CPSC 351 — Tutorial Exercise #4
Additional Practice Problems

About These Problems

These problems will not be discussed during the tutorial, and solutions for these problems will not be made available. They can be used as "practice" problems that can help you practice skills considered in the lecture presentation for Lecture #4, or in Tutorial Exercise #4.

Practice Problems

Each of these problems concern languages over the alphabet $\Sigma = \{\mathtt{a}, \mathtt{b}, \mathtt{c}\}$ — and continue one of the practice problems included with Tutorial Exercise #3.

1. Let L_1 be the set of strings $\omega \in \Sigma^\star$ such that ω includes at least four copies of $\mathtt{a}$ (which do not have to appear in a row — so that, for example, $\mathtt{aabaca} \in L_1$). Complete the design of a deterministic finite automaton

   $$M_1 = (Q_1, \Sigma, \delta_1, q_{0,1}, F_1)$$

   such that $L(M_1) = L_1$ — and prove that your answer is correct.

2. Let L_2 be the set of strings $\omega \in \Sigma^\star$ such that $\mathtt{aaaa}$ is a *substring* of ω — that is, $\omega = \mu\,\mathtt{aaaa}\,\nu$ for a pair of strings $\mu, \nu \in \Sigma^\star$. (Thus $\mathtt{aabaca} \notin L_2$.) Complete the design of a deterministic finite automaton

   $$M_2 = (Q_2, \Sigma, \delta_2, q_{0,2}, F_2)$$

   such that $L(M_2) = L_2$ — and prove that your answer is correct.

3. Let L_3 be the set of strings $\omega \in \Sigma^\star$ such that ω *ends with* $\mathtt{aaaa}$ — so that $\omega = \mu\mathtt{aaaa}$ for some string $\mu \in \Sigma^\star$. Complete the design of a deterministic finite automaton

   $$M_3 = (Q_3, \Sigma, \delta_3, q_{0,3}, F_3)$$

   such that $L(M_2) = L_2$ — and prove that your answer is correct.