

## Assignment No. 1

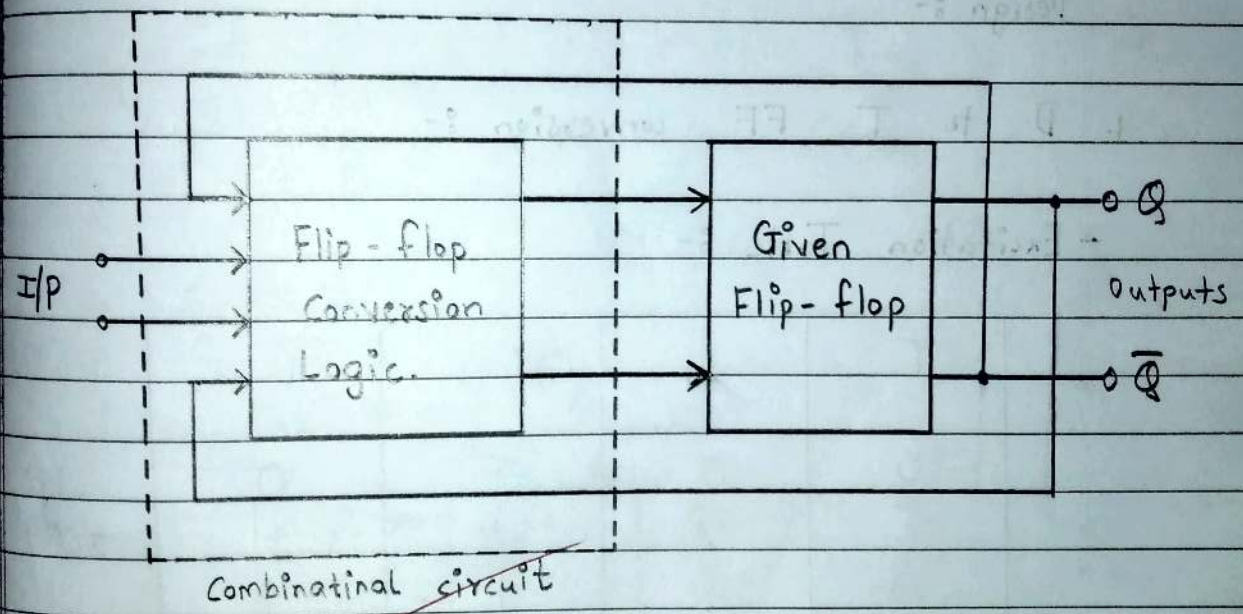
Title :- Flip-flop conversions.

Problem Statement :- Flip-flop conversion : Design and Realization.

Hardware and Software requirements :

Theory :-

Steps for flip-flop conversion :-



The required flip-flop is a combination of the given flip-flop (the flip-flop to be converted) and a combinational logic circuit using gates.

The inputs to flip-flop conversion logic are 'the data inputs' and the outputs of given flip-flop.

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The conversion logic is designed by combining the excitation tables of both the flip-flops.

The truth table of the conversion logic has data input and  $Q$  and  $\bar{Q}$  outputs of the given flip-flop as in whereas the inputs of the given FF are the outputs of the truth table.

Then we draw the K-Map of each output and obtain the simplified expressions. The conversion logic is then implemented using gates.

Design :-

1. D to T FF conversion :-

- Excitation Table :-

T	$Q_n$	$Q_{n+1}$	D	State
0	0	0	0	N/C
0	0	1	1	N/C
0	1	1	1	N/C
1	0	1	1	Set
1	1	0	0	Reset

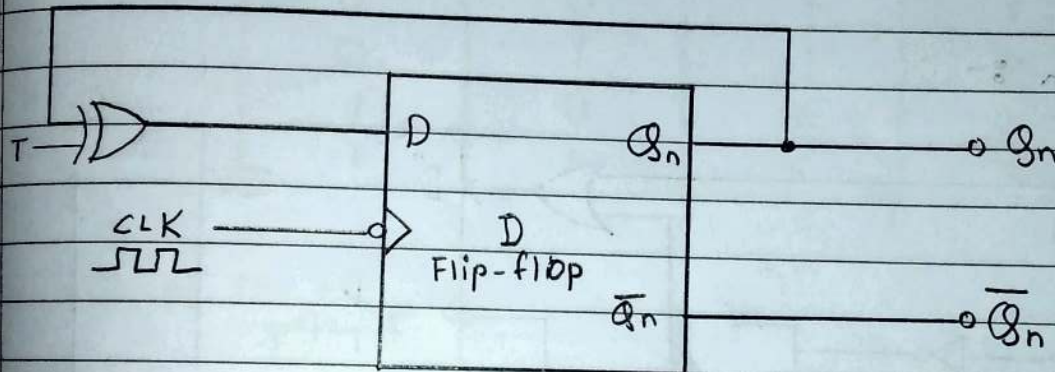
K-map :-

T \ Q <sub>n</sub>	0	1
0	0	1
1	1	0
	2	3

$$\therefore D = T\bar{Q}_n + \bar{T}Q_n$$

$$\therefore D = T \oplus Q_n$$

Diagram :-



D to S-R FF :-

Excitation Table :-

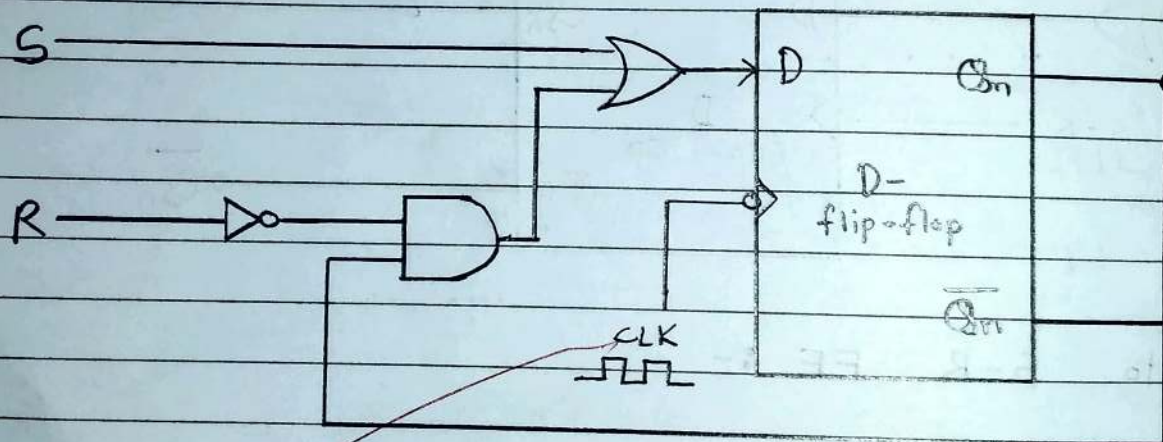
S	R	Q <sub>n</sub>	Q <sub>n+1</sub>	D
0	0	0	0	0
0	0	1	1	1
0	1	0	0	0
0	1	1	0	0
1	0	0	1	1
1	0	1	1	1
1	1	0	X	X
1	1	1	X	X

- K-Map :-

	S	RQ <sub>n</sub>	00	01	10	11	
0			0	1	0	0	
1			1	1	X	X	
			4	5	7	6	

$$\therefore D = S + \bar{R}Q_n$$

- Diagram :-



JK to SR FF :-

Excitation Table :-

S	R	$Q_n$	$Q_{n+1}$	J	K
0	0	0	0	0	X
0	0	1	1	X	0
0	1	0	0	0	X
0	1	1	0	0	1
1	0	0	1	1	0
1	0	1	1	X	0
1	1	0	X	X	X
1	1	1	X	X	X

K-Maps :-

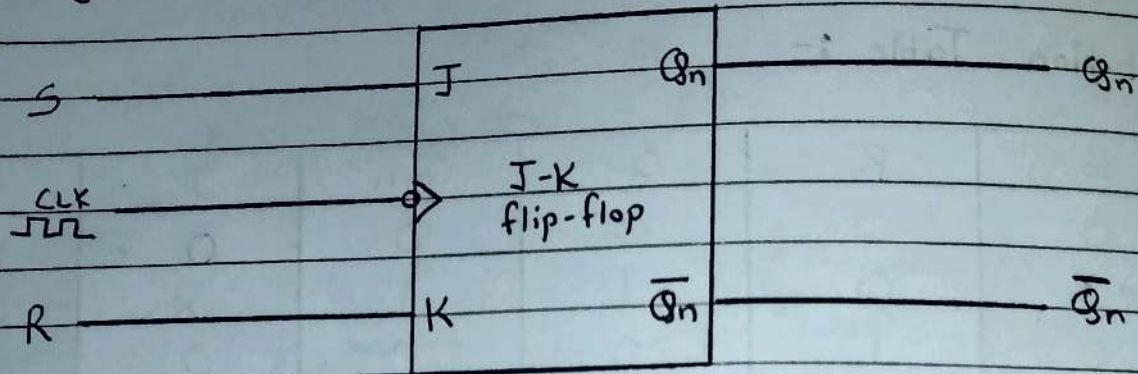
	$RQ_n$	00	01	11	10
S	0	0	X	0	0
	1	1	X	X	X

$\therefore J = S$

	$RQ_n$	00	01	11	10
S	0	X	0	1	X
	1	0	0	X	X

$\therefore K = R$

- Diagram :-



4. J-K to D FF :-

- Table :-

D	$Q_n$	$Q_{n+1}$	J	K
0	0	0	0	X
0	1	0	0	1
1	0	1	1	0
1	1	1	X	0

- K-Map :-

	$Q_n$	
D	0	1
0	0	0
1	1	1
	2	3

$\therefore J = D$

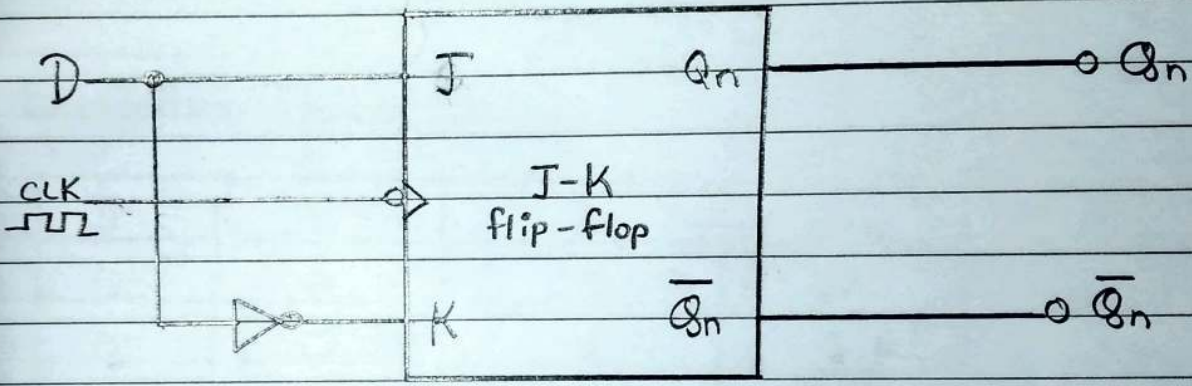
	$Q_n$	
D	0	1
0	X	1
1	0	0
	2	3

$\therefore K = \bar{D}$

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Diagram :-



Conclusion :- Hence, flip-flop conversions studied.