

# Real-Time and Embedded Systems: Problem Set 3

Dr. Colin Perkins

29 January 2007

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. Answers must be submitted by 9:00am on 5th February 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.