Real Time and Embedded Systems: Problem Set 3

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The third set of lectures has described some priority-driven scheduling algorithms and schedulability proofs for aperiodic and sporadic tasks. This problem set aims to test your understanding of these algorithms. You should answer all questions.

Question 1: Consider a system of three periodic tasks T_1 = (4, 1), T_2 = (5, 1) and T_3 = (10, 2). Demonstrate that this system can be scheduled using a) the rate monotonic algorithm; and b) the earliest deadline first (EDF) algorithm. [3 marks]

Question 2: The system from question 1 must also support the execution of three aperiodic jobs: A_1 which is released at time 1, A_2 which is released at time 8, and A_3 which is released at time 12. Each aperiodic job executes for 1 unit of time. The system is scheduled using the rate monotonic algorithm, with a server task, T_s = (3, 0.5) to schedule the aperiodic jobs. Is the system schedulable if T_s is a polling server? What are the response times of the aperiodic jobs? [3 marks]

Question 3: Is the system from question 2 schedulable if T_s is a deferrable server? What are the response times of the aperiodic jobs? [3 marks]

Question 4: Is the system from question 2 schedulable if T_s is a simple sporadic server? Explain your answer. [3 marks]

Question 5: A simple sporadic server can be defined for EDF systems, as well as for rate monotonic systems. Explain the difference between the consumption and replenishment rules for a simple sporadic server in a deadline driven system, compared to a rate monotonic system. [3 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 the completed exercise by 1:00pm on 8 February 2010 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 4, along with some limited individual written feedback. Tutorial 4 will also include a review of the solutions to this exercise, along with time for a question and answer session on this material.