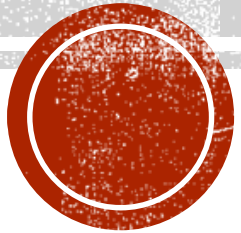
SEQUENTIAL LOGIC SYSTEM

Chapter 1 : Understand the features of Sequential Logic Circuits

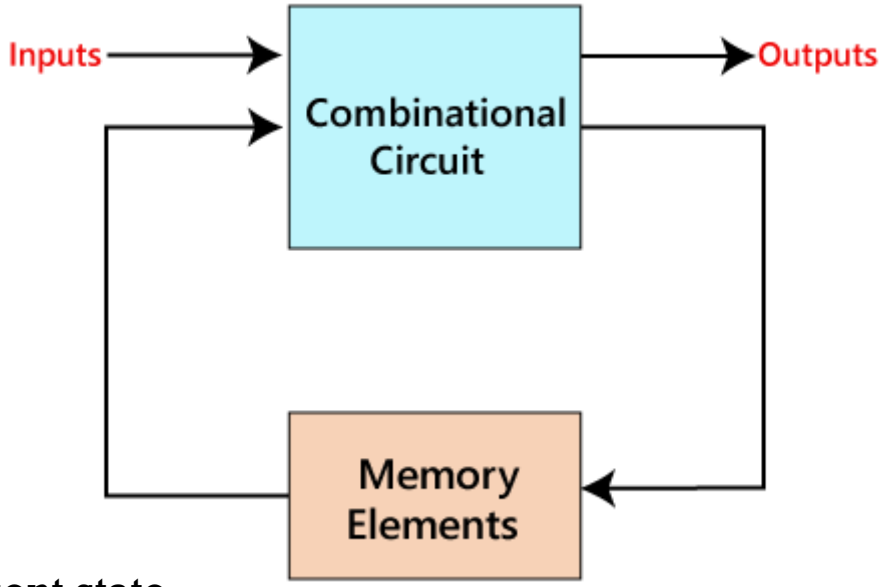


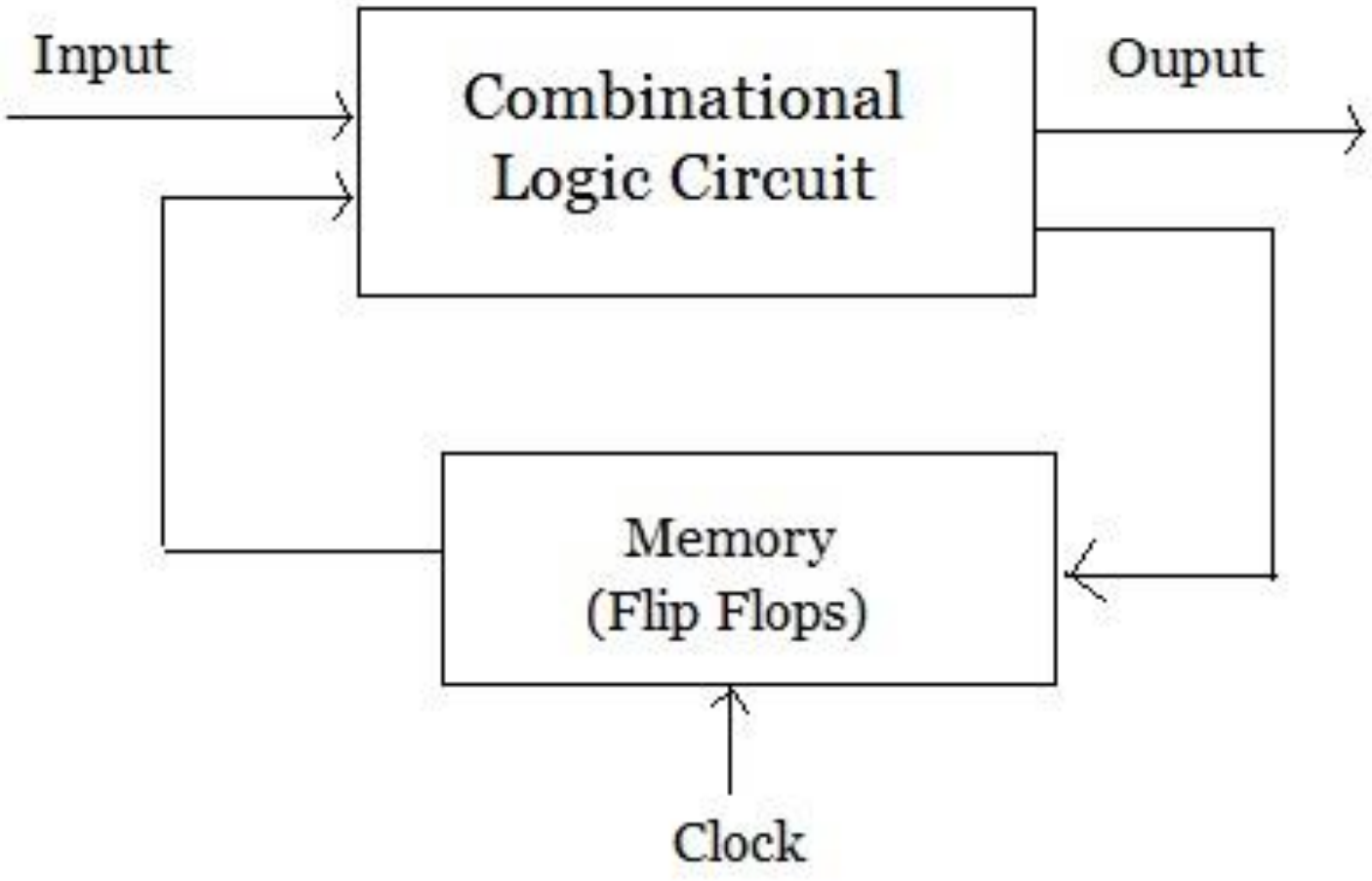
Course Instructor

Afifa Hoque

DEFINITION OF SEQUENTIAL LOGIC CIRCUIT

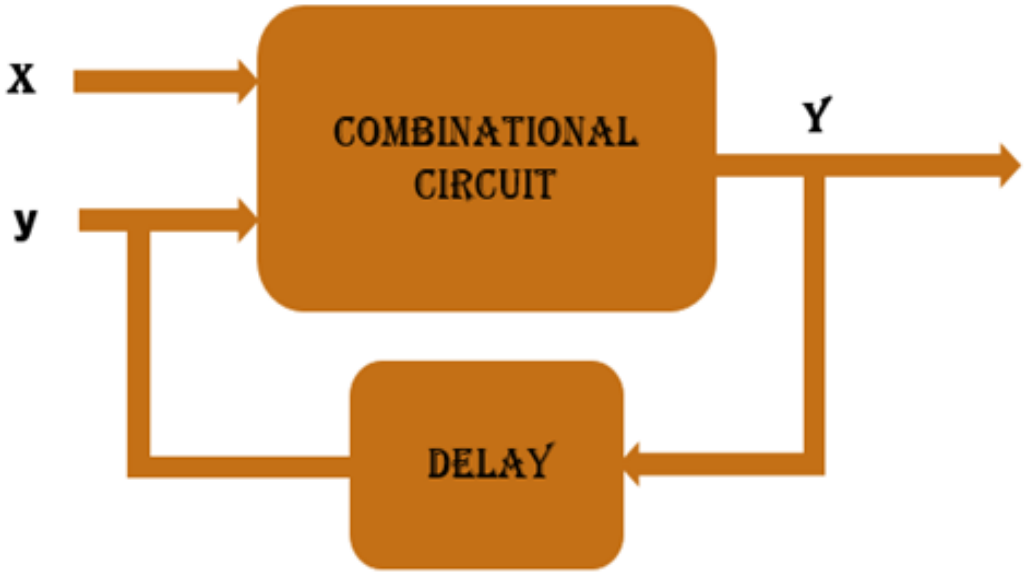
- Sequential logic consists of :
  1. Memory elements :
     - flip flops
     - Store the present states
  2. Combinational Logic :
     - Computes the outputs of the circuit
       a. Outputs depend on Inputs and current state
     - Computes the next state of the circuit
       a. Next state also depends on the inputs and the present state





TYPES OF SEQUENTIAL CIRCUIT

1. Synchronous Sequential Logic Circuit :
   - Uses a clock signal as an additional input
   - Changes in the memory elements are controlled by the clock
   - Changes happen at discrete instances of time

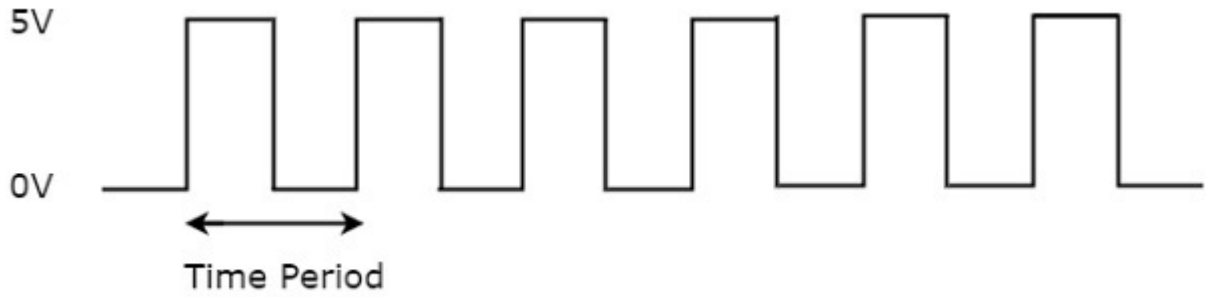


(CONT.)

1. Asynchronous Sequential Circuit
   - No clock signal
   - Changes in the memory elements can happen at any instance of time

DEFINITATIONS

- Clock : A signal used to synchronize the operations of an electronic system.



- Timing Diagram: A timing diagram is **a graph of the output of a logic gate with respect to the inputs of the gate**.

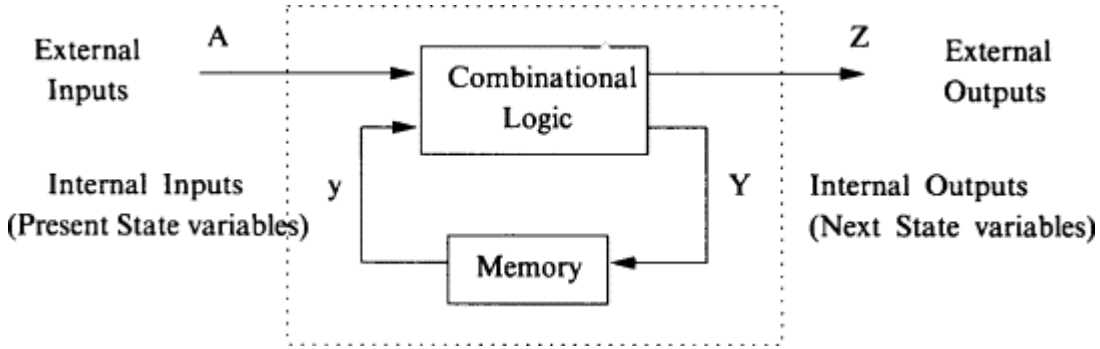
(CONT.)

- Latch :
  - **Basic storage elements that operate with signal levels**
  - Controlled by a clock transition are flip-flops
  - Level-sensitive devices
  - Useful for the design of the asynchronous sequential circuit

- **Flip-Flop :**
  - **An electronic circuit with two stable states that can be used to store binary data**
  - Stored data can be changed by applying varying inputs
  - **Five different types of flip flops are:**
    1) Set-Reset (SR) flip-flop or Latch.
    2) JK(**Jack Kilby)** flip-flop.
    3) D (Data or Delay) flip-flop.
    4) T (Toggle) flip-flop.
    5) MS-JK(Master Slave flip-flop

OPERATION OF SEQUENTIAL LOGIC SYSTEM

- Sequential logic is a type of logic circuit whose output depends not only on the present value of its input signals but **on the sequence of past inputs, the input history as well**. This is in contrast to combinational logic, whose output is a function of only the present input.
- Sequential circuits are essentially combinational circuits with feedback. A block diagram of a generalised sequential circuit is shown in Figure below. The generalised circuit contains a block of combinational logic which has two sets of inputs and two sets of outputs. The inputs are:



DIFFERENCE BETWEEN SYNCHRONOUS & ASYNCHRONOUS CIRCUIT

Synchronous Circuit

- Synchronous sequential circuits are digital circuits governed by clock signals.
- The synchronous sequential circuits are slower in its operation speed. This is due to the propagation delay of clock signal in reaching all elements of the circuit.
- The distributed clock signal consumes large power and dissipates large amount of heat.
- Synchronous circuits are used in counters, shift registers, memory unit.

Asynchronous Circuit

- Asynchronous sequential circuits are digital circuits that are not driven by clock. They can be called as self-timed circuits.
- The asynchronous sequential circuits are comparatively faster. Here, there is no clock signal but only the propagation delay of logic gates.
- Power consumption and heat dissipation are comparatively lower.
- Asynchronous circuits are used in low power and high speed operations.

THANK YOU