Finite State Machines

Course Information

Finite Automata

Language Recognition Devices
A finite automaton is a 5-tuple \((Q, \Sigma, \delta, q_0, F)\), where

1. \(Q\) is a finite set called the states,
2. \(\Sigma\) is a finite set called the alphabet,
3. \(\delta: Q \times \Sigma \rightarrow Q\) is the transition function,
4. \(q_0 \in Q\) is the start state, and
5. \(F \subseteq Q\) is the set of accept states.

The set of all strings accepted by a finite automaton \(M\) is called the language of machine \(M\), and is written \(L(M)\).

We say that \(M\) recognizes the language \(L(M)\).

Let \(M = (Q, \Sigma, \delta, q_0, F)\) be a finite automaton and let \(w = w_1w_2...w_n\) be a string where each \(w_i\) is a member of the alphabet \(\Sigma\). Then \(M\) accepts \(w\) if a sequence of states \(r_0, r_1, ..., r_n\) in \(Q\) exists with three conditions:

1. \(r_0 = q_0\),
2. \(\delta(r_i, w_{i+1}) = r_{i+1}\), for \(i = 0, ..., n-1\), and
3. \(r_n \in F\).
A language is called a **regular language** if some finite automaton recognizes it.

\[ L(M_1) = \{ w \mid w \text{ contains at least one 1 and an even number of 0s follow the last } 1 \} \]

\[ L(M_4) = \{ w \mid w \text{ is a string over } \{a, b\} \text{ that starts and ends with the same symbol } \} \]

Is \( L \) a string of 0s and 1s containing an even number of 1s) \( \) a regular language?

How about \( \{ w \mid w \text{ is a string of as and bs containing the substring } aba \} \)?