4200 - Formal Languages: Homework #5

Due on Mar 24, 2021 at 8:00am

Instructor: Dr. Anh Nguyen

Problem 1

30 points
Exercise 2.6. Give context-free grammars (CFGs) generating the following languages.

1. The set of strings over the alphabet $\Sigma = \{a, b\}$ with more a's than b's
2. The complement of the language $\{a^n b^n \mid n \geq 0\}$

Problem 2

15 points
Exercise 2.9. Give context-free grammars (CFGs) generating the following language:

$A = \{a^i b^j c^k \mid i = j \text{ or } j = k \text{ where } i, j, k \geq 0\}$

Is your grammar ambiguous? Why or why not? If yes, please provide an example of two different left-most derivations that generate the same string.

Problem 3

15 points
Exercise 2.14. Convert the following CFG into an equivalent CFG in Chomsky normal form, using the procedure given in Theorem 2.9.
Please provide all intermediate steps with comments on how you transform from the grammar from one version to another (these steps are critical for your work to be graded).

$$A \rightarrow BAB \mid B \mid \epsilon$$
$$B \rightarrow 00 \mid \epsilon$$