer's memory resources, including allocation, deallocation, and optimization of memory use.

28. **What is the difference between a primary memory and a secondary memory?**

    o   **Primary memory** (RAM) is fast and volatile, while **secondary memory** (HDD, SSD) is slower but non-volatile and used for long-term storage.

29. **What is the difference between user mode and kernel mode?**

    o   **User mode** is the mode in which applications run, while **kernel mode** is where the OS kernel executes and has full access to hardware.

30. **What is a device driver?**

    o   A device driver is software that allows the OS to communicate with hardware devices like printers, keyboards, and network interfaces.

Advanced Questions:

31. **What is RAID?**

    o   RAID (Redundant Array of Independent Disks) is a data storage technology that combines multiple disk drives for redundancy, performance, or both.

32. **What is the difference between RAID 0, RAID 1, and RAID 5?**

    o   **RAID 0**: Stripes data across disks for performance (no redundancy).

    o   **RAID 1**: Mirrors data across disks for redundancy.

o **RAID 5**: Uses striping and parity for redundancy and performance.

33. **What is the difference between preemptive and non-preemptive scheduling?**

   o **Preemptive** scheduling allows the OS to interrupt a running process to assign CPU time to another process, while **non-preemptive** scheduling lets a process run to completion.

34. **What is a socket in OS?**

   o A socket is an endpoint for communication between two machines over a network, commonly used in client-server applications.

35. **What is a critical section?**

   o A critical section is a part of the code that accesses shared resources and must be executed by only one process or thread at a time.

36. **What is an interrupt?**

   o An interrupt is a mechanism that temporarily halts the current execution of a program to allow the OS to respond to an event, like input from a user or hardware failure.

37. **What is an event-driven system?**

   o An event-driven system is one where the flow of the program is determined by events like user actions, sensor outputs, or messages from other programs.

38. **What is the purpose of a buffer?**

   o A buffer temporarily stores data to handle the differences in speed between two processes or devices (e.g., reading data from disk to memory).

39. **What is a bootloader?**

   o A bootloader is a small program that loads the OS into memory when a computer starts up.

40. **What is a system call interface (SCI)?**

   o The SCI is the interface between user applications and the kernel, enabling applications to request OS services.

41. **What is the difference between a process and a program?**

   o A **process** is an executing instance of a program, while a **program** is a static set of instructions stored on disk.

42. **What is memory-mapped I/O?**

   o Memory-mapped I/O is a method of performing input/output operations by mapping I/O devices directly into the system's memory space.

43. **What is the difference between a signal and a semaphore?**

- o A **signal** is a notification mechanism for inter-process communication, while a **semaphore** is used for synchronizing access to shared resources.

44. **What is the role of a file descriptor?**

   - o A file descriptor is a unique identifier used by the OS to access and manage open files or I/O streams.

45. **What is load balancing?**

   - o Load balancing is the process of distributing tasks across multiple resources (e.g., servers) to ensure optimal resource utilization and prevent overloading.

46. **What is a race condition?**

   - o A race condition occurs when multiple processes or threads attempt to access shared resources simultaneously, leading to unpredictable results.

47. **What is the purpose of a cache in memory management?**

   - o A cache stores frequently accessed data to speed up access and reduce the load on slower storage devices.

48. **What is process synchronization?**

   - o Process synchronization ensures that processes or threads coordinate their actions to prevent conflicts when accessing shared resources.

49. **What is the purpose of the fork() system call?**

   - o The fork() system call creates a new process by duplicating the calling process.

50. **What is a page replacement algorithm?**

   - o A page replacement algorithm determines which pages to swap in and out of memory when there is a page fault and memory is full (e.g., **LRU**, **FIFO**, **Optimal**).