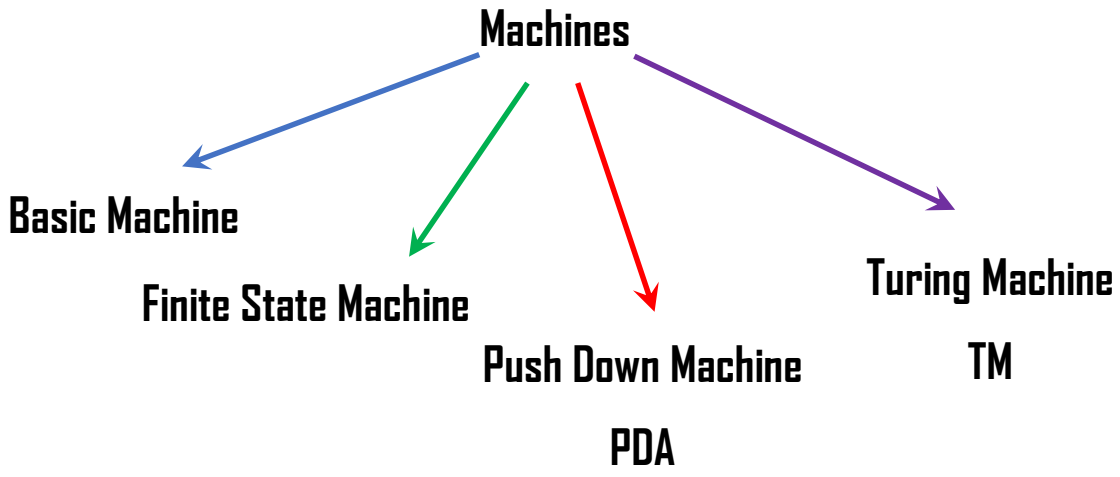


Basic machine:

A basic machine recognizes an input set (I) and produces an output set 0 ,where (I) and 0 are finite set.

This machine behaves like a function and maps the input set (I) to the output set (0).

We shall call this function machine function (**MAF**)

Example **/**

we can treat all logical gates (Or , And , Nand , Nor) as a basic machine (MAF)

in the case of (Or) gate 0 = { 0 , 1}

I = { (0 ,0) , (0 , 1) , (1 , 0) , (1 , 1) }

The (MAF) of (Or) gate is given by the following table :-

Input	(0,0)	(1,0)	(0,1)	(1,1)
Output	0	1	1	1

The basic machine has very limited ability. it can only interpret a set of input data and produce a set of output data. This machine possesses neither an internal state. Therefore, to improve the machine's capability we introduce the concept of internal states of the machine. This machine is called a finite state machine (FSM)

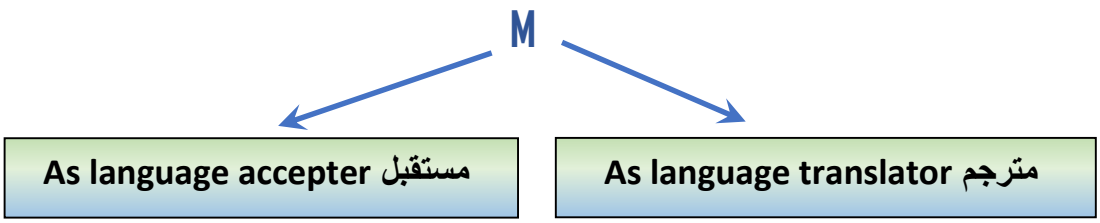
Finite State Automata (FSA)

Automata theory (also known as the Theory of Computation) is a theoretical branch of Computer Science and Mathematics, which mainly deals with the logic of computation with respect to simple machines, referred to as automata.

- The word automata come from the Greek word, which means "self-acting, self-moving".
- An automaton with a finite number of states is called a Finite Automaton (FA) or Finite-State Machine (FSM). This automaton consists of states (represented in the figure by circles) and transitions (represented by arrows).
- Automata theory is closely related to formal language theory. In this context, automata are used as finite representations of formal languages that may be infinite. Automata are often classified by the class of formal languages they can recognize, as in the Chomsky hierarchy, which describes a nesting relationship between major classes of automata
- Automata in many fields such as the theory of computation, compiler construction, artificial intelligence, parsing and formal verification.

Finite Automata(FA) is the simplest machine to recognize patterns. The finite automata or finite state machine is an abstract machine that has five elements or tuples. It has a set of states and rules for moving from one state to another but it depends upon the applied input symbol. Basically, it is an abstract model of a digital computer. The following figure shows some essential features of general automation.

Finite State Automata (FSA)



Language accepter (FA) ⟹ check if L is accepted .
Language translator (FST) ⟹ L is accepted find L1 (output of M) .

Formal definition for (FSA) :-

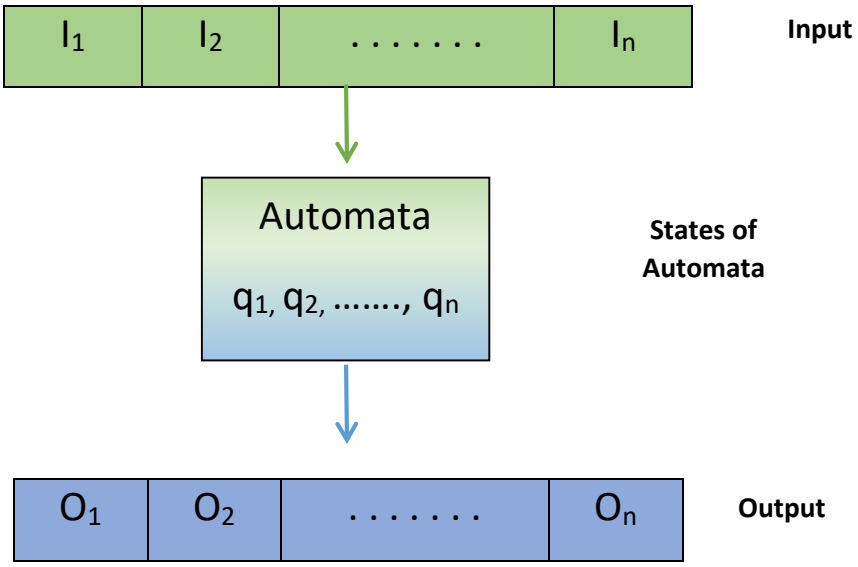


Figure: Features of Finite Automata

The above figure shows the following features of automata:

1. Input
2. Output
3. States of automata
4. State relation
5. Output relation

A Finite Automata consists of the following:

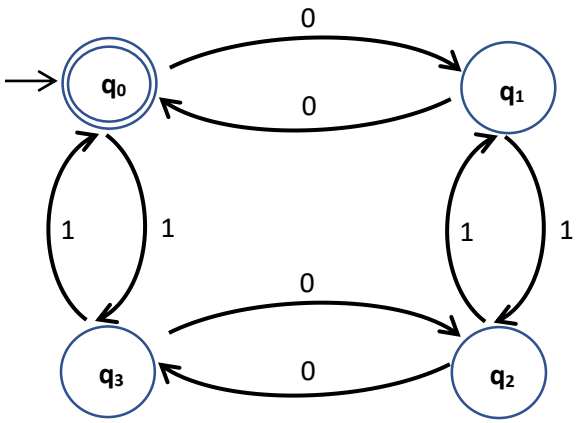
Q: Finite set of states.
Σ: a set of Input Symbols.
q: Initial state.
F: the set of Final States.
δ: Transition Function.

The formal specification of the machine is:

{ Q, Σ, q, F, δ }

Example /

let a transition follow:



Find FSA acceptor and check if the string (110101) is an input string to M acceptor or not?

Answer/

M= < Q, Σ, S, F, δ >

Q= {q_0 , q_1 , q_2 , q_3 }

Σ= {0, 1}

S= q_0

F={q_0}

δ (q_0 ,0) = q_1

δ (q_0 ,1) = q_3

δ (q_1 ,0) = q_0

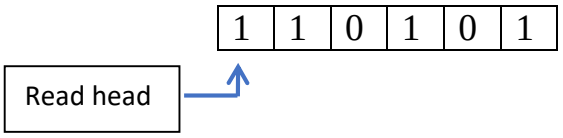
δ (q_1 ,1) = q_2

δ (q_2 ,0) = q_3

δ (q_2 ,1) = q_1

δ (q_3 ,0) = q_2

δ (q_3 ,1) = q_0



δ (q_0 ,1) = q_3

δ (q_3 ,1) = q_0

δ (q_0 ,0) = q_1

δ (q_1 ,1) = q_2

δ (q_2 ,0) = q_3

δ (q_3 ,1) = q_0 the final state

.: this string is the acceptor.

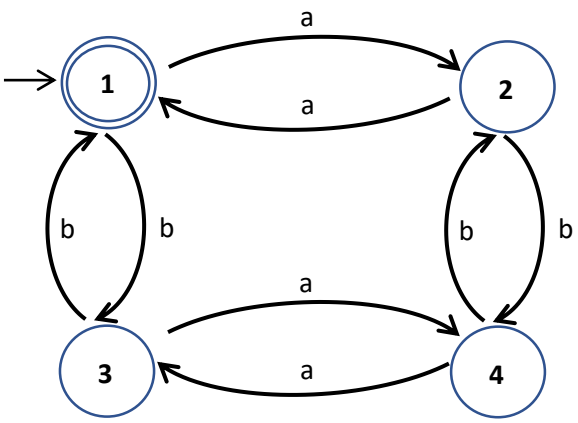
L = { X / (0 , 1)* , 0 and 1 is even}

Example **/**

Build an FA that accepts only the language of all words that must have (even-even) from the alphabet a, b?

L={w|w has even no. of a's and even no.of b's}

Σ= {a, b}



Find the following:

- (even a-odd b)
- (odd a-even b)
- (odd a-odd b)