

# CPSC 351 — Tutorial Exercise #2

## 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 #2, or in Tutorial Exercise #2.

### Practice Problems

Each of these problems concern languages over the alphabet  $\Sigma = \{a, b, c\}$ .

1. Let  $L_1$  be the set of strings  $\omega \in \Sigma^*$  such that  $\omega$  includes at least four copies of a (which do not have to appear in a row — so that, for example,  $aabaca \in L_1$ ). Using the design process that was described in the preparatory material for Lecture #2, design 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  $\omega \in \Sigma^*$  such that  $aaaa$  is a *substring* of  $\omega$  — that is,  $\omega = \mu aaaa \nu$  for a pair of strings  $\mu, \nu \in \Sigma^*$ . (Thus  $aabaca \notin L_2$ .) Using the design process that was described in the preparatory material for Lecture #2, design 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  $\omega \in \Sigma^*$  such that  $\omega$  *ends with*  $aaaa$  — so that  $\omega = \mu aaaa$  for some string  $\mu \in \Sigma^*$ . Using the design process that was described in the preparatory material for Lecture #2, design 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.