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## Real Time Systems – Homework 2

1. Sol:

For the C simulation, it is required that the fourth column be followed with a space. For example, a valid row is: **a <n spaces> 7 <n spaces> 3 <n spaces> 3 <at least one space>**,  $n = \{1, 2, 3, \dots\}$ .

Compilation is straightforward: **gcc RTS-HW2/RTS-HW2/main.c**

The executable takes 2 command line arguments:

s	whether or not to scan for the number of task, default is 3
file path	path to the file containing task set information (Users/johndoe/HW2/file1.txt..)

Program Output for the given task set:

**Input: Enter the number of tasks in the taskset**

**3**

**No. of tasks: 3**

#####

**Sorting by priority.....**

**Task: c**

**Period: 20.00**

**Computation Time: 5.00**

**Priority 3**

**Response time: 0.00**

**Task: b**

**Period: 40.00**

**Computation Time: 10.00**

**Priority 2**

**Response time: 0.00**

**Task: a**

**Period: 80.00**

**Computation Time: 40.00**

**Priority 1**

**Response time: 0.00**

#####

Calculating response times.....

i: 1, n: 0, val: 15

i: 1, n: 1, val: 15

i: 2, n: 0, val: 60

i: 2, n: 1, val: 75

i: 2, n: 2, val: 80

i: 2, n: 3, val: 80

Task: c

Period: 20.00

Computation Time: 5.00

Priority 3

Response time: 5.00

Task: b

Period: 40.00

Computation Time: 10.00

Priority 2

Response time: 15.00

Task: a

Period: 80.00

Computation Time: 40.00

Priority 1

Response time: 80.00

Program ended with exit code: 0

As we can see, the response times for all the tasks  $\leq$  their deadlines along with the condition  $w_i^n == w_i^{n+1}$  met.

Hence, this task set is schedulable by a fixed priority scheduler.

2. Sol:

Assuming higher priority value denotes higher priority:

a. Preemptive Fixed Priority Scheduler

T1	T3	T4	T6	T8	T1	T7	T2	T5	
0	3	11	13	15	18	20	21	26	28

Waiting times for

$$\begin{aligned} T1 &= (0-0) + (18-0) \\ &= 18 \end{aligned}$$

$$\begin{aligned} T2 &= (21-2) \\ &= 19 \end{aligned}$$

$$\begin{aligned} T3 &= (3-3) \\ &= 0 \end{aligned}$$

$$\begin{aligned} T4 &= (11-3) \\ &= 8 \end{aligned}$$

$$\begin{aligned} T5 &= (26-5) \\ &= 21 \end{aligned}$$

$$\begin{aligned} T6 &= (13-10) \\ &= 3 \end{aligned}$$

$$\begin{aligned} T7 &= (20-15) \\ &= 5 \end{aligned}$$

$$\begin{aligned} T8 &= 15 - 15 \\ &= 0 \end{aligned}$$

Therefore, the required average waiting time =  $\frac{\sum_{i=1}^8 \text{Waiting times}, T(i)}{8}$

$$\begin{aligned} &= (18 + 19 + 0 + 8 + 21 + 3 + 5 + 0) / 8 \\ &= 74 / 8 \\ &= 9.250 \text{ units} \end{aligned}$$

b. Non-Preemptive Fixed Priority Scheduler

T1	T3	T4	T6	T8	T7	T2	T5	
0	5	13	15	17	20	21	26	28

Waiting times for

$$T1 = 0$$

$$\begin{aligned} T2 &= (21-2) \\ &= 19 \end{aligned}$$

$$\begin{aligned} T3 &= (5-3) \\ &= 2 \end{aligned}$$

$$\begin{aligned} T4 &= (13-3) \\ &= 11 \end{aligned}$$

$$\begin{aligned} T5 &= (26-5) \\ &= 21 \end{aligned}$$

$$\begin{aligned} T6 &= (15-10) \\ &= 5 \end{aligned}$$

$$\begin{aligned} T7 &= (20-15) \\ &= 5 \end{aligned}$$

$$\begin{aligned} T_8 &= (17-15) \\ &= 2 \end{aligned}$$

$$\text{Therefore, the required average waiting time} = \frac{\sum_{i=1}^{i=8} \text{Waiting times}, T(i)}{8}$$

$$\begin{aligned} &= (0+19+2+11+21+5+5+2) / 8 \\ &= 65 / 8 \\ &= 8.125 \text{ units} \end{aligned}$$