Real-Time and Embedded Systems: Problem Set 2

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The second week of lectures has described clock-driven and priority-driven scheduling in some detail, describing algorithms and schedulability proofs. This problem set aims to test your understanding of these algorithms, and your ability to reason about the schedulability of systems. You should answer all questions.

Question 1: A system consists of three periodic tasks: (3, 1), (5, 2), and (8,3).

1. Construct an earliest deadline first schedule of this system in the interval (0, 32). Label any missed deadlines.

2. Construct a rate-monotonic schedule for this system in the interval (0, 32). Label any missed deadlines.

3. Suppose we want to reduce the execution time of the task with period 3 in order to make the task system schedulable according to the earliest deadline first (EDF) algorithm. What is the minimum amount of reduction necessary for the system to be schedulable by the EDF algorithm?

Question 2: A system contains five independent preemptable periodic tasks with utilization of $u_1 = 0.8$, $u_2 = u_3 = u_4 = u_5 = 0.01$. Can these tasks be scheduled using a rate monotonic algorithm? Explain your answer.

Question 3: The following systems of periodic tasks are to be scheduled and executed according to a structured cyclic schedule with fixed frame size. What is an appropriate frame size for each? What do the resulting cyclic scheduler tables look like?

1. (6, 1), (10, 2), and (18, 2)

2. (5, 0.1, (7, 1.0), (12, 6) and (45, 9)

Answers must be submitted by 5pm on 3rd February 2005. A drop box will be available for submissions in Lilybank Gardens and submissions will only be accepted via that drop box. This problem set is worth 5% of the mark for this module. The usual rules apply for late submissions: 20% of the mark will be deducted for each day late. Ensure your name and matriculation number are included on each submission, and attach a pink statement of originality form.