CSE 322: Introduction to Formal Models in Computer Science
Assignment #4
April 27, 1998
due: Monday, May 4

1. Exercise 2.3.1. Show the state diagram for a simple nondeterministic finite automaton for which interchanging final and nonfinal states does not produce the complementary language. State the languages accepted by these two automata (the one in your state diagram and the one with interchanged final states), and explain why these two languages are not complementary.

2. Exercise 2.3.2. Show the state diagram of some simple nondeterministic finite automaton M_1 such that, if you construct M by following the suggestion in the exercise, $L(M) \neq (L(M_1))^*$. Show the state diagram of the constructed M as well. Substantiate your answer by providing a string that is either in $L(M) - (L(M_1))^*$ or in $(L(M_1))^* - L(M)$, and state which.

3. Exercise 2.3.4. Be careful to omit no step, take no shortcut, and make no simplification in following the constructions. Show your intermediate work.

4. Exercise 2.3.7, parts (a), (b), (d). Use the method given in lecture. Contrary to the exercise instructions, do *not* simplify the regular expressions as you proceed. Show the state diagrams of the finite automata you have gone through to arrive at the final answer.

5. Consider the language
$$L = \{vv \mid v \in \{a, b\}^*\}.$$
In this problem you will investigate the importance of making a good choice of the string w in the pumping lemma in order to prove that L is not regular.

   (a) Suppose you choose $w = (ab)^{|K|}(ab)^{|K|}$. What goes wrong when you try to apply the pumping lemma with this choice of w?

   (b) Prove that L is not regular by starting with a good choice for $w \in L$.