Design and Analysis of Real-Time Systems SS 2013

Jan Reineke
Andreas Abel

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Assignment 11

Problem 1: Other-tasks-first Scheduling (4+6+4+4 Points)

Assume we are given a set of aperiodic tasks T with synchronous arrival times (i.e., $a_i = 0$ for all tasks). Further assume we are given a set $P \subseteq (T \times T)$, where $(t_1, t_2) \in P$ means that task t_1 has to be executed before task t_2. The goal of this exercise is to develop a preemptive scheduling algorithm for this setting that minimizes the maximum lateness.

1. The first idea to solve this problem might be to extend the EDF algorithm in the following way: At any moment, the system executes the task with the earliest deadline among the set of tasks T', such that $t' \in T'$ iff $\forall t \in T$, $(t, t') \in P$ implies that t has already been executed. Find an example that shows that this algorithm is not optimal with respect to minimizing the maximum lateness.
2. Develop an efficient scheduling algorithm that is optimal with respect to minimizing the maximum lateness. What is the complexity of your algorithm?
3. Argue why your algorithm is correct.
4. Execute your algorithm on the example you found in step 1 to show that it is indeed optimal.

Problem 2: Periodic Scheduling (4+4+4 Points)

Assume you are given the following two sets of tasks, where $\phi_i = 0$ and $T_i = D_i$ for all tasks:

	T_i	C_i
A	4	2
B	5	2
C	10	1

	T_i	C_i
A	3	1
B	6	3
C	24	2

1. Compute the system utilizations for both task sets and compare them to the Liu-Layland bound. What can you infer from the results?
2. Are the task sets schedulable by RM?
3. If they are not schedulable by RM, are they schedulable by (a) another static priority algorithm, (b) any other scheduling algorithm?