For each problem let $\Sigma = \{0, 1\}$.

1. Draw the transition diagram of a DFA that accepts each of the following languages.
   a. $\{\lambda, 1, 10, 11, 100\}$
   b. All strings that do not contain 111 as a substring.
   c. All strings beginning with a 1 that, interpreted as the binary representation of an integer (most significant bit on the left), are congruent to 2 mod 5 or 3 mod 5.
   d. All strings of length at least four whose final three symbols contain an odd number of 1’s.

2. Give a regular expression that denotes each of the following languages.
   a. All strings in which at least one 1 is not immediately preceded by a 0.
   b. All strings in which the second symbol from the start is a 1 and the second symbol from the end is a 1.

3. Construct a DFA equivalent to the following regular expressions.
   a. $(00 + 1)^* (11 + 0)^*$
   b. $((0 + 1)(0 + 1))^* + ((0 + 1)(0 + 1)(0 + 1))^*$

4. Describe in English the following regular expression: $0^*1(0 + 10^*1)^*$

5. Consider the DFA in Fig. 2.33(b) in the textbook, reproduced in Fig. 1.
   a. Describe in English the language accepted.
   b. Give an equivalent regular expression.

6. Consider the set of all strings in which the 10th symbol from the right end is a 1.
   a. Construct an NFA that accepts this language.
   b. If you were to construct a DFA to accept this language, how many states would you need?