General Questions on Operating Systems

1. Which of the following statements best describes the concept of kernel mode?
A) A mode in which user processes directly access the hardware
B) A mode in which the operating system executes code with elevated privileges
C) A mode used only by application programs
D) A mode reserved for external device drivers

2. Which of the following operations is directly managed by the operating system?
A) Source code compilation
B) Access to I/O devices
C) Interpretation of scripting languages
D) Debugging of user code

3. What is the main purpose of the file system?
A) To provide an interface for accessing files and secondary storage
B) To manage network communication between processes
C) To translate system calls into machine code
D) To execute background processes

4. During a context switch, which of the following pieces of information must always be saved?
A) Disk cache contents
B) The page table of all processes
C) Shared virtual memory contents
D) The CPU registers of the running process

5. What does the `exec()` *system call represent in Unix/Linux?*
A) It creates a new child process
B) It terminates the calling process
C) It replaces the code of the current process with a new program
D) It suspends the current process until a child terminates

CPU Scheduling Exercises

6. Compute the average waiting time using the First Come First Serve (FCFS) algorithm for the following system:
Processes and CPU times:
P1: Arrival = 0, CPU = 5 ms
P2: Arrival = 0, CPU = 3 ms
P3: Arrival = 0, CPU = 8 ms
P4: Arrival = 0, CPU = 6 ms

A) 5.5 ms
B) 6.25 ms
C) 7.25 ms
D) 7.5 ms

7. Compute the average waiting time using FCFS:
Processes and CPU times:
P1: Arrival = 0, CPU = 4 ms
P2: Arrival = 1, CPU = 6 ms
P3: Arrival = 2, CPU = 3 ms
P4: Arrival = 4, CPU = 5 ms

A) 4.5 ms
B) 5 ms
C) 5.25 ms
D) 6.75 ms

*8. Compute the average waiting time using Round Robin (RR) with time quantum **q = 2 ms**:*
Processes and CPU times:
P1: Arrival = 0, CPU = 5 ms
P2: Arrival = 0, CPU = 3 ms
P3: Arrival = 0, CPU = 6 ms
P4: Arrival = 0, CPU = 4 ms

A) 9 ms
B) 9.25 ms
C) 10 ms
D) 10.5 ms

*9. Compute the average waiting time using Round Robin (RR) with **q = 3 ms**:*
Processes and CPU times:
P1: Arrival = 0, CPU = 9 ms
P2: Arrival = 1, CPU = 5 ms
P3: Arrival = 7, CPU = 6 ms
P4: Arrival = 11, CPU = 4 ms

A) 7.5 ms
B) 8 ms
C) 8.25 ms
D) 9 ms

10. Compute the average waiting time using Shortest Job First (SJF – non-preemptive):
Processes and CPU times:
P1: Arrival = 0, CPU = 8
P2: Arrival = 0, CPU = 2
P3: Arrival = 0, CPU = 6
P4: Arrival = 0, CPU = 4

A) 4.5 ms
B) 4.75 ms
C) 5 ms
D) 5.5 ms

11. Compute the average waiting time using Shortest Remaining Time First (SRTF – preemptive):
Processes and CPU times:
P1: Arrival = 0, CPU = 8
P2: Arrival = 2, CPU = 5
P3: Arrival = 4, CPU = 2

A) 3 ms
B) 3.33 ms
C) 3.67 ms
D) 4.16 ms

*12. Compute the average waiting time using Round Robin (RR) (Arrival = 0 for all, **q = 4 ms**):*
Processes, CPU and I/O times:
P1: CPU 6, I/O 4, CPU 4
P2: CPU 5, I/O 2, CPU 3
P3: CPU 4, I/O 3, CPU 2

A) 8.33 ms
B) 8.67 ms
C) 9.25 ms
D) 9.33 ms

Process and Thread Creation

13. In a system with 10 processes, each one executes a `fork()`*. Assuming all calls succeed, how many processes will exist in total?*
A) 10
B) 20
C) 100

D) Depends on the operating system

14. What happens if a process calls `wait()` *when it has no active child processes?*
A) It remains indefinitely blocked
B) It terminates automatically
C) The operating system returns an immediate error
D) It blocks until another process wakes it up

15. In a multithreaded process, what do all threads share?
A) Stack
B) Program counter register
C) Address space (memory and global variables)
D) Thread identifier

16. What is the purpose of the `pthread_join()` *call?*
A) To create a new thread
B) To terminate a thread
C) To force thread synchronization
D) To wait for the termination of a specific thread

17. Which situation may occur if two threads access a global variable simultaneously without synchronization?
A) Starvation
B) Deadlock
C) Race condition
D) Context switch

Synchronization (Locks, Semaphores, Monitors)

18. Which property is essential to guarantee mutual exclusion?
A) All processes must be able to enter the critical section simultaneously
B) At most one process can be in the critical section at any given time
C) Each process must enter the critical section within a finite amount of time
D) A process must never be allowed to access the critical section

19. A semaphore initialized to 3 can be used to:
A) Allow up to three threads to access a shared resource simultaneously
B) Allow only one thread at a time to access a shared resource
C) Block all threads indefinitely
D) Implement one-to-one communication between two threads

20. Which of the following synchronization techniques avoids busy waiting?
A) Spinlock
B) Test-and-set lock
C) Monitor
D) Preemption