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: 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]

Question 2: Consider a system of three independent preemptable periodic tasks: $T_1 = (5, 2)$, $T_2 = (3, 1)$, and $T_3 = (15, 1, 4)$. Is this system schedulable using the Earliest Deadline First (EDF) algorithm? Explain your answer. [3 marks]

Question 3: A system consists of three periodic tasks: $T_1 = (3, 1)$, $T_2 = (5, 2)$, and $T_3 = (8, 3)$. Suppose we want to reduce the execution time of T_3 in order to make the task system schedulable according to the EDF algorithm. What is the minimum amount of reduction necessary for the system to be schedulable (tasks may execute for a fraction of a time unit)? [1 mark]

Question 4: Consider the following two systems of independent preemptable periodic tasks. Are these systems schedulable using the Rate Monotonic algorithm? Explain your answers. [7 marks]

- $T_1 = (5, 1)$, $T_2 = (3, 1)$, and $T_3 = (15, 3)$
- $T_1 = (5, 2)$, $T_2 = (4, 1)$, $T_3 = (10, 1)$, and $T_4 = (20, 3)$.

This problem set is worth 5% of the mark for this module. Answers must be submitted by 9:00am on 29th January 2007 via the locked box outside the Teaching Office. Submissions must be in an unsealed A4 envelope with your name, name of the course, and assessment number clearly written on the front. You must include your pink declaration of authorship form in the envelope. Please note that failure to provide an envelope may result in other students seeing your mark. Any late submission will be awarded zero marks unless accompanied by a valid special circumstances form.