Tutorial 4

1. In a system using single processor, a new process arrives at the rate of six processes per minute and each such process requires seven seconds of burst time. What is the CPU utilization?
   a. 70%
   b. 30%
   c. 60%
   d. 64%

2. Five jobs A, B, C, D and E are waiting in Ready Queue. Their expected runtimes are 9, 6, 3, 5 and 4 respectively. All jobs entered in Ready queue at time zero. They must run in _____ order to minimize average waiting time.
   a. B, A, D, E, C
   b. C, E, D, B, A
   c. E, D, C, B, A
   d. C, B, A, E, D

3. Consider a uniprocessor system executing three tasks T1, T2 and T3, each of which is composed of an infinite sequence of jobs (or instances) which arrive periodically at intervals of 3, 7 and 20 milliseconds, respectively. The priority of each task is the inverse of its period and the available tasks are scheduled in order of priority, with the highest priority task scheduled first. Each instance of T1, T2 and T3 requires an execution time of 1, 2 and 4 milliseconds, respectively. Given that all tasks initially arrive at the beginning of the 1st milliseconds and task pre-emptions are allowed, the first instance of T3 completes its execution at the end of _____ milliseconds.
   a. 5
   b. 10
   c. 12
   d. 15
4. Consider three CPU-intensive processes, which require 10, 20 and 30 time units and arrive at times 0, 2 and 6, respectively. How many context switches are needed if the operating system implements a shortest remaining time first scheduling algorithm? Do not count the context switches at time zero and at the end.
   a. 1
   b. 2
   c. 3
   d. 4

PID	Arrival Time	Burst Time
P1	0	10
P2	2	20
P3	6	30

5. Consider three processes, all arriving at time zero, with total execution time of 10, 20 and 30 units, respectively. Each process spends the first 20% of execution time doing I/O, the next 70% of time doing computation, and the last 10% of time doing I/O again.

The operating system uses a shortest remaining compute time first scheduling algorithm and schedules a new process either when the running process gets blocked on I/O or when the running process finishes its compute burst. Assume that all I/O operations can be overlapped as much as possible. For what percentage of time does the CPU remain idle?

a. 0%
b. 10.6%
c. 30.0%
d. 89.4%

6. Consider the following processes and their CPU burst time and find out average waiting time and average turnaround time using pre-emptive form of priority scheduling algorithm (Lower number represents higher priority).

Process	Burst Time (mills.)	Priority	Arrival Time (mills)
P1	9	5	0
P2	4	3	1
P3	5	1	2
P4	7	2	3
P5	3	4	4
Total	28		