EECS 571 **Homework No. 2** **Fall'10**

Due: October 11, 2010

Please submit computer-generated answers and submit a hardcopy by the class time on 10/11/10.

1. (**Rate-Monotonic Scheduling (RMS)**) This problem is concerned with RMS of a task set $T = \{T_i = (e_i, P_i) : i = 1, \ldots, n\}$ where e_i and P_i are the worst-case execution time and the period of T_i, respectively.

   (a) What are the disadvantages of the cyclic executives compared to RMA?

   (b) (1) What are the basic assumptions used in the original RMA proposed by Liu and Layland and why are they unrealistic?
   (2) Propose how to address these unrealistic assumptions. (If you borrowed solutions from someone else's paper(s), you should clearly cite them.)

   (c) Consider a three-task system where each preemption has an overhead of x. Assuming the three tasks' periods P_1, P_2, P_3 and execution times e_1, e_2, e_3 derive the maximum value of x for which the task set is RM-schedulable.

2. Interrupts typically arrive sporadically. When an interrupt arrives, it is handled immediately and in a non-preemptive fashion. The effect of interrupt handling on the schedulability of periodic tasks can be accounted for in the same manner as blocking time. To illustrate this, consider a system of 4 tasks: $T_1 = (2.5, 0.5)$, $T_2 = (4, 1)$, $T_3 = (10, 1)$ and $T_4 = (30, 6)$. Suppose there are two streams of interrupts. The inter-release time of interrupts in one stream is never less than 9, and that of the other stream is never less than 25. Suppose it takes at most 0.2 unit of time to service each interrupt. Like the periodic tasks, interrupt handler tasks are given fixed priorities higher than the periodic tasks. The interrupt stream with a shorter inter-release time receives higher priority.

   (a) What is the maximum amount of time each job in each periodic task may be delayed from completion by interrupts?

   (b) Let the maximum delay suffered by each job of T_i in part (a) be b_i, for i =1,2,3,4. Compute the time-demand functions of the tasks and determine if every task T_i can meet all its deadlines when the relative deadline of each task is the same as its period.

3. Show by means of a counter-example that if $d_i < P_i$, the condition $U \leq 1$ is not sufficient to ensure EDF-schedulability, where d_i, P_i, U are deadline, task period, and processor untilization, respectively.

4. If the deadline is not equal to the task period, RM is not necessarily an optimal static-priority algorithm. Show this by means of an example, that is, construct a task set which is not RM-schedulable, but is schedulable by some other assignment of static priorities.

5. Read and summarize two (2) papers scheduling one of which is related to extension of RMA and the other is unrelated to RMA.