

## Chapter 3 Exercises

1. Suppose a task consists of  $n$  subtasks  $J_i$  each of which has computation time  $c_i, i = 1, \dots, n$ . This task requests service at time  $k$  and has absolute deadline  $D$ . Give a formula to compute the latest deadline for completing each subtask such that the deadline of the entire task can be satisfied.

2. A scheduler is said to obey the stack discipline if whenever task A is preempted by task B, task A cannot resume execution before task B completes. A random scheduler is one that selects a task to execute every time unit by random choice. Does the random scheduler obey the stack discipline? Justify your answer clearly or give a counter example.

3. The rate-monotonic scheduling algorithm is used to assign priority to the following task set. All tasks arrive at time 0.

| task | period | computation time |
|------|--------|------------------|
| A    | 30     | 1                |
| B    | 10     | 1                |
| C    | 6      | 1                |
| D    | 5      | 1                |
| E    | 2      | 1                |

(a) Show a schedule. What is the maximum response time for each task? Show all your calculations.

(b) If the periods of the tasks in a task set are all multiples of a base unit, say 4, then is the static priority scheduler as good as the earliest deadline scheduler for this type of task sets? Give a proof or show a counter-example.

4. Determine whether the following task set is RM-schedulable. If yes, show an RM schedule. All tasks arrive at time 0.

| task | period | computation time |
|------|--------|------------------|
| A    | 50     | 8                |
| B    | 20     | 3                |
| C    | 35     | 15               |
| D    | 10     | 2                |

5. Schedule the task set in exercise 3 using the FIFO (FCFS) scheduler. Is the schedule feasible?

6. Schedule the task set in exercise 3 using the EDF scheduler.

7. Schedule the task set in exercise 3 using the LL scheduler.

8. Show three periodic tasks which do not satisfy the simple schedulable utilization (Schedulability Test 2) but can still be RM-scheduled.

9. Construct a set of periodic tasks (showing start times, computation times, and periods) which can be scheduled by the EDF algorithm but not by the RM algorithm.

11. Under what condition(s) are the rate monotonic algorithm and the earliest-deadline-first algorithm equivalent?

13. Consider the following three periodic tasks:

$T_1$ :  $c_{1,1} = 1, c_{1,2} = 2, c_{1,3} = 3, d_1 = p_1 = 18$ .

$T_2$ :  $c_{2,1} = 1, c_{2,2} = 2, d_2 = 5, p_2 = 6$

$T_3$ :  $c_3 = 1, d_3 = p_3 = 18$ .

$T_1$  must rendezvous with  $T_2$  after the first, second, and third scheduling blocks.

$T_2$  must rendezvous with  $T_1$  after the first scheduling block.

Construct a schedule for this task set.

14. Is it possible to find a set of  $n_3$  tasks which can be scheduled on a multiprocessor systems with  $n$  processors. Justify your answer.