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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).

- What is the utilization of the task set?
- What is the outcome of Liu & Layland's feasibility test for RM?
- Show that the tasks are schedulable using RM.

A

B

C

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

- The utilization U of the system is

$$U = \sum_{i=1}^n \frac{C_i}{T_i} = \frac{1}{3} + \frac{1}{4} + \frac{1}{5} \approx 0.783$$
- The utilization bound U_{lub} of the test is

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

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.

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

A

B

C

D

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)