Examination – V

*Answer **all** from Section A and any **six** from Section B*

SECTION – A [10 x 2 = 20]

1. With Round-Robin (RR) CPU Scheduling in a time shared system:
    1. Using very large time slices (quantas) degenerates into First Come First Serve (FCFS) algorithm.
    2. Using extremely small time slices improves performance.
    3. Using very small time slices degenerates into Last-In-First-Out (LIFO) algorithm.
    4. Using medium sized time slices leads to Shortest Request Time First (SRTF) algorithm.

2. The performance of Round-Robin (RR) Scheduling depends heavily on:
    1. Size of the process
    2. The I/O burst of the process
    3. The CPU burst of the process
    4. Size of the time quantum

3. Consider three CPU-intensive processes which requires 10, 20, and 30 time units and arrives at times 0, 2 and 6 respectively. How many *context switches* are needed if the operating system implements a *Shortest Remaining Time First (SRTF)* scheduling algorithm? Do not count the context switches at time zero and at the end.
    1. 1
    2. 2
    3. 3
    4. 4

4. Mutual Exclusion problem occurs:
    1. Between two *disjoint* processes that do not interact.
    2. Among processes that share resources.
    3. Among processes that do not use the same resource.
    4. Between two processes that uses different resources of different machine.

5. At a particular time of computation, the value of *counting semaphore* is 7. Then 20P operations and xV operations were completed on this semaphore. If the new value of semaphore is 5, then what is the value of *x*?
   1. 18
   2. 22
   3. 15
   4. 13

6. A process executes the following code: ***for(int i=9; i<n; i++) {fork()};*** The total number of child processes created is:
   1. n
   2. 2^n - 1
   3. 2^n
   4. $2^{(n+1)}$ - 1

7. Which of the following is NOT true of *deadlock prevention* and *deadlock avoidance* schemes?
   1. In deadlock prevention, the request for resources is always granted if the resulting state is safe.
   2. In deadlock avoidance, the request for resources is always granted if the result state is safe.
   3. Deadlock avoidance is less restrictive than deadlock prevention.
   4. Deadlock avoidance requires knowledge of resource requirements a priori.

8. Which of the following disk strategies is likely to give the best throughput?
   1. Farthest cylinder next
   2. Nearest cylinder next
   3. First come first served
   4. Elevator algorithm

9. Which of the following is an example of *Spooled Device*?
   1. A line printer used to print the output of a number of jobs.
   2. A terminal used to enter input data to a running program.
   3. A secondary storage device in a virtual memory system.
   4. A graphic display device.

10. Four jobs to be executed on a single processor system arrive at time 0 in the order A, B, C, D. Their CPU burst time requirements are 4, 1, 8, 1 time units respectively. The completion time of A under *round-robin* algorithm with time quantum of one time unit is:
    1. 10
    2. 4
    3. 8
    4. 9

SECTION – B [6 x 5 = 30]

1. Consider three processes (process id 0, 1, 2 respectively) with compute time bursts 2, 4, and 8 time units. All processes arrive at time zero. Consider the *longest remaining time first (LRTF)* scheduling algorithm. In LRTF, ties are broken by giving priority to the process with the lowest process id. Calculate the *average turn-around time*.

2. Draw the *process state diagram* of an OS in which (i) each process is in one of the five states: created, ready, running, blocked (i.e sleep or wait), or terminated, and (ii) only non-preemptive scheduling is used by the OS. Label the transitions appropriately.

3. Consider a disk pack with 16 surfaces, 128 tracks per surface and 256 sectors per track. 512 bytes of data are stored in a bit-serial manner in a sector. The capacity of the disk pack and the number of bits required to specify a particular sector in the disk are respectively:
   1. 256 Mb, 19 bits
   2. 256 Mb, 28 bits
   3. 512 Mb, 20 bits
   4. 64 Gb, 28 bits

4. The head of a moving head disk with 100 tracks numbered 0 to 99 is currently serving a request at track 55. If the queue of requests kept in FIFO order is 10, 70, 75, 23, 65 then which of the two disk scheduling algorithms FCFS (First Come First Served) and SSTF (Shortest Seek Time First) will require less head movement? Find the head movement for each of the algorithms.

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

```
#include<unistd.h>
int main()
{
        int i;
        for(i=0; i<15; i++)
                if(i%2 == 0)
                        fork();

        return 0;
}
```

   Calculate the total number of *child processes* created.

6. A computer handles several interrupt sources as follows:

- Interrupt from CPU temperature sensor (raises interrupt if CPU temperature is too high).
- Interrupt from Mouse (raises interrupt if the mouse is moved or a button is pressed).
- Interrupt from Keyboard (raises interrupt if a key is pressed or released).
- Interrupt from Hard Disk (raises interrupt when a disk read is completed).

Which one of these will be handled by the Interrupt Handler at the *Highest Priority*?

7. Draw the *Precedence Graph* for the concurrent program given below:

```
S1
parbegin
        begin
                S2 : S4
        end;
        begin
                S3;
                parbegin
                        S5;
                        begin
                                S6 : S8
                        end
                parend
        end;
        S7
parend;
S9
```

8. Consider the following set of processes, with the arrival times and the CPU-burst times given in milliseconds.

Process	Arrival Time	Burst Time
P1	0	5
P2	1	3
P3	2	3
P4	4	1

What is the *average turnaround time* for these processes with the *Preemptive Shortest Remaining Time First (SRPT)* algorithm?

9. Consider the 3 processes, P1, P2 and P3 shown in the table:

Process	Arrival Time	Burst Time
P1	0	5
P2	1	7
P3	3	4

The completion order of the 3 processes under the policies FCFS and RR2 (round-robin scheduling with CPU quantum of 2 time units) are:

(A) **FCFS**: P1, P2, P3; **RR2**: P1, P2, P3
(B) **FCFS**: P1, P3, P2; **RR2**: P1, P3, P2
(C) **FCFS**: P1, P2, P3; **RR2**: P1, P3, P2
(D) **FCFS**: P1, P3, P2; **RR2**: P1, P2, P3

10. A single processor system has *three* resource types X, Y, and Z, which are shared by three processes. There are 5 units of each resource type. Consider the following scenario, where the column **alloc** denotes the number of units of each resource type allocated to each process, and the column **request** denotes the number of units of each resource type requested by a process in order to complete its execution. Which of these processes will finish **LAST**?

Process	Alloc			Request		
	X	**Y**	**Z**	**X**	**Y**	**Z**
P0	1	2	1	1	0	3
P1	2	0	1	0	1	2
P2	2	2	1	1	2	0

(A) P0
(B) P1
(C) P2
(D) None of the above, since the system is in a *deadlock*

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