

Real Time and Embedded Systems: Problem Set 2

Dr. Colin Perkins

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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 independent, preemptable, periodic tasks: $(3, 1)$, $(5, 2)$, and $(10, 3)$.

1. Construct an earliest deadline first schedule of this system in the interval $[0, 30)$. Label any missed deadlines. [2 marks]
2. Construct a rate-monotonic schedule for this system in the interval $[0, 30)$. Label any missed deadlines. [2 marks]
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? [2 marks]

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. [5 marks]

Question 3: Consider a system of periodic tasks $T_1 = (6, 1)$, $T_2 = (10, 2)$, and $T_3 = (18, 2)$ that are to be scheduled and executed according to a structured cyclic schedule with fixed frame size. What is an appropriate frame size? [4 marks]

This problem set is worth 5% of the mark for this module, and is expected to take an hour or two to complete. You must submit your completed exercise by 1:00pm on 2nd February 2009 via the locked box outside the Teaching Office. You must include your pink declaration of authorship form with your submission. Any late submission will be awarded zero marks unless accompanied by a valid special circumstances form.

Marks will be returned in (or before) tutorial 3, along with some limited individual written feedback. Tutorial 3 will also include a review of the solutions to this exercise, along with time for a question and answer session on this material.