

CPSC 351 — Tutorial Exercise #5

Introduction to Nondeterministic Finite Automata

This exercise is intended to help you to understand nondeterministic finite automata and how they process strings.

The questions in this exercise concern a nondeterministic automaton $M = (Q, \Sigma, \delta, q_0, F)$, with alphabet $\Sigma = \{a, b\}$, that is as shown as shown in Figure 1, on page 2.

Getting Started

These initial problems will probably not be discussed during the tutorial. Please discuss them during office hours with the instructor, if you can, if you have trouble solving them.

1. Consider the nondeterministic finite automaton $M = (Q, \Sigma, \delta, q_0, F)$ that is as shown in Figure 1 on page 2.
 - (a) List the set, Q , of **states**.
 - (b) Which state in this nondeterministic finite automaton is the **start state**?
 - (c) List the set F of **accept states** in M .
 - (d) Draw a table for the **transition function** δ of M .
2. Draw the “tree of possibilities” corresponding to execution of this nondeterministic finite automaton, M , on each of the following strings.
 - (a) λ
 - (b) a
 - (c) b
 - (d) ab
 - (e) bba
 - (f) abaa

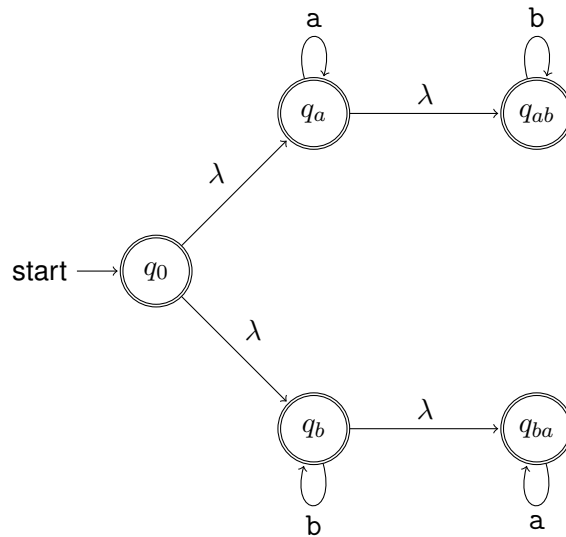


Figure 1: A Nondeterministic Finite Automaton

More Challenging Problems

As time permits, the following problems will be discussed during the tutorial. Once again, they concern the nondeterministic finite automaton M that is shown in Figure 1.

3. List the sets $C_{\lambda}(q)$ for each state q of M .
4. Describe, as precisely as you can, each of the following sets of strings — and say, briefly, how you might **prove** that your answers are correct.
 - (a) The set of strings $\omega \in \Sigma^*$ such that $q_0 \in \delta^*(q_0, \omega)$.
 - (b) The set of strings $\omega \in \Sigma^*$ such that $q_a \in \delta^*(q_0, \omega)$.
 - (c) The set of strings $\omega \in \Sigma^*$ such that $q_b \in \delta^*(q_0, \omega)$.
 - (d) The set of strings $\omega \in \Sigma^*$ such that $q_{ab} \in \delta^*(q_0, \omega)$.
 - (e) The set of strings $\omega \in \Sigma^*$ such that $q_0ba \in \delta^*(q_0, \omega)$.
5. Which strings are **accepted** by M ? Why? Which strings are **rejected** by M ? Why?
6. What is the language $L(M)$ of M ?