CSCI 4500/8506 – Fall 2011
Sample Questions for Quiz 3
(covers modules 4, 5, and 6)

1. The processes involved in the producer-consumer problem are those that
   a. need large amounts of memory.
   b. occasionally generate objects and those that then use those objects.
   c. are compute-bound and I/O-bound.

2. The objects that are being produced in the producer-consumer problem are generally characterized as
   a. blocks of memory, independent of their content.
   b. data objects, like indications of keys pressed or released on a keyboard.
   c. units of processor time available for process execution.

3. The processes in the producer-consumer problem are assumed to run
   a. at exactly the same rate.
   b. at about the same rate.
   c. at different and arbitrary rates, as is required by good solutions to race condition problems.

4. A buffer, or storage area, is required in the producer-consumer problem. This buffer holds
   a. objects produced before a consumer process is ready to use them.
   b. indications of when a producer process is allowed to run.
   c. objects that a consumer process considered, but then rejected as unsuitable.

5. Access to the buffer in the producer-consumer problem
   a. is always permitted for producers, but consumers must obtain explicit permission from a producer to access the buffer.
   b. is controlled by the last object removed from the buffer.
   c. is shared by producers and consumers, and so must occur only inside a critical section.

6. When the buffer in the producer-consumer problem is completely full
   a. consumer processes are executed more rapidly.
   b. a producer that has created an object must block until an empty space becomes available in the buffer.
   c. the number of producer processes is reduced by half.

7. When the buffer in the producer-consumer problem becomes empty
   a. consumer processes wishing to obtain an object must block until the producer places an object in the buffer.
   b. the speed with which producer processes are executed is increased.
   c. a dummy object is placed in the next buffer location that will be accessed by a consumer.

8. Assume a producer process is blocked while waiting on empty space in the buffer. In this case, a consumer process

   a. will awaken a producer when it removes an object from the buffer, allowing space for the producer to place another object.
   b. will remove and discard sufficient data objects (from the buffer) to make space available for the blocked producer to place additional objects in the buffer.
   c. change its priority to be at least as high as that of the the blocked producer process.

9. Consider that the statement **count = count + 1;** appears in multiple processes or threads in a system where the variable named **count** is accessible by multiple processes or threads. What must be done to ensure the value of **count** is correctly incremented when the statement is executed?

   a. Each of the processes or threads must have a unique (different) priority.
   b. It is impossible to guarantee that **count** will be properly incremented if multiple threads or processes contain the statement that can increment it.
   c. The statement must be in a critical section in each of the processes or threads that contains it.

10. Who proposed the semaphore data structure?

   a. Donald Shell
   b. Edgser Dijkstra
   c. Tony Hoare

11. What is the significance of the letters *P* and *V* when describing the fundamental operations on a semaphore?

   a. They correspond to the first letters of the French words that describe the operations.
   b. They correspond to the first letters of the Dutch words that describe the operations.
   c. None of the other answer choices is correct.

12. The problem with the producer consumer problem solution using the sleep and wakeup functions is related to the fact that

   a. a wakeup of a process (either a producer or a consumer) could be lost.
   b. in some cases, sleep will not cause a process to block.
   c. wakeup and sleep are not atomic operations.

13. A semaphore has two data components. One of these is a set. What type of data objects can this set contain?

   a. the identification of processes that currently hold (possess) one or more units of the resource controlled by the semaphore
   b. process identifications
   c. None of the other answer choices is correct.

14. A semaphore has two data components. One of these is an integer. What does the value of this integer represent?

   a. the number of processes currently holding (possessing) one or more units of the resource controlled by the semaphore
   b. the number of *waiting wakeups* for processes that request use of a resource controlled by the semaphore
   c. the number of items in the set associated with the semaphore

15. A *P* operation on a semaphore is also called a(n) _____ operation.

   a. left
   b. up
   c. down

16. A *V* operation on a semaphore is also called a(n) _____ operation.

   a. down
   b. increment
   c. up

17. When a *P* operation is executed on a semaphore with a count of zero,

   a. the identity of the process is added to the set associated with the semaphore, but the process continues execution.
   b. the process executing the P operation is blocked.
   c. the count is incremented and the process executing the P operation is blocked.

18. When a *V* operation is executed on a semaphore with a count of zero,

   a. if any processes are identified by the set associated with the semaphore, one of them is removed from the set and moved from the blocked to the ready state; otherwise the count is incremented by 1.
   b. the process executing the V operation is moved from the running to the blocked state, and its identity is added to the set associated with the semaphore.
   c. None of the other answer choices is correct.

19. Which of the semaphore operations, *P* or *V*, must be executed atomically?

   a. Both operations must be executed atomically.
   b. V must be executed atomically.
   c. Either all P or all V operations on a given semaphore must be executed atomically, but it makes no different which operation is selected for atomic operation.

20. In the semaphore-based solution to the producer/consumer problem, both the producer and the consumer processes use access to the shared buffer as a resource, and use it in a mutually-exclusive manner by performing down and up operations on a semaphore named *mutex*. What other resource do producer processes require if they are not going to be blocked?

  a. full locations in the buffer containing items previously produced
  b. empty locations in the buffer into which a producer can place an item
  c. None of the other answer choices is correct.

21. Who proposed the synchronization structure called a *monitor*?

  a. Maurice Bach and Marshall Kirk McKusick
  b. Niklaus Wirth and David Gries
  c. Tony Hoare and Per Brinch Hansen

22. A monitor is different from a semaphore or an event counter in several ways. A semaphore and an event counter are each data structures, but a monitor is

  a. a programming construct intended for inclusion in a programming language.
  b. a pair of data structures, each including a semaphore.
  c. a set of processes, each of which has access to a single resource at all times.

23. It is the responsibility of the compiler that processes the programming language supporting monitors to guarantee that

  a. only one process (or thread) is allowed to execute any of the functions or the initialization code inside the monitor at one time.
  b. no processes are executing inside the monitor if there are blocked processes sleeping on any of the monitor's condition variables.
  c. None of the other answer choices is correct.

24. A condition variable used with a monitor is similar to a semaphore in that it includes a set. It is different from a semaphore, however, in what way?

  a. The count associated with a condition variable may become negative.
  b. A condition variable includes two counts, one giving the number of resources in use, and one giving the number of processes waiting for a resource.
  c. There is no count associated with a condition variable.

25. A signal operation on a condition variable associated with a monitor, with no processes waiting on the condition variable,

  a. is ignored.
  b. causes the process performing the signal operation to become blocked on the same condition variable that was signaled.
  c. None of the other answer choices is correct.

26. Brinch Hansen and Hoare each proposed a different way of dealing with a process P that signaled a conditional variable and caused another process, say process Q, to be awakened. Why was it necessary to devise such strategies?

   a. The two strategies differed depending on whether Q needed to execute immediately after being signaled, or if it could possibly wait until P finished executing.
   b. The two strategies differed depending on whether it was possible for both processes, P and Q, to execute inside the monitor at the same time without competing for the same shared resources.
   c. The signaling process, P, is not allowed to continue execution inside the monitor while the awakened process, Q, is also executing inside the monitor.

27. Which of the following synchronization techniques can easily be used to support processes running on separate machines connected to a network?

   a. message passing
   b. event counters
   c. Each of the above techniques can be used to synchronize processes on separate machines connected to a network.

28. When a process executes the appropriate code to receive a message, what will likely happen if a message is not immediately available for it to receive?

   a. The process will block until such time as a message is available.
   b. An empty message will be given to the process.
   c. None of the other answer choices is correct.

29. In the producer-consumer solution using message passing, there is some initialization required. What takes place during this *one time only* initialization?

   a. The variable *empty* is set to the number of empty positions allowed for the storage of items made by the producer.
   b. Each of the consumer processes is placed in the blocked state.
   c. An appropriate number of messages, each marked as being *empty*, are sent from the consumer to the producer.

30. Which of the following statements about the equivalence of process synchronization techniques is true?

   a. Message passing and semaphores can be shown to be equivalent.
   b. Monitors and semaphores can be shown to be equivalent.
   c. Each of the techniques - monitors, event counters, semaphores, and message passing - can be shown to be equivalent to each of the others.

31. In the dining philosophers problem, the philosophers spend their lives alternating between thinking and

   a. working.
   b. traveling.
   c. eating.

32. The shared resource(s) in the dining philosophers problem is(are)

    a. food and seats at a circular table.
    b. forks.
    c. seats at a circular table.

33. The processes in the dining philosophers problem correspond to the behavior of

    a. the philosophers seating.
    b. the philosophers.
    c. the benefactor supplying the food.

34. Suppose there are 7 philosophers in the dining philosophers problem. At most how many of these could be eating at the same time?

    a. 3
    b. 1
    c. 2

35. Suppose there are 8 philosophers in the dining philosophers problem. What is the minimum number of these that may be eating at the same time?

    a. 5
    b. 2
    c. 4

36. When all that is impossible is eliminated, then whatever remains, however improbable,

    a. will occur with great frequency.
    b. must be the truth.
    c. is unimportant.

37. One way to find potential problems with a proposed solution to an IPC problem is to

    a. rewrite the solution using a different IPC mechanism.
    b. run the proposed solution on a system with one processor for each process.
    c. consider all possible execution sequences and eliminate those that are not causing problems.

38. One sequence of actions that must not be allowed in the dining philosophers problem is

    a. for each philosopher to pick up the fork to their left and then, while holding it, wait for the fork to their right.
    b. for all philosophers to be thinking at the same time.
    c. to alternate between all the odd-numbered philosophers eating and all the even-numbered philosophers eating.

39. A good solution to the dining philosophers problem must provide a reasonable measure of assurance that

    a. each philosopher will never have to wait longer than the time required for each other philosopher to eat before he or she is allowed to eat.
    b. no more than two other philosophers will be allowed to eat before a philosopher that is hungry will be allowed to eat.
    c. once a philosopher has indicated a desire to eat that he or she will be eventually allowed to do so.

40. Suppose in a proposed solution to the dining philosopher problem that a philosopher has indicated it is hungry, but it is forever denied the opportunity to eat. In this case, we say that the solution exhibits

    a. temporal instability.
    b. deadly embrace.
    c. indefinite postponement.

41. In the solution to the dining philosophers problem presented, a third state is associated with each philosopher. This additional state is called

    a. left fork.
    b. sleeping.
    c. hungry.

42. How many classes of processes are there in the readers/writers problem?

    a. more than 4
    b. 1
    c. 2

43. Each process in the readers/writers problem is involved with reading or writing what?

    a. a shared object, like a database
    b. a set of objects, normally not shared but assigned to individual reader and writer processes, but occasionally shared
    c. one or more objects, none of which may be access by more than one reader at a time

44. How many reader processes can be accessing an object in the readers/writers problem at the same time?

    a. at most one
    b. at most two
    c. as many as desired

45. How many writer processes can be accessing an object in the readers/writers problem at the same time?

   a. as many as there are reader processes
   b. the maximum of NW - NR and 1, where NW is the number of writer processes and NR is the number of reader processes
   c. at most one

46. In total, how many reader and writer processes may be accessing an object in the readers/writers problem at the same time?

   a. An arbitrarily large number of readers and at most one writer may be accessing an object at the same time.
   b. Readers and writers may not both access the shared object at the same time.
   c. At most one reader and one writer may access the shared object at the same time.

47. Which of the following are common variants of the reader/writer problem?

   a. maximum priority and minimum priority
   b. equal readers and writers, and unequal readers and writers
   c. reader priority and writer priority

48. Assume we allow reader processes to continually gain access to the shared object in the reader/writer problem, even if writers are waiting to access it. Which of the following is true?

   a. Indefinite posponement of writers can not occur.
   b. Indefinite postponement of writers could occur.
   c. None of the other answer choices is correct.

49. The solution presented for the reader/writer problem uses two semaphores. What resources have their access controlled by these semaphores?

   a. the variable that indicates the number of active writer processes, and the shared object
   b. the shared object and the variable that indicates which type of processes are currently accessing the shared object
   c. the variable that indicates the number of active reader processes, and the shared object

50. Assume there is a semaphore used to control access to the shared object in the reader/writer problem. Also assume there are four readers currently accessing the shared object. How many of those readers did a down operation on the semaphore to obtain their *current* access to the shared object?

   a. one
   b. two
   c. four

51. Assume there is a semaphore used to control access to the shared object in the reader/writer problem. Also assume five write operations have been performed on the shared object. How many down operations were performed by a writer process on the semaphore?

a. exactly one
b. at least one
c. five

52. The term *batch processing* historically refers to

a. the processing of a batch of jobs submitted all at once from an interactive terminal.
b. allowing one job to create additional jobs in batches.
c. the processing of a set of jobs that were all submitted as a group.

53. Batch processing today is most likely referred to as

a. interactive processing.
b. group processing.
c. background processing.

54. Jobs processed in batches

a. are usually related to each other.
b. usually do not perform I/O on terminals or other interactive devices.
c. are always run using the shortest-job first scheduling algorithm.

55. *Interactive* jobs

a. can use only text-mode devices, as opposed to devices capable of doing multimedia input/output.
b. can only perform input/output using the local keyboard, display, and mouse.
c. utilize terminals, mice, and other devices designed for human input and output.

56. Interactive processes

a. cannot directly perform network input/output, but must instead start a batch process to handle the network input/output.
b. are always started by batch processes.
c. typically require timely response from the system after user input occurs.

57. The term *scheduling* refers to

a. the processing of requests from processes in an order that is strictly the same as the order in which the requests were submitted.
b. all activities of a system associated with determining when various actions are to be performed.
c. None of the other answer choices is correct.

58. If a typical process is executed several times with the same data

    a. it should execute exactly the same sequence of instructions.
    b. it will produce output that is dependent on the number of other processes being executed at the same time.
    c. None of the other answer choices is correct.

59. Regardless of the number of processes being executed, or the code that processes are executing

    a. each process will receive the same amount of CPU time.
    b. each possible execution sequence of each process is finite.
    c. None of the other answer choices is correct.

60. The term *job scheduling* refers to

    a. the actual sequence in which processes are executed, regardless of the decisions about when they are to be executed.
    b. the scheduling of a job, or sequence of individual sequential steps.
    c. None of the other answer choices is correct.

61. Job scheduling is done using

    a. the number of users with accounts on a system.
    b. the number of times the job has been run over the past several time intervals in which scheduling decisions are made.
    c. information about the resources required by the entire job, and the currently available system resources.

62. Which of the following would be characterized as *high-level* scheduling?

    a. job scheduling
    b. thread scheduling
    c. instruction scheduling

63. Which of the following would be characterized as *low-level* scheduling?

    a. process scheduling
    b. job scheduling
    c. all of the above can be characterized as high-level scheduling.

64. To what does the term *turnaround time* apply?

    a. the time between submitting a non-interactive, or batch, job and receiving the results.
    b. the time at which a half-duplex communication line has the direction of communication changed.
    c. None of the other answer choices is correct.

65. Which of the following is **not** a goal of scheduling?

   a. process as many jobs in a given time period as possible.
   b. keep the CPU as idle as possible, reflecting effective use of the processor.
   c. Each of the above is a goal of scheduling.

66. When preemptive scheduling is used

   a. a running process can have the CPU taken away from it, and it can be returned to the ready state.
   b. any process can preempt any other process that is running.
   c. None of the other answer choices is correct.

67. The term *non-preemptive scheduling* is also called

   a. run-to-completion scheduling.
   b. batch scheduling.
   c. priority scheduling.

68. A *clock* in a computer system operates by

   a. measuring the rate at which the CPU is executing processes.
   b. providing periodic interrupts.
   c. effectively sending what appears to be input from a terminal with a constant, but programmable, interval.

69. Which of the following actions might be taken each time the primary system clock ticks?

   a. If any actions are scheduled to occur at the current time, then steps are taken to start those actions.
   b. The currently-running process is moved to the ready state and another process is selected for execution.
   c. None of the other answer choices is correct.

70. Suppose there are only three processes in a system, and they are compute-bound (that is, they do no input/output at all). Assume the processes are using round-robin scheduling with a quantum size of 10 milliseconds. Suppose each process needs 1 second (1000 milliseconds) of CPU time to complete its work. Ignoring the time required to switch the CPU between processes, after how long will the first process complete its work?

   a. 1010 milliseconds
   b. 2980 milliseconds
   c. 1020 milliseconds

71. The maximum amount of time a process may use the CPU before it is returned to the ready state in a round-robin system is called

   a. the quantum size of the process.
   b. the recycle period of the system.
   c. the clock period for the system.

72. If the quantum size in a system is very small, then most of the time in the system is spent

    a. performing context switches between processes.
    b. executing the idle process.
    c. processing the first process to obtain use of the CPU.

73. If the quantum size in a system is very large,

    a. the system effectively appears to be doing non-preemptive scheduling.
    b. a process will retain use of the CPU even while it is blocked.
    c. memory utilization will be very efficient.

74. In a system that uses priority scheduling

    a. a high priority process has its priority reduced if and when it becomes blocked.
    b. the process currently using the CPU is one of those that has the highest priority.
    c. None of the other answer choices is correct.

75. In a system that uses priority scheduling

    a. processes with the same priority can be run in a round-robin fashion.
    b. processes with the same priority are allowed only if the system has multiple processors.
    c. all processes with the highest priority must complete before any processes with a lower priority can be started.

76. In a UNIX system, when a process blocks for an input/output operation,

    a. its priority is changed to the lowest of all ready processes.
    b. the system assumes it is I/O bound (that is, spending most of its time perform input/output), and its priority is increased.
    c. None of the other answer choices is correct.

77. Suppose a system is using the inverse remainder of quantum variant of round-robin scheduling. A process uses 30 percent of its quantum before blocking. When it is eventually returned to the ready queue,

    a. it is placed at the front of the ready queue.
    b. it is placed at the rear of the ready queue.
    c. it is placed behind 30 percent of the processes in the ready queue, not at the rear.

78. The batch scheduling algorithm called *shortest job first* always selects the job with the smallest execution time to run next. This has the result of

    a. always yielding the smallest average turnaround time of any job scheduling algorithm.
    b. yielding the smallest standard deviation of the job turnaround times of any job scheduling algorithm.
    c. None of the other answer choices is correct.

79. Since the shortest job first algorithm cannot be used directly on interactive processes, a variation called *aging* is used. In this algorithm

a. the initial execution time estimate is either increased or decreased by a fixed percentage depending on whether the job used all of its quantum during the last time it used the CPU or not.
b. the estimated execution time for a process is a weighted sum of the previous execution time estimate and the last execution time.
c. None of the other answer choices is correct.

80. For many systems, the only criteria associated with the correct execution of a process is whether the process yields the correct results. Systems in which it is also required that actions be taken in a specified amount of time or at specified times are called

a. post-time systems.
b. real-time systems.
c. time-constrained systems.

81. A system in which failing to meet a deadline can result in total system failure or death is

a. permitted only if multiple processors are available.
b. called a *distributed system*.
c. called a *hard real-time system.*

82. Suppose a real-time system is going to process only two types of events. The first type of event occurs once every 10 milliseconds and requires 4 milliseconds of CPU time to process. The second event occurs once every 20 milliseconds. What is the most CPU time these 20-millisecond events can require if the system is to be considered schedulable?

a. 10 milliseconds
b. 6 milliseconds
c. 12 milliseconds

83. In the rate-monotonic scheduling algorithm

a. the system runs the process that has the greatest time before it must begin execution in order to meet its deadline.
b. each process gets a priority that is proportional to the frequency of occurrence of its triggering event.
c. processes are run to completion once they are selected for execution.

84. The term *swapping* describes a system that

a. handles both real-time and non-real-time processes.
b. moves the memory content of processes between primary memory and secondary storage if insufficient memory is available.
c. None of the other answer choices is correct.

85. Which of the following statements regarding the terms *policy* and *mechanism* is correct?

   a. Policies are rules governing which mechanisms may be used in implementing a particular system.
   b. A policy is a set of rules, or parameters associated with a set of rules, that are implemented using the available mechanisms in a system.
   c. None of the other answer choices is correct.