Lecture #6: Equivalence of Deterministic Finite Automata and Nondeterministic Finite Automata

What To Do Before the Lecture

1. Complete the preparatory viewing or reading for Lecture #6 — nothing that each video will probably be understandable if you play it at double speed.

2. ***Print*** and read through the rest of this document and — if you have time — try to solve the problems! These should help you to check that you understand how to use a given nondeterministic finite automaton to produce a deterministic finite automaton with the same language.

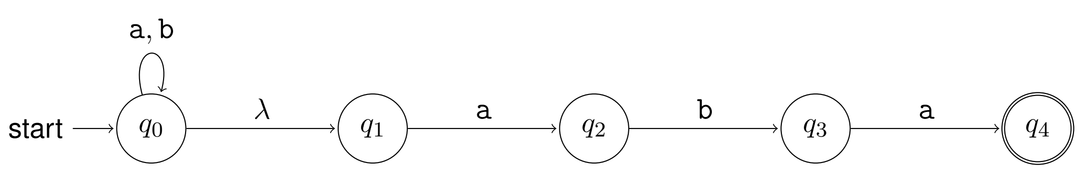
   The supplemental material also includes material that is for interest only. This includes proofs of various claims that are stated in the lecture material.

A Language and a Nondeterministic Finite Automaton

Let $\Sigma = \{\mathtt{a}, \mathtt{b}\}$ and let $L \subseteq \Sigma^\star$ be the following language:

$$L = \{w \in \Sigma^\star \mid \omega \text{ ends with } \mathtt{aba}\}.$$

Consider the following ***nondeterministic*** finite automaton $M = (Q, \Sigma, \delta, q_0, F)$ with the above alphabet Σ and the following transition diagram.



Problems To Be Solved

1. Apply a process, described in the lecture material, to use the given nondeterministic finite automaton to produce a ***deterministic finite automaton*** with the same language.

   Solution: $Cl_\lambda(q)$ has already been computed for each state q in the given nondeterministic deterministic finite automaton, during the previous lecture presentation. These will be used repeatedly when solving this problem.

   Initialization

   Our DFA, So Far:

   First Execution of the Body of the Main Loop

   Selecting a State whose Transitions should be Identified

   Computation of the Transition for the Symbol "`a`*"*

Computation of the Transition for the Symbol “`b`”

Our DFA, So Far

Reflections — What Have We Done? Which Strings Can Now Be Processed?

Second Execution of the Body of the Main Loop

Later Execution(s) of the Body of the Main Loop

Choosing the Accepting States

The DFA That Has Been Produced