Test-1
CS 300 – Operating Systems 12/10/2022

1. Consider, m[0]...m[4] be binary semaphores and P[0] .... P[4] be processes. Each process P[i] executes the following:

```
wait (m[i]); wait(m[(i+1) mode 4]);
{------
------
} release (m[i]); release (m[(i+1)mod 4]);
```

Will above processes satisfy the requirements of the synchronization? Justify your answer. **[03 Marks]**

2. The following C program is executed on a Unix/Linux system:

```
#include < unistd.h >
  int main ()
  {
      int i ;
      for (i=0; i<10; i++)
          if (i%2 == 0) fork ( ) ;
      return 0 ;
  }
```

How many child processes are created? Explain your answer. **[03 Marks]**

3. How many processes can be in ready state for a computer system with *n* number of CPUs? **[01 Marks]**

4. 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? Explain your answer **[04 Marks]**

5. Consider a system that has two CPUs and each CPU has two threads. Suppose three programs, P0, PI, and P2, are started with run times of 5, 10 and 20 mses, respectively. How long will it take to complete the execution of these programs? Explain your answer. Assume that all three programs are 100% CPU bound, do not block during execution, and do not change CPUs once assigned. **[04 Marks]**

6. Consider three concurrent processes P1, P2 and P3 as shown below, which access a shared variable D that has been initialized to 100.

P1	P2	P3
D = D + 20	D = D – 50	D = D + 10

The process are executed on a uniprocessor system running a time-shared operating system. If the minimum and maximum possible values of D after the three processes have completed execution are X and Y respectively, then what is the possible value of Y–X? Explain you answer. **[05 Marks]**

7. Consider the following four processes with arrival times (in milliseconds) and their length of CPU bursts (in milliseconds) as shown below :

Process	P1	P2	P3	P4
Arrival time	0	1	3	4
CPU burst time	3	1	3	Z

These processes are run on a single processor using preemptive Shortest Remaining Time First scheduling algorithm. If the average waiting time of the processes is 1 millisecond, then what is the value of Z? **[05 Marks]**