Logic Gate

College of
Engineering & Technology

Al-Mustaqbal
University

Level 1 , Semester 1
@ Department of prosthetic and orthotic Engineering

Prepared by
Dr. Samir Badrawi

Flip Flops

Logic Circuits : *Combinational Logic* & *Sequential Logic*

Combinational Logic:

- *Output depends only on current input*
- Has *no memory*

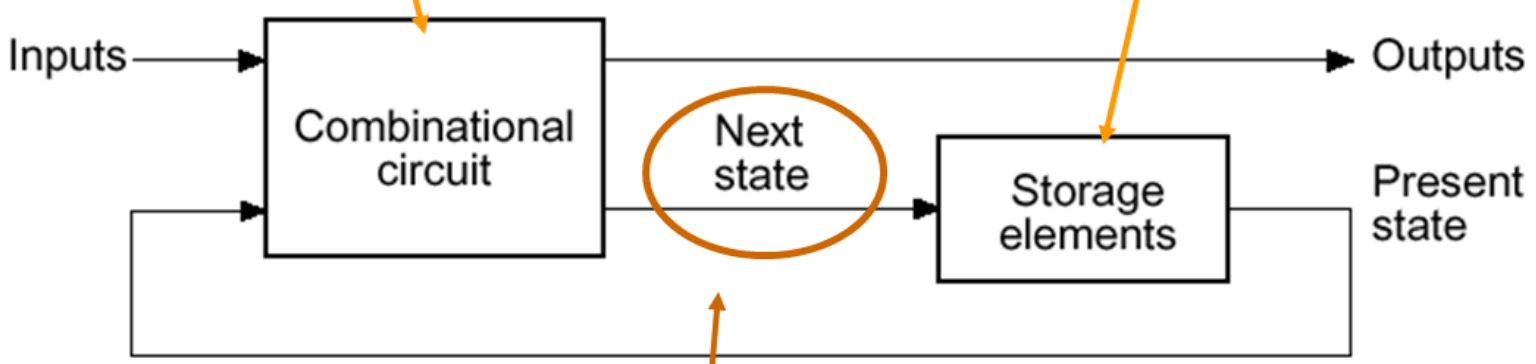
Sequential Logic:

- *Output depends not only on current input but also on past input values.*
- *Need some type of memory to remember the past input values*

Sequential Circuits

Circuits that we have learned so far

Information Storing Circuits



Timed "States"

Sequential Logic

The fundamentals of sequential logic is based on: *Bistable*, *monostable*, and *astable* logic devices called ***multivibrators (متعدد الاهتزازات)***.

Two categories of ***bistable*** devices are the:-
latch (المزلاج) and the **flip-flop (ن ط)**.

Monostable (ONE shot) **: one stable state**	**حالة واحدة مستقرة**
Astable **: No stable state**	**لاتوجد حالة مستقرة**
Biostable **: two stable state**	**حالتان مستقرتان**

Sequential Logic : concept

- Output Sequential Logic circuits remember past inputs and past circuit state.
- Outputs from the system are “fed back” as new inputs
- The storage elements are circuits that are capable of storing binary information: memory.

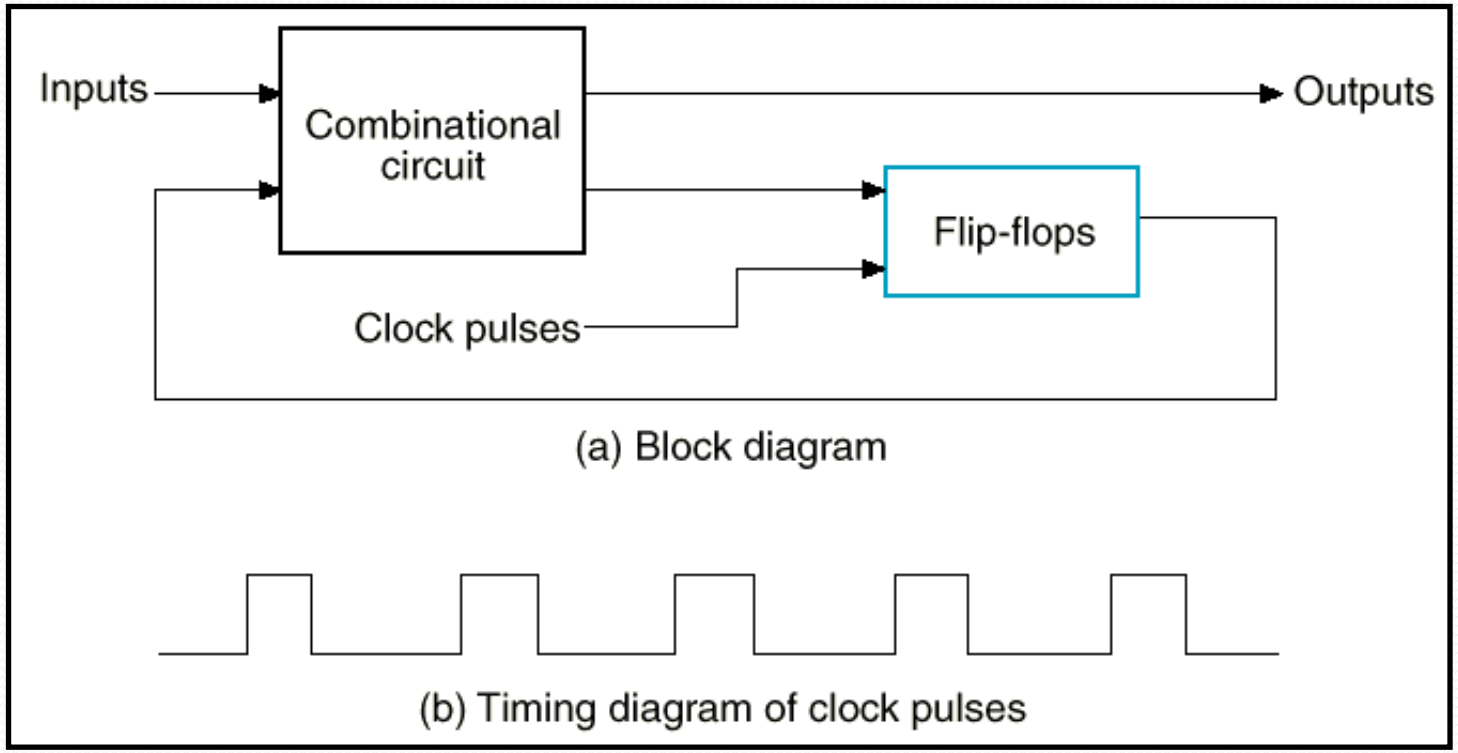
Synchronous *vs*. Asynchronous Sequential Logic

There are two types of sequential circuits:

- ***Synchronous*** sequential circuit: circuit output changes only at some discrete instants of time. This type of circuits achieves synchronization by using a timing signal called the ***clock***.

- ***Asynchronous*** sequential circuit: circuit output can change at **any** time (***clockless***).

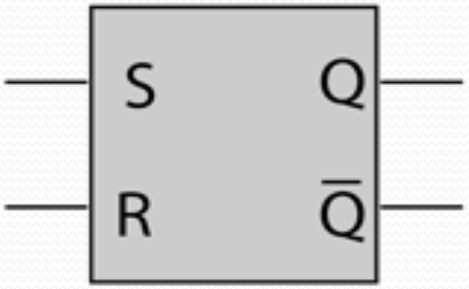
Synchronous Sequential Circuits: *Flip flops* as state memory



- The flip-flops receive their inputs from the combinational circuit and also from a clock signal with pulses that occur at fixed intervals of time, as shown in the timing diagram.

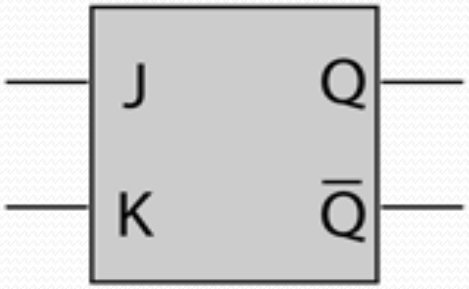
Flip-Flops

"Flip-flop" is the common name given to two-state devices which offer basic memory for sequential logic operations. Flip-flops are heavily used for digital data storage and transfer and are commonly used in banks called "registers" for the storage of binary numerical data.



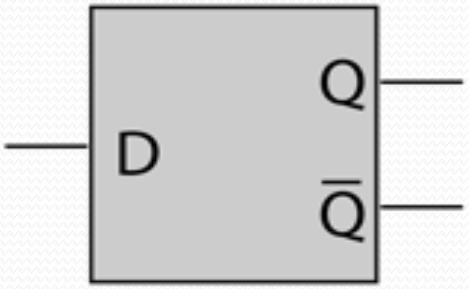
Set/Reset Type

Basic data storage device which holds data until reset occurs.



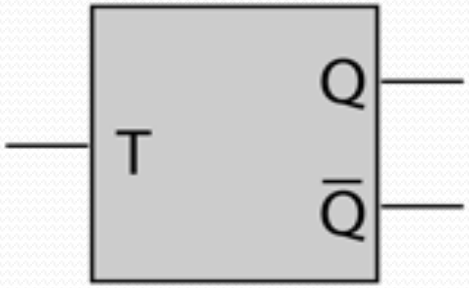
J-K Type

Most versatile of basic flip-flops. Two-input behavior plus toggle type behavior.



D Type

Basic data flip-flop has advantage of simpler wiring than J-K version.

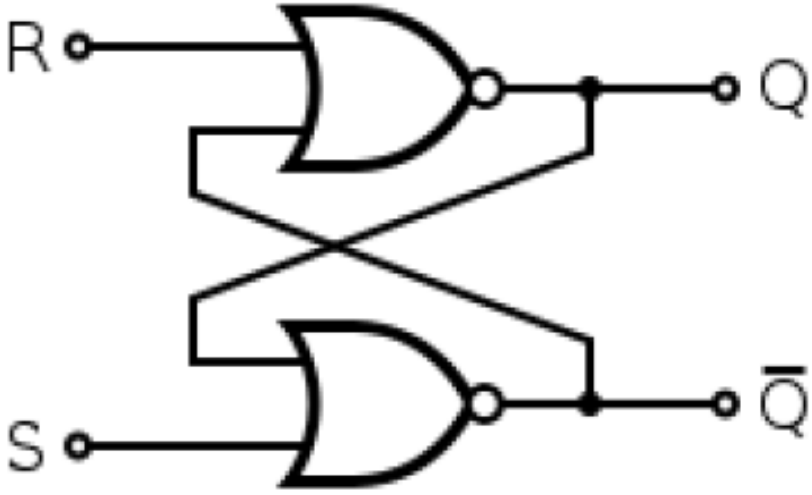


Toggle Type

"Toggle" action is useful for counters. Can be constructed from any of the basic flip-flops.

S-R Latch

An **SR latch** (Set/Reset) is an asynchronous device: it works independently of control signals and relies only on the state of the S and R inputs.
In the image, we can see that an SR latch can be created with two NOR gates that have a cross-feedback loop.



An SR latch made from two NOR gates.

تمارین

Quiz

MID