1. For each of the following regular expressions, write down three strings in the language generated by the expression, and give a short English description of the language. Assume \( \sum = \{0, 1\} \).

(a) \( 0^+ (0 \cup 1) 1^+ \)
(b) \( 0^* 10^* 10^* 10^* \)
(c) \( 0^* (100^*) 1^* \)
(d) \( (0 \cup 10)^* 1 (1 \cup 10)^* \)

2. Consider sets of binary strings \( A = \{0, 00, 000\} \) and \( B = \{11\} \). Show the language denoted by each of the following:

(a) \( A^0 \)
(b) \( A^1 \)
(c) \( A \cup A^2 \)
(d) \( AB^2 \)
(e) \( (AB)^2 \)
(f) \( B^3 \)
(g) \( A^* \)
(h) \( (A \cup B)^2 \)

3. For each of the following problems construct a deterministic finite automaton which describes or recognizes the language given. The underlying alphabet is \( \sum = \{0, 1\} \). Be sure to give DFAs and not NFAs. Do not use any notational conveniences or shortcuts given in lecture.

(a) \{ \( w \mid w \) begins with 01 and ends with 01. \}
(b) \{ \( w \mid w \) has an even number of 1’s. \}
(c) \{ \( w \mid w \) has two or three 1’s. \}
(d) \{ \( w \mid w \) has an even number of 0’s, and \( |w| \) is even. \}
(e) \{ \( w \mid w \) has an even number of 0’s and odd number of 1’s. \}
4. For each of the following problems, assume $\sum = \{a, b\}$.

(a) Convert the following NFA to a DFA.

(b) Write a regular expression that accepts the language defined by 4a.

(c) Convert the following NFA to a DFA.

(d) For each of the following strings, determine whether it is recognized by 4c or not.

i. bab

ii. aababbb

iii. aabaaaaa

iv. aabaaa

v. bbaabbb
5. Construct a NFA that accepts C-like comment delimited by /* and */. Do not handle nested comments (assume they are not allowed). For simplicity, use \( \Sigma = \{ /, *, c \} \) where \( c \) is the only (non-comment) character in the language. Then, write a regular expression for the NFA you constructed.

6. Let \( L \) be a regular language. Prove that \( R(L) \), strings in \( L \) reversed, is also a regular language.