



Lab#4

DFA

Finite Automata

An automaton with a finite number of states is called a Finite Automaton (FA) or Finite State Machine (FSM).

Finite Automaton can be classified into two types –

- Deterministic Finite Automaton (DFA)
- Non-deterministic Finite Automaton (NFA / NFA)

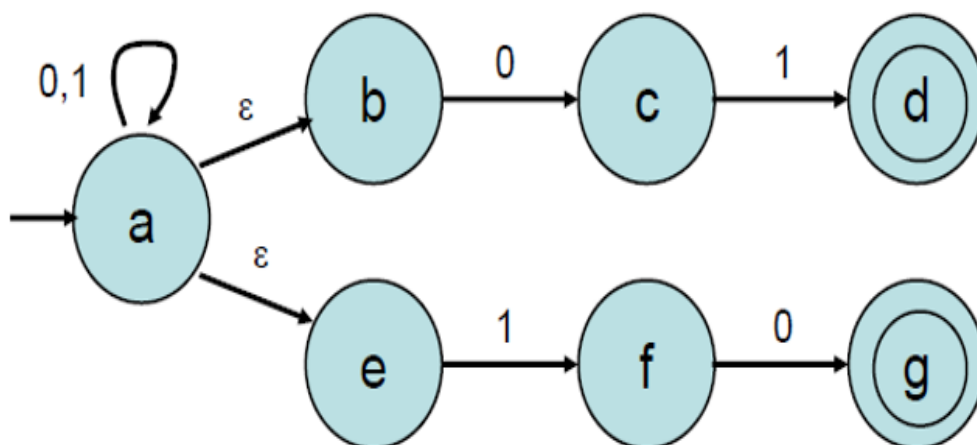
An automaton can be represented by a 5-tuple $(Q, \Sigma, \delta, q_0, F)$, where

- Q is a finite set of states.
- Σ is a finite set of symbols, called the alphabet of the automaton.
- δ is the transition function.
- q_0 is the initial state from where any input is processed ($q_0 \in Q$).
- F is a set of final state/states of Q ($F \subseteq Q$).

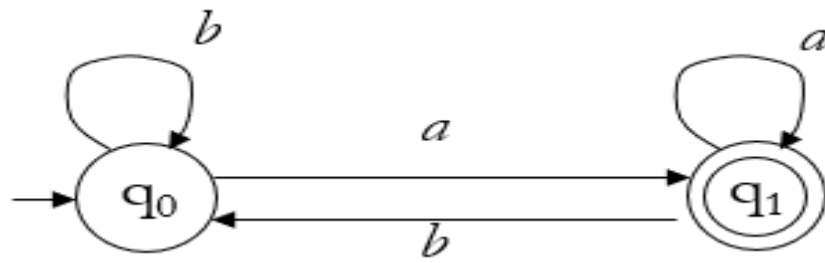
Examples

What does this FSM accept?

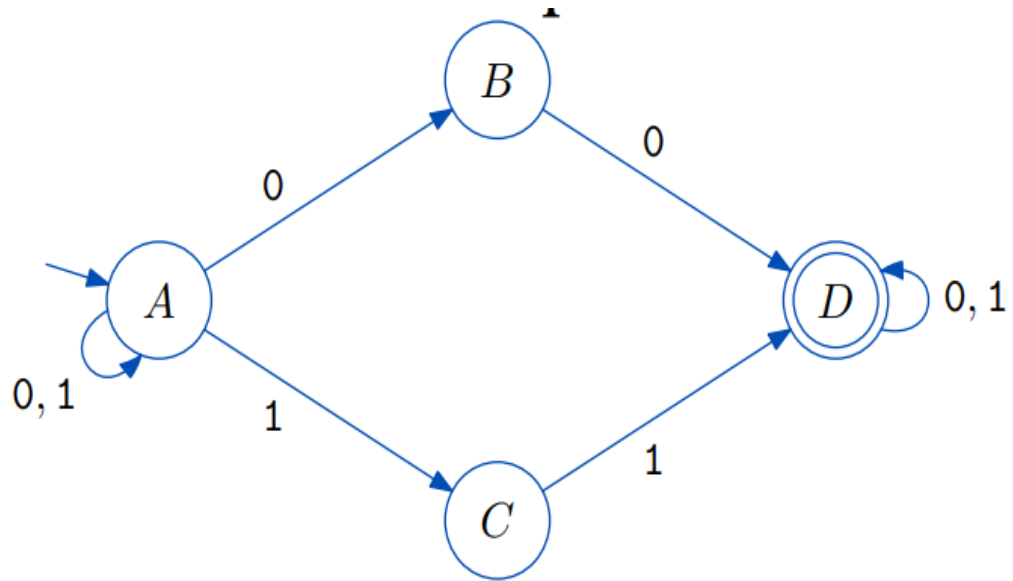
1.



2.



3.



Solutions

1. $(0+1)^*(01+10)$
2. $(a+b)^*a$
3. $(0+1)^*(00+11)(0+1)^*$

Deterministic Finite Automaton

For each input symbol, one can determine the state to which the machine will move.

Hence, it is called Deterministic Automaton.

As it has a finite number of states, the machine is called Deterministic Finite Machine or Deterministic Finite Automaton.

No ϵ -moves

Formal Definition of a DFA

A DFA can be represented by a 5-tuple $(Q, \Sigma, \delta, q_0, F)$ where –

- Q is a finite set of states.
- Σ is a finite set of symbols called the alphabet.
- δ is the transition function where $\delta: Q \times \Sigma \rightarrow Q$
- q_0 is the initial state from where any input is processed ($q_0 \in Q$).
- F is a set of final state/states of Q ($F \subseteq Q$).

Graphical Representation of a DFA

A DFA is represented by state diagrams in which.

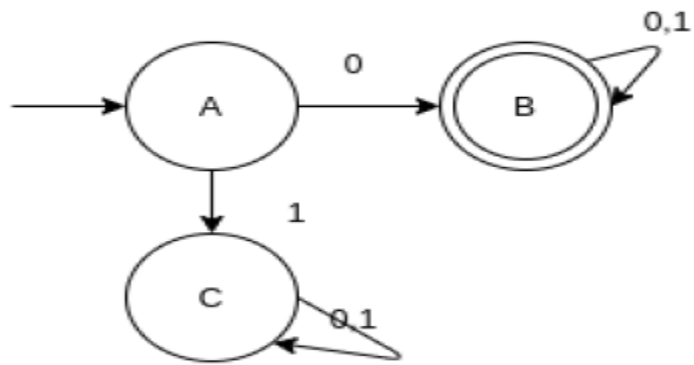
- The vertices represent the states.
- The arcs labeled with an input alphabet show the transitions.
- The initial state is denoted by an empty single incoming arc.
- The final state is indicated by double circles.

Examples

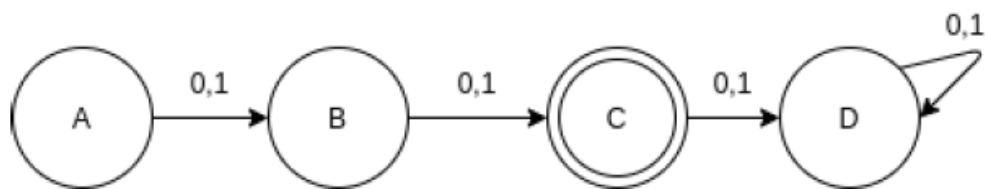
1. Design a DFA that accepts all strings starting with 0 over input alphabets $\Sigma = \{0,1\}$
2. Design a DFA that accepts all strings of length 2 over 0,1 $\{00,01,11,10\}$ over input alphabets $\Sigma = \{0,1\}$
3. Design a DFA for the language accepting strings starting with 'ab' over input alphabets $\Sigma = \{a, b\}$
4. All words with even count of letters $((a+b)(a+b))^*$ over input alphabets $\Sigma = \{a, b\}$
5. $L = \{ a^n b : n \geq 0 \}$, over input alphabets $\Sigma = \{a, b\}$

Solutions

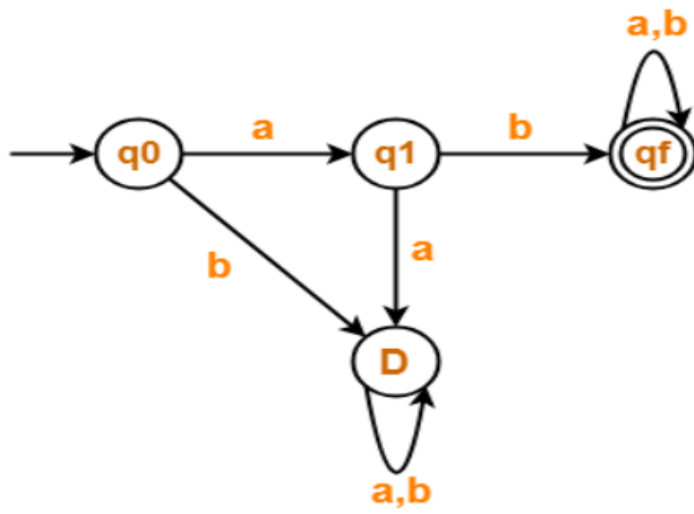
1.



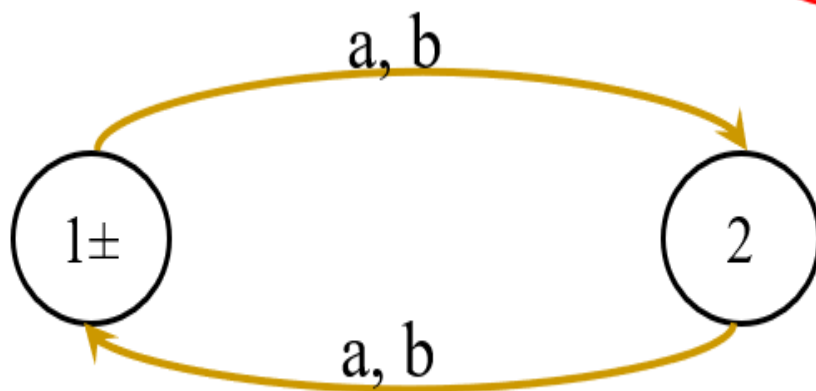
2.



3.



4.



5.

