CSE 322: Introduction to Formal Models in Computer Science
Assignment #1
October 3, 2005
due: Monday, October 10

In the assignments, all references to the textbook refer to the Second Edition. I will try to also give the corresponding reference to the First Edition, when it exists, in square brackets as follows: "[1st Ed: ...]". You are responsible for making sure you do the correct problem!

1. Give the formal description (i.e., the 5-tuple) of the DFA M_4 from Example 1.11 [1st Ed.: Example 1.4] on page 38. Use a 5×2 table to describe δ.
2. Exercise 1.6(a) [1st Ed: Exercise 1.4(a)].
3. Give the state diagram for a DFA that accepts those strings over the alphabet $\{0, 1\}$ that do not contain the substring 101.
4. Give the state diagram for a DFA that accepts the language of Exercise 1.7(e) [1st Ed: Exercise 1.5(e)], using as many states as you need.
5. Exercise 1.7, parts c, e, g [1st Ed: Exercise 1.5, parts c, e, f].
6. Problem 1.33 [1st Ed: Problem 1.26].
7. (a) Give the state diagram for a DFA M that accepts the language

$$L = \{w \in \{0, 1\}^* \mid w \text{ is the binary representation of a multiple of } 5\}.$$

   For the purposes of this problem, assume that ε represents the integer 0, and that leading 0's are o.k. For instance, ε, 11001, and 00101 are all in L, but 110 and 00001 are not.

   Hint: Let the state set be $\{q_0, q_1, q_2, q_3, q_4\}$, and maintain the property that w takes M from q_0 to q_i if and only if $w' \bmod 5 = i$, where w' is the integer with binary representation w. Now think, for example, about what the remainder mod 5 of (the integer with binary representation) $w1$ would be, if you know that the remainder mod 5 of (the integer with binary representation) w is 3.

   (b) Problem 1.37 [1st Ed: Problem 1.30]. Just specify the 5-tuple; you do not have to prove that it is correct.

   Hint: Take the state set to be $\{q_0, q_1, \ldots, q_{n-1}\}$, generalizing the hint above. The key part of the construction is to state, for $\sigma \in \{0, 1\}$, what $\delta(q_i, \sigma)$ would be.