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ENEL 452 - Assignment 3

1. 3 tasks

	task 1	task 2	task 3
period (ms)	10	39	1000
WCET (ms)	4	12	98

Total time loading?

$\tau_1 = (10, 4)$ $\tau_2 = (39, 12)$ $\tau_3 = (1000, 98)$

$U = \frac{4}{10} + \frac{12}{39} + \frac{98}{1000}$

$= 0.4 + 0.3077 + 0.098$

$= 0.8057$

not harmonic:

$U \leq 3(2^{1/3} - 1)$ max utilization

≤ 0.78

This set is not guaranteed to have a feasible schedule

→ Changing the period of τ_2 to 30 ms and τ_3 to 900 ms makes this harmonic, max $U \leq 100\%$

$U = \frac{4}{10} + \frac{12}{30} + \frac{98}{900}$

$= 90.9\%$

Total utilization increases, but the max U increases as well, so the total is now less than the max.

2. Preemptive system has 3 concurrent tasks.

Task	Cycle	Execution Time	Priority
A	10ms	4ms	3
B	20ms	5ms	1
C	40ms	10ms	2
Idle	~	5ms	~

a) i) System utilization

$U = \frac{4}{10} + \frac{5}{20} + \frac{10}{40}$

$= 0.4 + 0.25 + 0.25$

$= 0.9 = 90\%$

ii) RMS scheduled?

No. Since task C has the longest execution time, but not the lowest priority, this is not RMS scheduled

iii) Response time

$R_A = 4ms$ -> highest priority, always served first

$R_C^1 = 10ms + \left(\frac{10}{10}\right) 4ms = 14ms$

$R_C^2 = 10ms + \frac{14}{10}^2 4ms = 18ms$

$R_C^3 = 10ms + \frac{18}{10}^2 4ms = 18ms$

$R_B^1 = 5 + \frac{5}{10}^1 4 + \frac{5}{40}^1 10 = 19ms$

$R_B^2 = 5 + \frac{19}{10}^2 4 + \frac{19}{40}^1 10 = 23ms$

$R_B^3 = 5 + \frac{23}{10}^3 4 + \frac{23}{40}^1 10 = 27ms$

$R_B^4 = 5 + \frac{27}{10}^3 4 + \frac{27}{40}^1 10 = 27ms$

$R_A = 4ms \quad R_B = 27ms \quad R_C = 18ms$

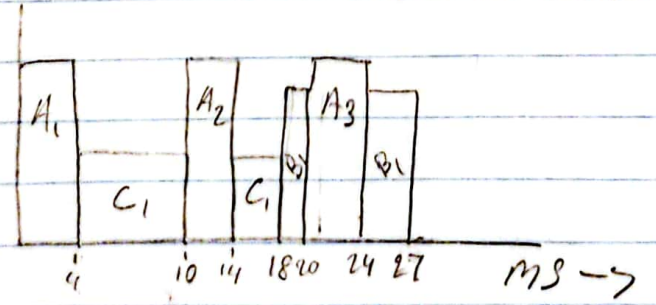
iv) Do they meet deadlines?

No. Task A meets the deadline by 6ms

Task B misses the deadline by 7ms

Task C meets the deadline by 22ms

v)



b) Task B prio = 2 Task C prio = 1

i) Utilization?

$U = \frac{4}{10} + \frac{5}{20} + \frac{10}{40}$

$= 90\%$

ii) Response time?

$R_A = 4ms$ → highest priority

$R_B^1 = 5 + \lceil \frac{5}{10} \rceil 4 = 9ms$

$R_B^2 = 5 + \lceil \frac{9}{10} \rceil 4 = 9ms$

$R_C^1 = 10 + \lceil \frac{10}{20} \rceil 5 + \lceil \frac{10}{10} \rceil 4 = 19ms$

$R_C^2 = 10 + \lceil \frac{19}{20} \rceil 5 + \lceil \frac{19}{10} \rceil 4 = 23ms$

$R_C^3 = 10 + \lceil \frac{23}{20} \rceil 5 + \lceil \frac{23}{10} \rceil 4 = 32ms$

$R_C^4 = 10 + \lceil \frac{32}{20} \rceil 5 + \lceil \frac{32}{10} \rceil 4 = 36ms$

$R_C^5 = 10 + \lceil \frac{36}{20} \rceil 5 + \lceil \frac{36}{10} \rceil 4 = 36ms$

$R_A = 4ms$ $R_B = 9ms$ $R_C = 36ms$

iii) Deadlines?

Yes. All tasks meet the deadline.

T_A meets by 6ms

T_B meets by 11ms

T_C meets by 4ms

iv)