Real-Time and Embedded Systems: Problem Set 2

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The second group 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 8 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 (tasks may execute for a fraction of a time unit)?

Question 2: A system contains five independent preemptable periodic tasks with utilization of $u_1 = 0.70$, $u_2 = 0.05$, $u_3 = u_4 = u_5 = 0.01$. 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 does the initial segment of the resulting cyclic scheduler table look like (you should draw enough of the table to illustrate your understanding of the process; there is no need to draw the entire table)?

1. (6, 1), (10, 2) and (18, 2)
2. (5, 0.1), (7, 1.0), (12, 6) and (45, 9)

This problem set is worth 5% of the mark for this module. Answers must be submitted by 5pm on 30th January 2006. A drop box will be available for submissions in Lilybank Gardens and submissions will only be accepted via that drop box. Any late submission will be awarded zero marks unless accompanied by a valid special circumstances form. Ensure your matriculation number is included on each submission, and attach a pink statement of originality form.