

# Sprints

## Week 4 Task

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### Scheduling & Types of Schedulers

#### Tasks

- **Task:** Schedule the following task set using rate-monotonic:  
T1 {P: 5, E: 2.5, D: 5}, T2 {P: 15, E: 4.5, D: 15}, T3 {P: 20, E: 3.5, D: 20}
  - Calculate the Urm.
  - Calculate the time-demand analysis.
  - Model the task set using Simso.
- **Provide a report with the above points using screenshots and comments on your results and analysis.**

[SPRINTS](#)

**Delivered By: Omar Adel Khedr**

## • Hand Analysis

Sprints

Week 4

Task Scheduling & Types of Schedulers

Tasks	Periodicity	Execution Time	Deadline
Task 1	5 ms	2.5 ms	5 ms
Task 2	15 ms	4.5 ms	15 ms
Task 3	20 ms	3.5 ms	20 ms

$$\bullet \text{Hyper period} = \text{LCM}(P_i) = 60 \text{ ms}$$

$$\bullet U = \frac{(12 \times 2.5) + (4 \times 4.5) + (3 \times 3.5)}{60}$$

$$U = 97.5 \%$$

$$\bullet U_{RM} = n(2^{1/n} - 1) = 3(2^{1/3} - 1)$$

$$U_{RM} = 77.976 \%$$

•  $U > U_{RM}$ ,  $U < 100\% \Rightarrow$  We need to calculate the time demand

Time Demand Analysis:  $w_i(t) = e_i + \sum_{k=1}^{i-1} \left\lceil \frac{t}{P_k} \right\rceil \cdot e_k$

Arrangement  $\Rightarrow$  Task 1, Task 2, Task 3

For Task 1

For Task 2

$$w_1(1) = 2.5 + 0 = 2.5 \text{ ms}$$

$$w_1(2) = 2.5 + 0 = 2.5 \text{ ms}$$

$$w_1(3) = 2.5 + 0 = 2.5 \text{ ms}$$

$$w_1(4) = 2.5 + 0 = 2.5 \text{ ms}$$

$$w_1(5) = 2.5 + 0 = 2.5 \text{ ms}$$

$2.5 < 5 \Rightarrow$  Schedulable

✓✓

$$w_2(1) = 4.5 + 2.5 \left\lceil \frac{1}{5} \right\rceil = 7 \text{ ms}$$

$$w_2(2) = 4.5 + 2.5 \left\lceil \frac{2}{5} \right\rceil = 7 \text{ ms}$$

$$w_2(3) = 4.5 + 2.5 \left\lceil \frac{3}{5} \right\rceil = 7 \text{ ms}$$

$$w_2(4) = 4.5 + 2.5 \left\lceil \frac{4}{5} \right\rceil = 7 \text{ ms}$$

$$w_2(5) = 4.5 + 2.5 \left\lceil \frac{5}{5} \right\rceil = 9.5 \text{ ms}$$

$$w_2(6) = 4.5 + 2.5 \left\lceil \frac{6}{5} \right\rceil = 9.5 \text{ ms}$$

$$w_2(7) = 4.5 + 2.5 \left\lceil \frac{7}{5} \right\rceil = 9.5 \text{ ms}$$

$$w_2(8) = 4.5 + 2.5 \left\lceil \frac{8}{5} \right\rceil = 9.5 \text{ ms}$$

$$w_2(9) = 4.5 + 2.5 \left\lceil \frac{9}{5} \right\rceil = 9.5 \text{ ms}$$

$$w_2(10) = 4.5 + 2.5 \left\lceil \frac{10}{5} \right\rceil = 9.5 \text{ ms}$$

For Task 3

$$w_3(1) = 3.5 + 2.5 \left\lceil \frac{1}{5} \right\rceil + 4.5 \left\lceil \frac{1}{15} \right\rceil = 10.5 \text{ ms}$$

$$w_3(2) = 3.5 + 2.5 \left\lceil \frac{2}{5} \right\rceil + 4.5 \left\lceil \frac{2}{15} \right\rceil = 10.5 \text{ ms}$$

$$w_3(3) = 3.5 + 2.5 \left\lceil \frac{3}{5} \right\rceil + 4.5 \left\lceil \frac{3}{15} \right\rceil = 10.5 \text{ ms}$$

$$w_3(4) = 3.5 + 2.5 \left\lceil \frac{4}{5} \right\rceil + 4.5 \left\lceil \frac{4}{15} \right\rceil = 10.5 \text{ ms}$$

$$w_3(5) = 3.5 + 2.5 \left\lceil \frac{5}{5} \right\rceil + 4.5 \left\lceil \frac{5}{15} \right\rceil = 10.5 \text{ ms}$$

$$w_3(6) = 3.5 + 2.5 \left\lceil \frac{6}{5} \right\rceil + 4.5 \left\lceil \frac{6}{15} \right\rceil = 13 \text{ ms}$$

$$w_3(7) = 3.5 + 2.5 \left\lceil \frac{7}{5} \right\rceil + 4.5 \left\lceil \frac{7}{15} \right\rceil = 13 \text{ ms}$$

$$w_3(8) = 11 + 2.5 \left\lceil \frac{8}{5} \right\rceil + 4.5 \left\lceil \frac{8}{15} \right\rceil = 13 \text{ ms}$$

$$w_3(9) = 11 + 2.5 \left\lceil \frac{9}{5} \right\rceil + 4.5 \left\lceil \frac{9}{15} \right\rceil = 13 \text{ ms}$$

$$w_3(10) = 11 + 2.5 \left\lceil \frac{10}{5} \right\rceil + 4.5 \left\lceil \frac{10}{15} \right\rceil = 13 \text{ ms}$$

$$w_3(11) = 11 + 2.5 \left\lceil \frac{11}{5} \right\rceil + 4.5 \left\lceil \frac{11}{15} \right\rceil = 15.5 \text{ ms}$$

$$w_3(12) = 11 + 2.5 \left\lceil \frac{12}{5} \right\rceil + 4.5 \left\lceil \frac{12}{15} \right\rceil = 15.5 \text{ ms}$$

$$w_3(13) = 11 + 2.5 \left\lceil \frac{13}{5} \right\rceil + 4.5 \left\lceil \frac{13}{15} \right\rceil = 15.5 \text{ ms}$$

$$w_3(14) = 11 + 2.5 \left\lceil \frac{14}{5} \right\rceil + 4.5 \left\lceil \frac{14}{15} \right\rceil = 15.5 \text{ ms}$$

$$w_3(15) = 11 + 2.5 \left\lceil \frac{15}{5} \right\rceil + 4.5 \left\lceil \frac{15}{15} \right\rceil = 15.5 \text{ ms}$$

$$w_3(16) = 11 + 2.5 \left\lceil \frac{16}{5} \right\rceil + 4.5 \left\lceil \frac{16}{15} \right\rceil = 22.5 \text{ ms}$$

$$w_3(17) = 11 + 2.5 \left\lceil \frac{17}{5} \right\rceil + 4.5 \left\lceil \frac{17}{15} \right\rceil = 22.5 \text{ ms}$$

$$w_3(18) = 11 + 2.5 \left\lceil \frac{18}{5} \right\rceil + 4.5 \left\lceil \frac{18}{15} \right\rceil = 22.5 \text{ ms}$$

$$w_3(19) = 11 + 2.5 \left\lceil \frac{19}{5} \right\rceil + 4.5 \left\lceil \frac{19}{15} \right\rceil = 22.5 \text{ ms}$$

$$w_3(20) = 11 + 2.5 \left\lceil \frac{20}{5} \right\rceil + 4.5 \left\lceil \frac{20}{15} \right\rceil = 22.5 \text{ ms}$$

$$w_2(11) = 4.5 + 2.5 \left\lceil \frac{11}{5} \right\rceil = 12 \text{ ms}$$

$$w_2(12) = 4.5 + 2.5 \left\lceil \frac{12}{5} \right\rceil = 12 \text{ ms}$$

$$w_2(13) = 4.5 + 2.5 \left\lceil \frac{13}{5} \right\rceil = 12 \text{ ms}$$

$$w_2(14) = 4.5 + 2.5 \left\lceil \frac{14}{5} \right\rceil = 12 \text{ ms}$$

$$w_2(15) = 4.5 + 2.5 \left\lceil \frac{15}{5} \right\rceil = 12 \text{ ms}$$

$$12 < 15 \Rightarrow$$
 Schedulable

✓✓

$$w_3(18) = 3.5 + 2.5 \left\lceil \frac{18}{5} \right\rceil + 4.5 \left\lceil \frac{18}{15} \right\rceil = 22.5 \text{ ms}$$

$$w_3(19) = 3.5 + 2.5 \left\lceil \frac{19}{5} \right\rceil + 4.5 \left\lceil \frac{19}{15} \right\rceil = 22.5 \text{ ms}$$

$$w_3(20) = 3.5 + 2.5 \left\lceil \frac{20}{5} \right\rceil + 4.5 \left\lceil \frac{20}{15} \right\rceil = 22.5 \text{ ms}$$

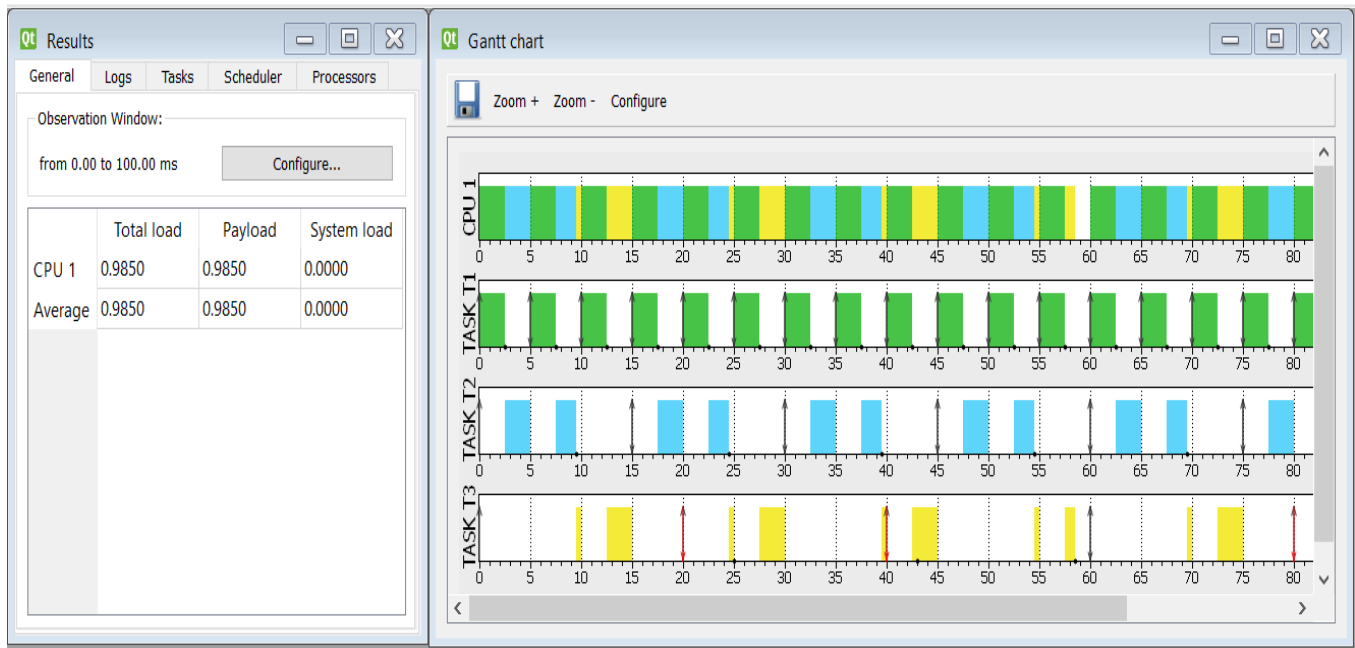
$$22.5 > 20$$

$$\Rightarrow$$
 Not Schedulable

✗✗

From the analysis: Task 3 isn't schedulable which means that the whole system isn't feasible (T3:  $w(20) = 22.2 \text{ ms} > \text{Deadline}$ )

## • Simso Simulation Results



## • Comments

1. Only Task 3 misses the deadline as predicted from the results of the calculations
2. The Bound test wasn't able to decide if the system is schedulable or not as  $U > U_{rm}$  but  $U < 100\%$
3. As the RM is the most optimal scheduling policy among other fixed priority schedulers, that means that no other fixed priority scheduler can make the system feasible
4. System is heavily loaded ( $CL = 98.5\%$ )