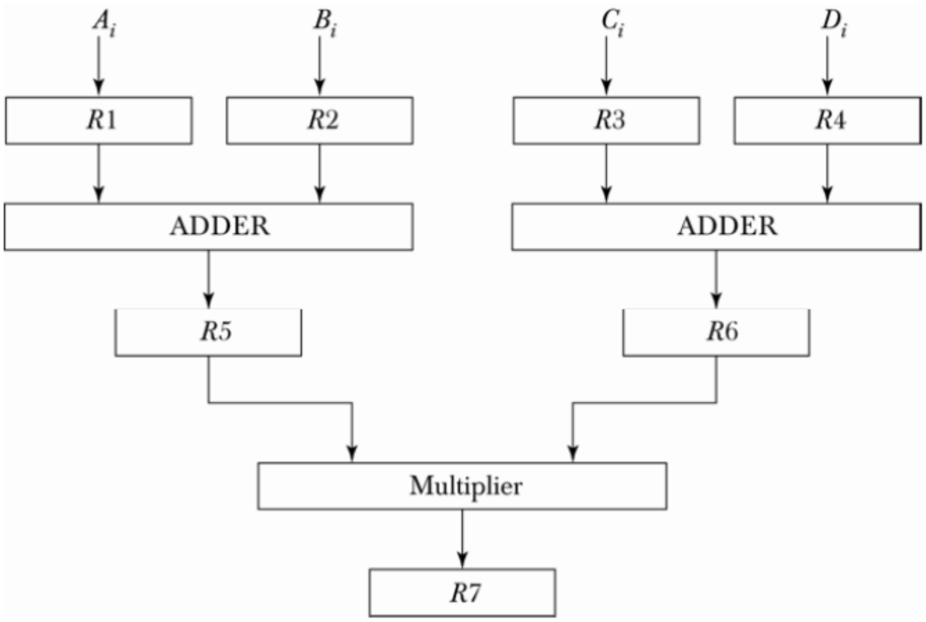
Solution: Tut 7

1.



2.

Segment	1	2	3	4	5	6	7	8	9	10	11	12	13
1	T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8					
2		T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8				
3			T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8			
4				T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8		
5					T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8	
6						T_1	T_2	T_3	T_4	T_5	T_6	T_7	T_8

$(k + n - 1)t_p = 6 + 8 - 1 = 13$ cycles

3.

k = 6 segments
n = 200 tasks $(k + n - 1) = 6 + 200 - 1 = 205$ cycles

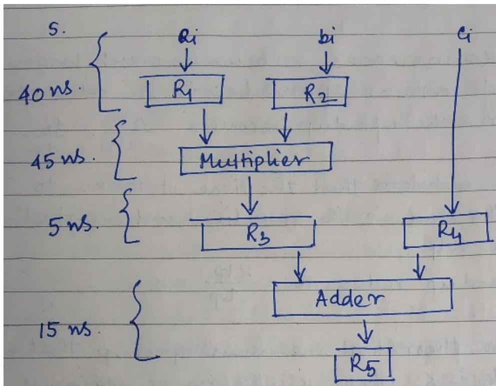
4.

$t_n = 50$ ns
$k = 6$
$t_p = 10$ ns
$n = 100$

$$S = \frac{nt_n}{(k+n-1)t_p} = \frac{100 \times 50}{(6-99) \times 10} = 4.76$$

$$S_{max} = \frac{t_n}{t_p} = \frac{50}{10} = 5$$

5.



Cl1.	Cl2	Cl3	Cl4	Cl5	Cl6	Cl7.	Cl8	Cl9
T_1	T_2	T_3	T_4	T_5	T_6	T_7		
	T_1	T_2	T_3	T_4	T_5	T_6	T_7	
		T_1	T_2	T_3	T_4	T_5	T_6	T_7

In between timings are not same.

then cycle time is calculated as $t = \max_i [t_i] + d$.

where t_i is the time delay of the circuitry in the ith stage of the pipeline.

d is the time delay of a latch, in general very much less than the $\max_i [t_i]$.

so in this problem $\max_i [t_i] = 45$ ns. $d = 5$ ns.

a. minimum cycle time is calculated as $t_p = 45 + 5 = 50$ ns.

b. Removing R_3 & R_4 the required time $t_n = 40 + 45 + 15$
$= 100$ ns.

c. speed up for 10 tasks $\rightarrow \dfrac{nt_n}{(K+n-1)t_p} = \dfrac{10 \cdot 100}{(3+10-1) \cdot 50}$

$= 1.67$.

speed up for 100 tasks $\Rightarrow \dfrac{nt_n}{(K+n-1)t_p} = \dfrac{100 \cdot 100}{(3+100-1) \cdot 50}$

$= 1.96$.

d. Maximum speed up possible $= t_n/t_p = 100/50 = 2$.

6. a. $t_p = \max_i [t_i] + d$

$= 95 + 5 = 100$ ns.

~~add 100 pairs no. of no.~~ no of tasks $n = 100$.
segment $K = 4$.

$\therefore$ Time to complete 100 tasks $= (n+K-1)t_p$
$= (100+4-1) \cdot 100$
$= 10300$ ns.
$= 10.3$ μs.