We will learn three different mathematical models of computation in this course.

1) Finite state automaton

2) Push down automaton

3) Turing machine

The most simpler model is
Finite automaton (singular)
Finite Automata (Plural).

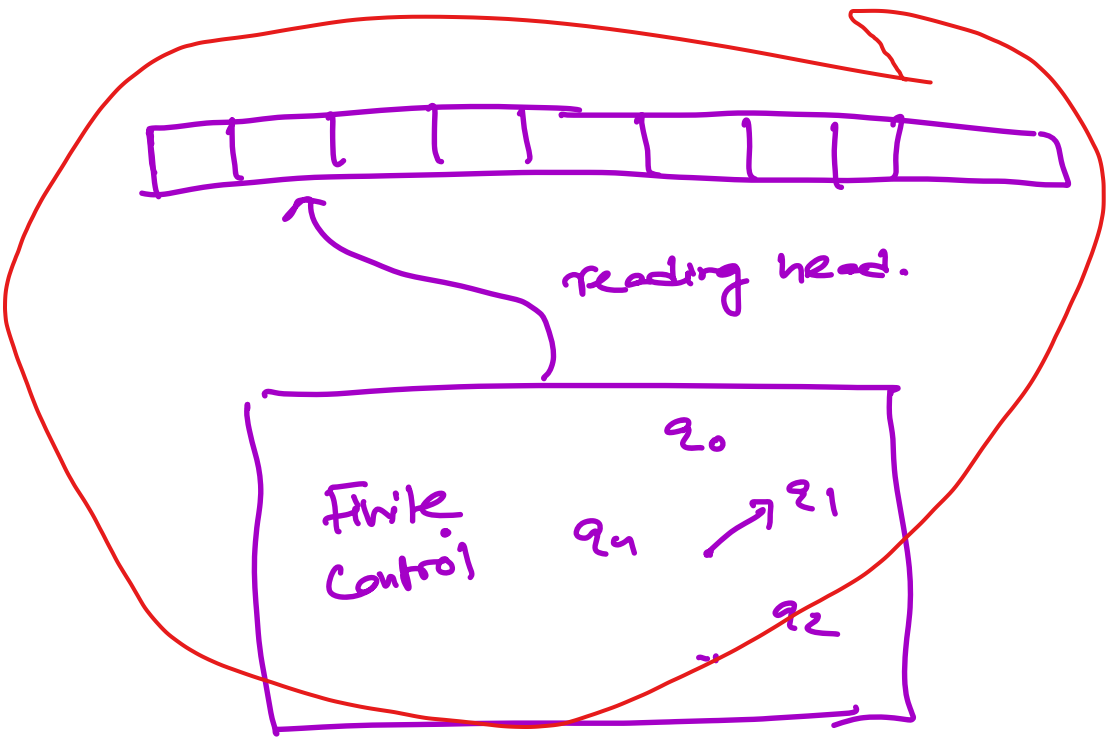
This is a restricted model of the modern computer with the following restrictions

→ Finite 'pre-defined' memory

→ Takes input in the form of a string

→ gives no output, only

check the membership of the input string.



Formal definition

A deterministic finite automaton is a quintuple $M = (Q, \Sigma, \delta, q_0, F)$,

Where $Q \rightarrow$ set of finite states

$\Sigma \rightarrow$ alphabet

$\delta : Q \times \Sigma \rightarrow K$.

$q_0 \leftarrow$ initial state

$F \subseteq K$, final state.

this is not less than
this represent subset

Property

Given an automaton for a language L, and a string s,

If the automata ends on a final state after the scanning of the last symbol of s then

$s \in L$

else $s \notin L$.

example

Consider the language

$L = \{ w \in (0+1)^* \mid w$ starts with $0 \}$

Define $Q = \{q_0, q_1, q_2\}$

$\Sigma = \{0, 1\}$

$q_0 \leftarrow$ the start state

$q_1 \leftarrow$ the final state

δ is defined as follows

$$\delta(q_0, 0) = q_1$$

$$\delta(q_0, 1) = q_2$$

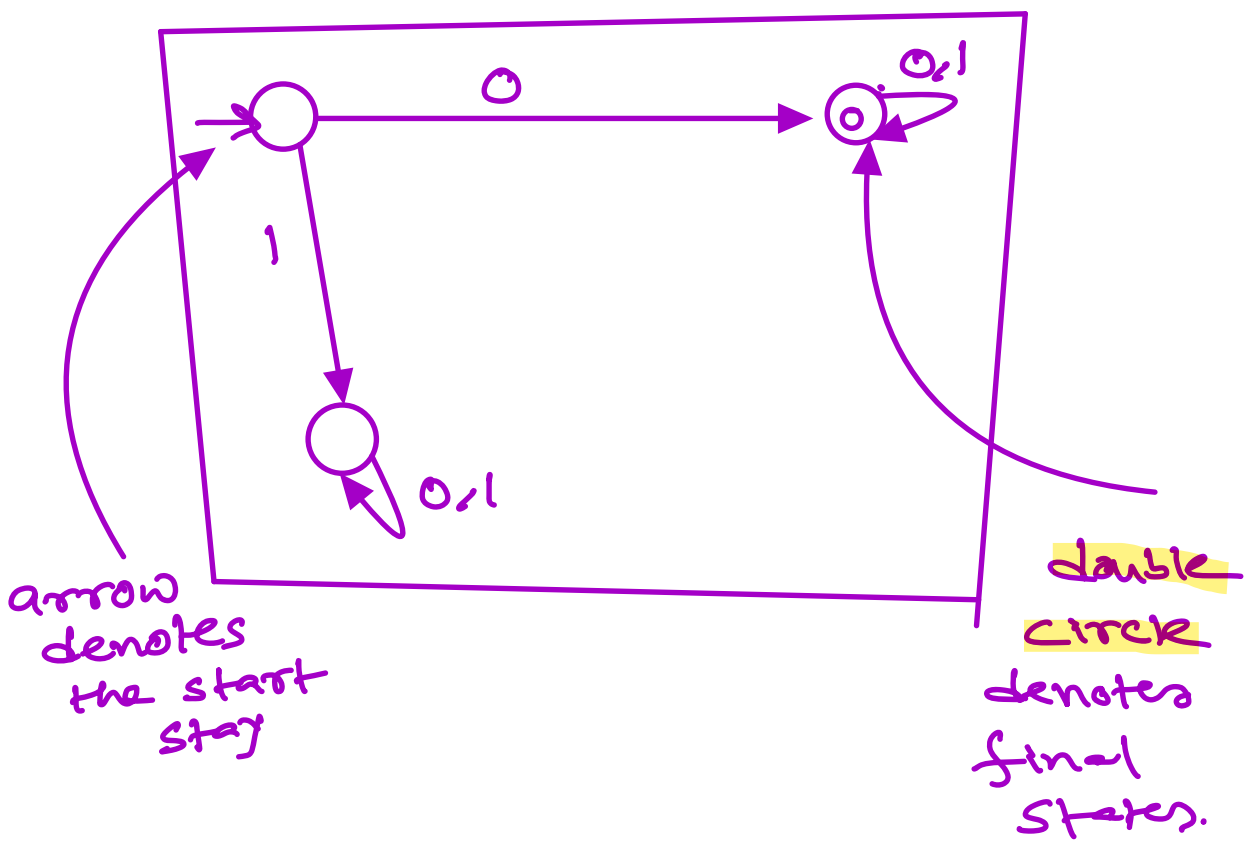
$$\delta(q_1, 0) = q_1$$

$$\delta(q_1, 1) = q_1$$

$$\delta(q_2, 0) = q_2$$

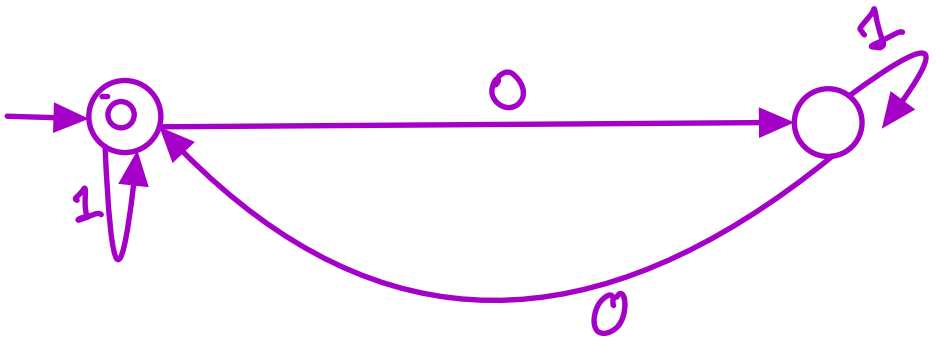
$$\delta(q_2, 1) = q_2$$

Pictorial representation



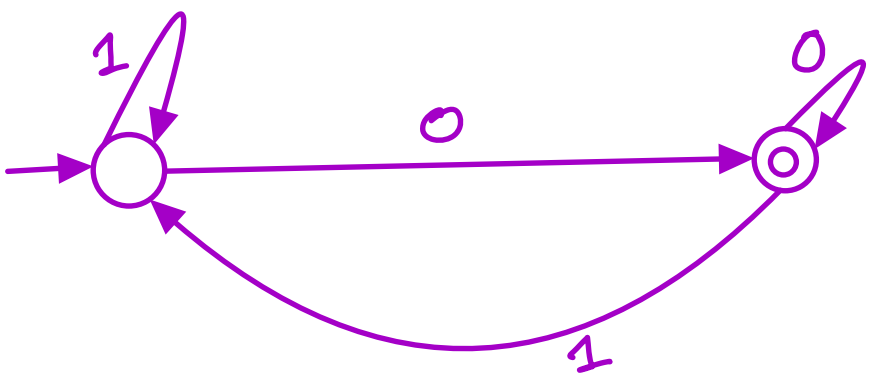
Example -2

Let $L = \{ w \in (0+1)^* \mid w$ has even number of 0's$\}$



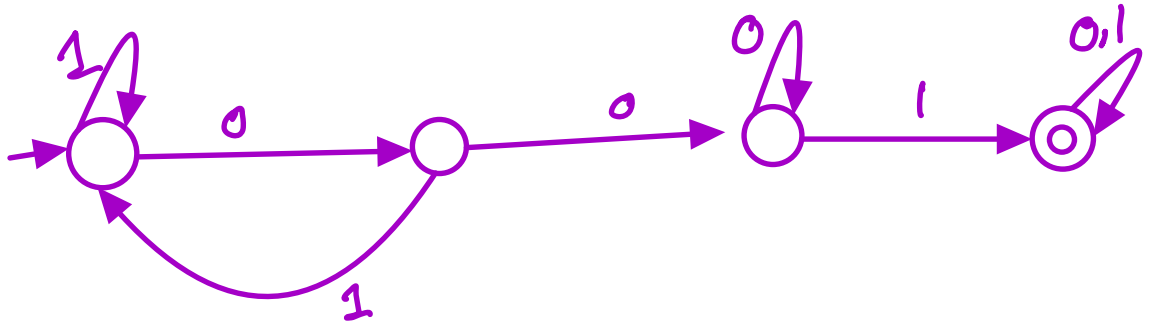
Example-3

Let $L = \{ w \in (0+1)^* \mid w$ ends with 0$\}$



Example-4

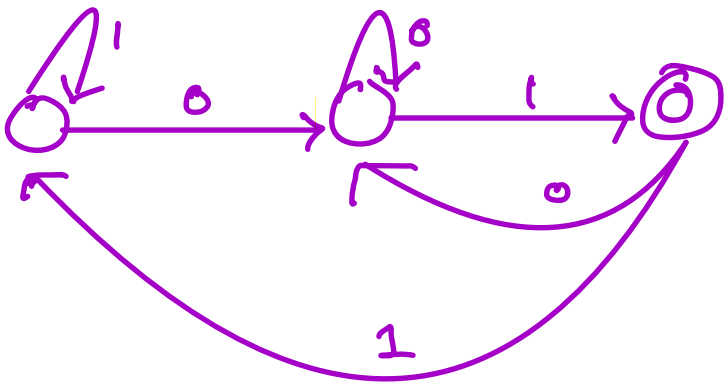
$L = \{ w \in (0+1)^* \mid w$ has 001 as a substring$\}$



Some more examples

(1) $L = \phi$

(2) Set of all binary string ends with 01.



(3) The set of all binary strings that represents integer divisible by 3.

Example:

Let $L = \{ w \in (0+1)^* \mid w$ is a binary representation of an integer divisible by $3 \}$