CS 424. Homework #3.

Please work on the homework independently. It is due Thursday Oct 17th, in class. **Please return the answer sheet only (i.e., the last page).**

Q1: Please find the best answer to each of the following questions.

1. You are scheduling a very large number of independent periodic tasks on a uniprocessor using *preemptive rate monotonic* scheduling. What would be the utilization bound? (If you answer (d), please fill in the blank.) **(1 point)**

a) 0

b) ln 2

c) 1

d) Other (please indicate value in the answer sheet)

2. How would the answer above change if the rate monotonic scheduler was non-preemptive? **(1 point)**

a) 0

b) ln 2

c) 1

d) Other (please indicate value in the answer sheet)

3. Which of the following scheduling policies is the optimal fixed priority scheduling policy for tasks with relative deadlines that are *smaller than or equal to* periods? **(1 point)**

a) Rate Monotonic

b) Deadline Monotonic

c) EDF

d) FIFO

4. Which of the following combinations of scheduling policy and locking protocol offers the best schedulability for independent periodic tasks? **(1 point)**

a) Deadline monotonic scheduling with priority-ceiling protocol

b) Deadline monotonic scheduling with priority-inheritance protocol

c) Deadline monotonic scheduling with regular lock/unlock operations (i.e., neither of the above protocols)

d) FIFO scheduling with regular lock/unlock operations

5. Three periodic tasks T1, T2 and T3, have periods P1=100, P2=40, and P3=16 seconds, and computation times C1=13, C2=3, and C3=2 seconds. They are scheduled using rate monotonic scheduling. The computation time, C1, includes a critical section of size B1=10 seconds. Similarly, the computation time, C2, includes one critical section of size B2=2 seconds. (Both are for the same resource.) The priority ceiling protocol is used. What is the processor utilization for this task set? (Note: The question asks about *utilization*, not *utilization bound*.) **(1 point)**

a) 33%

b) 38%

c) 43%

d) 48%

6. In the task set in Problem 5, what is the maximum amount of priority inversion (i.e., blocking experienced by a higher priority task due to lower priority tasks) that a task can experience? **(1 point)**

a) None

b) 2 seconds

c) 10 seconds

d) 12 seconds

7. Using the exact schedulability test, determine the exact worst case response time of task T_1 in the above example.

a) 13 seconds

b) 18 seconds

c) 20 seconds

d) 22 seconds

Q2: For each of the following three task sets, use the exact schedulability test to determine the worst-case response time of task T_2 *if it is schedulable*. Otherwise, if the task is not schedulable, just say "unschedulable". In each task set, C_i, P_i, and D_i denote the processing time, period, and relative deadline of task *i* respectively. If relative deadline is not mentioned, assume that it is equal to period. Assume that *deadline-monotonic* scheduling is used. **(3 points)**

a)	**b)**	**c)**
Task 1:	Task 1:	Task 1:
$C_1 = 5$, $P_1 = 8$, $D_1 = 7$	$C_1 = 4.2$, $P_1 = 10$, $D_1 = 9$	$C_1 = 4.5$, $P_1 = 7$
Task 2:	Task 2:	Task 2:
$C_2 = 2.2$, $P_2 = 11$, $D_2 = 9.3$	$C_2 = 2$, $P_2 = 12$, $D_2 = 6$	$C_2 = 5.4$, $P_2 = 13$
7.2	**2**	**Unschedulable**