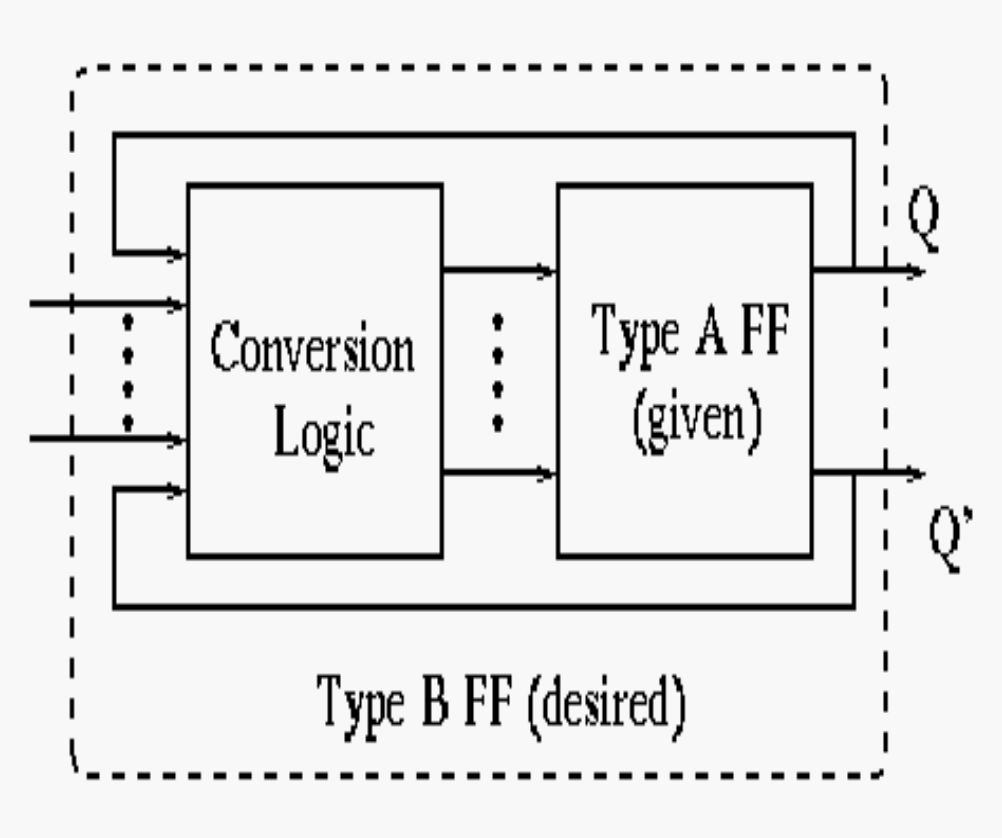
Flip flop Conversion

Flipflop Conversions

The purpose is to convert a given type A FF to a desired type B FF using some conversion logic.



Excitation Table

The key here is to use the excitation table, which shows the necessary triggering signal (SR, JK, D and T) for a desired flip flop state transition $Q_t - Q_{t+1}$:

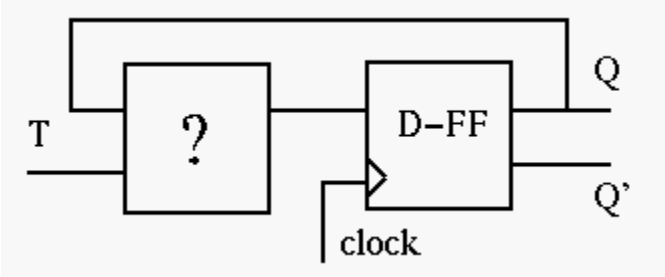
Q_t	Q_{t+1}	S	R	J	K	D	T
0	0	0	x	0	x	0	0
0	1	1	0	1	x	1	1
1	0	0	1	x	1	0	1
1	1	x	0	x	0	1	0

Excitation Table of Flip flops based on characteristics table

Convert a D-FF to a T-FF

The output of D flip flop should be as the output of T flip flop.

We need to design the circuit to generate the triggering signal D as a function of T and Q: D = f(T, Q)



Consider the excitation table of T and D Flip flops.

Write Down Excitation Table of T, Qn and Qn+1, D. For the K-map, consider T and Qr As Input and D as output.

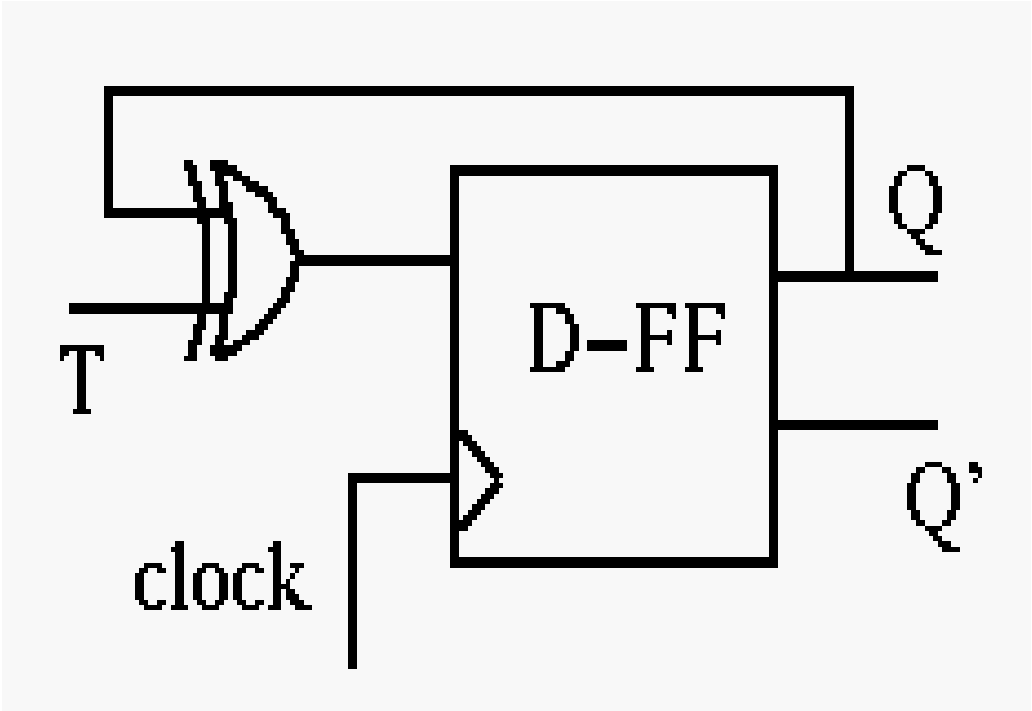
D = TQn' + T'Qn (Ex- OR gate)

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

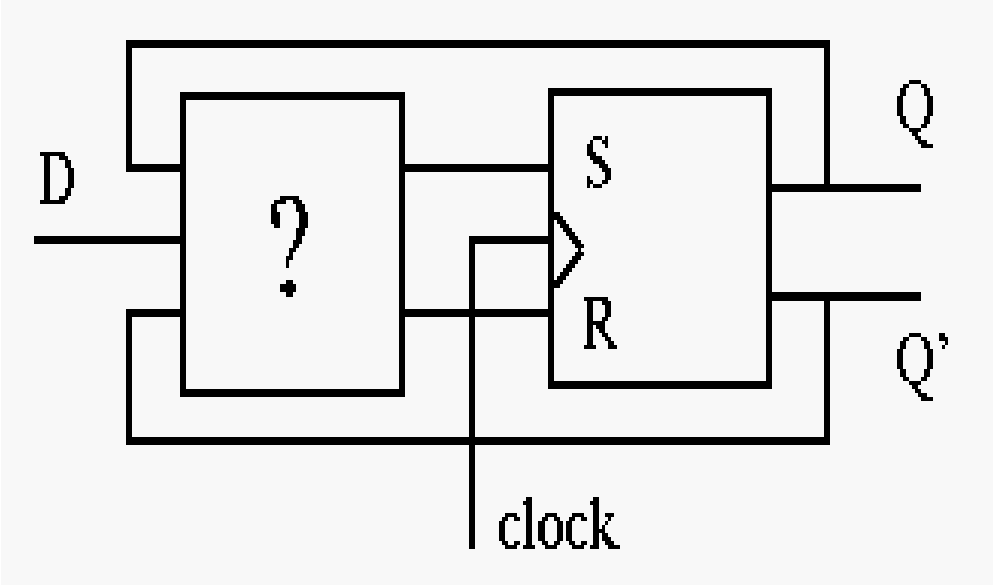
Convert a D-FF to a T-FF

Treating as a function of and current FF state Q (Q_t), we have:

$$D = T'Q + TQ' = T \oplus Q$$



Convert a RS-FF to a D-FF

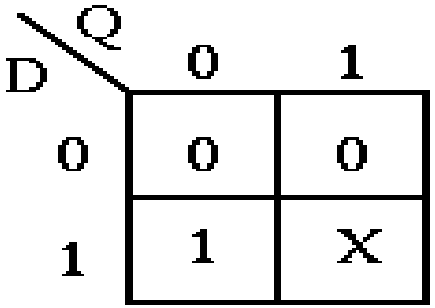


We need to design the circuit to generate the triggering signals S and R as functions of D and Q.

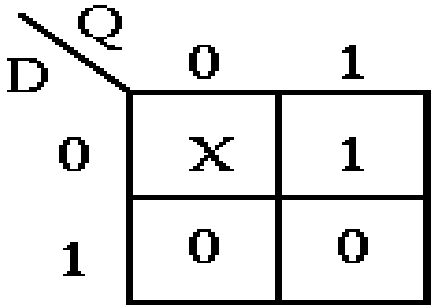
Consider the excitation table

D	Q_t	Q_{t+1}	S	R
0	0	0	0	x
1	0	1	1	0
0	1	0	0	1
1	1	1	x	0

The desired signal S and R can be obtained as functions of D and Q current FF state from the Karnaugh maps:

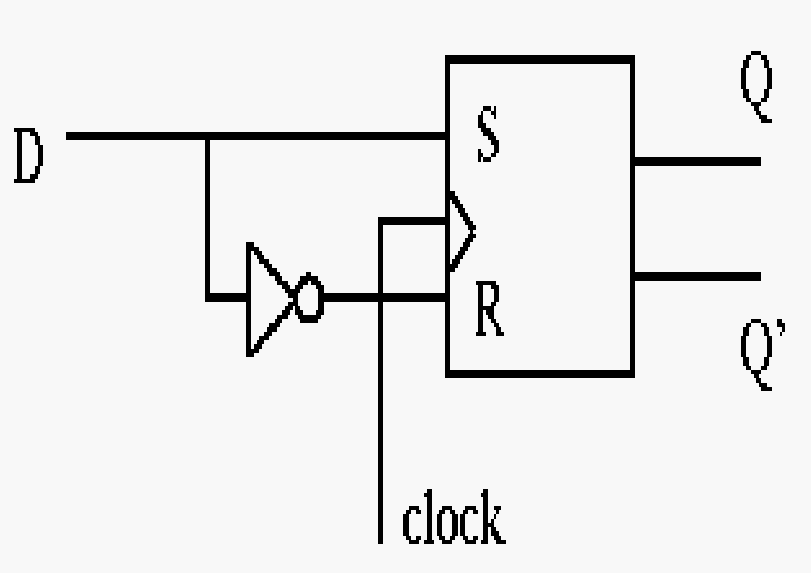


S=D

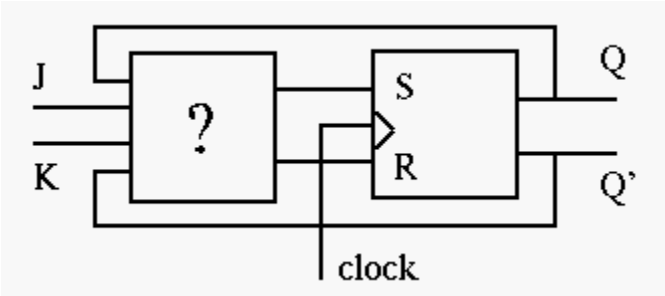


R=D'

Convert a D-FF to a T-FF



Convert a RS-FF to a JK-FF

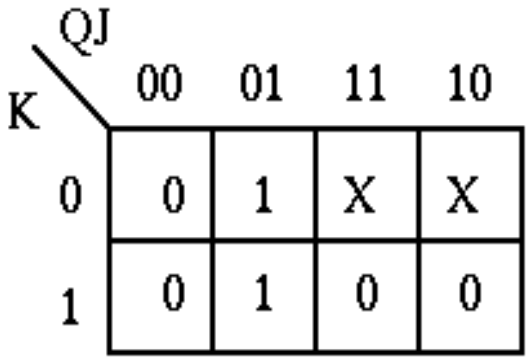


We need to design the circuit to generate the triggering signals S and R as functions of J, K and Q. Consider the excitation table:

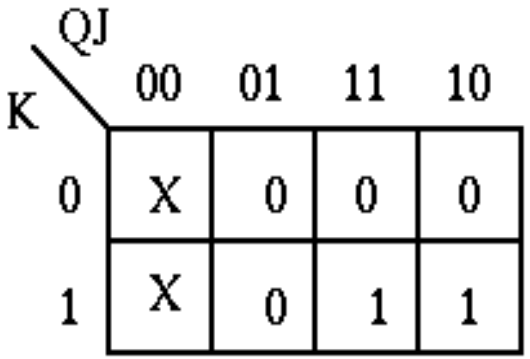
J	K	Q_t	Q_{t+1}	S	R
0	x	0	0	0	x
1	x	0	1	1	0
x	1	1	0	0	1
x	0	1	1	x	0

Convert a RS-FF to a JK-FF

The desired signal S and R as functions of J, K and current FF state Q can be obtained from the Karnaugh maps:

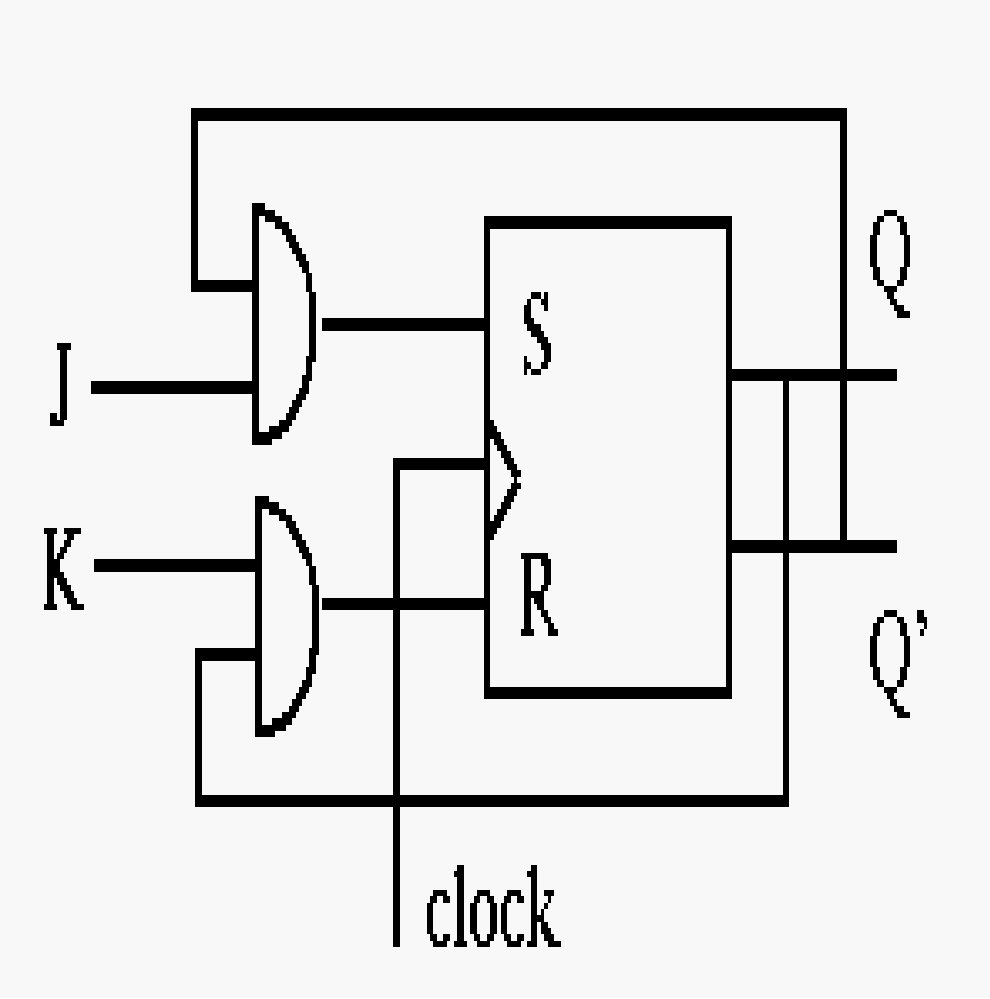


S=Q'J



R=QK

Convert a RS-FF to a JK-FF



Assignment 23: Total Conversions

SR ---- JK
D
T
D ------ T
SR
JK
T --------D
SR
JK
JK------ D
T
SR

Total Conversions – 12 (Practice for all)