Development of Real-Time Systems Assignment 3

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Theory assignment:

Finding the frame size for each task set:

1. T1(15, 1, 14) T2(20, 2, 26) T3(22, 3)

   Solution

   HyperPeriod(H) = 660.
   Requirement 1 : f >= 3;
   Requirement 2 : candidates divide H evenly
   f = {22, 20, 15, 12, 11, 10, 6, 5, 4, 3, 2, 1}
   Requirement 3:
   $2f - \gcd(p_i, f) <= d_i$
   After Calculations, **the largest possible frame size: 6**

2. T1(4, 1) T2(5, 2, 7) T3(20, 5)

   Solution

   HyperPeriod(H) = 20.

   Requirement 1 : f >= 5;

   Requirement 2 : candidates divide H evenly

   f = {20, 10, 5, 4, 2, 1}

   Requirement 3:

   $2f - \gcd(p_i, f) <= d_i$

   After Calculations, **the largest possible frame size: 4**

   f = 4 does not fulfill the requirement 1, so jobs from T3 must split into parts.

3. T1(5, 0.1) T2(7, 1) T3(12, 6) T4(45, 9)

Solution

HyperPeriod(H) = 1260.

Requirement 1 : f >= 9;

Requirement 2 : candidates divide H evenly

f = {45, 42, 36, 35, 30, 28, 21, 20, 18, 15, 14, 12, 10, 9, 7, 6, 5, 4, 3, 2, 1}

Requirement 3:

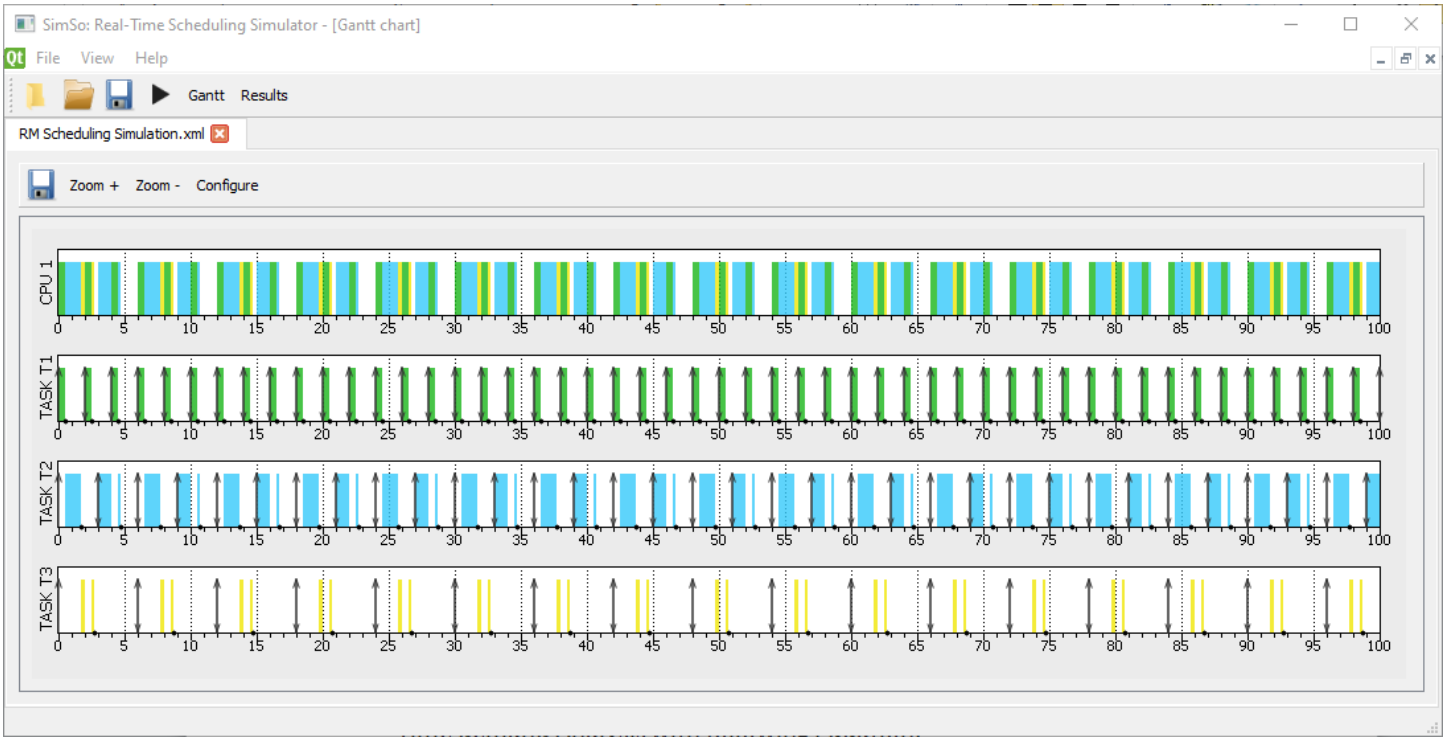
$2f - \gcd(p_i, f) <= d_i$

After Calculations, **the largest possible frame size: 3**

f = 3 does not fulfill the requirement 1, so jobs from T3 and T4 must split into parts.

Simulation assignment:

tasks T1(2, 0.5), T2(3, 1.2), T3(6, 0.5) and the RM scheduler into the SimSo simulator.



What is the utilization factor of the system and what is the value for Urm(3)?

utilization factor of the system = 0.5/2 + 1.2/3 + 0.5 /6 = **0.73333** .

Urm(n) = $n(2^{1/n}-1)$.

Urm(3) = $3(2^{1/3} - 1)$ = **0.779** .

Since U < Urm(3) **The System is Feasible.**

What is the minimum/maximum/average response time of all tasks?

Time demand Analysis with following Equation.

$$W_i(t) = \sum_{k=0}^{i-1} \left\lceil \frac{t}{p_k} \right\rceil e_k$$

	minimum	maximum	average
Task 1	0.5	0.5	0.5
Task 2	1.7	2.2	1.95
Task 3	2.2	4.4	3.3

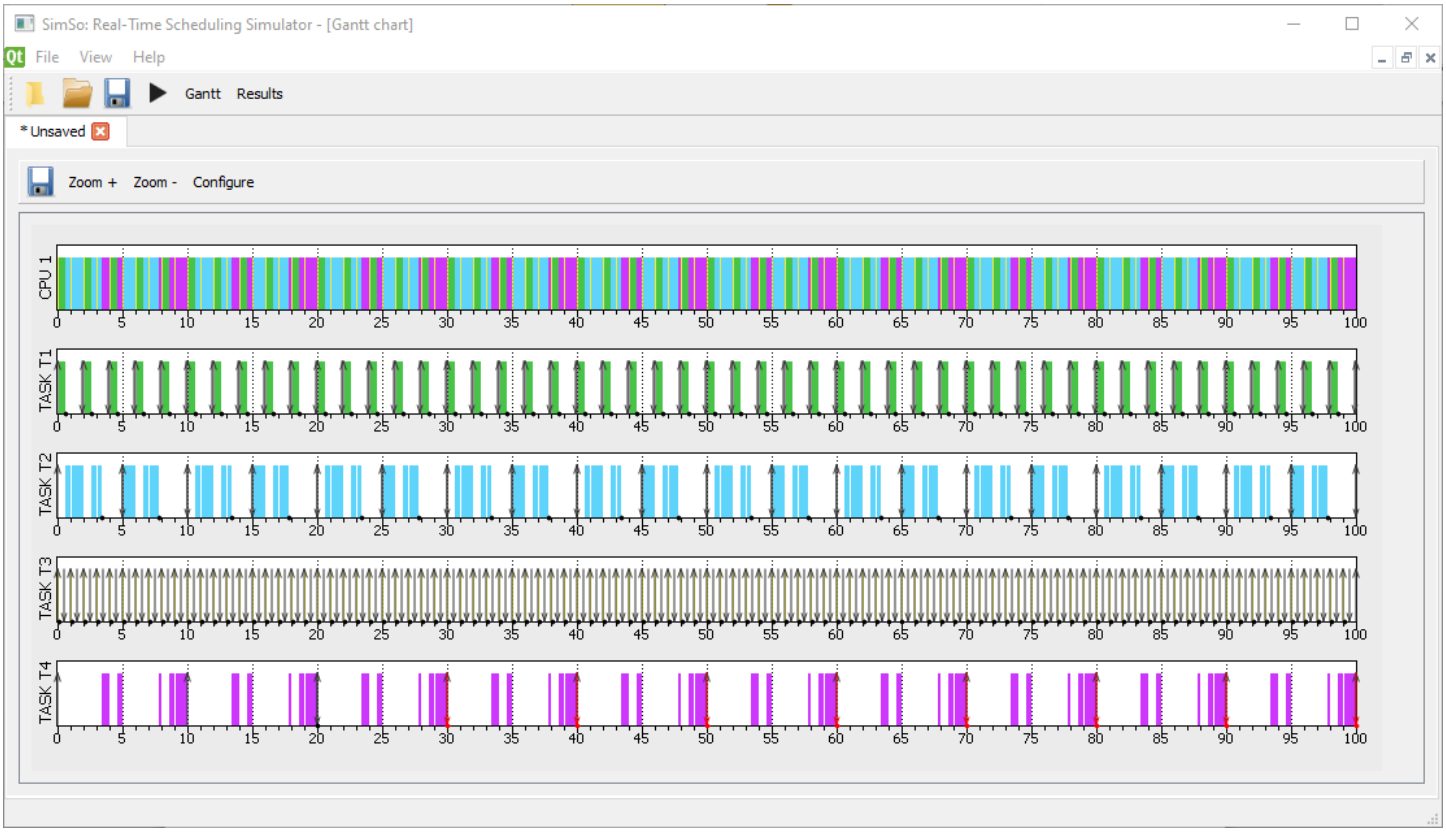
Is any task missing the deadline? Which task? Where?

No Task miss the deadline. Since U < Urm(3) The System is Feasible.

If a deadline is missed, could it be avoided by changing the scheduler?

No deadline is missed . The System is Feasible.

tasks T1(2, 0.5, 1.9) T2(5, 2) T3(1, 0.1, 0.5) T4(10, 5, 20) and the EDF scheduler into the SimSo simulator.



What is the utilization factor of the system and what is the value for Urm(4)?

utilization factor = 0.5/2 + 2/5 + 0.1 /1 + 5/10 =1.25 .

Urm(n) = $n(2^{1/n} -1)$.

Urm(4) = $4(2^{1/4} - 1) = 0.756828$.

The **System is NOT Feasible** because **utilization factor > 1**.

What is the minimum/maximum/average response time of all tasks?

	minimum	maximum	average
Task 1	0.6	0.7	0.65
Task 2	1.7	2.2	1.95
Task 3	2.6	4.0	3.3
Task 4	7.6	12.5	10.05

Is any task missing the deadline? Which task? Where?

Task 4 miss the deadline of the second job (which release at t=10) at t = 30 and miss the deadline of the second job after that Time.

If a deadline is missed, could it be avoided by changing the scheduler?

it could not be avoided by changing the scheduler because **utilization factor > 1**, so The **System is NOT Feasible.**