Operating System Fundamentals

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Assignment 07 (Week 7)

Q1. Which of the following is a famous synchronization problem that illustrates the challenge of resource allocation to avoid deadlock?

(A) The Readers-Writers problem
(B) The Dining Philosophers problem
(C) The Bounded-Buffer problem
(D) The Producer-Consumer problem

Ans: (B) The Dining Philosophers problem

Q2. Which of the following conditions must be met for process P_i, to enter its critical section according to Peterson's algorithm?

(A) The `turn' variable is not equal to j OR the `flag[j]` variable is FALSE
(B) The `turn` variable is equal to j OR the `flag[j]` variable is TRUE
(C) The `turn` variable is equal to j AND the `flag[j]` variable is TRUE
(D) Both `flag[i]` AND `flag[j]` must be TRUE

Ans: (A) The `turn' variable is not equal to j OR the `flag[j]` variable is FALSE

Q3. Which of the following is the primary characteristic of the "test_and_set" instruction used for process synchronization?

(A) It guarantees that a process will not enter a busy-waiting loop
(B) It reads a value from a memory location and stores a new value, all in a single, uninterruptible step
(C) It ensures that processes are granted access to a critical section on a first-come, first-served basis
(D) It can be implemented entirely in software without any special hardware support

Ans: (B) It reads a value from a memory location and stores a new value, all in a single, uninterruptible step

Q4. A counting semaphore is initialized to a value of 10. What is the final value of the semaphore after 12 P operations and 15 V operations have been performed, assuming no processes are ever blocked?

(A) 11
(B) 12
(C) 13
(D) 14

Ans: (C) 13

Q5. Which of the following is the primary disadvantage of using busy waiting for process synchronization?

(A) It can lead to a deadlock between processes
(B) It is difficult to implement in most modern programming languages
(C) It ensures that the critical section is always available
(D) It wastes CPU cycles by continuously checking a condition

Ans: (D) It wastes CPU cycles by continuously checking a condition

Q6. In a single-processor system, two processes, P1 and P2 run concurrently. They share a variable X, initialized to 10. Process P1 executes the statement X=X+5 and P2 executes the statement X=X-3. If the execution is not synchronized, what are the possible final values of X?

(A) 7 only
(B) 12 only
(C) 15 only
(D) 7 or 12 or 15

Ans: (D) 7 or 12 or 15

Q7. The Producer-Consumer problem can be solved using semaphores. Which of the following semaphore initialization schemes is correct for a bounded buffer of size N?

(A) mutex = 1, empty = N, full = 0
(B) mutex = N, empty = 1, full = 0
(C) mutex = 1, empty = 0, full = N
(D) mutex = 0, empty = N, full = 1

Ans: (A) mutex = 1, empty = N, full = 0

Q8. A semaphore ‘S’ is initialized to 1. In a program with multiple threads, the following code is executed. What will be the final value of ‘S’ after 5 threads successfully execute this code fragment?

```
wait(S);
// Critical section code
signal(S);
```

(A) -1
(B) 0
(C) 1
(D) 2

Ans: (C) 1

Q9. Solution to critical section problem via semaphore generally contains a WAIT(S) at the beginning and SIGNAL(S) at the end of the critical section. If these two are reversed, the property(ies) violated is/are (select the closest answer):

(A) Mutual exclusion
(B) Progress

(C) Bounded wait
(D) All of the other options

Ans: (A) Mutual exclusion

Q10. The test_and_set instruction (used for process synchronization) returns
(A) True
(B) False
(C) Equal to parameter passed
(D) None of the other options

Ans: (D) None of the other options