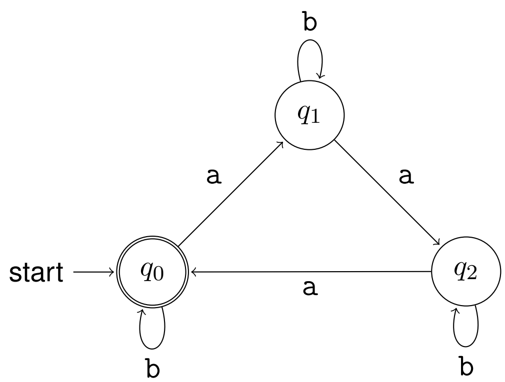
Lecture #2: Introduction to Deterministic Finite Automata
Lecture Presentation

Review of Preparatory Material

Problems To Be Solved

Consider a deterministic finite automaton $M = (Q, \Sigma, \delta, q_0, F)$ that has alphabet $\Sigma = \{\mathtt{a}, \mathtt{b}\}$ and that can be represented as follows.



One can see from this picture that $Q = \{q_0, q_1, q_2\}$, q_0 is the start state (as the representation of M as a 5-tuple also shows) and that $F = \{q_0\}$.

1. Consider the ***transition function*** $\delta : Q \times \Sigma \to Q$ for this deterministic finite automaton.

   (a) Complete this specification of this function.

   $\delta(q_0, \mathtt{a}) =$ $\qquad$ $\delta(q_1, \mathtt{a}) =$ $\qquad$ $\delta(q_2, \mathtt{a}) =$

   $\delta(q_0, \mathtt{b}) =$ $\qquad$ $\delta(q_1, \mathtt{b}) =$ $\qquad$ $\delta(q_2, \mathtt{b}) =$

   (b) Give a ***transition table*** for this deterministic finite automaton.

2. Consider the string $\omega = \texttt{abaabb}$.

(a) Complete the following table to compute $\delta^\star(q_0, \omega)$.

$\delta^\star(q_0, \lambda) =$

$\delta^\star(q_0, \texttt{a}) =$

$\delta^\star(q_0, \texttt{ab}) =$

(b) Complete the following derivation of $\delta^\star(q_0, \omega)$ (which uses the definition of the extended transition function directly).

$$\begin{aligned}\delta^\star(q_0, \omega) &= \delta^\star(q_0, \texttt{abaabb}) \\ &= \delta(\delta^\star(q_0, \texttt{abaab}), \texttt{b}) \\ &= \end{aligned}$$

3. What are the states q_0, q_1 and q_2 used to keep track of, as symbols in an input string are being processed?

4. Now let $S_i = \{\omega \in \Sigma^\star \mid \delta^\star(q_0, \omega) = q_i\}$ for $i = 0$, $i = 1$, and for $i = 2$.

   (a) How are these sets related to the languages L_0, L_1 and L_2 that were considered in the previous lecture presentation? Why?

(b) What can be concluded, now, about S_0, S_1, S_2, using the results that were stated and proved in the previous lecture presentation?

(c) What is the language of M? How can this be proved?