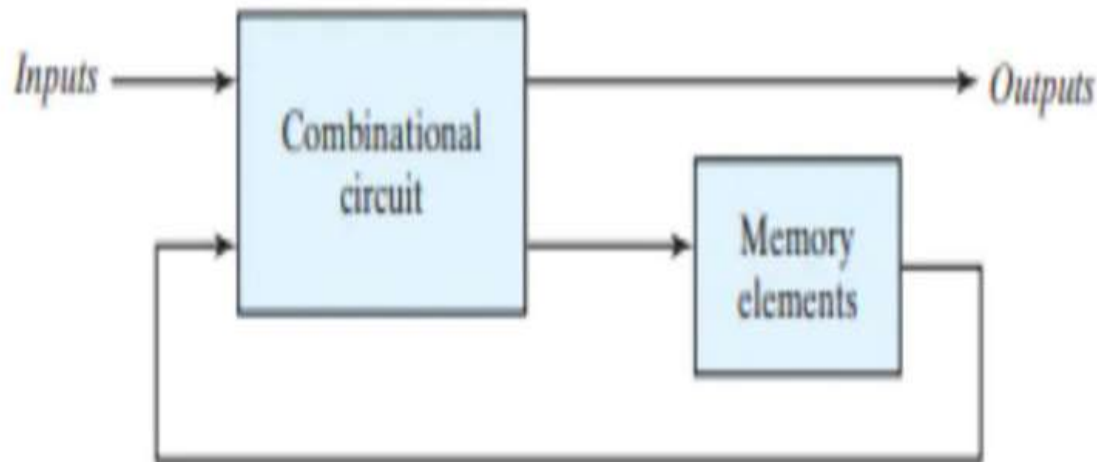


SEQUENTIAL CIRCUITS

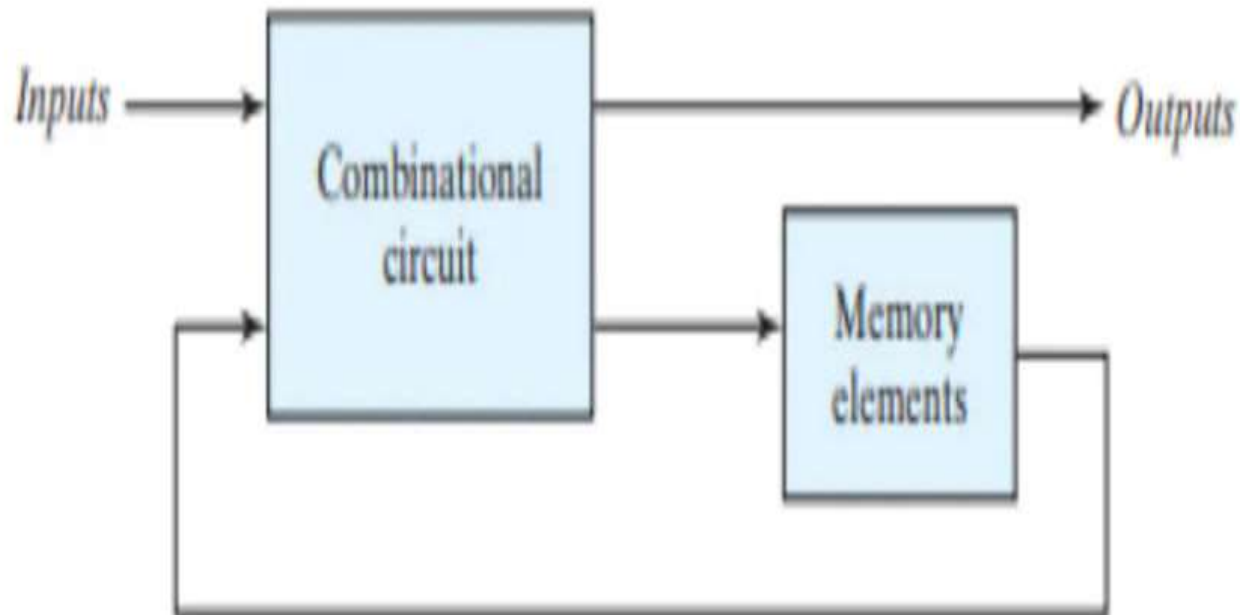
Sequential Circuits consists of a combinational circuit to which memory elements are connected to form a feedback path. The memory elements are devices capable of storing binary information.

The binary information stored in these elements at any given time defines the state of the sequential circuit at that time.



- The sequential circuit receives binary information from external inputs (x_n) that, together with the present state (y_{n-1}) of the memory elements, determine the binary value of the outputs (y_n).
- A sequential circuit is specified by a time sequence of inputs, outputs, and internal states.

$$f(x_n, y_{n-1}) = y_n$$

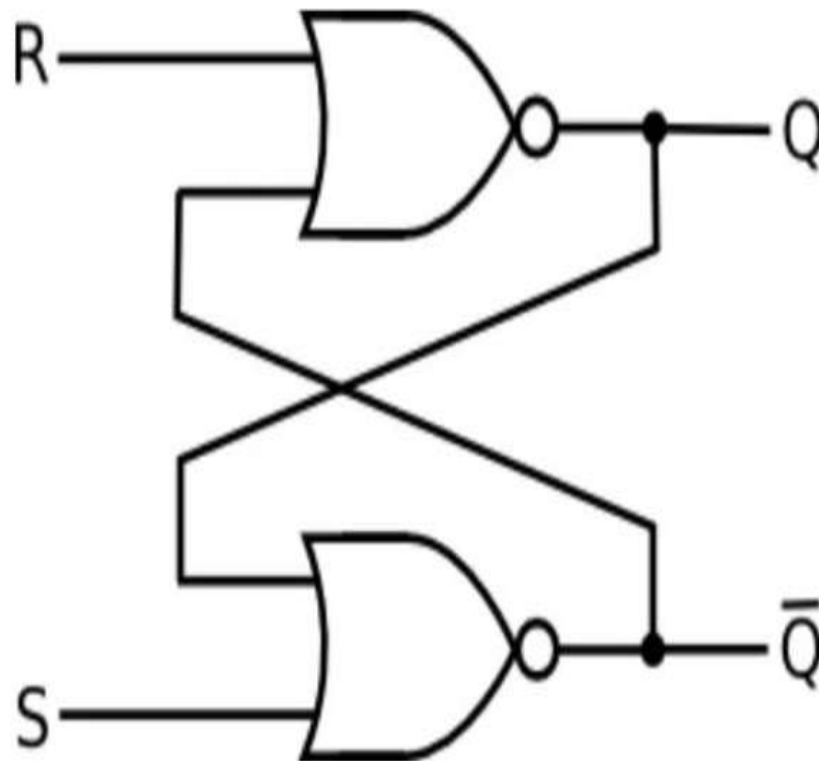


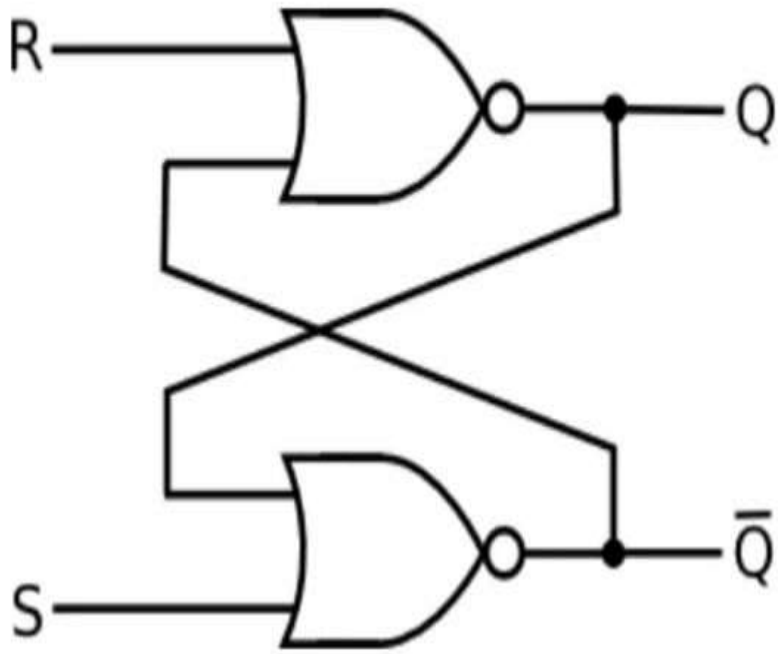
Latches

- Latch means to hold something or something which do not change.
- latches are the basic building blocks of any flip flop and they are capable of holding 1 bit until necessary.
- Storage elements that operate with signal levels are referred to as latches.
- Latches are level sensitive devices.

NOR Latch

- The SR latch is a circuit with two cross-coupled NOR gates or two cross-coupled NAND gates, and two inputs labeled S for set and R for reset.
- Outputs Q_n and Q_n' are the complement of each other, in valid scenario.





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	X
1	1	1	X

Flip flop

1. Latches are the basic circuits from which all flip-flops are constructed.
2. The storage elements (memory) used in clocked sequential circuits are called flipflops.
3. A flip-flop is a binary storage device capable of storing one bit of information. In a stable state, the output of a flip-flop is either 0 or 1 (it is called bi-stable multi-vibrator).
4. A flip-flop is said to be stable if it has complementary behavior.
5. Latches are level sensitive devices; flip-flops are edge-sensitive devices.
6. Storage elements that operate with signal levels are referred to as latches; those controlled by a clock transition are flip-flops.