CSE331 Automata and Computability

Lecture 5.2: Deterministic Finite Automata

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Classification of Finite Automata

There are two types of finite automata:

1. Deterministic Finite Automata (DFA)
2. Non Deterministic Finite Automata

Deterministic Finite Automata (DFA)

A DFA is an automaton where for each input symbol, there is exactly one transition. 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 is a finite set of symbols called the alphabet
- δ is the transition function defined as $\delta : (Q \times \Sigma) \rightarrow Q$
- q_0 is the initial/start state from where any input is processed and $q_0 \in Q$
- F is a set of final state(s) and $F \subseteq Q$

Transition Function, δ

The transition function takes in two parameters:

1. A state, $q_{current} \in Q$
2. An input symbol $a \in \Sigma$

The output of a transition function is exactly one state, $q_{next} \in Q$

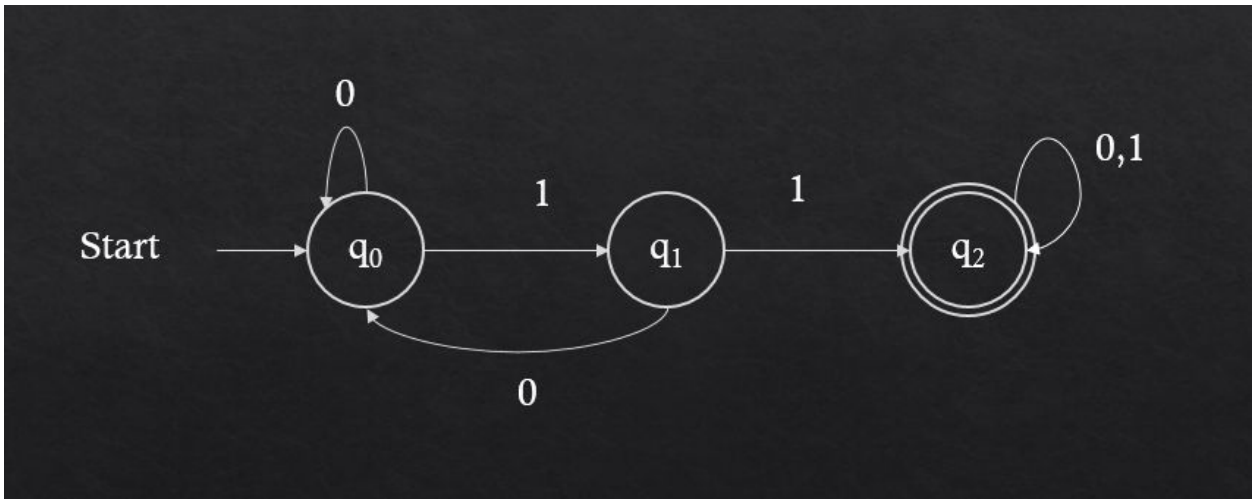
Given a state and an input symbol, a transition function dictates the next state of the automaton.

Example

A DFA that accepts binary strings with two consecutive 1s or binary strings that contain the substring 11.

Graph Representation

This is the graph representation of the DFA. In this representations, the start state is marked by an arrow and the final state(s) is marked with a double circle.



In this DFA:

- Q is $\{q_0, q_1, q_2\}$
- Σ is {1, 0} since it works with binary strings
- q_0 is the initial/start state
- F is a $\{q_2\}$

The transition function for this DFA yeilds:

- $\delta (q_0, 0) \rightarrow q_0$
- $\delta (q_0, 1) \rightarrow q_1$
- $\delta (q_1, 0) \rightarrow q_0$
- $\delta (q_1, 1) \rightarrow q_2$
- $\delta (q_2, 0) \rightarrow q_2$
- $\delta (q_2, 1) \rightarrow q_2$

Transition Table

A DFA can also be represented as a table where the rows contain the states and the columns contain the input symbols. In a transition table, the start state is marked by an arrow and the final state(s) is marked by an asterisk . For the given DFA, the transition table would be:

	0	**1**
→q_0	q_0	q_1
q_1	q_0	q_2
***q_2**	q_2	q_2