

Assignment 3

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15/10/2019

Theory assignment

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• Theory assignment

1) $T_1(15, 1, 14)$ $T_2(20, 2, 26)$ $T_3(22, 3)$

Requirement 1: $f \geq \max(15, 20, 22) = 22$

Requirement 2: $f = \{22, 20, 15, 11, 6, 4, 3, 2, 1\}$

Requirement 3: $2f - \text{gcd}(p_i, f) \leq D_i$

f	(15, 1, 14)	(20, 2, 26)	(22, 3)
22	$2 \cdot 22 - 1 \leq 14$ X		
20	$2 \cdot 20 - 5 \leq 14$ X		
15	$2 \cdot 15 - 15 \leq 14$ X		
11	$2 \cdot 11 - 1 \leq 14$ X		
6	$2 \cdot 6 - 3 \leq 14$ ✓	$2 \cdot 6 - 5 \leq 26$ ✓	$2 \cdot 6 - 2 \leq 22$ ✓

Largest frame size is 6

2) $T_1(4, 1)$ $T_2(5, 2, 7)$ $T_3(20, 5)$

R1: $f \geq \max(4, 5, 20) = 20$

R2: $f = \{20, 10, 5, 4, 2, 1\}$

R3:

f	(4, 1)	(5, 2, 7)	(20, 5)
20	$2 \cdot 20 - 4 \leq 4$ X		
10	$2 \cdot 10 - 2 \leq 4$ X		
5	$2 \cdot 5 - 1 \leq 4$ X		
4	$2 \cdot 4 - 4 \leq 4$ ✓	$2 \cdot 4 - 1 \leq 7$ ✓	$2 \cdot 4 - 4 \leq 20$ ✓

Largest frame size is 4

However, T_3 's execution time doesn't fulfill R1 (5 is not smaller than 4)

→ T_3 must be split into 2 parts.

∴ T_3 execution will be in 2 stages

3) $T_1(5, 0, 1)$ $T_2(7, 1)$ $T_3(12, 6)$ $T_4(45, 9)$

$$R_1: f \geq \max(0, 1, 1, 6, 9) = 9$$

$$R_2: f \in \{45, 15, 12, 7, 5, 4, 3, 2, 1\}$$

R_3

f	$(5, 0, 1)$	$(7, 1)$	$(12, 6)$	$(45, 9)$
45	$2 \cdot 45 - 5 \leq 5 \times$			
15	$2 \cdot 15 - 5 \leq 5 \times$			
12	$2 \cdot 12 - 1 \leq 5 \times$			
7	$2 \cdot 7 - 1 \leq 5 \times$			
5	$2 \cdot 5 - 5 \leq 5 \checkmark$	$2 \cdot 5 - 1 \leq 7 \times$		
4	$2 \cdot 4 - 1 \leq 5 \times$			
3	$2 \cdot 3 - 1 \leq 5 \checkmark$	$2 \cdot 3 - 1 \leq 7 \checkmark$	$2 \cdot 3 - 3 \leq 12 \checkmark$	$2 \cdot 3 - 3 \leq 45 \checkmark$

Largest frame size is 3

However, execution time of T_4 and T_3 is larger than 3

→ doesn't fulfill R_1 .

∴ T_3 will be in 2 stages
and

T_4 will be in 3 stages

Simulation assignment

1. T1(2, 0.5), T2(3, 1.2), T3(6, 0.5)

What is the utilization factor of the system and what is the value for $U_{RM}(3)$

	Total load	Payload	System load
CPU 1	0.7410	0.7410	0.0000
Average	0.7410	0.7410	0.0000

As shown in the screenshot, the total utilization of the system is **0.741**, which is very similar to the theoretical value $U = 0.5/2 + 1.2/3 + 0.5/6 = 0.733$

Whereas $U_{RM} = 3(2^{1/3} - 1) = 0.7798$

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

Response time:				
Task	min	avg	max	std dev
TASK T1	0.500	0.500	0.500	0.000
TASK T2	1.700	1.700	1.700	0.000
TASK T3	2.700	2.700	2.700	0.000

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

No task was missing.

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

No task was missing.

2. T1(2, 0.5, 1.9) T2(5, 2) T3(1, 0.1, 0.5) T4(10, 5, 20)

What is the utilization factor of the system and what is the value for $U_{RM}(4)$

	Total load	Payload	System load
CPU 1	1.0000	1.0000	0.0000
Average	1.0000	1.0000	0.0000

From the screenshot, the total utilization factor is **1.0**. On the other hand, the theoretical value is $U = 0.5/2 + 2/5 + 0.1/1 + 5/10 = 1.25$

$$U_{RM} = 4(2^{1/4} - 1) = 0.7568$$

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

Response time:				
Task	min	avg	max	std dev
TASK T1	0.600	0.600	0.600	0.000
TASK T2	2.800	3.100	3.400	0.300
TASK T3	0.100	0.100	0.100	0.000
TASK T4	20.000	20.000	20.000	0.000

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

No task was missing. However, I played with it with other schedulers. In the case of using RM scheduler, part of T4 will be aborted due to missing the deadline.

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

As mentioned in the previous question, no task was missed. But in the case if deadline is missed, changing scheduler could solve the problem,