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Example: scheduling using RM

Problem: Assume a system with tasks according to the figure below. The timing properties of the tasks are given in the table. Schedule the tasks using rate-monotonic scheduling (RM).

a) What is the utilization of the task set?

b) What is the outcome of Liu & Layland's feasibility test for RM?

c) Show that the tasks are schedulable using RM.

Task	C_i	O_i	T_i
A	1	0	3
B	1	0	4
C	1	0	5

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Example: scheduling using RM

a) The utilization U of the system is

$$U = \sum_{i=1}^{n} \frac{C_i}{T_i} = \frac{1}{3} + \frac{1}{4} + \frac{1}{5} \approx 0.783$$

b) The utilization bound U_{lub} of the test is

$$U_{lub} = n\left(2^{1/n} - 1\right) = 3\left(2^{1/3} - 1\right) \approx 0.780$$

Since $U > U_{lub}$ and the test is only a sufficient one, we cannot yet determine whether the task set is schedulable or not.

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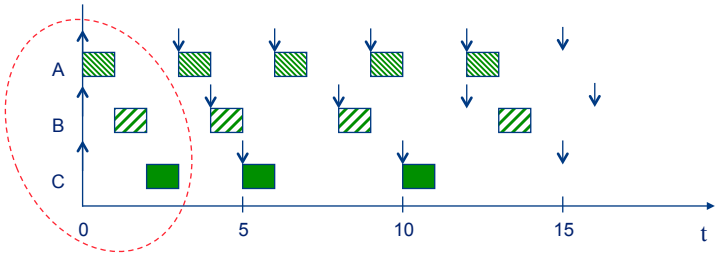
Example: scheduling using RM

c) Simulate an execution of the tasks:



Liu & Layland have shown that if the task set is schedulable when all tasks arrive at the same time (i.e., at t = 0), then the task set is also schedulable in all other cases. Hence, it is enough to demonstrate that the first instance of each task will meet its deadline.

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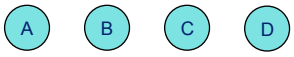
Example: scheduling using EDF

Problem: Assume a system with tasks according to the figure below. The timing properties of the tasks are given in the table.

a) What is the utilization of the task set?
b) What is the outcome of Liu & Layland's feasibility test for EDF?
c) Show that the tasks are not schedulable using RM.
d) Show that the tasks are schedulable using EDF.



Task	C_i	O_i	T_i
A	1	0	3
B	1	0	4
C	1	0	5
D	1	0	5

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Example: scheduling using EDF

a) The utilization U of the system is

$$U = \sum_{i=1}^{n} \frac{C_i}{T_i} = \frac{1}{3} + \frac{1}{4} + \frac{1}{5} + \frac{1}{5} \approx 0.983$$

b) Since $U < 1$ we know that the task set is schedulable according to Liu & Layland.

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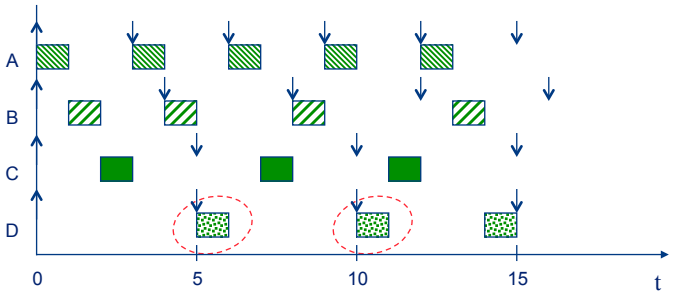
Example: scheduling using EDF

c) We cannot use Liu & Layland's test for RM since it will produce a negative result and the test is only a sufficient one. Instead, we can simulate an execution of the tasks using RM to show that the task set is not schedulable:



The first and second instance of task D misses its deadline!

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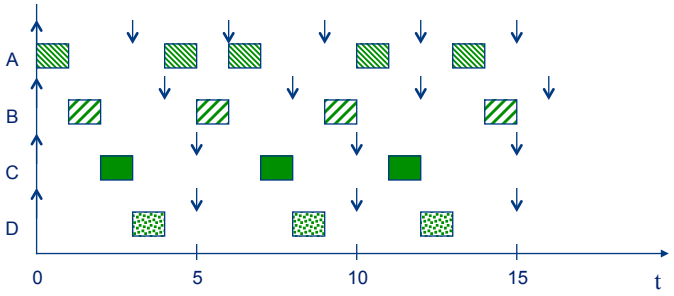
Example: scheduling using EDF

d) Simulate an execution of the tasks using EDF:



Now, the schedule is feasible! Note that this has already been shown theoretically in sub-problem b)