Real Time and Embedded Systems: Problem Set 3

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3rd February 2009

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: Briefly explain the differences in budget consumption and replenishment rules between a deferrable server and a polling server. Describe how this can be expected to change the response times of any aperiodic jobs [3 marks].

Question 2: Consider a system of three periodic tasks T_1 = (3, 1), T_2 = (4, 0.5) and T_3 = (10, 2). Demonstrate that this system can be scheduled using the rate monotonic algorithm and the earliest deadline first algorithm. [3 marks]

Question 3: The system from question 2 must also support the execution of three aperiodic jobs: A_1 which is released at time 0.5, A_2 which is released at time 12.25, and A_3 which is released at time 17. Each of the aperiodic jobs executes for 0.75 units of time. The system is scheduled using the rate monotonic algorithm, with a server task, T_s = (5, 0.5) to schedule these aperiodic jobs. Show the resulting schedules for sufficient time to illustrate how the aperiodic tasks are scheduled and to demonstrate correctness (or otherwise) of the schedule, and calculate the response times for each of the aperiodic tasks, if the server is scheduled as a) a polling server; or b) a deferrable server. You should explain the process you used to derive each schedule, showing how the server budget changes over time. [6 marks]

Question 4: 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 your completed exercise by 1:00pm on 9th 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 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.