Embedded Systems Problem Set 10

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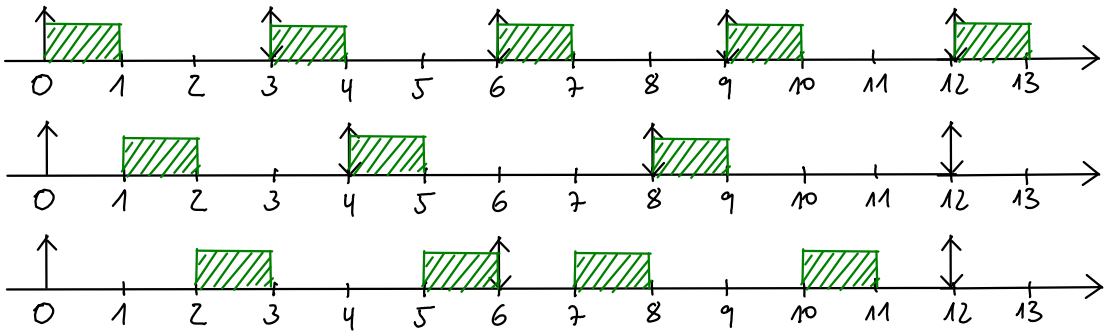
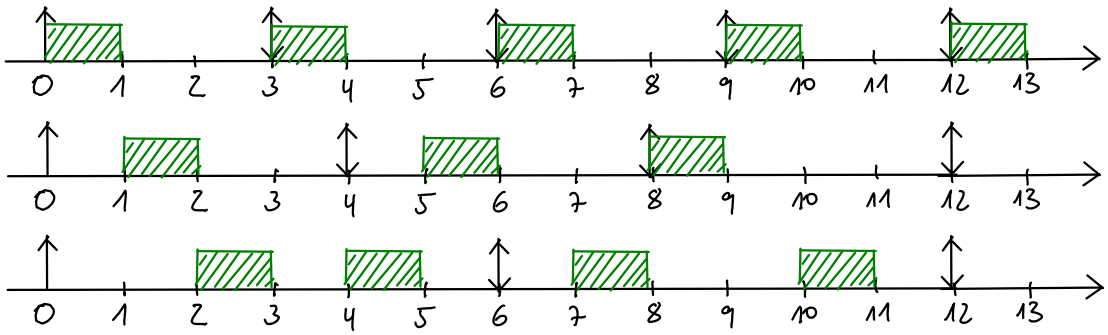
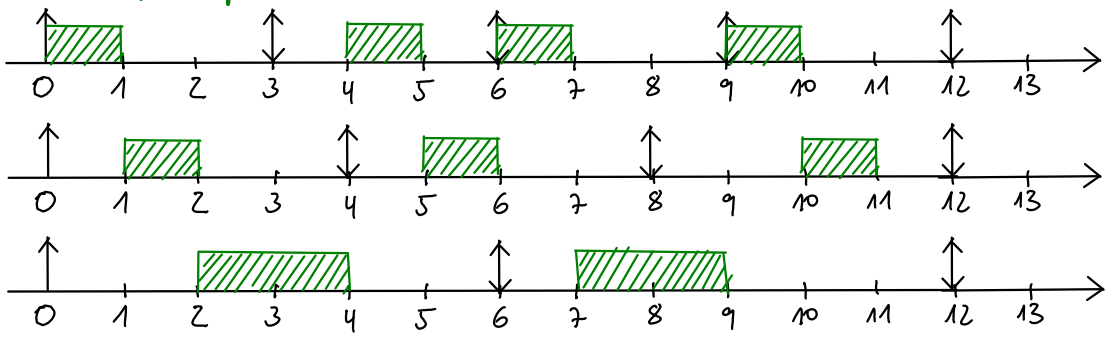
1a) RM



b) EDF



c) Non-preempt.



2a) $T_1 = D_1 = 200 \rightsquigarrow F_1 = 1 \quad C_1 = 4$

$T_2 = D_2 = 10 \rightsquigarrow F_2 = 20 \quad C_2 = 1$

$T_3 = D_3 = 40 \rightsquigarrow F_3 = 5 \quad C_3 = 2$

$T_4 = D_4 = 50 \rightsquigarrow F_4 = 4 \quad C_4 = 6$

$\Rightarrow 2 \cdot C_1 + (F_2+1) C_2 + (F_3+1) C_3 + (F_4+1) C_4$

$= 8 + 21 + 12 + 30$

$= 71$

$< 200 \quad \Rightarrow$ There exists a RM schedule.

b) $\sum_{i=1}^{5} \frac{C_i}{D_i} \overset{!}{\leq} 5(2^{\frac{1}{5}} - 1) \approx 0.743492$

$\Leftrightarrow \frac{1}{10} + \frac{18}{100} + \frac{2}{20} + \frac{5}{50} + \frac{x}{25} \overset{!}{\leq} 0.743492$

$\Leftrightarrow 10 + 18 + 10 + 10 + 4x \overset{!}{\leq} 74.3492$

$\Leftrightarrow 4x \overset{!}{\leq} 26.3492$

$\Leftrightarrow x \overset{!}{\leq} 6.5873$

$\rightsquigarrow$ x must **at most** be **6**, s.t. a RM schedule is guaranteed by Liu and Layland.

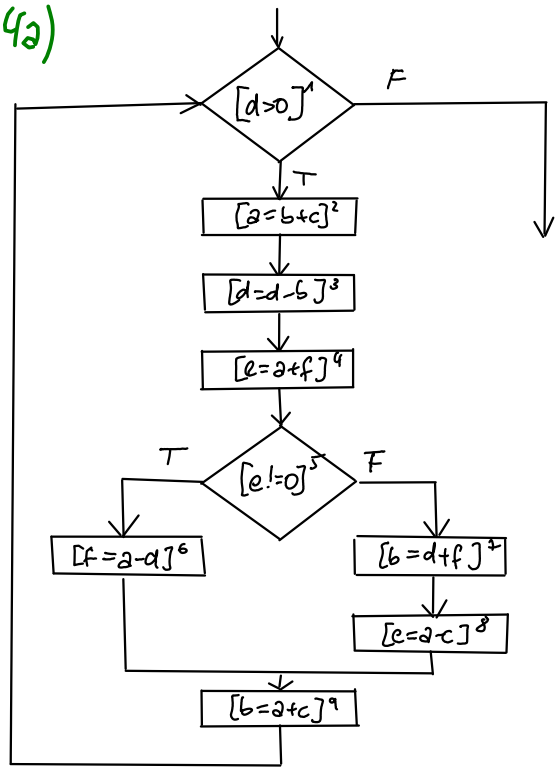
3a) $U(\Gamma) = \frac{1}{3} + \frac{2}{4} + \frac{1}{8} = \frac{1}{3} + \frac{1}{2} + \frac{1}{8} = \frac{8+12+3}{24} = \frac{23}{24}$

- $\frac{23}{24} \leq 1 \Rightarrow \exists$ EDF schedule
- $3(2^{\frac{1}{3}} - 1) \approx \frac{18.7}{24} \Rightarrow \nexists$ RM schedule

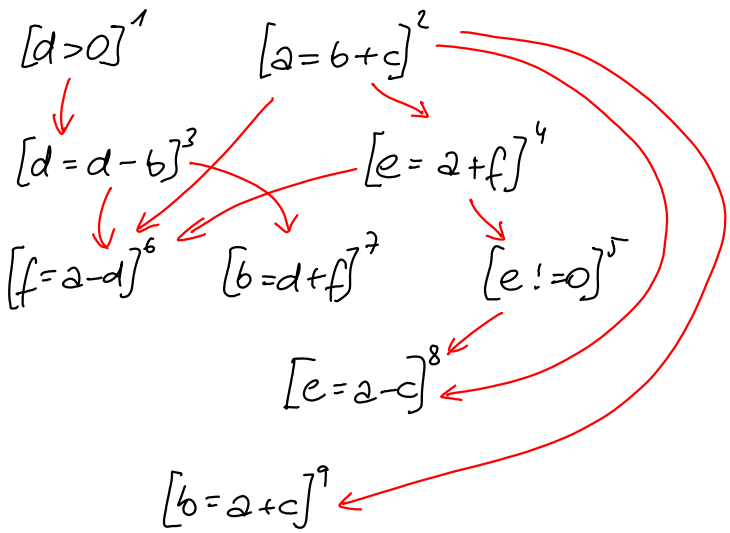
b) $U(\Delta) = \frac{1}{2} + \frac{1}{3} + \frac{1}{4} = \frac{6+4+3}{12} = \frac{13}{12} \Rightarrow \nexists$ EDF Schedule, $\nexists$ RM Schedule

c) $U(\Pi) = \frac{1}{2} + \frac{1}{5} + \frac{2}{8} + \frac{1}{10} = \frac{10+4+5+2}{20} = \frac{21}{20} \Rightarrow \nexists$ EDF Schedule, $\nexists$ RM Schedule

4a)



b)



c)

$[d>0]^1$: $\{b, c, d, e, f\}$ (by assumption)

$[a=b+c]^2$: $\{b, c, f\}$

$[d=d-b]^3$: $\{a, b, c, f\}$

$[e=a+f]^4$: $\{a, c, d, f\}$

$[e!=0]^5$: $\{a, c, d, e, f\}$

$[f=a-d]^6$: $\{a, c, d, e, f\}$

$[b=d+f]^7$: $\{a, c, d, f\}$

$[e=a-c]^8$: $\{a, c, d, f\}$

$[b=a+c]^9$: $\{a, c, d, e, f\}$