Week 7 Tutorial Session

1. Give context-free grammars for the following languages. Briefly explain what the rules in your grammar represent. If you use more than one variable, also briefly explain what the variables mean. Justify your answer.

   (a) $L_1 = \{w \in \{0, 1\}^* \mid w \text{ is a palindrome}\}$

   A palindrome is a word that reads the same forward and backward. Examples of palindromes in English are `level` and `madam`.

   (b) $L_2 = \{0^a 1^b \mid a \neq b\}$

   (c) $L_3 = \{w \in \{0, 1\}^* \mid w \text{ contains the same number } 0\text{s and } 1\text{s}\}$

2. Consider the following context-free grammar G:

$$S \to SS \mid T$$
$$T \to aTb \mid ab$$

   (a) What is the language $L(G)$ of the grammar?

   (b) Show that G is ambiguous.

   (c) Give an equivalent, unambiguous grammar for the same language.