CS4023

1. Which of the following is the primary goal of process synchronization?

A) To ensure that processes execute in parallel
B) To ensure mutual exclusion and prevent race conditions
C) To increase the speed of process execution
D) To allow processes to communicate with each other

2. Which hardware feature is typically used to implement synchronization in multi-core systems?

A) Semaphores
B) Atomic instructions
C) Mutex locks
D) Conditional variables

3. Which of the following is true about a mutex lock?

A) It allows multiple threads to acquire the lock simultaneously.
B) It is used for mutual exclusion to protect critical sections.
C) It does not block threads waiting for the lock.
D) It can only be used by processes, not threads.

4. A semaphore is initialized with a value of 3. If three processes each perform a wait operation, what will the value of the semaphore be?

[✓ A) 0]
B) -1
C) 3
D) 6

5. Which of the following is a method for preventing deadlock in a system?

A) Ignoring deadlock and allowing it to resolve itself
B) Using a deadlock detection algorithm periodically
C) Removing one of the necessary deadlock conditions (e.g., breaking circular wait)
D) Allowing processes to request resources arbitrarily

6. In a system using semaphores, what does the signal operation do?

[✓ A) Increases the semaphore value and potentially unblocks waiting processes]
B) Decreases the semaphore value and blocks processes
C) Starts a new process
D) Allocates memory for the semaphore

7. Which of the following is a solution to the problem of starvation in process synchronization?

A) FIFO scheduling
B) Priority scheduling
[✓ C) Ensuring that each process eventually gets access to the shared resource]
D) Disabling interrupts

8. In Linux, what is the default state of a semaphore after calling sem_init() with a value of 0?

[✓ A) Locked]
B) Unlocked
C) Waiting
D) Undefined

9. What is the main reason for using a monitor in synchronization?

A) To allow multiple processes to communicate simultaneously
B) To automatically handle deadlocks
[✓ C) To provide a higher-level abstraction for mutexes and condition variables]
D) To allocate memory efficiently

10. Which of the following statements accurately describes the atomicity of the Compare and Swap (CAS) operation?

A) CAS guarantees that the value of the variable is always modified, regardless of its initial value
[✓ B) CAS guarantees that the comparison and update are done in a single, uninterrupted operation]
C) CAS guarantees the update only if the process is not in a critical section
D) CAS does not ensure mutual exclusion in a multi-threaded environment

11. Which of the following statements about deadlock is correct?

A) Deadlock is impossible to occur in a system using semaphores.
[✓ B) Deadlock can be prevented by ensuring no circular wait conditions.]
C) Deadlock detection is the most common method used to prevent deadlock.
D) Deadlock can always be resolved by restarting the affected processes.

12. What happens if a thread tries to acquire a mutex lock that is already held by another thread?

A) The thread proceeds to execution.
[✓ B) The thread waits until the mutex becomes available.]

C) The thread is blocked indefinitely.
D) The thread is terminated.

13. Which of the following is the main goal of the Banker's algorithm?

A) To prevent starvation in multi-threaded applications
B) To detect deadlocks and handle them appropriately
[✓ C) To allocate resources safely and avoid deadlock]
D) To prioritize process execution based on resource usage

14. Which of the following is not a valid condition for preventing deadlock in an operating system?

[✓ A) Mutual exclusion]
B) No preemption
C) Circular wait
D) Hold and wait

15. What is the primary disadvantage of using a spinlock for synchronization?

A) It causes threads to block indefinitely.
B) It can lead to high CPU utilization because threads are constantly checking for lock availability.
C) It cannot be used in multi-core systems.
D) It guarantees that threads will never block.

16. In a system with multiple processes and resources, which of the following is the best strategy for deadlock avoidance?

A) Always allow processes to hold resources indefinitely.
B) Allocate resources based on the process's priority to avoid circular wait.
C) Use a maximum resource claim strategy to ensure safe resource allocation.
D) Periodically restart all processes to clear any potential deadlock.

17. Which of the following problems arises when multiple processes repeatedly attempt to acquire locks on different resources, leading to a situation where no process can make progress?

A) Starvation
B) Race condition
C) Deadlock
[✓ D) Livelock]

18. Consider a system with multiple processes and resources. If the system is using a resource allocation graph to detect deadlock, which of the following is a necessary condition for the system to be in a state of deadlock?

A) There must be a cycle in the resource allocation graph involving both processes and resources.
B) All resources in the system must be in use at the same time.
C) The wait-for graph must contain at least one cycle, but it should not contain any processes holding resources.
D) The system must have a cycle in the resource allocation graph, where all processes are holding at least one resource.

19. In a system that uses semaphores for synchronization, consider the following sequence of events: Process A executes a wait(s) on semaphore s with an initial value of 1, then Process B executes wait(s) on the same semaphore. Which of the following is the correct final state of the semaphore s and the processes?

A) The semaphore s becomes 1, and both processes A and B proceed.
B) Process A is blocked, and Process B proceeds, with semaphore s being 0.
C) Both Process A and Process B are blocked, with semaphore s being 0.
D) Process A proceeds, but Process B is blocked until Process A signals the semaphore.

20. Given that process P1 has an allocation of (1, 2, 3), and the maximum demand is (3, 3, 4), process P2 has an allocation of (2, 1, 1), and maximum demand (4, 2, 3), and the available resources are (3, 2, 2), which of the following statements is true according to the Banker's Algorithm?

A) The system is in a safe state
B) Process P1 can immediately finish without causing a deadlock
C) Process P2 needs to request additional resources to avoid deadlock
D) The available resources are insufficient for any process to proceed

Q1

What is deadlock in the context of a computer system?

A) A situation where two or more processes are unable to access resources and wait indefinitely for each other to release them.
B) A situation where a process keeps executing without ever reaching a stopping point.
C) A situation where multiple processes are executed in parallel without synchronization.
D) A situation where a process fails to execute due to missing resources.

Q2

Which of the following best describes livelock?

A) A **system** in which processes are unable to execute any tasks.

B) A system where processes continuously execute but do not make any progress.

C) A system where processes are deadlocked but attempt to recover.

D) A system where only one process can run at a time due to resource constraints.

Q3

In which of the following situations can deadlock occur?

A) Processes repeatedly exchange messages and wait for acknowledgment.
B) Processes make forward progress without waiting for other processes.
C) Processes are blocked forever because each is waiting for resources held by others.
D) A single process holds all system resources and prevents others from executing.

Q4

Which statement accurately distinguishes deadlock from livelock?

A) Deadlock results in processes being blocked, while livelock involves processes actively running but making no progress.
B) Deadlock occurs in the case of a single process, while livelock requires multiple processes.
C) Deadlock occurs when processes keep running and cannot stop, whereas livelock involves processes being unable to run at all.
D) There is no difference; both terms describe the same situation in different contexts.

Q5

Which of the following is a characteristic of a system experiencing deadlock?

A) The system continues executing, but processes are stuck in an infinite loop.
B) Processes continuously try to execute but keep getting interrupted by other processes.
C) Processes wait indefinitely for each other to release resources, causing a halt in progress.
D) Resources are allocated without any synchronization, causing random execution delays.

Q6

In a system with multiple types of resources (such as CPUs, files, and I/O devices), which of the following conditions must be met for a resource type to be properly defined?

A) The system must ensure that each resource is unique and cannot be shared between threads.

B) The instances of the resource type must be identical, such that a thread requesting a resource will be satisfied by any available instance of that resource type.

C) A thread can request resources only from a single resource type.

D) The number of resource types must be minimized to avoid deadlock.

Q7

In the context of multithreaded applications, which sequence of actions must a thread follow to properly manage/uses resources?

A) Request, Use, Release

B) Release, Request, Use

C) Use, Request, Release

D) Request, Release, Use

Q8

In a system where threads use mutex locks, what is a common cause of deadlock?

A) Threads acquiring and releasing locks in the same order without any overlap.
B) A thread requesting and holding a lock while simultaneously waiting for another lock that is held by another thread.
C) Locks are always granted immediately, without any waiting.
D) Locks being released immediately after use, without any delays.

Q1

Which of the following is NOT one of the four key conditions for a deadlock to occur in a system?

a) Mutual Exclusion

b) Hold and Wait

c) Resource Allocation

d) Circular Wait

Q2

In the context of deadlock, the 'Mutual Exclusion' condition refers to which of the following?

a) Each process must hold one or more resources and cannot release them until its execution is complete.
b) At least one resource must be held in a non-shareable mode.
c) Processes must request resources in a circular chain.
d) Processes must be in a blocked state while waiting for resources.

Q3

The 'Hold and Wait' condition for deadlock implies:

a) A process is holding at least one resource and is waiting for additional resources currently held by other processes.
b) A process cannot hold any resource and must request all resources at once.
c) A process releases all resources once it finishes execution.
d) Processes are never allowed to hold resources while waiting for others.

Q4

Which of the following statements best describes the 'Circular Wait' condition?

a) Processes are allowed to request resources, but must release them immediately once granted.
b) Processes are arranged in a circular chain, where each process is waiting for a resource held by the next process in the chain.
c) Resources are always allocated to processes in a strict sequential order.
d) Resources are shared by all processes and cannot be held exclusively by any single process.

Q5

In the context of deadlock prevention, which of the following approaches eliminates the 'No Preemption' condition?

a) Allowing processes to release resources while waiting for others.

b) Allowing resources to be forcibly 强行taken away from a process holding them.

c) Ensuring that processes never request more than one resource at a time.

d) Forcing processes to release all resources before requesting new ones.

Q1

What is the primary purpose of a Resource Allocation Graph (RAG)?

- A) To visualize process execution order
- B) To model and detect deadlocks in a system
- C) To manage process scheduling
- D) To track resource usage over time

Q2

In a Resource Allocation Graph, which of the following represents a request from a process for a resource?

- A) An edge from a resource to a process
- B) An edge from a process to a resource
- C) A bidirectional edge between process and resource
- D) A self-loop on the resource node

Q3

In a Resource Allocation Graph, what does an edge from a resource to a process indicate?

- A) The process is holding the resource
- B) The resource is being requested by the process
- C) The resource is shared between processes
- D) The resource has been completed

Q4

Which condition must be true for a deadlock to exist in a system with a Resource Allocation Graph?

- A) There must be a cycle in the graph with no resource holding
- B) There must be a cycle involving only process nodes
- C) There must be a cycle involving both process and resource nodes
- D) There must be no cycles in the graph

Q5

If there is a cycle in the Resource Allocation Graph but no process is requesting additional resources, what can be inferred?

- A) The system is deadlocked
- B) The system is not deadlocked
- C) The system is in a safe state
- D) The cycle indicates potential for a deadlock