

Tutorial 3

CSN-232 Operating Systems

Answer the following questions and provide a short (3-4 lines max) justification for your answer:

Q1. The atomic fetch-and-set x, y instruction unconditionally sets the memory location x to 1 and fetches the old value of x in y without allowing any intervening access to the memory location x . consider the following implementation of P and V functions on a binary semaphore.

```
void P (binary_semaphore *s) {
    unsigned y;
    unsigned *x = &(s->value);
    do {
        fetch-and-set x, y;
    } while (y);
}

void V (binary_semaphore *s) {
    S->value = 0;
}
```

Which one of the following is true?

- A. The implementation may not work if context switching is disabled in P.
- B. Instead of using fetch-and-set, a pair of normal load/store can be used
- C. The implementation of V is wrong
- D. The code does not implement a binary semaphore

Q2. Consider the methods used by processes P1 and P2 for accessing their critical sections whenever needed, as given below. The initial values of shared Boolean variables S1 and S2 are randomly assigned.

Method used by P1	Method used by P2
while (S1==S2); Critical Section S1=S2;	while(S1!=S2); Critical Section S2=not(S1);

- A. Mutual exclusion but not progress
- B. Progress but no mutual exclusion
- C. Neither mutual exclusion nor progress
- D. Both mutual exclusion and progress

Q3. A shared variable x , initialized to zero, is operated on by four concurrent processes W, X, Y, Z as follows. Each of the processes W and X reads x from memory, increments by one, stores it to memory, and then terminates. Each of the processes Y and Z reads x from memory, decrements by two, stores it to memory, and then terminates. Each process before reading x invokes the P operation (i.e., wait) on a counting semaphore S and invokes the V operation (i.e., signal) on the semaphore S after storing x to

memory. Semaphore S is initialized to two. What is the maximum possible value of x after all processes complete execution?

- A. -2
- B. -1
- C. 1
- D. 2

Q4. Consider the following threads, T1, T2, and T3 executing on a single processor, synchronized using three binary semaphore variables, S1, S2, and S3, operated upon using standard wait() and signal(). The threads can be context switched in any order and at any time.

T1	T2	T3
<pre>while(true){ wait(S3); print("C"); signal(S2); }</pre>	<pre>while(true){ wait(S1); print("B"); signal(S3); }</pre>	<pre>while(true){ wait(S2); print("A"); signal(S1); }</pre>

Which initialization of semaphores would print the sequence BCABCABCA.....?

- A. S1= 1; S2=1; S3=1
- B. S1= 1; S2=1; S3=0
- C. S1= 1; S2=0; S3=0
- D. S1= 0; S2=1; S3=1