

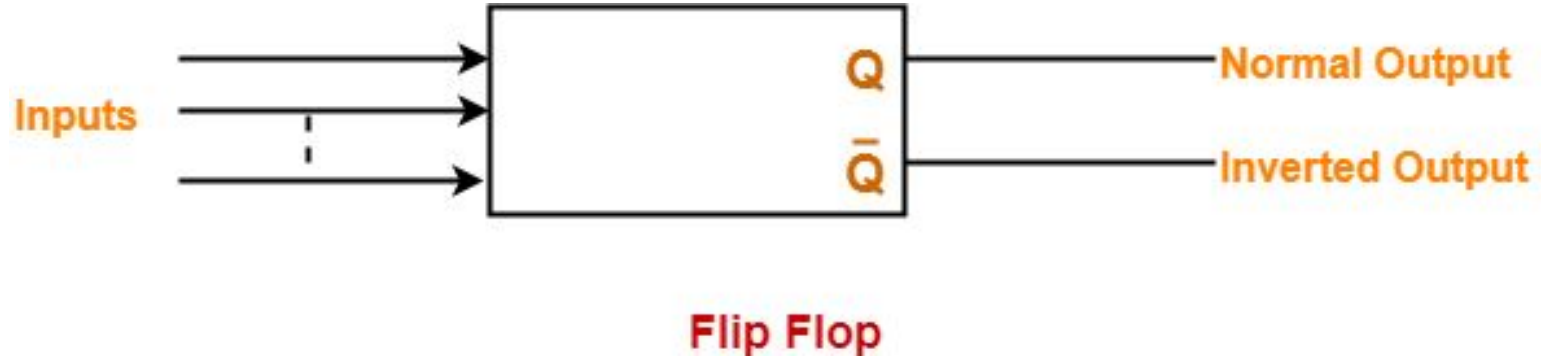
# Flip flops

# Introduction

- A Flip Flop is an electronic circuit that is capable of storing one bit of information.
- It is a memory element that is capable of storing one bit of information.
- It has two stable states either 0 or 1.

# Introduction

A flip flop has two outputs as shown-



# Flip flop types

Flip flops are of different types depending on how their inputs and clock pulses cause transition between two states.

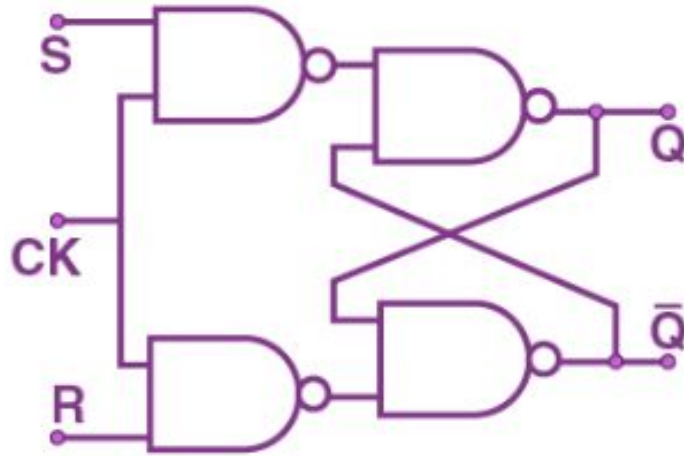
There are 4 basic types of flip flops-

1. SR Flip Flop
2. JK Flip Flop
3. D Flip Flop
4. T Flip Flop

# SR Flip flop

- SR flip flop is the simplest type of flip flops.
- It stands for **Set Reset flip flop**.
- It is a clocked flip flop.
- Following are the two methods for constructing a SR flip flop-
  1. By using NOR latch
  2. By using NAND latch

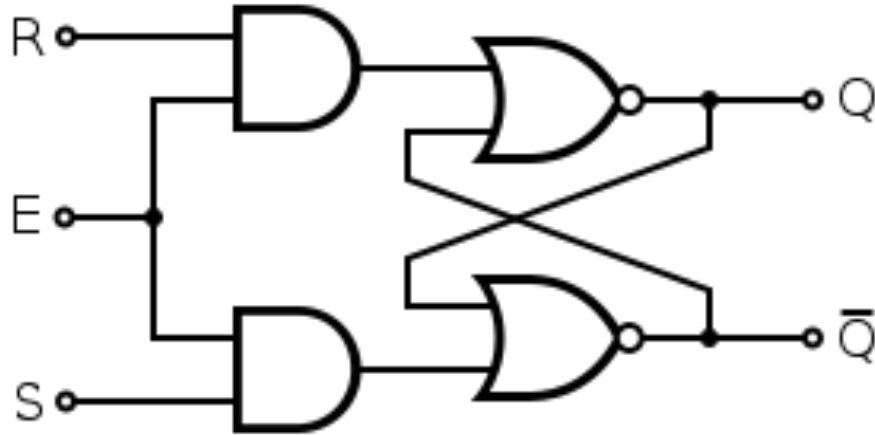
# 1. Construction of SR Flip Flop By Using NAND Latch-



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	-

## 2. Construction of SR Flip Flop By Using NOR Latch-

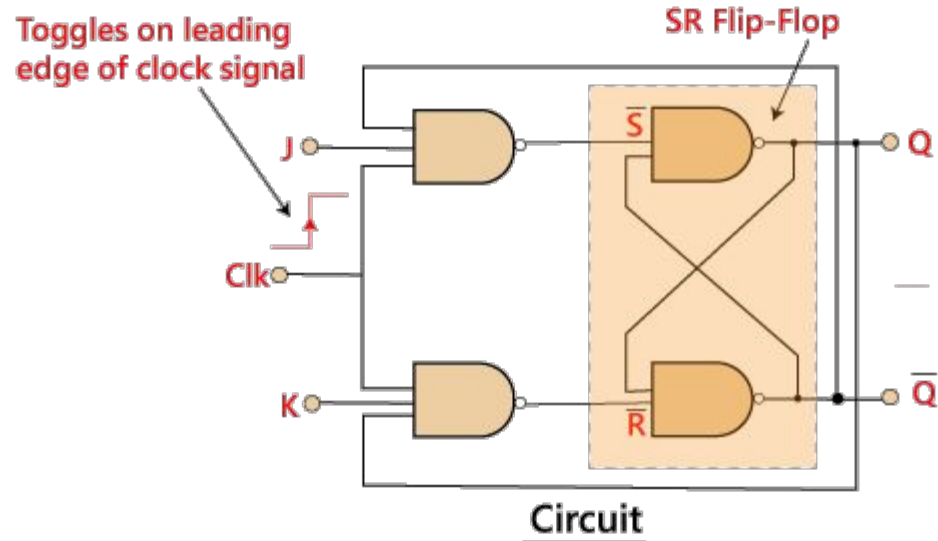


# JK Flip flop

- JK flip flop is a refined & improved version of SR flip flop that has been introduced to solve the problem of indeterminate state that occurs in SR flip flop when both the inputs are 1.
- There are following two methods for constructing a JK flip flop-



# JK Flip flop



J	K	$Q_n$	$Q_{n+1}$	State
0	0	0	0	$Q_n$ (Hold)
0	0	1	1	
0	1	0	0	Reset
0	1	1	0	
1	0	0	1	Set
1	0	1	1	
1	1	0	1	Toggle
1	1	1	0	

# JK Flip flop

J	K	$Q_n$	$Q_{n+1}$	State
0	0	0	0	$Q_n$ (Hold)
0	0	1	1	
0	1	0	0	Reset
0	1	1	0	
1	0	0	1	Set
1	0	1	1	
1	1	0	1	Toggle
1	1	1	0	

		$KQ_n$			
		00	01	11	10
J	0		1		
	1	1	1		1

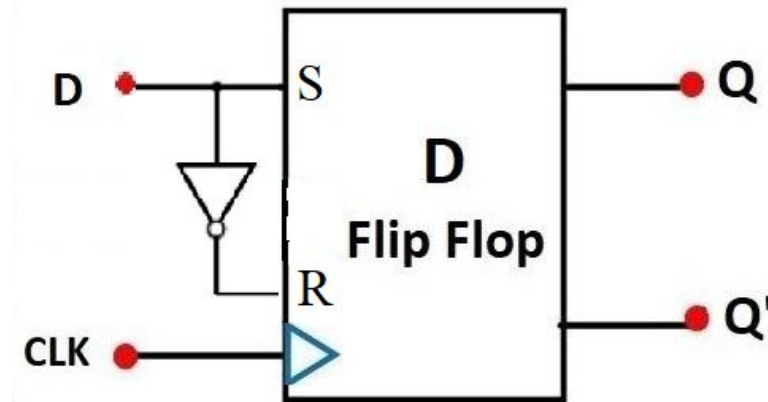
$\therefore$  Characteristic equation is  $Q_{n+1} = J\bar{Q}_n + \bar{K}Q_n$

# D Flip flop

- D stands for data thus it is used to store data.
- The basic building block of D flip flop is SR flip flop.
- In SR flip flop if both i/p are same, o/p is either no change or it is invalid (*i/o -> 00, No change and o/p -> 1 1, Invalid*).
- These conditions can be avoided by making them complement of each other. This modified SR flip flop is called as D flip flop.

# D Flip flop

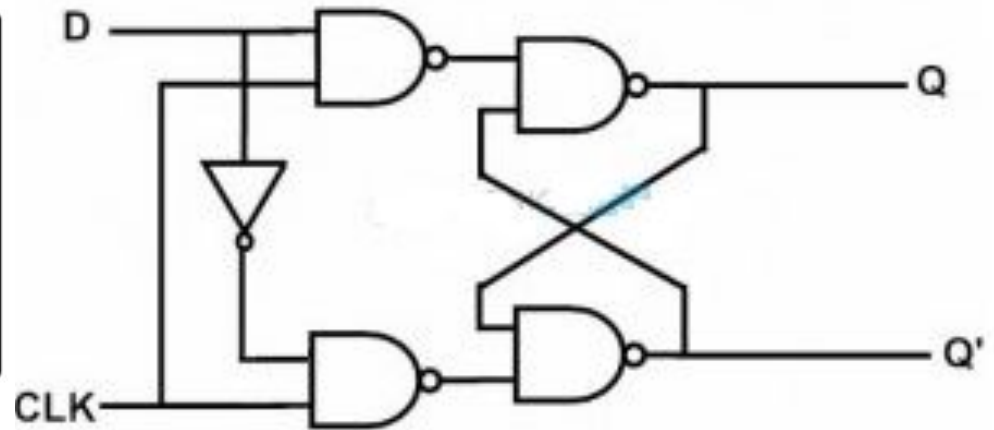
- The input D goes directly to i/p S and its complement is applied to R i/p. Due to this, only two i/p conditions exist:  $S=0 \ \& \ R=1$  or  $S=1 \ \& \ R=0$ .



# D Flip flop

D	S	R	Q	State
	0	0	Previous State	No Change
0	0	1	0	Reset
1	1	0	1	Set
	1	1	?	Forbidden

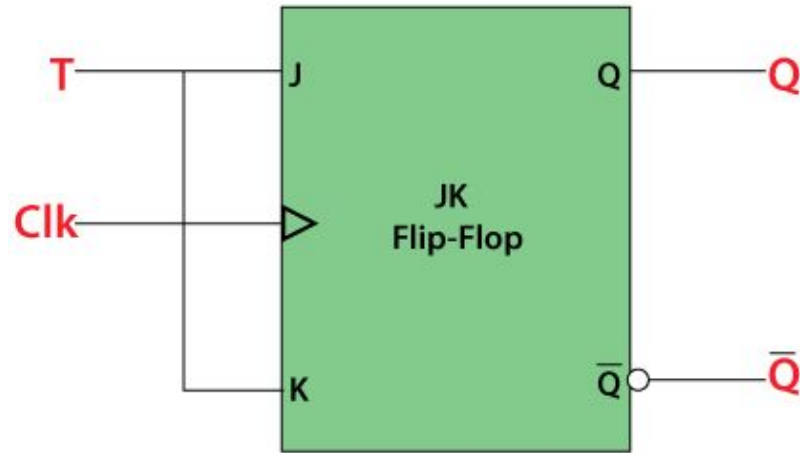
SR & D Flip Flop TruthTable



# T (Toggle) Flip flop

- We can design the T flip flop by making simple modifications to the JK flip flop.
- The T flip flop is a single input device and hence by connecting J and K inputs together and giving them with single input called T, we can convert a JK flip flop into T flip flop.
- So, a T flip flop is sometimes called as single input JK flip flop.

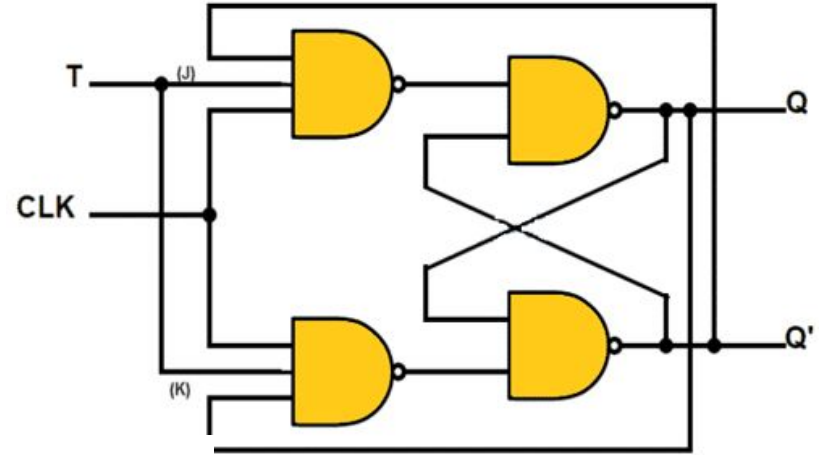
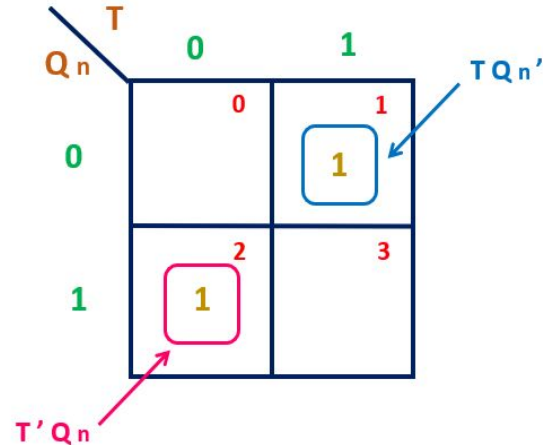
# T (Toggle) Flip flop



# T (Toggle) Flip flop

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

$T$	$Q_{n+1}$
0	$Q_n$
1	$Q_n'$



$$Q_{n+1} = TQ_n' + T'Q_n$$

$$= T \oplus Q_n$$