CS321 - Homework 2

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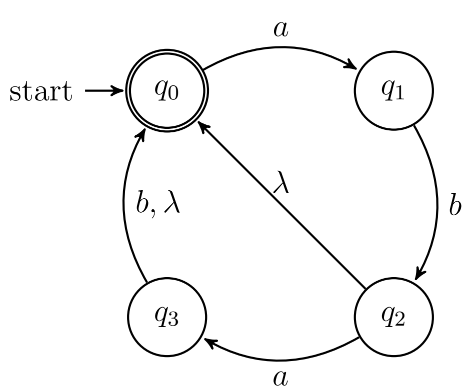
Section 2.2

6 For the nfa in Figure 2.9, find $\delta^*(q_0, 1010)$ and $\delta^*(q_1, 00)$.

$$\delta^*(q_0, 1010) = \{q_0, q_2\}$$
$$\delta^*(q_1, 00) = \{q_0, q_2\}$$

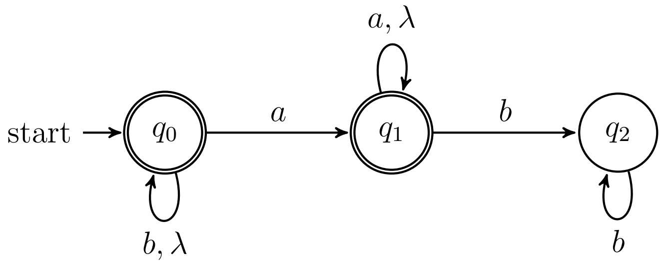
7 Design an NFA with no more than five states for the set

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

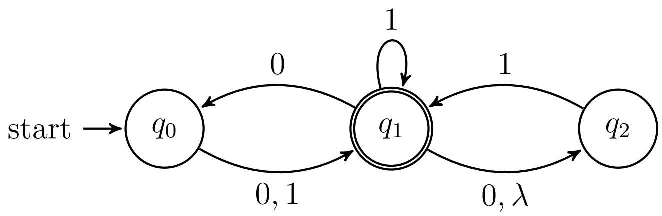


10(a) Find an NFA with three states that accepts the language

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

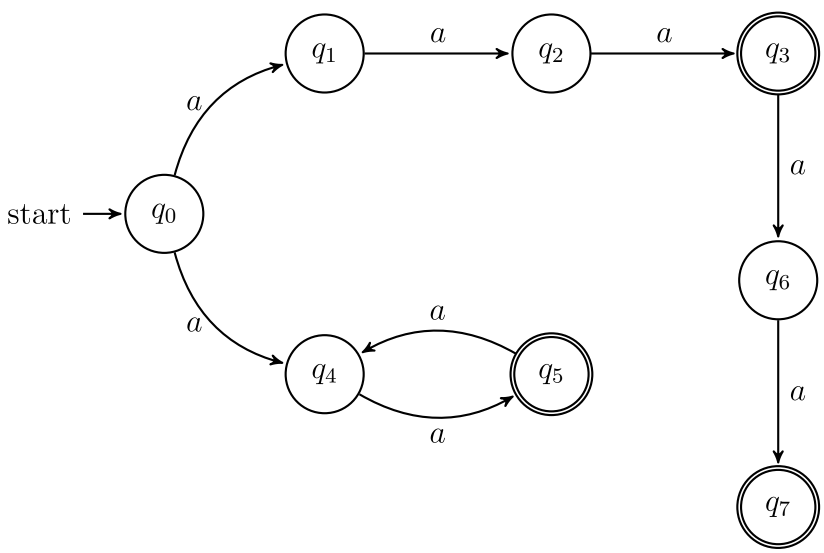


12 Which of the strings 00, 01001, 10010, 000, 0000 are accepted by the following nfa?



The strings accepted are: 01001, and 000.

14 Let L be the language accepted by the nfa in Figure 2.8. Find an nfa that accepts $L \cup \{a^5\}$.



18 Consider the following modification of Definition 2.6. An nfa with multiple initial states is defined by the quintuple

$$M = (Q, \Sigma, \delta, Q_0, F),$$

where $Q_0 \subseteq Q$ is a set of possible initial states. The language accepted by such an automaton is defined as

$$L(M) = \{w : \delta^*(q_0, w) \text{ contains, } q_f, \text{ for any } q_0 \in Q_0, q_f \in F\}.$$

Show that for every nfa with multiple initial states there exists an nfa with a single initial state that accepts the same language.

For any nfa with multiple initial states that accepts a language L, you can deconstruct that nfa into each possiple combination of initial and final states. An nfa that accepts the same language L can then be chosen from one of the available combinations.

Section 2.3

6 Is it true that for every nfa $M = (Q, \Sigma, \delta, q_0, F)$ the complement of $L(M)$ is equal to the set $\{w \in \Sigma^*, \delta^*(q_0, w) \cap (Q - F) \neq \emptyset\}$? If so, prove it; if not, give a counterexample.

By definition of $\overline{L(M)}$, if $L(M)$ does not accepts a string w, then that string is accepted by $\overline{L(M)}$. Since $w \in F$, in $L(M)$, then $w \in (Q - F)$ in $\overline{L(M)}$.