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

1. Draw the transition diagram of a DFA equivalent to the following regular expressions.
   a. $01 + (0 + 11)^*$
   b. $(00)^* + (000)^*$

2. Draw the transition diagram of a DFA that accepts each of the following languages.
   a. All strings that contain an even number of 0's or exactly two 1's.
   b. All strings beginning with a 1 that, interpreted as a the binary representation of an integer (most significant bit on the left), are congruent to 3 mod 5 or 4 mod 5.
   c. All strings of length at least four whose final three symbols contain an even number of 1's.

3. Give a regular expression denoting the language of all strings that do not contain 00 as a substring.

4. Describe in English the language denoted by the regular expression $0^*1(0 + 10^*1)^*$.

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

6. Give a regular expression equivalent to the DFA in Fig. 2.2 in the textbook, reproduced below.

7. 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?