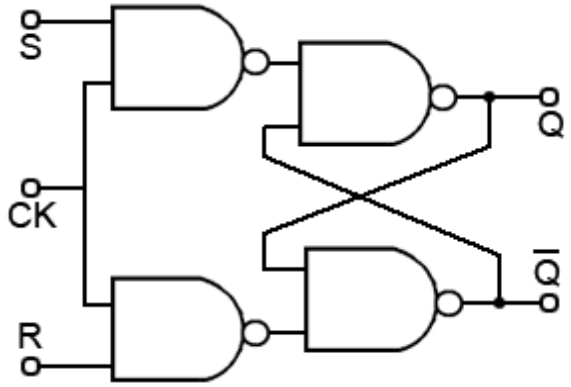
Flip-Flop Conversion

Steps To Convert from One Flip Flop to Other :

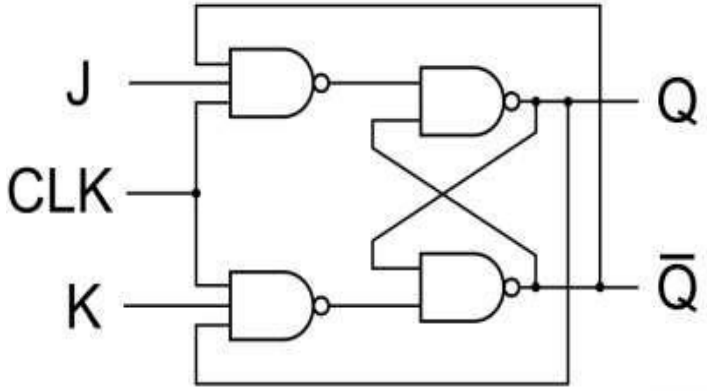
1. Draw the Truth Table of required flip flop.
2. Write the corresponding outputs of sub-flip flop to be used from the Excitation Table.
3. Draw the Conversion table.
4. Draw K-Maps using required flip flop inputs and obtain excitation functions for sub-flip flop inputs.
5. Construct logic diagram according to the functions obtained.

Truth Table (Characteristics Table)



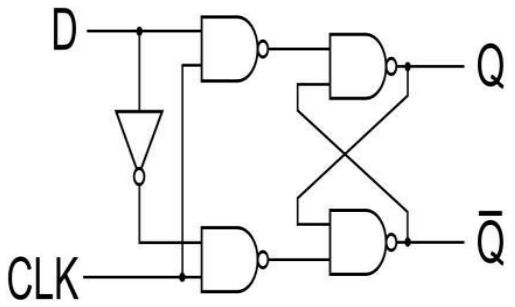
TRUTH TABLE

S	R	Q_N	Q_{N+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	-
1	1	1	-

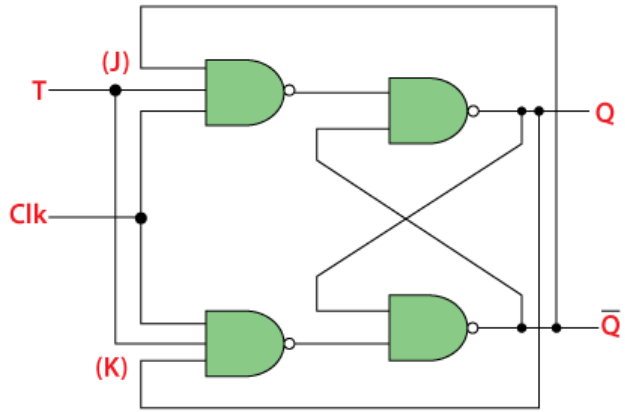


TRUTH TABLE

J	K	Q_N	Q_{N+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0



Q	D	Q(t+1)
0	0	0
0	1	1
1	0	0
1	1	1



T	Q_n	Q_{n+1}
0	0	0
0	1	1
1	0	1
1	1	0

Excitation Table:

- During design of sequential circuits,

Required transition form present state to next state and to find Flip Flop input conditions that will cause the required transition.

- For this reason we need a table , Such a table is called a flip-flop excitation table.

Excitation Table

Q_N	Q_{N+1}	S	R	J	K	D	T
0	0	0	X	0	X	0	0
0	1	1	0	1	X	1	1
1	0	0	1	X	1	0	1
1	1	X	0	X	0	1	0

Conversion of SR Flip Flop to JK Flip Flop

1. Truth Table for JK flip-flop

Inputs		Outputs	
J	K	Q_n	Q_{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	0	1
1	1	1	0

2. Excitation Table for SR flip-flop

Outputs		Inputs	
Q_n	Q_{n+1}	S	R
0	0	0	X
0	1	1	0
1	0	0	1
1	1	X	0

3. Conversion Table

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

4. K-map Simplification

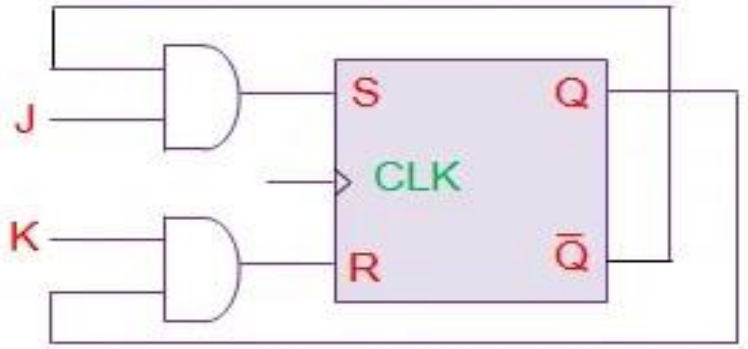
J \ KQ_n	00	01	11	10
0	0 [0]	X [1]	0 [3]	0 [2]
1	1 [4]	X [5]	0 [7]	1 [6]

$S = J\bar{Q}_n$

J \ KQ_n	00	01	11	10
0	X [0]	0 [1]	1 [3]	X [2]
1	0 [4]	0 [5]	1 [7]	0 [6]

$R = KQ_n$

5. Circuit Design



Q. Conversion of D Flip Flop to SR Flip Flop

1. Truth Table for SR flip-flop

S	R	Q_n	Q_{n+1}
0	0	0	0
0	0	1	1
0	1	0	0
0	1	1	0
1	0	0	1
1	0	1	1
1	1	invalid	
1	1	invalid	

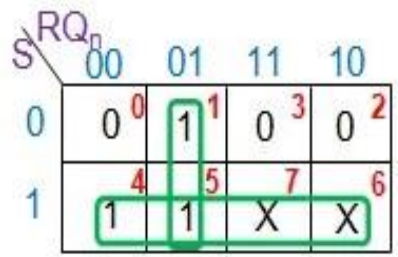
2. Excitation Table for D flip-flop

Outputs		Input
Q_n	Q_{n+1}	D
0	0	0
0	1	1
1	0	0
1	1	1

3. Conversion Table

S	R	Q_n	Q_{n+1}	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	invalid		X
1	1	invalid		X

4. K-map Simplification



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

5. Circuit Design