

TUTORIAL THREE**CPU Scheduling**

1. State whether each of the following statements are true or false. Justify your answers.
 - (a) A process scheduling discipline is preemptive if the CPU cannot be forcibly removed from a process.
 - (b) When a new process is admitted in the system, the short-term scheduler must execute in order to keep the CPU busy.
 - (c) For a process, response time = turnaround time – waiting time.
 - (d) Partitioned multi-processor scheduling suffers from migration overheads due to data in private core-specific caches.

2. Consider the following set of processes, with the CPU burst time given in milliseconds:

<u>Process</u>	<u>CPU Burst Time</u>	<u>Priority</u>	<u>Arrival Time (Order)</u>
P ₁	10	3	0 (1)
P ₂	1	1	0 (2)
P ₃	2	3	2 (1)
P ₄	1	4	2 (2)
P ₅	5	2	4 (1)

- (a) Draw six Gantt charts illustrating the execution of these processes using
 - i. Shortest Job First (SJF), Preemptive Priority-based (smaller priority number implies higher priority) and Round-Robin (quantum=2) uni-processor scheduling.
 - ii. First-Come First-Served (FCFS) partitioned multi-processor scheduling with P₁, P₅ on core 1 and P₂, P₃ and P₄ on core 2.
 - iii. Shortest Remaining Time First (SRTF) and Round-Robin (quantum=2) global multi-processor scheduling with 2 cores.
 - (b) What is the turnaround time of each process for each scheduling algorithm in part (a)?
 - (c) What is the waiting time of each process for each scheduling algorithm in part (a)?
 - (d) Which of the schedulers in part (a) results in the minimal average waiting time (separately for uni- and multi-processors)?
3. Measurements of a certain system have shown that the average process runs for time T before blocking on I/O. A process switch requires time S , which is effectively wasted (overhead). Define what is meant by CPU efficiency. For round robin scheduling with quantum Q , give a formula for the CPU efficiency for each of the following cases:
 - (a) $Q \rightarrow \infty$
 - (b) $Q > T$
 - (c) $S < Q < T$
 - (d) $Q = S$
 - (e) $Q \rightarrow 0$

