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| Operating Systems Course                | <b>Deadline:</b> 20 April 2012    |
| <b>Assignment 3:</b> Process Scheduling | <b>Instructor:</b> Hossein Momeni |
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### **Problem 1.**

Five batch jobs A through E, arrive at a computer center at almost the same time. They have estimated running times of 10, 6, 2, 4, and 8 minutes. Their (externally determined) priorities are 3, 5, 2, 1, and 4, respectively, with 5 being the highest priority.

For each of the following scheduling algorithms, determine the mean process turnaround time. Ignore process switching overhead.

- a) Round robin.
- b) Priority scheduling.
- c) First-come, first-served (run in order 10, 6, 2, 4, 8).
- d) Shortest job first.

For (a), assume that the system is multi-programmed, and that each job gets its fair share of the CPU. For (b) through (d) assume that only one job at a time runs, until it finishes. All jobs are completely CPU bound

### **Problem 2.**

Suppose there are four processes, P1, P2, P3, and P4, with respective arrival times of 1 ms, 3 ms, 4 ms, and 5 ms, and processing requirements of 4 ms each. The processes are assigned priorities 1, 2, 3, and 4, respectively, with a higher number being higher priority. The processes are scheduled preemptively and scheduling overheads are considered negligible.

- a. What is the average completion time for these processes if the processes are scheduled using first come first serve?
- b. What is the average completion time for these processes if the processes are scheduled using Round-Robin scheduling, assuming a time quantum of 2 ms? Assume that processes are initially queued in FIFO order.

**Problem 3.**

For a real-time system with 3 periodic events following periods is considered:

– 100, 200, 500

If processing of events needs 50,30,100 (Msec) of CPU time, can the load be handled?

**Problem 4.**

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.)

**Problem 5.**

What is a **system call**? Using the terms user mode and kernel mode, explain how a system call is performed by the operating system.

**Problem 6.**

What is the main advantage of the **microkernel approach** to system design? What are the disadvantages of the microkernel approach?