

Homework 2 Solutions

CS 321

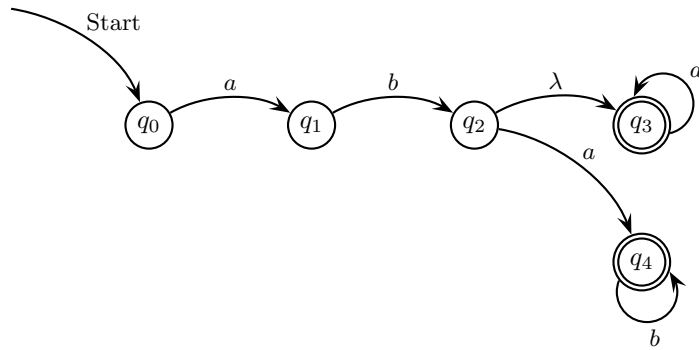
2.2.6

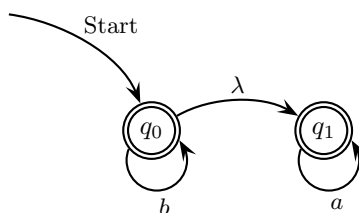
$$\delta^*(q_0, 1010) = \{q_0, q_2\}$$

$$\delta^*(q_1, 00) = \emptyset$$

2.2.7

$$L = \{abab^n : n \geq 0\} \cup \{aba^n : n \geq 0\}$$





2.2.10(a)

Find an nfa with three states that accepts the language

$$L = \{a^n : n \geq 1\} \cup \{b^m a^k : m \geq 0, k \geq 0\}$$

Notice that this language is equivalent to just $\{b^m a^k : m \geq 0, k \geq 0\}$. That is, the strings of the form $\{a^n : n \geq 1\}$ are captured for $m = 0$ and $k \geq 1$. With this observation it is easy to create an NFA with just two states as shown above. If desired we could add a third state, as asked for by the problem, by simply adding a new state q_2 that has no arcs entering it.

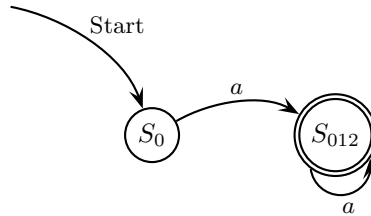
Problem 2.2.12

The following strings are accepted by the NFA: 01001, 000.

Problem 2.3.1

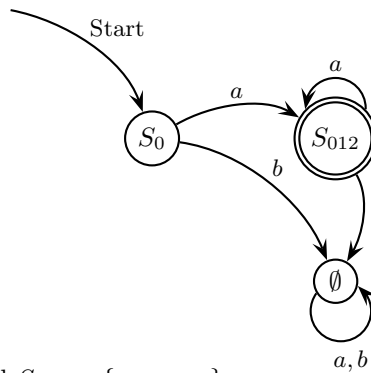
Since no alphabet was specified we will perform the construction for both the alphabet $\Sigma = \{a\}$ and alphabet $\Sigma = \{a, b\}$.

For $\Sigma = \{a\}$ we get,



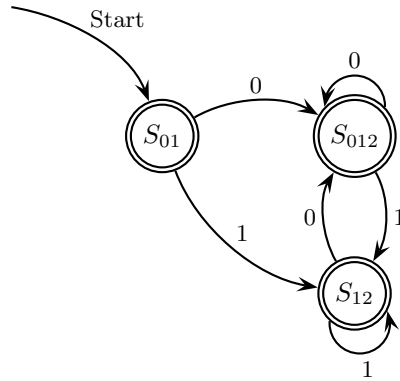
where $S_0 = \{q_0\}$ and $S_{012} = \{q_0, q_1, q_2\}$.

For $\Sigma = \{a, b\}$ we get,



where $S_0 = \{q_0\}$ and $S_{012} = \{q_0, q_1, q_2\}$.

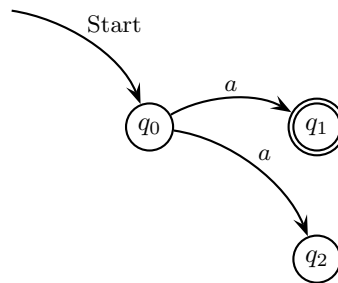
2.3.3



where $S_{01} = \{q_0, q_1\}$, $S_{012} = \{q_0, q_1, q_2\}$, and $S_{12} = \{q_1, q_2\}$.

2.3.6

This is not true in general. Consider the following three state NFA N :



Clearly we have that $a \in L(N)$. However, the language

$$L' = \{w : w \in \Sigma^*, \delta^*(q_0, w) \cap (Q - F) \neq \emptyset\}$$

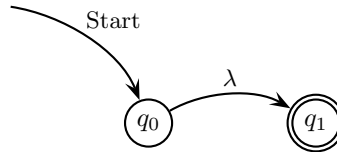
also contains a since $\delta^*(q_0, a) = \{q_1, q_2\}$ and $Q - F = \{q_0, q_2\}$, giving that $\delta^*(q_0, a) \cap (Q - F) = \{q_2\}$ which is not empty. This shows that $L' \neq \overline{L(N)}$ since $a \notin \overline{L(N)}$.

2.3.11

The answer is in the back of your textbook.

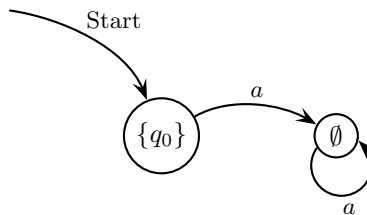
Exercise A

Consider the alphabet $\Sigma = \{a\}$ and the following NFA N :



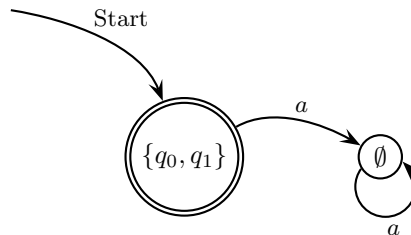
Notice that $L(N) = \{\lambda\}$.

The DFA M produced by NFA-TO-DFA* is:



The language for this DFA is $L(M) = \emptyset$ which is not equivalent to $L(N)$.

The procedure taught in class will produce the following DFA M' :



and we get that $L(M') = \{\lambda\} = L(N)$ as desired.