Lecture #13 – blackboard scribble

Determine L_{max}, the largest interval to examine:

$$U = U_1 + U_2 + U_3 = \frac{1}{2} + \frac{1}{4} + \frac{1}{8} = 0{,}5 + 0{,}25 + 0{,}125 = 0{,}875$$

Since $U < 1$: $L_{max} = \min(L_{BRH}, L_{LCM})$

$$L_{BRH} = \max\left\{D_1, D_2, D_3, \frac{\sum_{i=1}^{3}(T_i - D_i)U_i}{1-U}\right\}$$

$$(T_1 - D_1) \cdot U_1 = (2-1) \cdot 0{,}5 = 0{,}5$$

$$(T_2 - D_2) \cdot U_2 = (4-2) \cdot 0{,}25 = 0{,}5$$

$$(T_3 - D_3) \cdot U_3 = (8-3) \cdot 0{,}125 = 0{,}625$$

$$L^* = \frac{\sum (T_i - D_i)U_i}{1-U} = \frac{0{,}5 + 0{,}5 + 0{,}625}{1 - 0{,}875} = \frac{1{,}625}{0{,}125} = 13$$

$$L_{BRH} = \max\{D_1, D_2, D_3, L^*\} = \max\{1, 2, 3, 13\} = 13$$

$$L_{LCM} = LCM\{T_1, T_2, T_3\} = LCM\{2, 4, 8\} = 8$$

$$L_{max} = \min(L_{BRH}, L_{LCM}) = \min(13, 8) = 8$$

Task	C_i	D_i	T_i
τ_1	1	1	2
τ_2	1	2	4
τ_3	1	3	8

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Determine the control points:

$$K = \{ D_i^k \mid D_i^k = kT_i + D_i \,,\ D_i^k \leq L_{max} \,,\ 1 \leq i \leq n \,,\ k \geq 0 \}$$

$$K_1 = \{ D_1^k \mid D_1^k = kT_1 + D_1 \,,\ D_1^k \leq 8 \,,\ k = \overbrace{0,1,2,3}^{L_{max}/T_1 = 4} \} = \{1, 3, 5, 7\}$$

$$K_2 = \{ D_2^k \mid D_2^k = kT_2 + D_2 \,,\ D_2^k \leq 8 \,,\ k = 0, 1 \} = \{2, 6\}$$

$$K_3 = \{ D_3^k \mid D_3^k = kT_3 + D_3 \,,\ D_3^k \leq 8 \,,\ k = 0 \} = \{3\}$$

Processor demand must be checked at the following control points:

$$K = \{1, 2, 3, 5, 6, 7\}$$

we define a table and examine each control point

Task	C_i	D_i	T_i
τ_1	1	1	2
τ_2	1	2	4
τ_3	1	3	8

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L	$N_1^L \cdot C_1$	$N_2^L \cdot C_2$	$N_3^L \cdot C_3$	$C_P(0,L)$	$C_P(0,L) \leq L$?
1	$\Big(\underbrace{\Big\lfloor \frac{1-1}{2} \Big\rfloor}_{0} + 1\Big) \cdot 1 = 1$	$\Big(\underbrace{\Big\lfloor \frac{1-2}{4} \Big\rfloor}_{-1} + 1\Big) \cdot 1 = 0$	$\Big(\underbrace{\Big\lfloor \frac{1-3}{8} \Big\rfloor}_{-1} + 1\Big) \cdot 1 = 0$	$1+0+0=1$	ok!
2	$\Big(\Big\lfloor \frac{2-1}{2} \Big\rfloor + 1\Big) \cdot 1 = 1$	$\Big(\Big\lfloor \frac{2-2}{4} \Big\rfloor + 1\Big) \cdot 1 = 1$	$\Big(\Big\lfloor \frac{2-3}{8} \Big\rfloor + 1\Big) \cdot 1 = 0$	$1+1+0=2$	OK!
3	$\Big(\Big\lfloor \frac{3-1}{2} \Big\rfloor + 1\Big) \cdot 1 = 2$	$\Big(\Big\lfloor \frac{3-2}{4} \Big\rfloor + 1\Big) \cdot 1 = 1$	$\Big(\Big\lfloor \frac{3-3}{8} \Big\rfloor + 1\Big) \cdot 1 = 1$	$2+1+1=4$	Not ok!

$$N_i^L = \Big\lfloor \frac{L - D_i}{T_i} \Big\rfloor + 1$$

Task	C_i	D_i	T_i
τ_1	1	1	2
τ_2	1	2	4
τ_3	1	3	8

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L	$N_1^L \cdot C_1$	$N_2^L \cdot C_2$	$N_3^L \cdot C_3$	$C_p(0,L)$	$C_p(0,L) \le L$?
1	$\left(\underbrace{\left\lfloor\frac{1-1}{2}\right\rfloor}_{0}+1\right)\cdot 1=1$	$\left(\underbrace{\left\lfloor\frac{1-2}{4}\right\rfloor}_{-1}+1\right)\cdot 1=0$	$\left(\underbrace{\left\lfloor\frac{1-3}{8}\right\rfloor}_{-1}+1\right)\cdot 1=0$	$1+0+0=1$	ok!
2	$\left(\left\lfloor\frac{2-1}{2}\right\rfloor+1\right)\cdot 1=1$	$\left(\left\lfloor\frac{2-2}{4}\right\rfloor+1\right)\cdot 1=1$	$\left(\left\lfloor\frac{2-3}{8}\right\rfloor+1\right)\cdot 1=0$	$1+1+0=2$	ok!
3	$\left(\left\lfloor\frac{3-1}{2}\right\rfloor+1\right)\cdot 1=2$	$\left(\left\lfloor\frac{3-2}{4}\right\rfloor+1\right)\cdot 1=1$	$\left(\left\lfloor\frac{3-3}{8}\right\rfloor+1\right)\cdot 1=1$	$2+1+1=4$	Not ok!
5	$\left(\left\lfloor\frac{5-1}{2}\right\rfloor+1\right)\cdot 1=3$	$\left(\left\lfloor\frac{5-2}{4}\right\rfloor+1\right)\cdot 1=1$	$\left(\left\lfloor\frac{5-3}{8}\right\rfloor+1\right)\cdot 1=1$	$3+1+1=5$	ok!
6	$\left(\left\lfloor\frac{6-1}{2}\right\rfloor+1\right)\cdot 1=3$	$\left(\left\lfloor\frac{6-2}{4}\right\rfloor+1\right)\cdot 1=2$	$\left(\left\lfloor\frac{6-3}{8}\right\rfloor+1\right)\cdot 1=1$	$3+2+1=6$	ok!
7	$\left(\left\lfloor\frac{7-1}{2}\right\rfloor+1\right)\cdot 1=4$	$\left(\left\lfloor\frac{7-2}{4}\right\rfloor+1\right)\cdot 1=2$	$\left(\left\lfloor\frac{7-3}{8}\right\rfloor+1\right)\cdot 1=1$	$4+2+1=7$	ok!

NOTE: floor function

some task missed deadline

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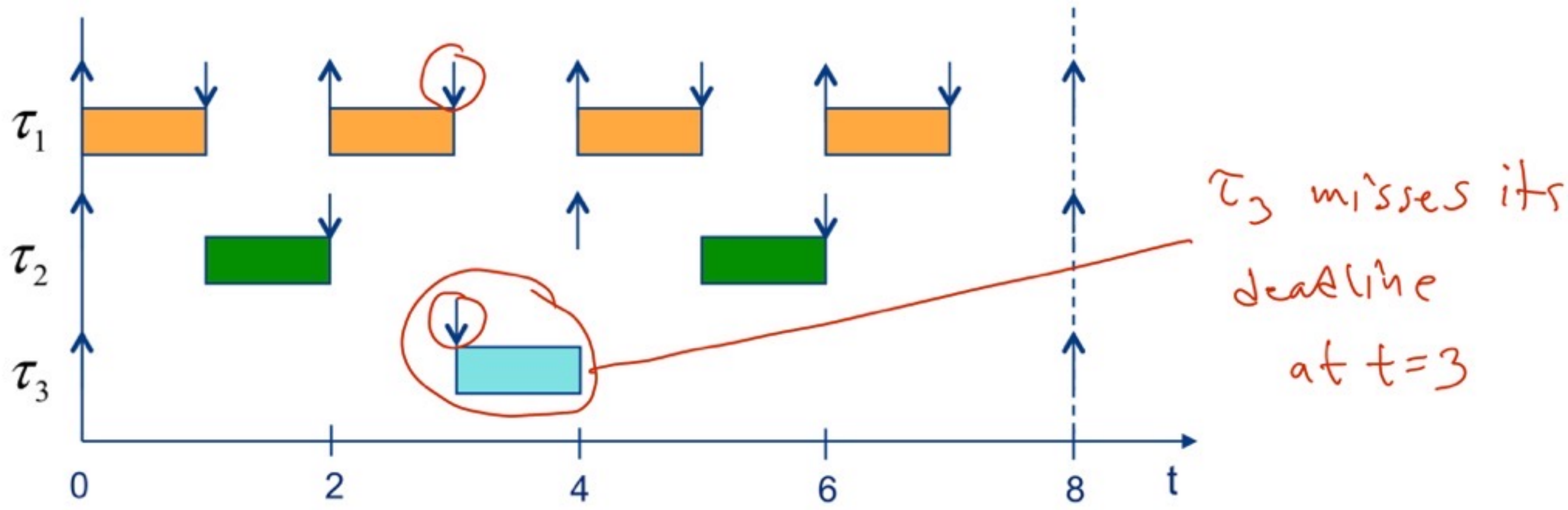
As we saw in the beginning of the lecture the resulting schedule could look like this:



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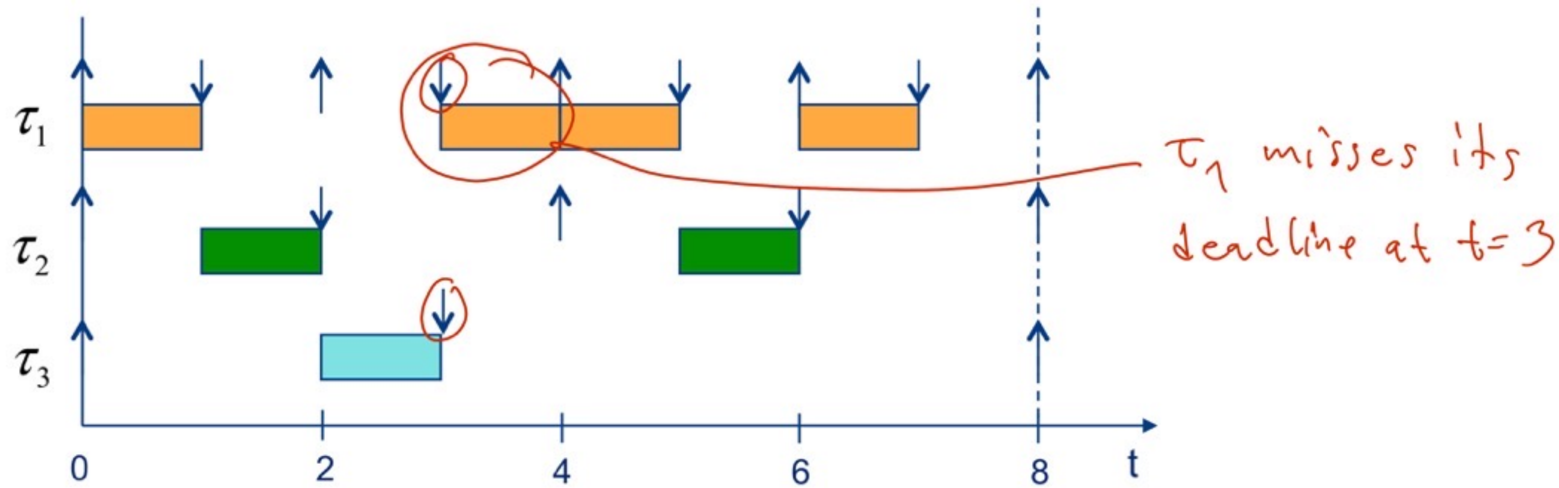
But, it could also look like this, as tasks τ_1 and τ_3 both have a deadline at $t=3$ (= they have the same EDF priority)



Consequently, the analysis does not say which task will miss its deadline at $t=3$ (only that some task does)