Roll Number: _____ Name: _____

Thapar Institute of Engineering & Technology, Patiala
(Deemed to be University)

Department of Electronics & Communication Engineering
Mid Semester Test

BE- ENC
Date- Sept. 27, 2022
Time: 02 Hours, M.M.: 35

UCS303: Operating Systems

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NOTE: * Attempt all questions. All questions carry equal marks
** Assume any missing information.

Q1. **a).** Draw the process state diagram to explain the various states a *"process"* undergoes? Mention different schedulers in the process state diagram. **(3)**

b). Explain non-preemptive vs preemptive CPU scheduling with examples? **(2)**

c). What is CPU starvation and how an OS deals with starvation? **(2)**

Q2. **a).** What is *"time quanta"* in round-robin scheduling? **(1)**

b). Consider the following table with processes and their respective times: **(4)**

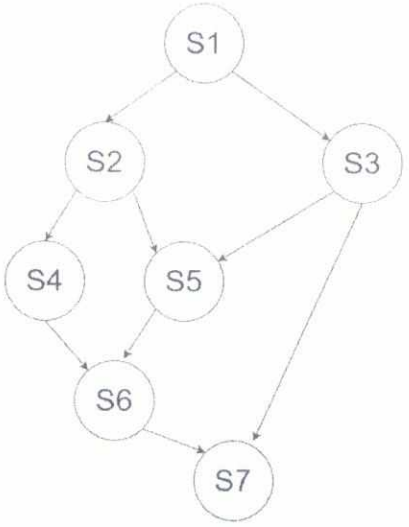
Pid	Arrival Time	Burst Time	Priority
1	0	5	5
2	1	7	2
3	2	3	1
4	4	15	3
5	5	20	4

Find the average turn-around time, and average waiting time of all the processes, if priority CPU scheduling with a preemption algorithm is used. Assume the higher number as a smaller priority.

c). Four jobs (A, B, C, and D) to be executed on a single processor system arrive at the time "0" with CPU time requirements of 4, 1, 8, and 1 time units respectively in the order of (D C B A). What is the completion time for C under round-robin scheduling with time quanta of 1 unit? **(2)**

Q3. **a).** Write the conditions for the concurrent processing of two statements? **(2)**

b). Write a concurrent program using the *"fork-join"* data structure for the precedence graph shown below: **(3)**



c) Briefly explain the *producer-consumer* problem with an example. **(2)**

Q4. **a).** At a particular time, the value of counting semaphore 'C' is twenty. Find the final value of the semaphore after twenty-three 'P' operations, twenty 'V' operations, five 'P' operations, and three 'V' operations. **(2)**

b). Consider three processes A, B, and C to be scheduled as per the SRTF algorithm. The process 'A' is known to be scheduled first, and when, 'A' has been running for '7' units of time, the process 'C' has arrived. Process 'C' has run for '1' unit of time, then process 'B' has arrived and completed running in '2' units of time. Then, what could be the minimum burst time of the processes 'A' and 'C'? **(3)**

c). What is a critical-section problem? Briefly explain the three requirements of a solution to the critical section problem. **(2)**

Q5. **a).** Define deadlock and briefly explain the necessary conditions for the occurrence of a deadlock? **(2)**

b). Consider a system with three resource types A, B, and C having 10, 5, and 7 instances respectively. There are 5 processes (P1, P2, P3, P4, and P5) to be executed. P1 has declared its maximum requirements as 7, 5, and 3, and has acquired 0, 1, and 0 instances of A, B, and C respectively. Similarly, P2's maximum requirement is 3, 2, and 2, and acquired 2, 0, and 0. P3's maximum requirement is 9, 0, and 2 and has acquired 3, 0, and 2. P4 has declared 2, 2, and 2 as its maximum requirement and has acquired 2, 1, and 1. P5's maximum requirement is 4, 3, and 3 and has acquired 0, 0, and 2. If there are 3, 3, and 2 instances of A, B, and C respectively i.e., available at this instant. Find a safe sequence using which this system can avoid the deadlock. **(5)**