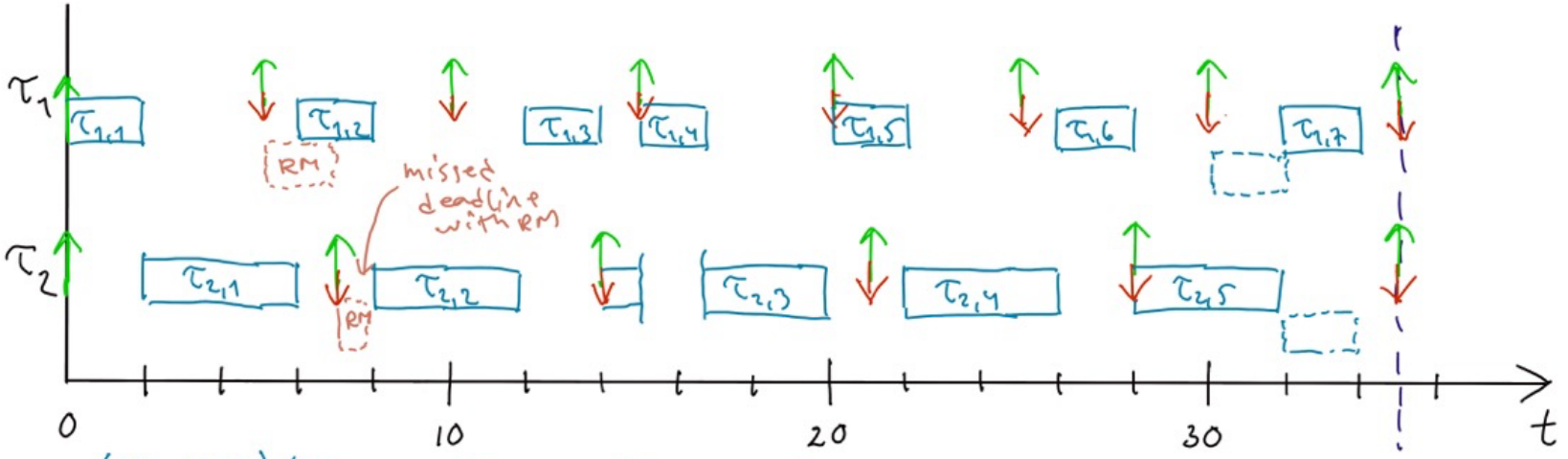
Exercise #5 – blackboard scribble

a) Simulate the execution of tasks using EDF scheduling with the hyperperiod

LCM{5, 7} = 35

Task	C_i	D_i	T_i
τ_1	2	5	5
τ_2	4	7	7



$(\tau_{1,1}, 0, 2)$ $(\tau_{2,1}, 2, 6)$ $(\tau_{1,2}, 6, 8)$ $(\tau_{2,2}, 8, 12)$ $(\tau_{1,3}, 12, 14)$ $(\tau_{2,3}, 14, 15)$ $(\tau_{1,4}, 15, 17)$
$(\tau_{2,3}, 17, 20)$ $(\tau_{1,5}, 20, 22)$ $(\tau_{2,4}, 22, 26)$ $(\tau_{1,6}, 26, 28)$ $(\tau_{2,5}, 28, 32)$ $(\tau_{1,7}, 32, 34)$

b) Since EDF scheduling is known to be optimal for the given assumption this is the best possible schedule. [How would RM behave?]

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a) The utilization of the task set is

$$U = \sum_{i=1}^{3} \frac{C_i}{T_i} = \frac{1}{7} + \frac{1}{14} + \frac{4}{18} \approx 0{,}44$$

Task	C_i	D_i	T_i
τ_1	1	7	7
τ_2	1	14	14
τ_3	4	18	18

$D_i = T_i$

The utilization bound U_{RM} for $n=3$ tasks is

$$U_{RM} = n\left(2^{1/n} - 1\right) = 3 \cdot \left(2^{1/3} - 1\right) \approx 0{,}78 \qquad U < U_{RM}$$

The test succeeds $\Rightarrow$ The task set is schedulable!

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b) The utilization of the task set is

$$U = \sum_{i=1}^{4} \frac{C_i}{T_i} = \frac{1}{7} + \frac{1}{14} + \frac{4}{18} + \frac{X}{100} = 0{,}44 + 0{,}01X$$

The utilization bound U_{RM} for 4 tasks is

$$U_{RM(4)} = 4\left(2^{1/4} - 1\right) \approx 0{,}76$$

The test succeeds if

$$U \leq U_{RM(4)} \Rightarrow 0{,}44 + 0{,}01X \leq 0{,}76 \Rightarrow$$

$$\Rightarrow 0{,}01X \leq 0{,}76 - 0{,}44 \Rightarrow X \leq 100 \cdot 0{,}32 = 32$$

Task	C_i	D_i	T_i
τ_1	1	7	7
τ_2	1	14	14
τ_3	4	18	18
τ_4	X	100	100

Note: this result assumes Liu & Layland's sufficient test.
other analysis methods could give higher values of X.
(e.g. response-time analysis)