Finite Automaton can be classified into two types −

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

Deterministic Finite Automaton (DFA)

In DFA, 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.**

Formal Definition of a DFA

A DFA can be represented by a 5-tuple (Q, ∑, δ, q0, F) where −

* **Q** is a finite set of states.
* **∑** is a finite set of symbols called the alphabet.
* **δ** is the transition function where δ: Q × ∑ → Q
* **q0** is the initial state from where any input is processed (q0 ∈ Q).
* **F** is a set of final state/states of Q (F ⊆ Q).

Graphical Representation of a DFA

A DFA is represented by digraphs called **state diagram**.

* 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.

Example

Let a deterministic finite automaton be →

* Q = {a, b, c},
* ∑ = {0, 1},
* q0 = {a},
* F = {c}, and

Transition function δ as shown by the following table −

|  |  |  |
| --- | --- | --- |
| **Present State** | **Next State for Input 0** | **Next State for Input 1** |
| **a** | a | b |
| **b** | c | a |
| **c** | b | c |

Its graphical representation would be as follows −

