University of Glasgow | School of Computing Science

Assessed Coursework

Course Name	**Advanced Operating Systems (M)**			
Coursework Number	**Exercise 1**			
Deadline	**Time:**	**11:00am**	**Date:**	**30 January 2014**
% Contribution to final course mark	**4%**			
Solo or Group ✓	**Solo**	✓	**Group**	
Anticipated Hours	**2**			
Submission Instructions	**Submit via drop-box outside Teaching Office**			
Please Note: This Coursework cannot be Re-Done				

Code of Assessment Rules for Coursework Submission

Deadlines for the submission of coursework which is to be formally assessed will be published in course documentation, and work which is submitted later than the deadline will be subject to penalty as set out below.

The primary grade and secondary band awarded for coursework which is submitted after the published deadline will be calculated as follows:

(i) in respect of work submitted not more than five working days after the deadline
   a. the work will be assessed in the usual way;
   b. the primary grade and secondary band so determined will then be reduced by two secondary bands for each working day (or part of a working day) the work was submitted late.

(ii) work submitted more than five working days after the deadline will be awarded Grade H.

Penalties for late submission of coursework will not be imposed if good cause is established for the late submission. You should submit documents supporting good cause via MyCampus.

Penalty for non-adherence to Submission Instructions is 2 bands

You must complete an "Own Work" form via
https://webapps.dcs.gla.ac.uk/ETHICS for all coursework
UNLESS submitted via Moodle

Advanced Operating Systems (M): Exercise 1

Dr Colin Perkins

23 January 2014

The lectures in the first week of the course have introduced priority-driven scheduling for real-time tasks. This problem set aims to test understanding of that material, and to give practice in determining if a real-time system can be scheduled. You should answer all questions.

Question 1: Consider the following two systems of independent preemptable periodic tasks that are scheduled on a single processor. Can these systems be scheduled using the Rate Monotonic algorithm or the Earliest Deadline First algorithm? Explain your answers. [10 marks]

- $T_1 = (6, 1)$, $T_2 = (4, 1)$, and $T_3 = (24, 3)$
- $T_1 = (5, 2)$, $T_2 = (4, 1)$, $T_3 = (10, 1)$, and $T_4 = (20, 3)$.

Question 2: A system comprises three independent, preemptable, periodic tasks: $T_1 = (3, 1)$, $T_2 = (8, 2)$, and $T_3 = (8, 3)$. We want to reduce the execution time of T_3 so the system can be scheduled using the Rate Monotonic algorithm. What is the minimum amount of reduction necessary if the system is to be correctly scheduled (tasks may execute for a fraction of a time unit)? [4 marks]

Question 3: How does the maximum utilisation test for earliest deadline first scheduling change if the relative deadline of a task differs from that task's period? [4 marks]

Question 4: We considered several priority-driven scheduling algorithms for real-time systems. These algorithms make *locally optimal* decisions about which job to run, based on the priorities of the runnable tasks when a scheduling decision is to be made, but the resulting schedules are often not globally optimal. Discuss why the resulting schedules are often not globally optimal. [4 marks]

Question 5: The periodic tasks $T_1 = (3, 1)$, $T_2 = (4, 2)$, and $T_3 = (6, 1)$ are scheduled in a preemptive manner according to the rate monotonic algorithm on a single processor. Draw a graph of the time-demand function for each of the three tasks. Can these tasks be scheduled? Justify your answer. [8 marks]

Answers must be submitted by 11:00am on 30 January 2014. As per the Code of Assessment policy regarding late submissions, submissions will be accepted for up to 5 working days beyond this due date. Any late submissions will be marked as if submitted on time, yielding a band value between 0 and 22; for each working day the submission is late, the band value will be reduced by 2. Submissions received more than 5 working days after the due date will receive an H (band value of 0).

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 4% of the mark for this course. Ensure that your name and matriculation number are included on each submission, and that you have submitted a statement of originality. Submissions that do not follow these submission instructions will be penalised two bands.