1. In Question 5 of the previous assignment, you considered the following CFGs:
   
   (a) \( S \to aS | bS | a | b | \varepsilon \)
   
   (b) \( S \to XaaaX \)
       \( X \to aX | bX | \varepsilon \)
   
   (c) \( S \to aaS | aaaS | a \)
   
   (d) \( S \to aX | bS | a | b \)
       \( X \to aX | a \)

   Determine which are ambiguous, and for each of those find a string that shows that the
   CFG is ambiguous.

2. Let \( L \) be the language corresponding to the RE \( b(ab)^* \). For the following CFG for \( L \),
   determine the number of derivation trees for the string \( bababab \).

   \[ S \to SaS | b \]

3. Give a regular grammar for \( L \) of the previous exercise.

4. Give a CFG for the complement of \( \{0^n1^n : n \geq 0\} \).

5. Construct a PDA for the language of the previous exercise.

6. A CFG is called **linear** if the right-hand side of every production contains at most one
   variable. Thus a regular grammar is always linear. But a linear grammar need not
   generate a regular language: for example, we saw that palindromes are generated by a
   linear grammar.

   Show that the set of languages generated by linear grammars is closed under union.

Due: Thursday October 13