

**Chapter 5 – Concurrency: Mutual Exclusion and Synchronization**True / False Questions:

1. Distributed processing can be defined as the management of multiple processes executing on multiple, distributed computer systems.
2. Both process interleaving and process overlapping are examples of concurrent processes and both present the same basic problems.
3. Concurrency issues are a concern on multiprocessor systems, but do not impact uniprocessor systems.
4. Starvation refers to the situation where competing processes are denied access to a resource due to scheduling problems.
5. Any facility or capability that is to provide support for mutual exclusion must make certain assumptions about relative process speeds and the number of processors in the system.
6. Peterson's Algorithm for solving mutual exclusion is only valid for two processes and cannot be generalized to the case of n processes.
7. In a uniprocessor machine, concurrent processes cannot be overlapped; they can only be interleaved.
8. Weak semaphores guarantee freedom from starvation, but strong semaphores do not.
9. A finite circular buffer and an infinite buffer are two ways to implement a data storage area for the classic Producer/Consumer Problem.
10. The major difficulty with semaphores is that wait and signal operations may be scattered throughout a program and it is difficult to see the overall effect of these operations on the semaphores they affect.
11. Message passing provides both synchronization and communication, which are fundamental requirements for interacting processes.
12. In a message passing system, one queuing discipline alternative is to allow the receiver to inspect the message queue and select which message to receive next.
13. In the communications mechanism of a message passing system, only the receiver of the communication can be blocking.
14. In indirect addressing, as applied to message passing, messages are sent to a temporary shared data structure typically known as a mailbox.
15. The Producer/Consumer problem is typically considered a special case of the Readers/Writes problem, with only one reader and one writer

Multiple Choice Questions:

1. Concurrency plays a major part in which of the following specific contexts:
  - a. Multiple applications
  - b. Structured applications
  - c. O/S structure
  - d. All of the above
2. Examples of solutions to the concurrency problem that do not involve busy waiting are the following:
  - a. Semaphores and monitors
  - b. Message passing and caching

- c. Producers and consumers
  - d. None of the above
3. A basic echo procedure (that echoes a typed character to the screen) running on a multiprocessor system can produce erroneous output if:
    - a. Two processes deadlock while in the echo code
    - b. Access to the echo procedure is unsynchronized
    - c. Access to the echo procedure is synchronized
    - d. None of the above
  4. In order to implement mutual exclusion on a critical resource for competing processes, only one program at a time should be allowed:
    - a. In the critical section of the program
    - b. To perform message passing
    - c. To Exhibit cooperation
    - d. None of the above
  5. The following requirement must be met by any facility or capability that is to provide support for mutual exclusion:
    - a. Only one process at a time can be allowed into a critical code section
    - b. A process remains in its critical code section for a finite time only
    - c. No assumptions can be made about relative process speeds
    - d. All of the above
  6. Processes that are designed to be able to pass execution control back and forth between themselves are referred to as:
    - a. Threads
    - b. Coroutines
    - c. Busy waiting processes
    - d. None of the above
  7. In a uniprocessor system, mutual exclusion can be guaranteed by:
    - a. Overlapping processes
    - b. Interleaving processes
    - c. Disabling interrupts
    - d. All of the above
  8. A semaphore that does not specify the order in which processes are removed from the queue is called a:
    - a. Weak semaphore
    - b. Strong semaphore
    - c. Binary semaphore
    - d. None of the above
  9. The finite circular buffer is used to implement which of the following basic queuing strategies:
    - a. FILO
    - b. LIFO
    - c. FIFO
    - d. None of the above
  10. A chief characteristic of a monitor is:
    - a. A maximum of two processes may be executing in a monitor at a time

- b. Local data variables of the monitor are accessible by any procedure requesting use of the monitor
  - c. A process enters the monitor by invoking one of its procedures
  - d. All of the above
11. In synchronization involving message passing, the sender of a message can be:
- a. Either blocking or non-blocking
  - b. Only blocking
  - c. Only non-blocking
  - d. All of the above
12. In a system employing message passing, when a message is sent to a shared temporary data structure, this general approach is known as:
- a. Direct addressing
  - b. Indirect addressing
  - c. Blocking
  - d. None of the above
13. In a system employing message passing, the typical message is divided into two primary sections:
- a. Header and mailbox
  - b. Body and mailbox
  - c. Destination ID and Source ID
  - d. None of the above
14. The Reader/Writer problem requires that certain conditions be satisfied, such as:
- a. Readers may read from the file while writers are writing to it
  - b. Multiple writers may write to the file simultaneously
  - c. Any number of readers may simultaneously read from the file
  - d. None of the above
15. A reason why the Producer/Consumer problem cannot be considered a special case of the Reader/Writer problem with a single writer (the producer) and a single reader (the consumer) is:
- a. The producer and consumer must be both reader and writer
  - b. The consumer must perform writes while the reader performs reads
  - c. The Producer/Consumer problem doesn't deal with concurrency issues
  - d. None of the above

Fill-In-The-Blank Questions:

1. Many approaches to achieving mutual exclusion are software solutions that require the use of a technique called \_\_\_\_\_.
2. The basic requirement for support of concurrent process is the ability to enforce \_\_\_\_\_.
3. In order to protect shared variables (and other shared global resources) the system must control the \_\_\_\_\_.
4. The situation where Process 1 (P1) holds Resource 1 (R1), while P2 holds R2, and P1 needs R2 to complete and P2 needs R1 to complete is referred to as \_\_\_\_\_.
5. When only one process is allowed in its critical code section at a time, then \_\_\_\_\_ is enforced.

6. The technique in which a process can do nothing until it gets permission to enter its critical section but continues to test the appropriate variable to gain entrance is called \_\_\_\_\_.
7. In multiprocessor configurations, special machine instructions that carry out two actions in a single instruction cycle are said to do so \_\_\_\_\_.
8. A semaphore whose definition includes the FIFO policy for releasing blocked processes from the queue is called a \_\_\_\_\_.
9. The Barbershop Problem uses \_\_\_\_\_ to implement concurrency.
10. A monitor supports \_\_\_\_\_ by the use of condition variables that are contained within the monitor and accessible only within the monitor.
11. A blocking send, blocking receive message passing scenario is sometimes referred to as a \_\_\_\_\_.
12. The shared data structures that temporarily hold messages in a message passing system employing indirect addressing are generally referred to as \_\_\_\_\_.
13. In the \_\_\_\_\_ addressing implementation of message passing, the “send” primitive includes a specific identifier of the destination process.
14. The classic concurrency problem that involves readers and writers that can both read from and write to a shared data area is the \_\_\_\_\_ Problem.
15. The classic concurrency problem that involves multiple readers that can read from a shared data area when no single writer is exclusively writing to it is the \_\_\_\_\_ Problem.