Assignment 7
CSCI-661 Foundations of Computer Science Theory
due Monday, April 15, 2024

1. **(6 points)**

   (a) For all languages A and B, if A and B are not context-free, then $A \cup B$ is not context-free.

   This statement is TRUE / FALSE (indicate your answer).
   If you answered "TRUE," informally and briefly explain your answer. If you answered "FALSE," give a simple counterexample.

   (b) For all languages A and B, if A and B are not context-free, then $A \cap B$ is not context-free.

   This statement is TRUE / FALSE (indicate your answer).
   If you answered "TRUE," informally and briefly explain your answer. If you answered "FALSE," give a simple counterexample.

   (c) For every language A, if A is not context-free, then $\overline{A}$ is not context-free.

   This statement is TRUE / FALSE (indicate your answer).
   If you answered "TRUE," informally and briefly explain your answer. If you answered "FALSE," give a simple counterexample.

2. **(4 points)** Draw a DFA and give the rules for a linear CFG that generates the language with all strings over $\{a, b\}$ that contain bba as substring or start with ab.

3. **(4 points)** Solve Exercise 3.1 items a,c,d from your textbook.

4. **(4 points)** Solve Exercise 3.2 items b,c,d from your textbook.

5. **(4 points)** Solve a problem of your choice from 3.9 through 3.21 (one which is not solved in the selected solutions section of the book). Read and think about problem 3.22.

6. **(5 points)** Suppose you are given a string $w \in \{0, 1\}^*$ placed on a Turing Machine tape. Give the state diagram for the Turing Machine required to take the initial number in binary notation, w, and replace it on the tape with a number in binary notation, w'. The result, w', is formed by adding 1 to w.