

# Assignment 3

## Theory assignment 1

The following part of assignment is a purely theoretical task that requires no additional tools. The task is to find the largest possible frame size for the cyclic structured scheduler by following requirements 1,2 and 3 for finding the largest frame size. The following three task sets should be used:

1. T1(15, 1, 14) T2(20, 2, 26) T3(22, 3)
2. T1(4, 1) T2(5, 2, 7) T3(20, 5)
3. T1(5, 0.1) T2(7, 1) T3(12, 6) T4(45, 9)

-Provide a written report which should contain:

- Calculations for each step for finding the frame size for each task set
- Resulting frame size for each task set

### Solution 1:

$$F = \frac{H}{f} \quad (\text{Cyclic Scheduler})$$

F = Frame size

H = Hyper Period

f = number of frames that equally divide in hyper period

	P	e	D
T1	15	1	14
T2	20	2	26
T3	22	3	22

$$H(\text{Hyper Period}) = \text{LCM of Period of all Task} = \text{LCM}(15, 20, 22) = 660$$

Finding f

Criteria 1: f should be large enough that an entire task fits,  $(f \geq e_{i_{\max}}) \rightarrow f \geq 3$

Criteria 2: f should divide the hyper period equally,  $(\frac{f}{H}) \rightarrow f = 1, 2, 3, 4, 5, 6, 10, 11, 12, 15, 20, 22, 30, 33, 44, 55, 60, 66, 110, 132, 165, 220, 330, 660$

Criteria 3: A frame gap should be present between release and deadline  $(2f - \gcd(P_i, f) \leq D_i) \rightarrow f = 6, 5, 4, 3, 2$

Hence final values of f can be 3,4,5,6

### Solution 2:

$$F = \frac{H}{f} \quad (\text{Cyclic Scheduler})$$

F = Frame size

H = Hyper Period

f = number of frames that equally divide in hyper period

	P	e	D
T1	4	1	4
T2	5	2	7
T3	20	5	20

H(Hyper Period) = LCM of Period of all Task = LCM(4, 5, 20) = 20

Finding f

Criteria 1: f should be large enough that an entire task fits,  $(f \geq e_{i_{\max}}) \rightarrow f \geq 5$

Criteria 2: f should divide the hyper period equally  $\left(\frac{f}{H}\right) \rightarrow f = 1, 2, 4, 5, 10, 20$

Criteria 3: A frame gap should be present between release and deadline  $(2f - \gcd(P_i, f) \leq D_i) \rightarrow f = 4, 2$

Since minimum frame size should be at least 5 as per criteria1.

$f=4, 2$  and the task will have to be split to be accommodated in the frame.

### Solution 3:

$$F = \frac{H}{f} \quad (\text{Cyclic Scheduler})$$

F = Frame size

H = Hyper Period

f = number of frames that equally divide in hyper period

	P	e	D
T1	5	0.1	5
T2	7	1	7
T3	12	6	12
T4	45	9	45

H(Hyper Period) = LCM of Period of all Task = LCM(5, 7, 12, 45) = 1260

Finding f

Criteria 1: f should be large enough that an entire task fits,  $(f \geq e_{i_{\max}}) \rightarrow f \geq 9$

Criteria 2: f should divide the hyper period equally  $\left(\frac{f}{H}\right) \rightarrow f = 1, 2, 3, 4, 5, 6, 7, 9, 10, 12, 14, 15, 18, 20, 21, 28, 30, 35, 36, 42, 45, 60, 63, 70, 84, 90, 105, 126, 140, 180, 210, 252, 315, 420, 630, 1260$

Criteria 3: A frame gap should be present between release and deadline  $(2f - \gcd(P_i, f) \leq D_i) \rightarrow f = 3, 2$

Since minimum frame size should be at least 9 as per criteria1.

$f=3, 2$  and the task will have to be split to be accommodated in the frame.

## Simulation assignment 1

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

Ans: Utilization Factor = 0.7333

$$U_{rm} = 0.7797$$

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

Ans:

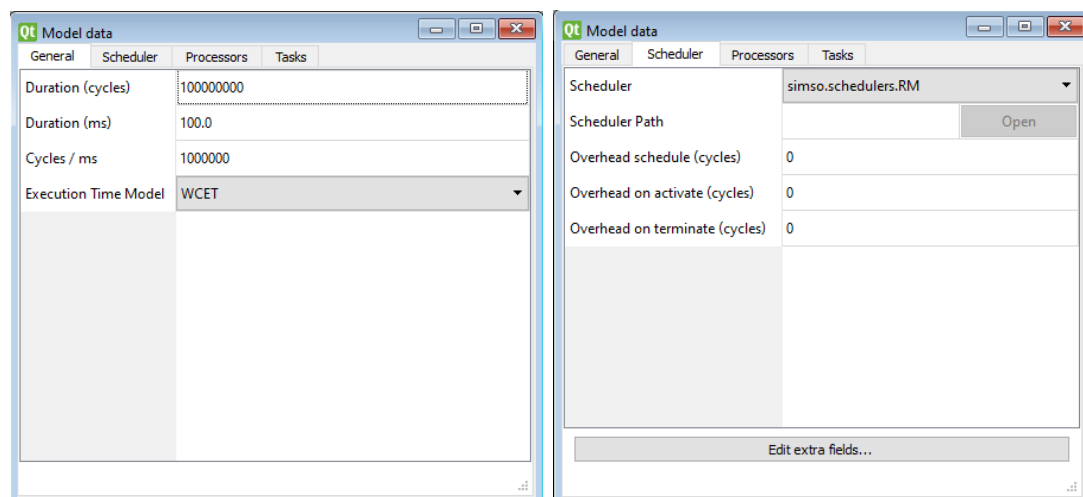
Task	min	avg	max	std dev
TASK T1	0.500	0.500	0.500	0.000
TASK T2	1.700	1.700	1.700	0.000
TASK T3	2.700	2.700	2.700	0.000

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

Ans: No

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

Ans: Yes



Qt Model data

General Scheduler Processors Tasks

id	Name	CS overhead	CL overhead	Speed
1	CPU 1	0	0	1.0

Edit data fields...

Remove selected processor(s) Add processor

Qt Model data

General Scheduler Processors Tasks

Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)
2	-	2	0.5
3	-	3	1.2
6	-	6	0.5

Edit data fields...

Remove selected task(s) Add task Generate Task Set

## Results

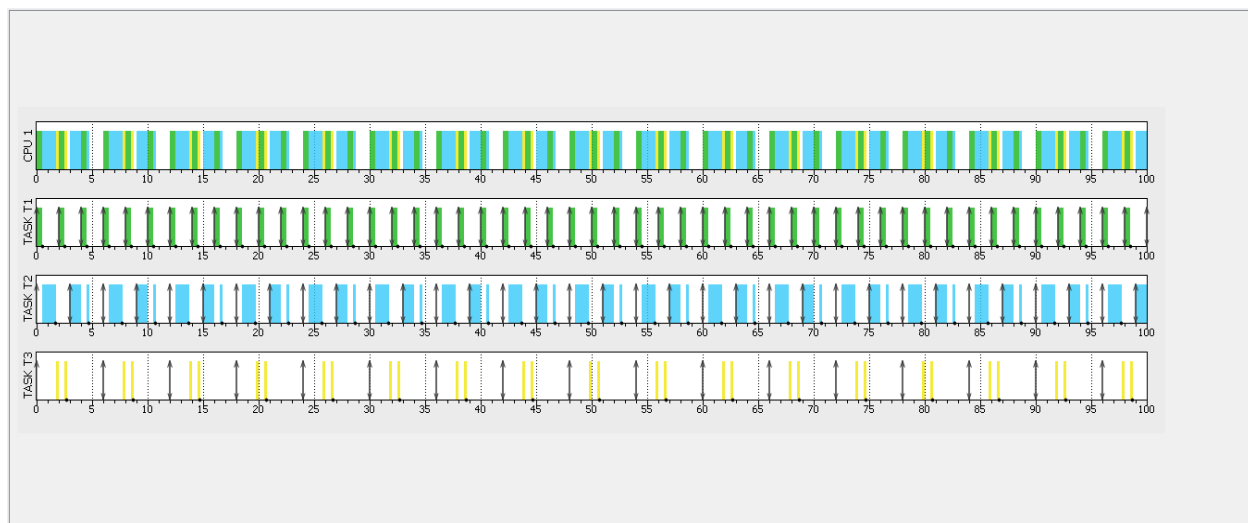
Qt Results

General Logs Tasks Scheduler Processors

Observation Window:  
from 0.00 to 100.00 ms Configure...

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

## Gantt:



## Simulation assignment 2

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

Utilization Factor: 1.25

$U_{rm}$ : 0.7568

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

Ans:

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?

Ans: Yes Task 4 was missed

Similarly was missed at T2\_4,T2\_5,T2\_6,etc.

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

Ans: Yes

Qt Model data

General Scheduler Processors Tasks

Duration (cycles) 100000000

Duration (ms) 100.0

Cycles / ms 1000000

Execution Time Model WCET

Qt Model data

General Scheduler Processors Tasks

Scheduler simso.schedulers.EDF

Scheduler Path  Open

Overhead schedule (cycles) 0

Overhead on activate (cycles) 0

Overhead on terminate (cycles) 0

Edit extra fields...

Qt Model data

General Scheduler Processors Tasks

id	Name	CS overhead	CL overhead	Speed
1	CPU 1	0	0	1.0

Edit data fields...

Qt Model data

General Scheduler Processors Tasks

Period (ms)	List of Act. dates (ms)	Deadline (ms)	WCET (ms)
2	-	1.9	0.5
5	-	5	2
1	-	0.5	0.1
10	-	20	5

Edit data fields...

## Results

Qt Results

General Logs Tasks Scheduler Processors

Observation Window:  
from 0.00 to 100.00 ms

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

## Gantt:

