hw 6

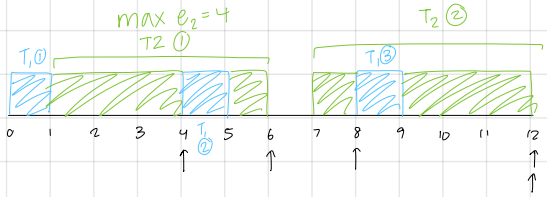
Oviya Seeniraj

Problem 1

a) LCM (4, 6) = 12

T_1 must execute $\frac{12}{4} = 3x$

T_2 must execute $\frac{12}{6} = 2x$



e_2 max = 4S

(b) Total computation time ≤ processor time available

Still dependent on deadlines:

Task 1 must repeat every 4s

Task 2 must repeat every 6s

Lowest common multiple: 12s

Task 1 will repeat $\frac{12}{4} = 3x$

Task 2 will repeat $\frac{12}{6} = 2x$

$e_1 + e_2 \leq p_1$ (assumed to be min)

$1 + e_2 \leq 4S$

$e_2 \leq 3S$

e_2 max = 3S

(c) $U = \sum_{i=1}^{n} \frac{e_i}{p_i}$

(a) $\frac{1}{4} + \frac{4}{6} = 0.91\overline{6}$

(b) $\frac{1}{4} + \frac{3}{6} = 0.75$

RMS utilization is better

(d) $\frac{e_1}{4} + \frac{e_2}{6} = 1 \rightarrow$ Yes, is possible

$e_1 = 0$ and $e_2 = 6$ yield 100% utilization

Since e_1 will never take up execution time, t_2 can run forever

Problem 2

(a) EDF requires $U \leq 1$

$$\frac{e_1}{p_1} + \frac{e_2}{p_2} \leq 1$$

$$\frac{1}{4} + \frac{e_2}{6} \leq 1$$

$$\frac{e_2}{6} \leq \frac{3}{4}$$

$$e_2 \leq \frac{18}{4}$$

$$\boxed{e_2 \leq 4.5s}$$

(b) Less pre-emption: EDF (deadlines dictate execution, priority unfixed)
Better utilization: EDF ($1 > 0.9\overline{16}$)

Problem 4

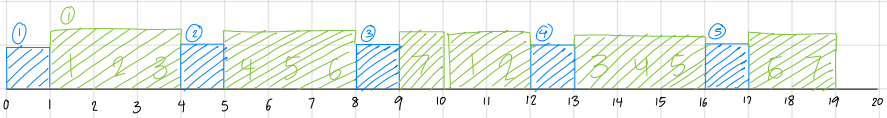
(a) $\frac{20}{4}$ => task 1 executes 5 times

$\frac{20}{10}$ => task 2 executes 2 times

Frame time ≤ shortest deadline (4)

Frame 1	Frame 2	Frame 3	Frame 4	Frame 5
Task 1	Task 1	Task 1	Task 1	Task 1
	Task 2			

$\sum \frac{e_i}{D_i} \rightarrow \frac{1}{4} + \frac{7}{10} = 0.95 \leq 1$, schedule is feasible

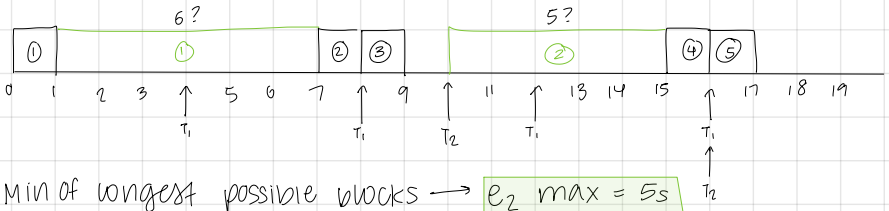


(Preemptive scheduling)

Yes, the schedule is feasible

(b) No, it is not. When T_2 acquires the mutex and T_1 attempts to preempt T_2, it inherits T_2's priority and will be unable to interrupt T_2's execution. T_2 breaking up T_1s means there are at least 7 seconds between two T_1 executions, which does not work with the deadlines (7 > 4s).

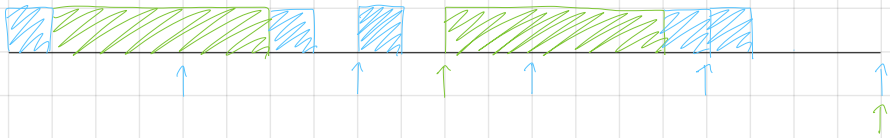
(c) Maximum execution time of e_2 w/ mutex lock (no preemption), since locked, anytime algo not so useful



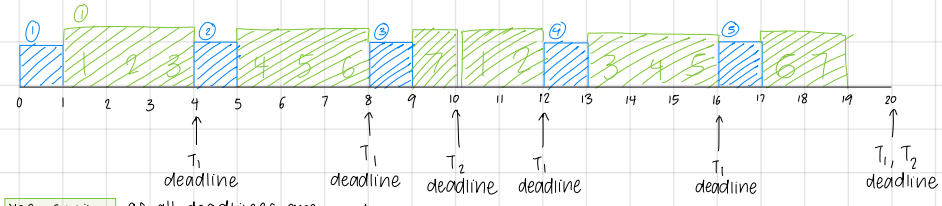
Min of longest possible blocks → e_2 max = 5s

Blue is task 1
Green is task 2

Valid schedule:



(d)



Yes, feasible as all deadlines are met

(e) $\frac{1}{4} + \frac{2}{5} + \frac{e_2}{10} \leq 1 \rightarrow 0.65 + \frac{e_2}{10} \leq 1 \rightarrow e_2 \leq 3.5 \rightarrow$ e_2 max = 3s b/c question says to assume exec. time alw. pos. integers

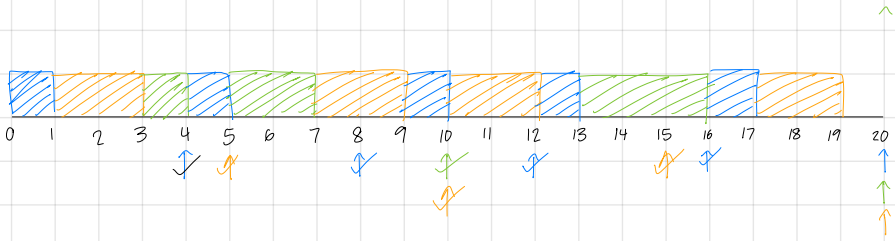
Task 1 executes 5 times

Task 2 executes 2 times terminates early both times

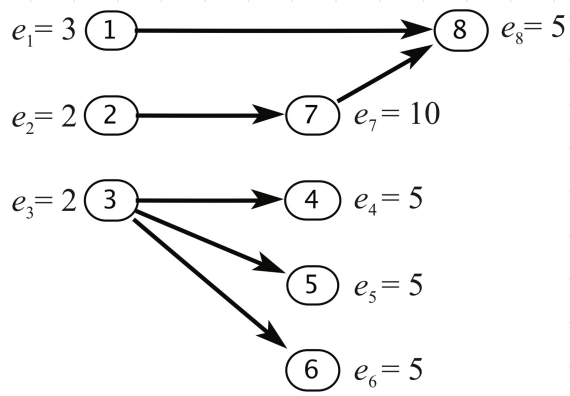
Task 3 executes 4 times

Deadlines

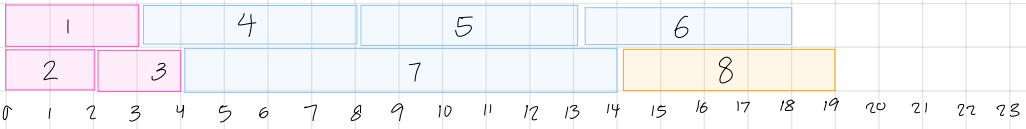
Task 1	Task 2	Task 3
4	5	10
8	10	20
12	15	
16	20	
20		



Problem 6

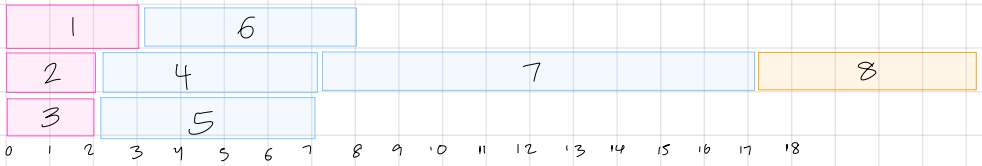


a)



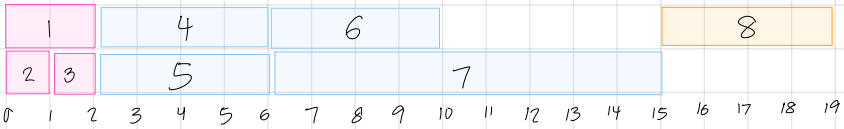
Makespan = 19

b)



Makespan = 22

c)



Makespan = 19, same as a