CS 330 - Winter 2020
Assignment W1

Due: Wednesday, January 15, 2020 (start of class)

You should submit a physical copy of your written homework at the start of class. Be sure to include a collaboration statement with your assignment, even if you worked alone.

[25 points] Problem 1

Consider the following task set, where $J_i = (C_i, D_i)$:

$$\tau = \{J_1, J_2, J_3, J_4\} = \{(1, 2), (4, 10), (3, 4), (2, 5)\}.$$

a) Apply the schedulability test for EDD (covered in class and Buttazzo p. 58). Write each equation as a separate line.

b) Is this task set schedulable by EDD?

c) Draw the schedule generated by EDD.

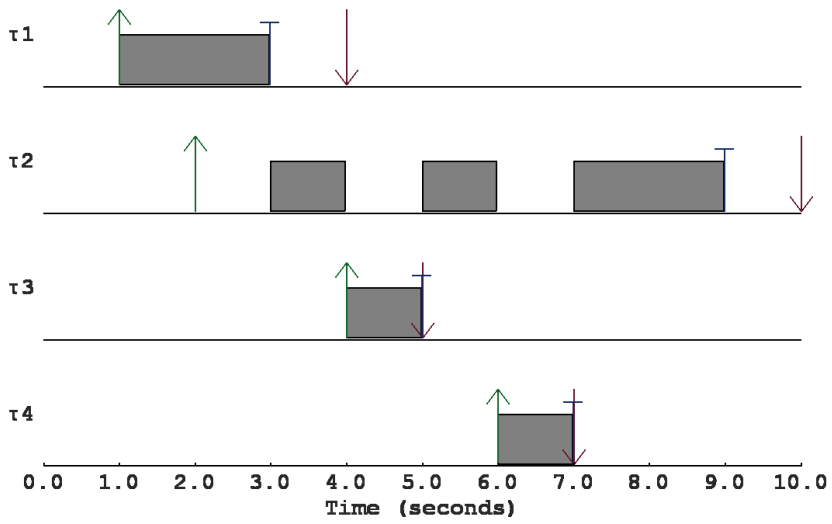
d) What is the start time for task $\tau_2 = (4, 10)$?

e) What is the start time for task $\tau_4 = (2, 5)$?

f) What is the finishing time for task $\tau_4 = (2, 5)$?

[20 points] Problem 2 [Fixed]

a) [Fixed] The following schedule was generated using EDF. For this problem, consider each release time or deadline independently. For each, what is the range of valid values, assuming the other release times and deadlines do not change, such that all scheduled intervals remain the same?

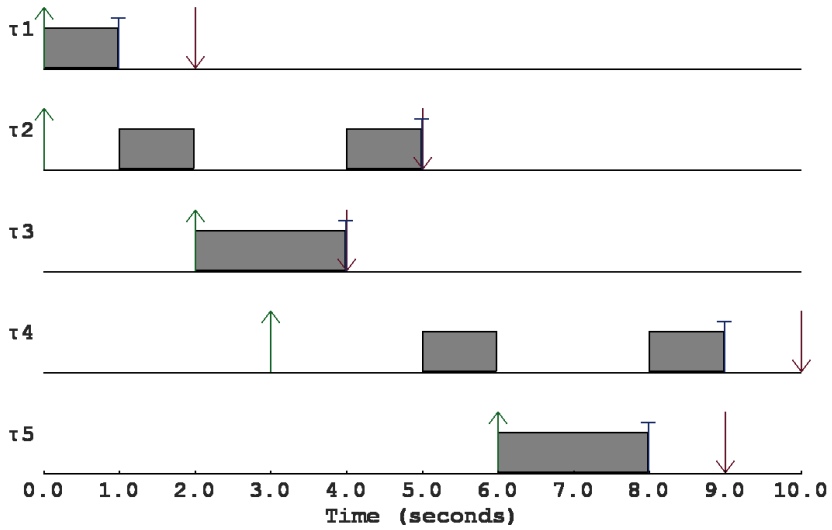


b) Given your annotated schedule, what is a possible description of the set of aperiodic tasks? Your answer should be of the form $\tau = \{J_1, J_2, J_3, J_4\}$, where $J_i = (\Phi_i, C_i, D_i)$.

[25 points] Problem 3

Consider the following task set (Figure 3.6 on Buttazzo p. 62):

$$\tau = \{J_1, J_2, J_3, J_4, J_5\} = \{(0, 1, 2), (0, 2, 5), (2, 2, 2), (3, 2, 7), (6, 2, 3)\}.$$



a) Apply the schedulability test for EDF (covered in class and Buttazzo p. 63) at time $t = 3$, when J_4 is released. Write each equation as a separate line.

b) Apply the schedulability test for EDF at time $t = 6$, when J_5 is released. Write each equation as a separate line.

c) Now assume that tasks J_4's deadline is decreased and J_5's release is moved forward: $J_4 = (3, 2, 5)$ and $J_5 = (4, 2, 3)$. Draw the new schedule.

d) Given the modified task set from part (c), apply the schedulability test for EDF at time $t = 4$, when J_5 is released. Write each equation as a separate line.

[10 points] Problem 4

The proof of optimality of EDF uses a similar swapping argument to that of EDD. Prove that such a swap does not increase the maximum lateness.

Hint: Your proof should use tasks $\sigma(t)$ and $E(t)$, and refer to their deadlines and finish times. You can use an example similar to the one in class with tasks J_a, J_b, and J_c, but you should not use a concrete example with actual numbers.

[10 points] Problem 5

The following questions assess your understanding of optimality and what we can conclude based on the fact that EDD is optimal.

a) A task set is schedulable by Algorithm A. What can we say about the task set's schedulability by EDD? Choose one:

1. This task set is schedulable by EDD.
2. This task set is not schedulable by EDD.
3. More information is needed to determine schedulability under EDD.

b) A task set is *not* schedulable by Algorithm A. What can we say about the task set's schedulability by EDD? Choose one:

1. This task set is schedulable by EDD.
2. This task set is not schedulable by EDD.
3. More information is needed to determine schedulability under EDD.

c) A task set is schedulable by EDD. What can we say about the task set's schedulability by a different algorithm, called Algorithm A? Choose one:

1. This task set is schedulable by Algorithm A.
2. This task set is not schedulable by Algorithm A.
3. More information is needed to determine schedulability under Algorithm A.

d) A task set is *not* schedulable by EDD. What can we say about the task set's schedulability by a different algorithm, called Algorithm A? Choose one:

1. This task set is schedulable by Algorithm A.
2. This task set is not schedulable by Algorithm A.
3. More information is needed to determine schedulability under Algorithm A.

[10 points] Problem 6

Draw the pruned scheduling tree for the following set of non-preemptive tasks, and mark the branches that are pruned by Bratley's algorithm. Your final tree should have a similar form to Figure 3.10 (Buttazzo p. 67).

$$\tau = \{J_1, J_2, J_3, J_4\} = \{(0, 6, 18), (4, 2, 4), (2, 4, 7), (6, 2, 4)\}$$