

### CS 424. Homework #3.

Please work on the homework independently. It is due Thursday Oct 13th, in class.

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**Q1: Please find the best answer to each of the following questions. Please return the answer sheet only (i.e., the last page).**

1. Police arrived at the scene of a car accident. If 5% of drunk drivers end up in accidents, which of the following is true?

- a) There is a 5% chance that the driver was drunk
- b) 95% of the drivers who end up in car accidents are sober
- c) Both (a) and (b)
- d) None of the above

2. (Needs some thinking) You are scheduling independent periodic tasks on a uniprocessor using *non-preemptive* rate-monotonic scheduling. What would be the utilization bound? (If you answer (d), please fill in the blank.)

- a) 0%
- b) 50%
- c) 69%
- d) Other (please fill in): \_\_\_\_\_

3. Which of the following scheduling policies has the highest utilization bound in the context of (preemptive) scheduling of independent periodic tasks on a single processor (core)?

- a) Rate Monotonic
- b) EDF
- c) Shortest Job First
- d) FIFO

4. Which of the following policies ensures deadlock-free scheduling?

- a) Priority-inheritance
- b) Priority-ceiling
- c) FIFO
- d) None of the above

5. Which of the following statements best defines unbounded priority inversion in real-time scheduling of periodic tasks with critical sections?

- a) It is a phenomenon that occurs when multiple low priority tasks block a high priority task because a priority inheritance protocol is used instead of the priority ceiling protocol.
- b) It refers to a situation when a high priority task is blocked by a single low priority task because the latter locks a resource needed for the former.
- c) It refers to a scheduling anomaly in which arbitrarily many low priority tasks end up delaying a high priority task even when some of the former do not lock any resources needed for the latter.
- d) It is a condition when a low priority task locks an arbitrarily long critical section.

6. Which of the following is true of rate monotonic scheduling of independent periodic tasks (whose deadlines are equal to their periods) on a uniprocessor?

- a) It is the optimal static-priority scheduling policy
- b) It is the optimal dynamic-priority scheduling policy
- c) It will meet all deadlines of any task set of a 50% utilization
- d) Both (a) and (c)

7. Three periodic tasks T1, T2 and T3, have periods  $P_1=20$ ,  $P_2=10$ , and  $P_3=5$  seconds, and computation times  $C_1=2$ ,  $C_2=1$ , and  $C_3=2$  seconds. The computation time,  $C_1$ , includes a critical section of size  $B_1=1$  second. Similarly, the computation time,  $C_3$ , includes a critical section of size  $B_3=1.5$  seconds. (Both are for the same resource.) The priority ceiling protocol is used. What is the utilization of this task set?

- a) 60%
- b) 65%
- c) 90%
- d) 95%

8. In the task set in Problem 7, 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?

- a) None
- b) 1 second
- c) 1.5 seconds
- d) 2.5 seconds

9. Which of the following statements best describe the schedulability of the task set presented in Problem 7 (on a uniprocessor)?

- a) It is unschedulable.
- b) It is schedulable by EDF but not Rate Monotonic
- c) It is schedulable by Rate Monotonic, but not EDF
- d) It is schedulable by both EDF and Rate Monotonic

10. Your robot runs three independent periodic tasks on a single core, using the rate monotonic scheduling policy. In order to make sure that each task invocation finishes by the end of its period, which of the following is (approximately) the maximum utilization you would recommend running the core at?

- a) 69%
- b) 73%
- c) 75%
- d) 77%

**Please copy your answers to the answer sheet on the next page and return the answer sheet only.**

Name \_\_\_\_\_

NetID \_\_\_\_\_

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Answers (write "a", "b", "c", or "d"):

1)

2)

3)

4)

5)

6)

7)

8)

9)

10)