Quaid-e-Awam University of Engineering, Science and Technology

بسم الله الرحمن الرحيم

In the name of Allah, the Most Merciful, the Most Kind

Date: 15-11-2021

BCS 103
Digital Logic & Computer Architecture

Lecture 33 and 34

Department of Computer Science

LAST LECTURE

In the Last Lecture

- **Multiplexer**
- **De-multiplexer**

TODAY'S LECTURE

Today we will discuss about:

- **Sequential Logic Circuits**
- **Flip-Flop**

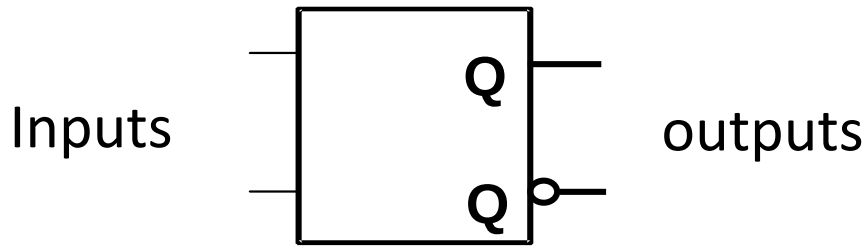
Combinational vs Sequential Circuits

- **Combinational circuits** are defined as the time independent circuits which do not depends upon previous inputs to generate any output are termed as combinational circuits.
- **Sequential circuits** are those which are dependent on clock cycles and depends on present as well as past inputs to generate any output.

Flip Flop

Flip Flop

- Flip-Flop is a memory element which is capable of storing one bit of information and it is mostly used in clocked sequential circuits.
- A Flip-Flop has two outputs, one for normal value and other for complement value of the bit stored in it.
- A Flip-Flop can maintain a binary state indefinitely (as long as power is delivered to the circuit) until directed by an input signal to switch states.
- A Flop-Flop is also known as Bistable Multivibrator.



Flip Flop

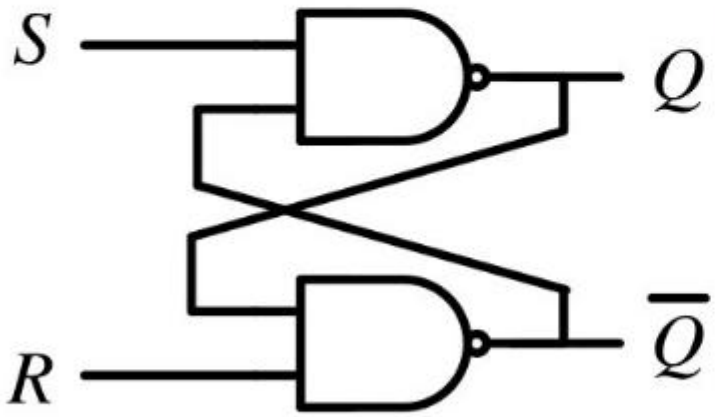
- Flip-Flops are of different types depending on how their inputs and clock pulses cause transition between two states.
- There are four Basic types:
    1. SR Flip-Flop / RS Flip-Flop
    2. JK Flip-Flop
    3. D Flip-Flop
    4. T Flip-Flop

Flip Flop Usage / Applications

- For Memory circuits
- For Logic Control Devices
- For Counter Devices
- For Register Devices

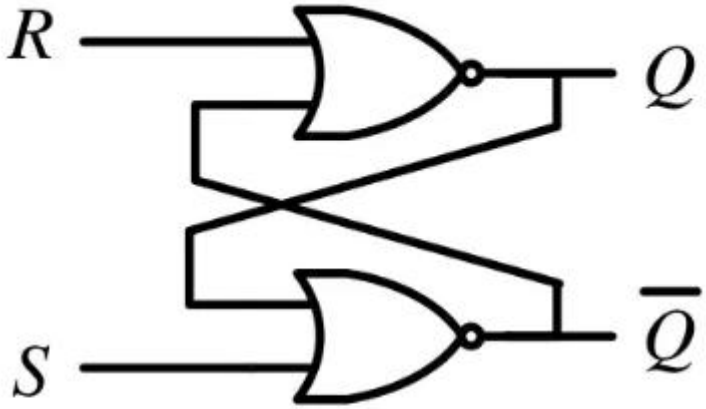
SR Flip Flop

SR Flip Flop - NAND GATE LATCH



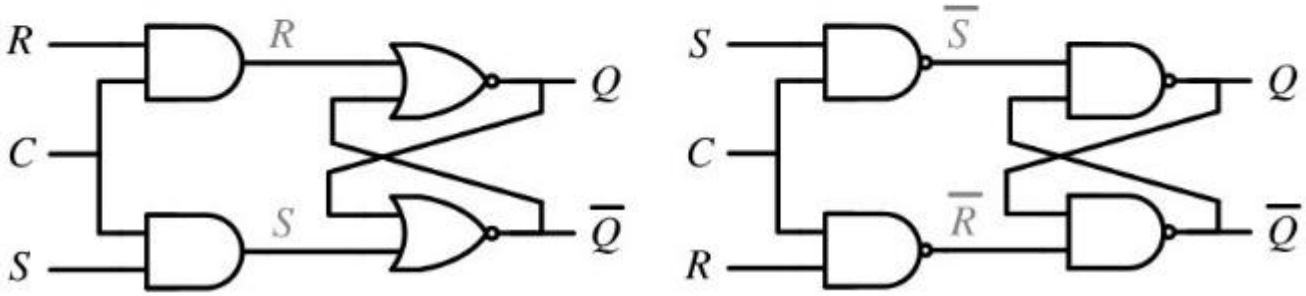
S R	Q	
0 0	$Q=Q'=1$	Invalid
0 1	1	Set
1 0	0	Reset
1 1	Q_0	No change

RS Flip Flop - NOR GATE LATCH



S	R	Q	
0	0	Q_0	No change
0	1	0	Reset
1	0	1	Set
1	1	$Q=Q'=0$	Invalid

Clocked SR Flip Flop



C S R	Q	
0 x x	Q_0	No change
1 0 0	Q_0	No change
1 0 1	0	Reset
1 1 0	1	Set
1 1 1	$Q=Q'$	Invalid

Thanks