Exercise 2

1. Consider the context-free grammar:

   S -> S S + | S S * | a

   and the string aa + a*.

   a. Give a leftmost derivation for the string.

   b. Give a rightmost derivation for the string.

   c. Give a parse tree for the string.

   d. Is the grammar ambiguous or unambiguous? Justify your answer.

2. Consider the context-free grammar:

   S -> S + S | S S | (S) | S * | a

   and the string (a+a)*a.

   a. Give a leftmost derivation for the string.

   b. Give a rightmost derivation for the string.

   c. Give a parse tree for the string.

   d. Is the grammar ambiguous or unambiguous? Justify your answer.

3. Design grammars for the following languages:

   a. The set of all strings of 0s and 1s such that every 0 is immediately followed by at least one 1.

   b. The set of all strings of 0s and 1s that are palindromes; that is, the string reads the same backward as forward.

   c. The set of all strings of 0s and 1s with an equal number of 0s and 1s.

   d. The set of all strings of 0s and as in which 011 does not appear as a substring.