Roll Num: Name:

CS3523: Operating Systems 2

Quiz1 – Spring 2022

Scheduling Algorithms

1. Five batch jobs, A through E, arrive at a computer center at essentially the same time. They have an estimated running time of 15, 9, 3, 6, and 12 minutes, respectively. Their (externally defined) priorities are 6, 3, 7, 9, and 4, respectively, with a lower value corresponding to a higher priority. For each of the following scheduling algorithms, determine the turnaround time for each process and the average turnaround for all jobs. Ignore process switching overhead. Explain how you arrived at your answers. In the last three cases, assume only one job at a time runs until it finishes, and all jobs are completely processor bound.

(a) round robin with a time quantum of 1 minute
(b) priority scheduling
(c) FCFS (run in order 15, 9, 3, 6, and 12)
(d) shortest job first

(8 pts)

2. Consider a variation of round robin scheduling, say NRR scheduling. In NRR scheduling, each process can have its own time quantum, q. The value of q starts out at 40 ms and decreases by 10 ms each time it goes through the round robin queue, until it reaches a minimum of 10 ms. Thus, long jobs get decreasingly shorter time slices.

(a) Develop the Gantt chart for scheduling algorithm for three jobs A, B, and C that arrive in the system having estimated burst times of 100 ms, 120 ms, and 60 ms respectively. Then compute the waiting times and the average waiting time as well. **(6 pts)**

(b) Also identify some advantages and disadvantages that are associated with this algorithm as compared to traditional round robin. **(3 pts)**

3. Five jobs are waiting to be run. Their expected run times are 9, 6, 3, 5, and X. In what order should they be run to minimize average response time? (Your answer will depend on X.) **(3 pts)**

4. Consider two processes, P1 and P2 , where p1 = 40, t1 = 25, p2 = 75, and t2 = 30.
(a) Can these two processes be scheduled using rate-monotonic scheduling? Illustrate your answer using a Gantt chart. **(4 pts)**

(b) Illustrate the scheduling of these two processes using earliest-deadline-first (EDF) scheduling. **(4 pts)**

5. A system is predominated by periodic tasks and so rate monotonic scheduling (RMS) is proposed as a way to resolve multitask scheduling conflicts. Assume that in a given time span the system has five tasks with parameters as listed below:

- Task P1: Processing Time C1 = 20; Period T1 = 90
- Task P2: Processing Time C2 = 30; Period T2 = 250
- Task P3: Processing Time C3 = 70; Period T3 = 370
- Task P4: Processing Time C4 = 50; Period T4 = 330

- Task P5: Processing Time C5 = 125; Period T5 = 2000

We have seen that the following equation provides an upper bound on the number of tasks that Rate Monotonic Scheduling (RMS) algorithm can successfully schedule: $n(2^{(1/n)}-1)$.
If RMS is used, analyze whether the tasks can be successfully scheduled as per this equation. **(5 pts)**