1. **A(n) _____ refers to where a process is accessing/updating shared data.**
   A) critical section
   B) entry section
   C) mutex
   D) test-and-set

   critical section

2. **Assume an adaptive mutex is used for accessing shared data on a Solaris system with multiprocessing capabilities. Which of the following statements is not true?**
   A) A waiting thread may spin while waiting for the lock to become available.
   B) A waiting thread may sleep while waiting for the lock to become available.
   C) The adaptive mutex is only used to protect short segments of code.
   D) Condition variables and semaphores are never used in place of an adaptive mutex.

   Condition variables and semaphores are never used in place of an adaptive mutex.

3. **Assume there are three resources, R1, R2, and R3, that are each assigned unique integer values 15, 10, and 25, respectively. What is a resource ordering which prevents a circular wait?**
   A) R1, R2, R3
   B) R3, R2, R1
   C) R3, R1, R2
   D) R2, R1, R3

   R2, R1, R3

4. **____ can be used to prevent busy waiting when implementing a semaphore.**
   A) Spinlocks
   B) Waiting queues
   C) Mutex lock
   D) Allowing the wait() operation to succeed

   Waiting queues

5. **A ____ could be preempted from a process.**
   A) mutex lock
   B) CPU
   C) Semaphore
   D) file lock

   CPU

6. **A cycle in a resource-allocation graph is ___.**
   A) a necessary and sufficient condition for deadlock in the case that each resource has more than one instance
   B) a necessary and sufficient condition for a deadlock in the case that each resource has exactly one instance
   C) a sufficient condition for a deadlock in the case that each resource has more than once instance
   D) is neither necessary nor sufficient for indicating deadlock in the case that each resource has exactly one instance

   a necessary and sufficient condition for a deadlock in the case that each resource has exactly one instance

7. **A deadlocked state occurs whenever ___.**
   A) a process is waiting for I/O to a device that does not exist
   B) the system has no available free resources
   C) every process in a set is waiting for an event that can only be caused by another process in the set
   D) a process is unable to release its request for a resource after use

   every process in a set is waiting for an event that can only be caused by another process in the set

8. **In a system resource-allocation graph, ___.**
   A) a directed edge from a process to a resource is called an assignment edge
   B) a directed edge from a resource to a process is called a request edge
   C) a directed edge from a process to a resource is called a request edge
   D) None of the above

   a directed edge from a process to a resource is called a request edge

9. **An instruction that executes atomically ___.** **A) must consist of only one machine instruction** **B) executes as a single, uninterruptible unit** **C) cannot be used to solve the critical section problem** **D) All of the above**	executes as a single, uninterruptible unit
10. **____ is/are not a technique for managing critical sections in operating systems.** **A) Peterson's solution** **B) Preemptive kernel** **C) Nonpreemptive kernel** **D) Semaphores**	Peterson's solution
11. **A Java thread may release a lock under which of the following circumstances?** **A) It exits a synchronized method.** **B) It invokes the notify() method.** **C) It invokes the wait() method.** **D) Both (A) and (B).**	Both (A) and (B).
12. **One necessary condition for deadlock is _____, which states that a process must be** **holding one resource and waiting to acquire additional resources.** **A) hold and wait** **B) mutual exclusion** **C) circular wait** **D) no preemption**	hold and wait
13. **One necessary condition for deadlock is _____, which states that a resource can be** **released only voluntarily by the process holding the resource.** **A) hold and wait** **B) mutual exclusion** **C) circular wait** **D) no preemption**	no preemption
14. **One necessary condition for deadlock is ___, which states that at least one resource must** **be held in a nonsharable mode.** **A) hold and wait** **B) mutual exclusion** **C) circular wait** **D) no preemption**	mutual exclusion
15. **One necessary condition for deadlock is _____, which states that there is a chain of waiting processes whereby P0 is waiting for a resource held by P1, P1 is waiting for a resource held** **by P2, and Pn is waiting for a resource held by P0.** **A) hold and wait** **B) mutual exclusion** **C) circular wait** **D) no preemption**	circular wait
16. **A race condition ___.** **A) results when several threads try to access the same data concurrently** **B) results when several threads try to access and modify the same data concurrently** **C) will result only if the outcome of execution does not depend on the order in which instructions are executed** **D) None of the above**	results when several threads try to access and modify the same data concurrently
17. **A semaphore ___.** **A) is essentially an integer variable** **B) is accessed through only one standard operation** **C) can be modified simultaneously by multiple threads** **D) cannot be used to control access to a thread's critical sections**	is essentially an integer variable
18. **A solution to the critical section problem does not have to satisfy which of the following** **requirements?** **A) mutual exclusion** **B) progress** **C) atomicity** **D) bounded waiting**	atomicity

19. **A spinlock ___.** **A) is never advantageous** **B) will ultimately result in a context switch when a process must wait on a lock** **C) does not require a context switch when a process must wait on a lock** **D) is useful when locks are expected to be held for long amounts of time**	does not require a context switch when a process must wait on a lock
20. **To handle deadlocks, operating systems most often ____.** **A) pretend that deadlocks never occur** **B) use protocols to prevent or avoid deadlocks** **C) detect and recover from deadlocks** **D) None of the above**	pretend that deadlocks never occur
21. **A transaction ___.** **A) performs multiple logical functions** **B) is a single instruction** **C) is a single operation** **D) performs a single logical function**	performs a single logical function
22. **A __ type presents a set of programmer-defined operations that are provided mutual exclusion within it.** **A) transaction** **B) signal** **C) binary** **D) monitor**	monitor
23. **What is the purpose of the mutex semaphore in the implementation of the bounded-buffer problem using semaphores?** **A) It indicates the number of empty slots in the buffer.** **B) It indicates the number of occupied slots in the buffer.** **C) It controls access to the shared buffer.** **D) It ensures mutual exclusion.**	It ensures mutual exclusion.
24. **When using semaphores, a process invokes the wait() operation before accessing its critical section, followed by the signal() operation upon completion of its critical section. Consider reversing the order of these two operations—first calling signal(), then calling wait(). What would be a possible outcome of this?A) Starvation is possible.** **B) Several processes could be active in their critical sections at the same time.** **C) Mutual exclusion is still assured.** **D) Deadlock is possible.**	Several processes could be active in their critical sections at the same time.
25. **Which of the following statements is true?** **A) A counting semaphore can never be used as a binary semaphore.** **B) A binary semaphore can never be used as a counting semaphore.** **C) Spinlocks can be used to prevent busy waiting in the implementation of semaphore.** **D) Counting semaphores can be used to control access to a resource with a finite number of instances.**	Spinlocks can be used to prevent busy waiting in the implementation of semaphore.
26. **Which of the following statements is true?** **A) A safe state is a deadlocked state.** **B) A safe state may lead to a deadlocked state.** **C) An unsafe state is necessarily, and by definition, always a deadlocked state.** **D) An unsafe state may lead to a deadlocked state.**	An unsafe state may lead to a deadlocked state.

27. **Which one of the following statements are incorrect when a Java thread invokes the wait()**
method?
A) The thread is placed in the wait set for the object.
B) The thread release the object lock.
C) The state of the thread is set to blocked.
D) The thread that has been waiting the longest becomes the new owner of the lock.

The thread that has been waiting the longest becomes the new owner of the lock.