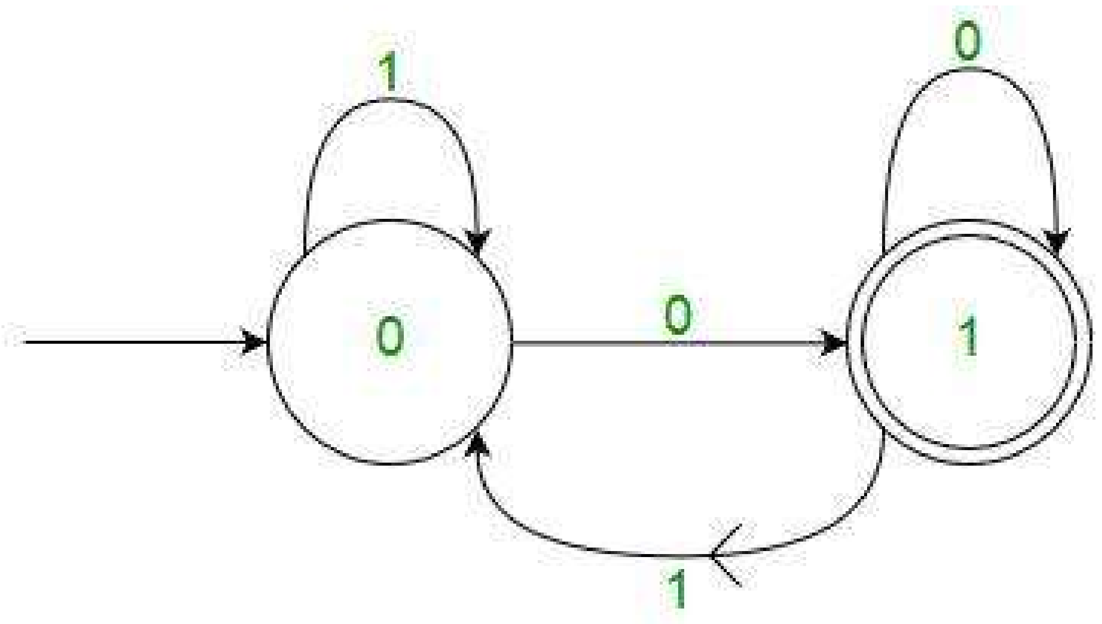


DFA

Deterministic Finite Automata

- The finite Automata are called deterministic finite automata if the m/c reads an i/p string one symbol at a time
- Deterministic refers to uniqueness of the computation
- In DFA there is only path for specific input from the current state to the next state
- DFA does not accept the null move, ie it can not change state without any input character
- Can have multiple final states
- Used in Lexical Analysis in complier

Definition of DFA

- A Deterministic Finite Automata has 5-tuples

  $M = (Q,\Sigma,\delta,qo,F)$

Q: finite set called the states

Σ: finite set called the alphabets

δ: transition specifying from which state on which input symbol where the transition goes ($Q x \Sigma$)

qo: initial state

F: set of final states

Graphical representation of DFA

- The state is represented by vertices
- The arc labelled with an i/p character show the transition
- The initial state is marked with an arrow
- The final state is denoted by double circle

Acceptance of Language

- A language acceptance is defined if a string “w” is accepted by a machine M ie if it is reaching the final state by taking the string “w”
- Not accepted if not reaching the final state

Example of DFA

Q. Let DFA be Q={a,b,c} qo= {a} Σ={0,1} F={C}

Present state	0	1
→ a	a	b
b	c	a
C*	b	c

Transitions

$\delta(a, 0) = a$

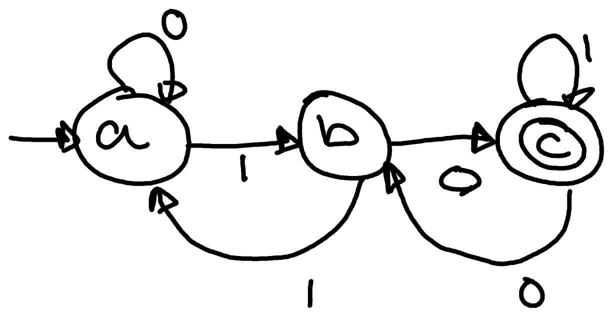
$\delta(a, 1) = b$

$\delta(b, 0) = c$

$\delta(b, 1) = a$

$\delta(c, 0) = b$

$\delta(c, 1) = c$



	0	1
$\rightarrow q_0$	–	q_1
q_1	q_2	q_1
$*q_2$	q_2	q_1

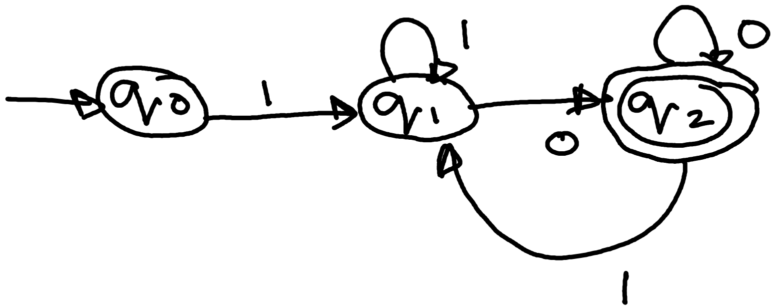
Example of DFA

X 01010

Q. Design DFA with Σ={0,1} accepts the strings which start with 1 and ends with 0.

Probable strings = 10, 100, 110, 10110

Min length = 2 ; states required = $\overset{\text{min}+1}{2+1} = 3$



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

$\delta(q_0, 1) = q_1$

$\delta(q_1, 0) = q_2$

$\delta(q_1, 1) = q_1$

$\delta(q_2, 0) = q_2$

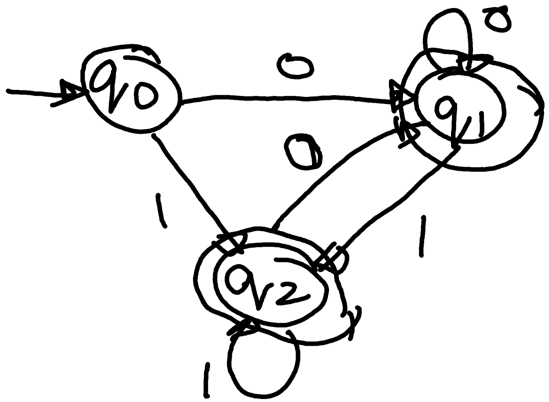
$\delta(q_2, 1) = q_1$

$M = \{Q, \Sigma, \delta, q_0, F\} = \{\{q_0, q_1, q_2\}, \{0, 1\}, \delta, q_0, q_2\}$

Example of DFA

Q. Design DFA that checks whether the given 2-bit binary number is even or odd.

Min length = 2; No. of states = 3



00 → 0
10 → 2

11 → 3
01 → 1

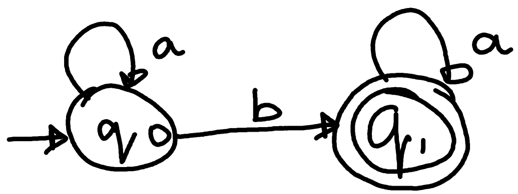
Example of DFA

abba ✗

Q. Design DFA with Σ={a,b} that accepts the strings with only one 'b' in the string

b, ab, aaaab, ---

Min size of string = 1 ; No. of states = 1+1 = 2



$\delta(q_0, a) = q_0$

$\delta(q_0, b) = q_1$

$\delta(q_1, a) = q_1$

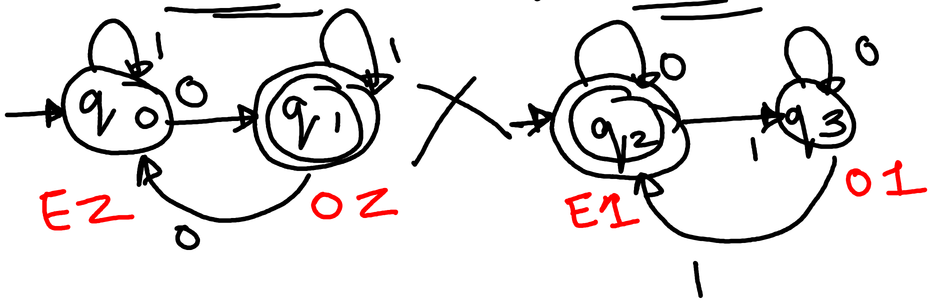
$\delta(q_1, b) = \phi$

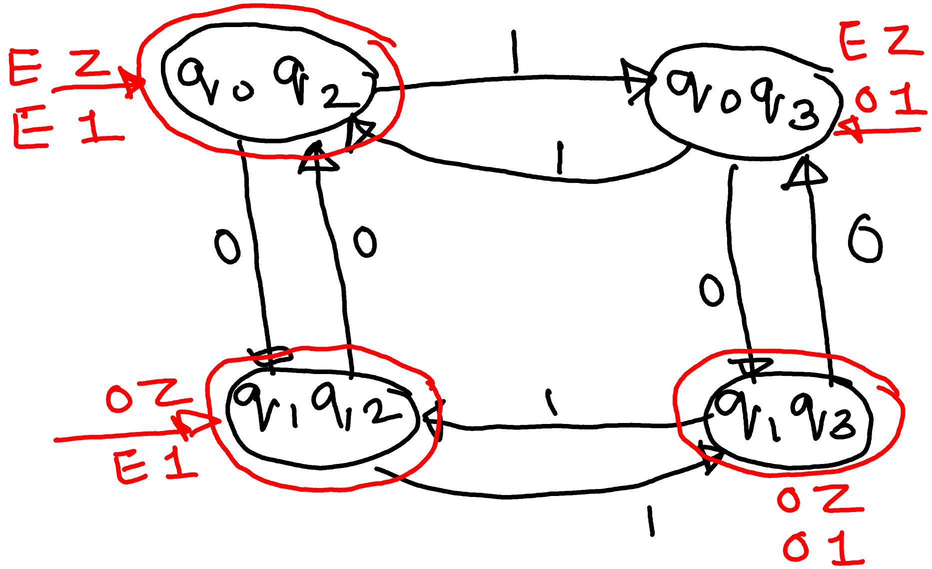
$M = \{\{q_0, q_1\}, \{a, b\}, \delta, q_0, q_1\}$

Example of DFA

Q. Design DFA with Σ={0,1} accepts the strings with odd no's 0's or even no's of 1

odd no 0's Even no 1





Example of DFA

Example of DFA

Q. Design DFA with Σ={0,1} accepts the strings with odd no's 0's and even no's of 1