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.
   False, preemptive scheduling is where an executing task is interrupted by a timer interrupt at a fixed date

   (b) When a new process is admitted in the system, the short-term scheduler must execute in order to keep the CPU busy.
   no. that is a job for the long term scheduler. short term scheduler is used for processes moving btw ready and running state

   (c) For a process, response time = turnaround time – waiting time.
   false, response time is the time from arrival of the process until the first moment the CPU is allocated.

   (d) Partitioned multi-processor scheduling suffers from migration overheads due to data in private core-specific caches.
   yes. when process moves from one core to the next, data would have to be re-retrieved into the cache from the hard disk.

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

Process	CPU Burst Time	Priority	Arrival Time (Order)
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 P_1, P_5 on core 1 and P_2, P_3 and P_4 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) $Q \rightarrow 0$