EECS 571 **Homework No. 3** **Fall'10**

Due: Monday, November 1, 2010

Please submit computer-generated answers and submit a hardcopy by the class time on 10/31/07.

1. Consider the following task set:

Task	e_i	P_i	σ_i	Critical Section	Execution Time
T_1	4	10	S_1, S_2	S_1	1
T_2	6	20	S_2, S_3	S_2	2
T_3	10	35	S_3	S_3	3

   where σ_i is the set of critical sections accessed by T_i. What are the blocking times of these tasks under the priority ceiling protocol? Is the task set RM-schedulable?

2. Show that the priority ceiling protocol is not optimal. Do this by creating a task set which has unnecessary blocking, i.e., if we removed the blocking, the system would still operate correctly without any deadlock.

3. Text Problem 3.5.

4. (Text Problem 3.8) Assuming that the priority inheritance algorithm is followed, construct an example where there are N tasks, and the highest-priority task is blocked once by every one of the other $N-1$ tasks.

5. Devise a scheduling scheme that performs like (a) the rate-monotonic scheduling algorithm when the number of tasks to schedule is large *and* (b) the EDF algorithm when the number of tasks to schedule is small.

6. A system contains 3 periodic tasks (period, execution time), (2.5, 1), (4, 0.5), (5, 0.75), and their total utilization is 0.675.

   (a) The system also contains a periodic server (2, 0.5) which is scheduled with the periodic tasks rate-monotonically.
   (i) Suppose the periodic server is a basic sporadic server. What are the response times of the following two aperiodic jobs: One arrives at time 3 and has execution time 0.75, and the other arrives at 7.5 and has execution time 0.6.
   (ii) Suppose the periodic server is a deferred server. What are the response times of the above two aperiodic tasks?

   (b) Can we improve the response times by increasing the frequency of the periodic server?

7. In case of resource shortage because of failures, one may have to extend task periods or even skip tasks, e.g., execute the task once every two periods of the task. What does this imply in physical control systems and when and how to alter task periods during the operation of the controlled system?

8. State (i) why general scheduling algorithms that deal with task dependencies have seldom been implemented, (ii) how task dependencies are handled without relying on such general scheduling algorithms, and (iii) what cost one has to pay to achieve (ii). Read and critique the paper by S. Kodase *et al.* in the reading list on the course URL.

9. (**Paper Reading**) Read and summarize one paper on scheduling dependent tasks, one paper on scheduling aperiodic tasks, and one paper on multiprocessor scheduling of precedence-constrained tasks.