Advanced Operating Systems (M): Exercise 1

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The lectures in the second week of the course have introduced priority-driven algorithm scheduling for real-time tasks. This problem set seeks to test your understanding of that material, and to give you practice in determining the schedulability of real-time systems. You should answer all questions.

Question 1: A system consists of three independent, preemptable, periodic tasks: (3, 1), (5, 2), and (10,3) running on a single processor.

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. [4 marks]

Question 3: Briefly describe the features of the POSIX 1003.1b API that allow implementation of Rate Monotonic scheduling [3 marks]. Highlight a significant limitation of the API for implementing periodic tasks in a real-time system [2 marks].

Answers must be submitted by 9:00am on 31 January 2011. A drop box will be available for submissions in outside the Teaching Office in Lilybank Gardens, and submissions will only be accepted via that drop box. This problem set is worth 5% of the mark for this course. Ensure that your name and matriculation number are included on each submission, and that you have completed a statement of originality form.