LECTURE 02

Finite State Machine

Course Code   : CSE 3103
Course Title : Theory of Computation

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Finite State Machine (FAM)

Definition of FAM

FAM is denoted as a 5 tuple: $M = (Q, \Sigma, \delta, q0, F)$ where:

1. Q is a finite set of all possible states.
2. Σ is the finite set of symbol Called Alphabet.
3. δ is the transition function and consists of transitions like $Q \times \Sigma \to Q$.
    Two method for representing transition function:
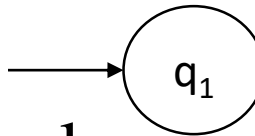   1. Transition table
    2. Transition diagram
4. q0 belongs to Q and it is the start state.
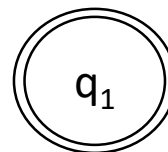5. F is a subset of Q and is the set of accepted states.

State

- State represent the current status of our machine.
- Vertices in the transition graph represent state that is denoted by Circle.

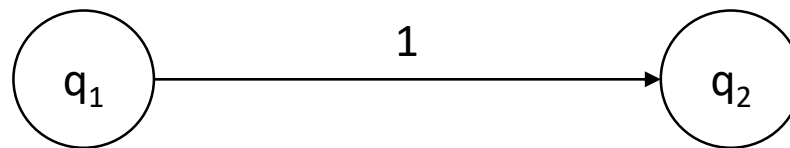q_1
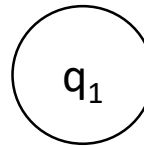
- Initial state have an empty arc.

$\longrightarrow$ q_1

- Final state have double circle.

q_1

	Inputs	
q_1		
-> q_1		
*q_1		

States

Arc

- Arc represent the transition of Machine State based on input. The input is labeled with the arc.

For example, A machine change it's state from q_1 to q_2 when it encounters a input '1'.

Finite State Machine (FAM)

Finite-state machines are of two types:

1. Deterministic finite-state machines or Deterministic Finite Automata(DFA)

2. Non-deterministic finite-state machines or Non-deterministic Finite Automata (NFA)
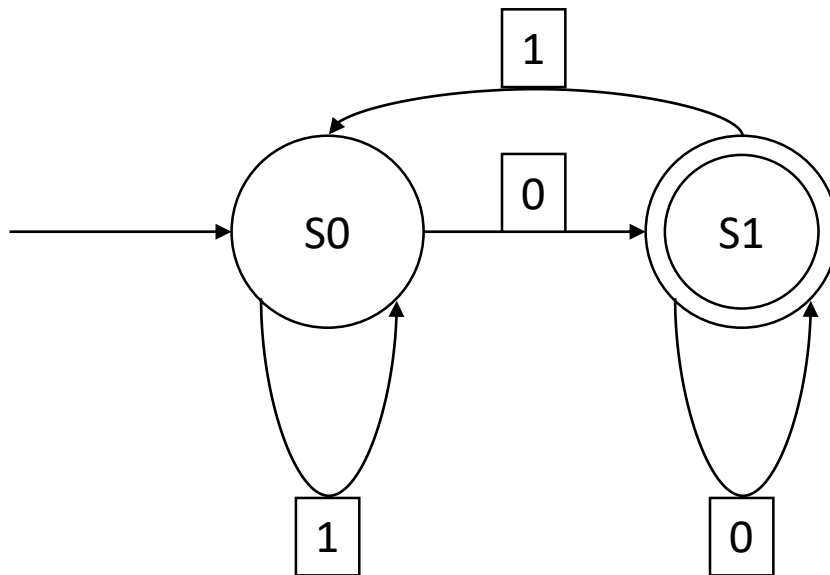
Deterministic Finite Automata(DFA)

Characteristics of DFA

- There is no Null Transition.

- There is only one transition for a specific input symbol.

- For any state, there must be one transition for each input symbol.

Example

All binary even numbers.

Language = {0, 10, 010, 100, 110, . . .}

Q = {S0, S1}
Σ = {0, 1}
$\leftarrow \delta$
Q0 = {S0}
F = {S1}

MORE LANGUAGE EXAMPLE

1. All binary even numbers.

2. All three digit binary even numbers.

3. Identifier in C programming Language.

4. All binary number starting with 101.

5. All binary number ending with 111.

6. All binary number starting with 111 and ending with 101.

7. All string that contains "aba" as sub string over the alphabet Σ = {a, b, c, d}.

8. All binary numbers that contains even number of 0.

9. All binary numbers that contains odd number of 1.