ENEL452: Assignment 3

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1. 3 tasks:

$C_0 = 10\,ms$

$C_1 = 39\,ms$

$C_2 = 1\,s$

WCETs:

$P_0 = 4\,ms$

$P_1 = 12\,ms$

$P_2 = 98\,ms$

Total time loading:

$$U_0 = \frac{P_0}{C_0} = \frac{4ms}{10ms} = 0.4$$

$$U_1 = \frac{P_1}{C_1} = \frac{12ms}{39ms} = 0.31$$

$$U_2 = \frac{P_2}{C_2} = \frac{98ms}{1s} = 0.098$$

$$U_{total} = 0.8056 = 0.81$$

Is it schedulable?

$n = 3$

$$n(2^{1/n} - 1) = 3(2^{1/3} - 1) = 77.98\%$$

∴ Since the total utilization is greater than the RMS criterion this task is set to have a feasible schedule. No rewrite needed since the tasks are schedulable according to the RMS.

2.

a) Task A: $U_A = \frac{P_A}{C_A} = \frac{4ms}{10ms} = 0.4$

Task B: $U_B = \frac{P_B}{C_B} = \frac{5ms}{20ms} = 0.25$

Task C: $U_C = \frac{P_C}{C_C} = \frac{10ms}{40ms} = 0.40$

i) Total utilization: $U_A + U_B + U_C = 0.4 + 0.25 + 0.40$

$U_T = 0.9 = 90\%$ utilization

ii) $n = 3$: $n(2^{1/n} - 1) = 3(2^{1/3} - 1) = 0.7797 \times 100 = 77.98\%$

∴ Since $0.7797 < U_T$ the task is RMS scheduled.

iii) Task A = 4ms since it has the highest priority so it won't be pre-empted by other tasks meaning the response time is the same as the execution time

Task C = 4ms + 10ms = 14ms

Task B = 4ms + 10ms + 5ms = 19ms

iv) Task A: Cycle = 10ms and executes in 4ms → 10ms - 4ms = 6ms

∴ Beats deadline by 6ms.

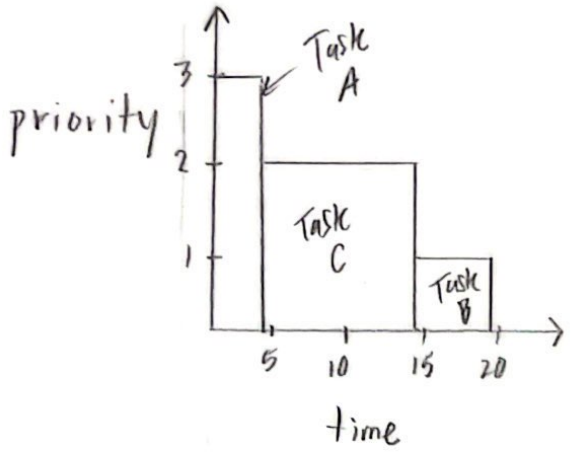
Task B: Cycle = 40ms and executes in 10ms → 40ms - 14ms = 26ms

∴ Beats deadline by 26ms.

Task C: Cycle = 20ms and executes in 5ms → 20ms - 19ms = 30ms

∴ Beats deadline by 30ms.

v) execution timeline



b) i) $U_T = ?$

$$U_T = U_A + U_B + U_C$$

$$= \left(\frac{4ms}{10ms} + \frac{5ms}{20ms} + \frac{10ms}{40ms} \right) = 0.9 \times 100\% = 90\% \text{ utilization}$$

ii) response times = ?

Task A = 4ms

Task B = 4ms + 5ms = 9ms

Task C = 4ms + 5ms + 10ms = 19ms

iii) Task A = 10ms - 4ms = 6ms → beats by 6ms

Task B = 20ms - 9ms = 11ms → beats by 11ms

Task C = 40ms - 19ms = 21ms → beats by 21ms

iv)