

The theoretical problem:

To find the largest possible frame size for a set of tasks using the cyclic structured scheduler, we have to follow three requirements:

- 1- The largest frame size ( $f$ ) must be equal to or larger than the execution time of the largest tasks
- 2- We must list all candidates which divide the hyper period evenly. The hyper period ( $h$ ) is the least common multiple of periods of all tasks.
- 3- We must check that the candidate follows the condition:

$$2f - \gcd(P_i, f) \leq D_i$$

Where gcd is the great common divisor.

Going through the given three sets of Tasks:

I- Set #1

T1(15,1,4) – T2(20,2,26) – T3(22,3)

	$P$	$e$	$D$
$T_1$	1 5	1	14
$T_2$	2 0	2	26
$T_3$	2 2	3	22(=P, when N/A)

a – following the first criteria  $f$  must be larger or equal to 3. Then  $f \geq 3$

b – following the second criteria, we have to find the hyper period which will be equal to 660. And then we must find all the values that can divide this value evenly which will be:  
1, 2, 3, 4, 5, 6, 10, 11, 12, 15, 20, 22.

c – following the final criteria, we should apply to abovementioned formula for each task at each candidate which we will show in the next table.

$$2f - \gcd(P_i, f) \leq D_i$$

$f$	$T_1(D_1=14)$	$T_2(D_2=26)$	$T_3(D_3=22)$
22	$2(22) - \gcd(15, 22)$ $44 - 1 = 43$		
20	$2(20) - \gcd(15, 20)$ $40 - 5 = 35$		
15	$2(15) - \gcd(15, 15)$ $30 - 15 = 15$		
12	$2(12) - \gcd(15, 12)$ $24 - 3 = 21$		
11	$2(11) - \gcd(15, 11)$ $22 - 1 = 21$		
10	$2(10) - \gcd(15, 10)$ $20 - 5 = 15$		
6	$2(6) - \gcd(15, 6)$ $12 - 3 = 9$	$2(6) - \gcd(20, 6)$ $12 - 2 = 10$	$2(6) - \gcd(22, 6)$ $12 - 2 = 10$

Answer is 6

II-

Set #2

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

	$P$	$e$	$D$
$T_1$	4	1	4
$T_2$	5	5	7
$T_3$	2	5	2
	0		0

a – following the first criteria  $f$  must be larger or equal to 5. Then  $f \geq 5$

b – following the second criteria, we have to find the hyper period which will be equal to 20. And then we must find all the values that can divide this value evenly which will be: 1, 2, 4, 5, 10, 20.

c – following the final criteria, we should apply to abovementioned formula for each task at each candidate which we will show in the next table.

$$2f - \gcd(P_i, f) \leq D_i$$

$f$	$T_1(D_1=4)$	$T_2(D_2=7)$	$T_3(D_3=20)$
20	$2(20) - \gcd(4, 20)$ $40 - 4 = 36$		
10	$2(10) - \gcd(4, 10)$ $20 - 2 = 18$		
5	$2(5) - \gcd(4, 5)$ $10 - 1 = 9$		
4	$2(4) - \gcd(4, 4)$ $8 - 4 = 4$	$2(4) - \gcd(5, 4)$ $8 - 1 = 7$	$2(4) - \gcd(20, 4)$ $8 - 4 = 4$

Answer is 4 in the first stage then 1 in the next stage

III-

Set #3

$T_1(5,0.1) - T_2(7,1) - T_3(12,6) - T_4(45,9)$

	$P$	$e$	$D$
$T_1$	5	0.1	5
$T_2$	7	1	7
$T_3$	1	6	1
	2		2
$T_4$	4	9	4
	5		5

a – following the first criteria  $f$  must be larger or equal to 9. Then  $f \geq 9$

b – following the second criteria, we have to find the hyper period which will be equal to 1260. And then we must find all the values that can divide this value evenly which will be: 45; 15; 12; 9; 7; 6; 5; 4; 3; 2; 1

c – following the final criteria, we should apply to abovementioned formula for each task at each candidate which we will show in the next table.

$$2f - \gcd(P_i, f) \leq D_i$$

$f$	$T_1(D_1=5)$	$T_2(D_2=7)$	$T_3(D_3=12)$	$T_4(D_4=45)$
45	$2(45) - \gcd(5, 45)$ $90 - 5 = 85$			
15	$2(15) - \gcd(5, 15)$ $30 - 5 = 25$			
12	$2(12) - \gcd(5, 12)$ $24 - 1 = 23$			
9	$2(9) - \gcd(5, 9)$ $18 - 1 = 17$			
7	$2(7) - \gcd(5, 7)$ $14 - 1 = 13$			
6	$2(6) - \gcd(5, 6)$ $12 - 1 = 11$			
5	$2(5) - \gcd(5, 5)$ $10 - 5 = 5$	$2(5) - \gcd(7, 5)$ $10 - 1 = 9$		
4	$2(4) - \gcd(5, 4)$ $8 - 1 = 7$			
3	$2(3) - \gcd(5, 3)$ $6 - 1 = 5$	$2(3) - \gcd(7, 3)$ $6 - 1 = 5$	$2(3) - \gcd(12, 3)$ $6 - 1 = 5$	$2(3) - \gcd(45, 3)$ $6 - 1 = 5$

Answer is 3.

For T3, its execution will be on two stages each one is 3

For T4, its execution will be on three stages each one is 3.