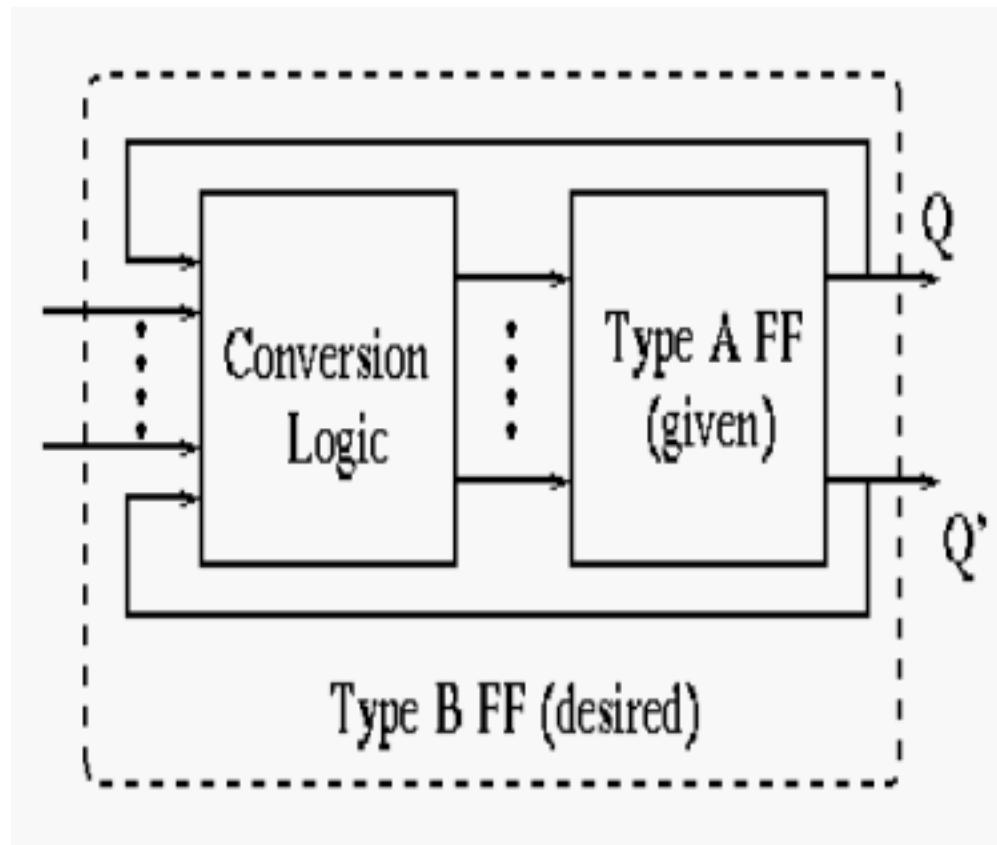


# **Flip flop Conversion**

## **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

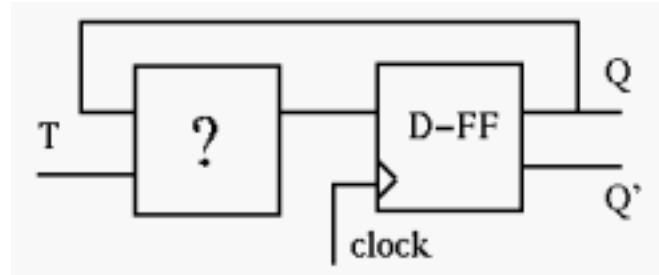
triggering signal (SR, JK, D and T) for a desired flip flop state transition  
 $Q_t - Q_{t+1}$ :

$Q_t$	$Q_{t+1}$	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,  $Q_n$  and

$Q_{n+1}$ , D. For the K-map, consider T and  
 $Q_n$

As Input and D as output.

$$D = TQ_n' + T'Q_n \text{ (Ex- OR gate)}$$

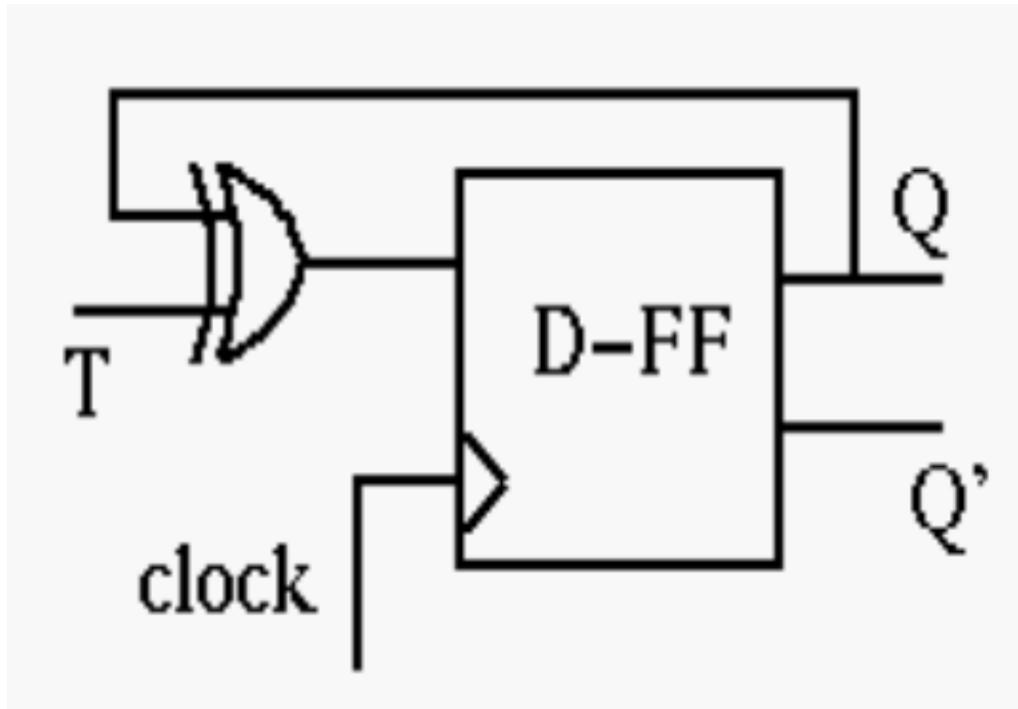
T	$Q_n$	$Q_{n+1}$	D
0	0	0	0
1	0	1	1
1	1	0	0
0	1	1	1

**Convert a D-FF to a T-FF**

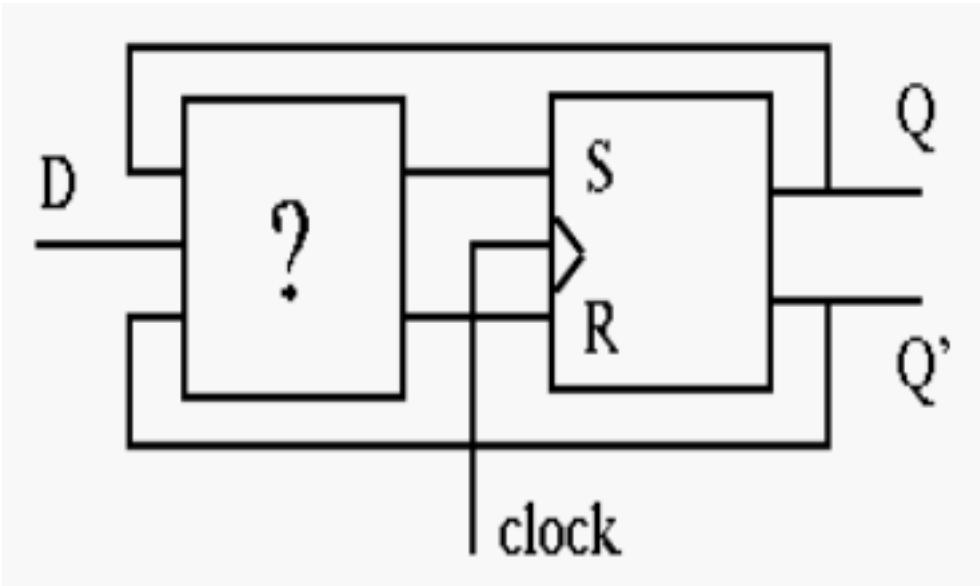
Treating as a function of and current FF state Q ( $Q_t$ ), we

have:

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



Convert a RS-FF to a D-FF

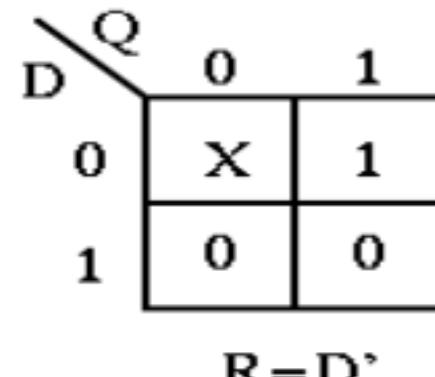
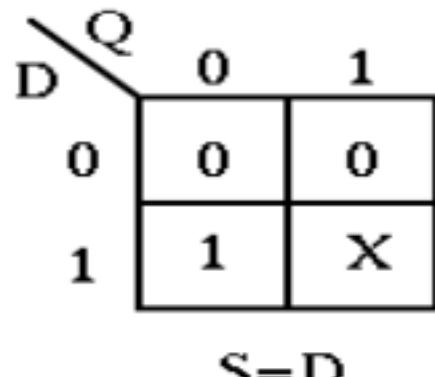


We need to design the circuit to generate the triggering signals S and R as functions of D and Q.

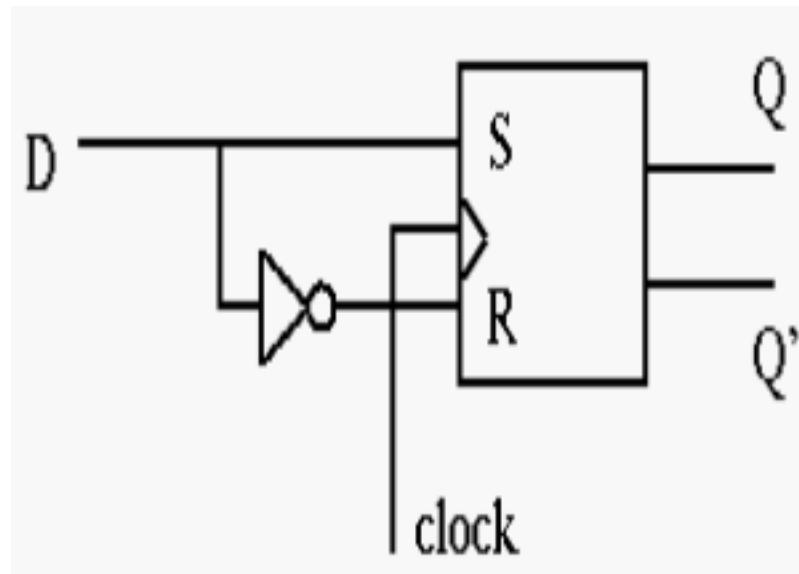
Consider the excitation table

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

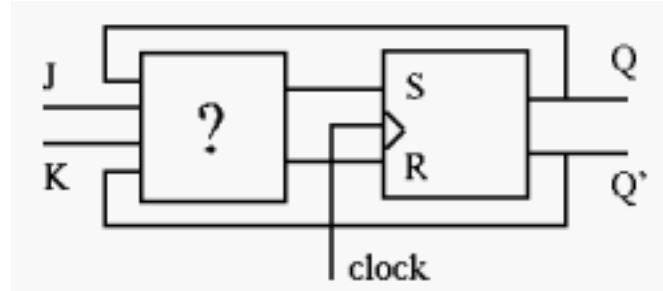
The desired signal S and R can be obtained as functions of D and Q current FF state from the Karnaugh maps:



## 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:

		QJ	00	01	11	10
		K	0	1	X	X
		0	0	1	X	X
		1	0	1	0	0

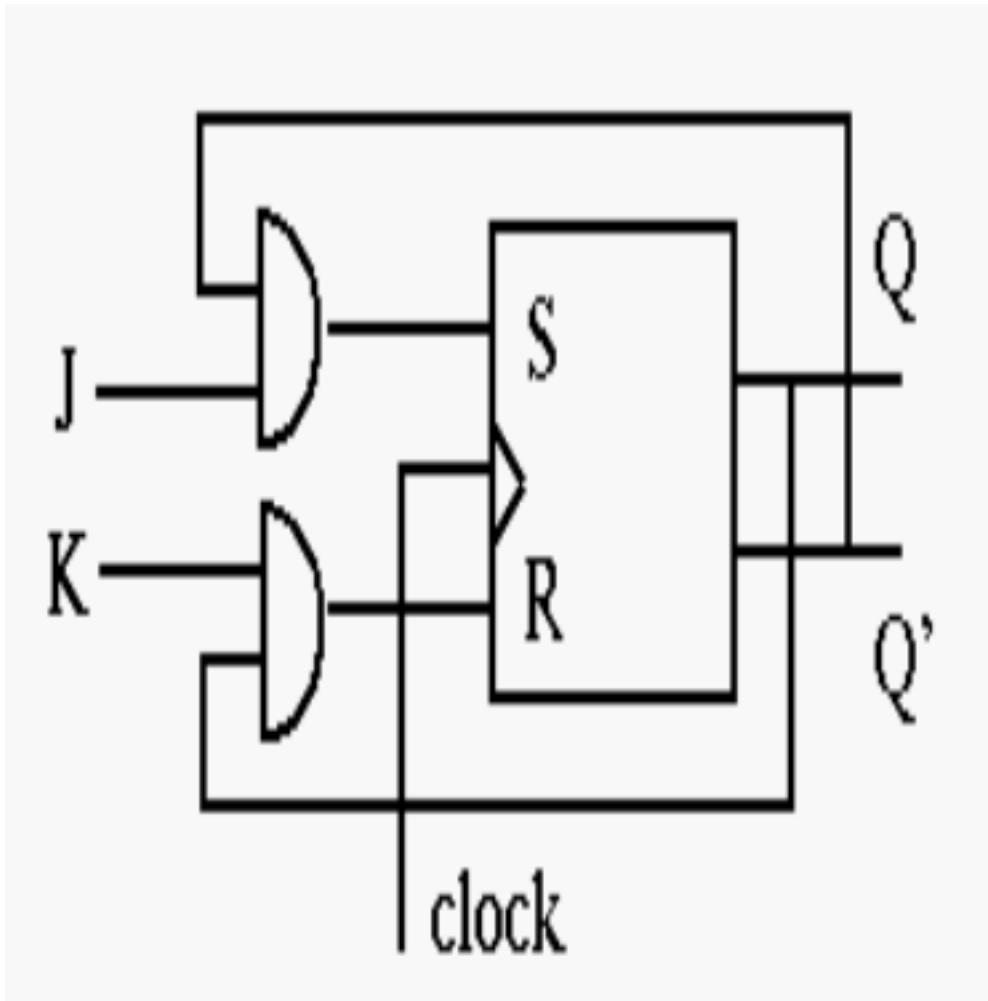
$$S = Q'J$$

		QJ	00	01	11	10
		K	0	1	0	0
		0	X	0	0	0
		1	X	0	1	1

$$R = QK$$

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)

**Assignment - 23**

How about this conversion?

