CSE 322: Introduction to Formal Models in Computer Science
Assignment #1
January 11, 2002
due: Friday, January 18

1. Give the formal description of the DFA M_2 from Exercise 1.1. Use a 4×2 table to describe δ.

2. Exercise 1.4, parts a, f, i.

3. Exercise 1.5, parts c, e, f.

4. Problem 1.25.

5. (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) Suppose you wanted to solve part 5a now for multiples of k instead of multiples of 5, and you took the state set to be $\{q_0, q_1, \ldots, q_{k-1}\}$, generalizing the hint above. For $\sigma \in \{0,1\}$, what would $\delta(q_i, \sigma)$ be? What is the initial state and the set F of accept states?