Class Examples on Real-Time Scheduling

ELC 4438
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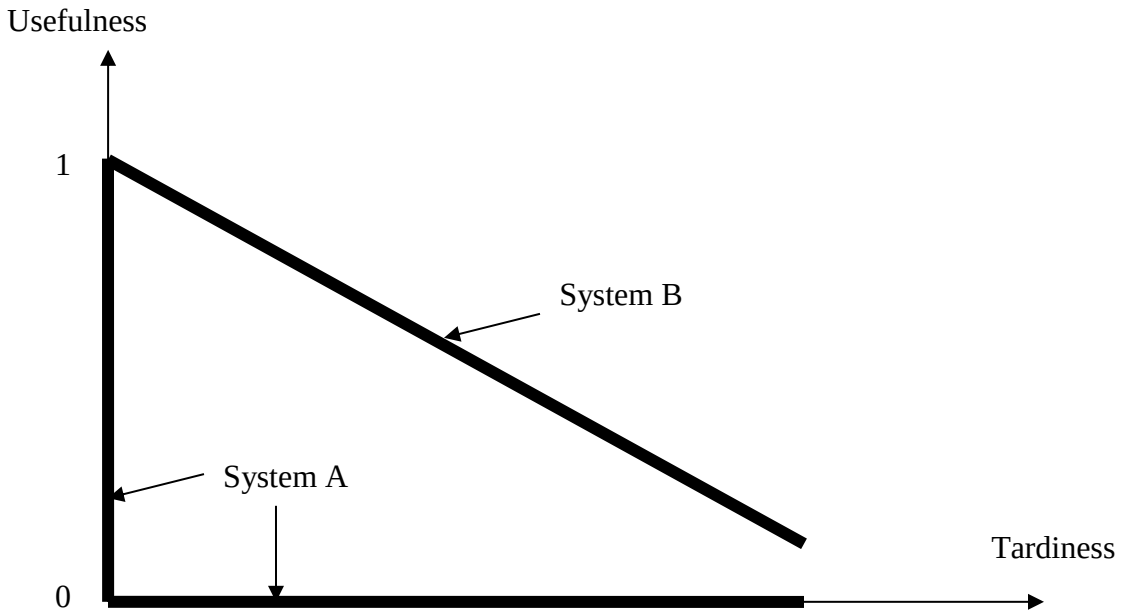
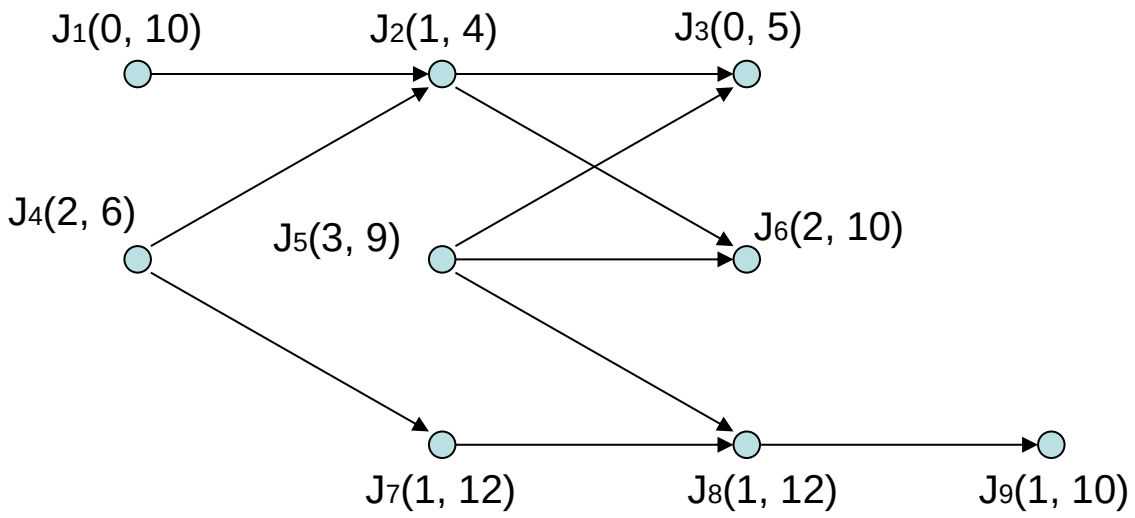
1. One can determine whether a real-time system is hard or soft by its usefulness function. From the following diagram, tell whether system A and B are hard or soft real-time systems and explain why. (Hint: First, you need to explain what tardiness is.)



2. The feasible interval of each job in the precedence graph is given next to its name. The execution time of all jobs is equal to 1.

   (a) Find the effective release times and effective deadlines of the jobs in the precedence graph.
   (b) Find an earliest-deadline-first (EDF) schedule of the jobs. (Determine the priority level of each job, draw a timing graph, and discuss any conflict.)
   (c) If there is any conflict in (b), we shall use a faster processor. Suppose the jobs have the same execution time, what is the maximum execution time for a feasible system? Redo part (b) with this new execution time.



3. Suppose there are two preemptable jobs J_1 and J_2 being executed by a single processor. They can be expressed as $J_1(0, 6, 3)$ and $J_2(2, 5, 2)$, where the three parameters are respectively the release time, the deadline, and the execution time.

   Discuss the slack of J_1 before its completion when
   (a) J_1 has higher priority, (b) J_2 has higher priority.

4. A system contains three periodic tasks $T_1(50, 50, 25, 100)$, $T_2(0, 25, 10, 20)$, and $T_3(10, 125, 25, 50)$ – in the form $T_i(\varphi_i, p_i, e_i, D_i)$. What are the release times of the first and second jobs of each task? Find the hyperperiod of the system. Assume that all three tasks are preemptive; is it possible to schedule T_1, T_2, and T_3 on a single processor? If yes, construct the working segment over one hyperperiod of a deadline-monotonic (DM) schedule of the system. If not, why?