CSCI 450 Fall 2024
Homework 4

Problem 1: (1 pt) Show that the language $L = \{w: n_a(w) = n_b(w)\}$ is not regular.

Problem 2: (1 pt) Is the language $L = \{w \in \{a, b, c\}^*: |w| = 3n_a(w)\}$ regular? Prove it.
(Hint: pick a string w that satisfies $|w| = 3n_a(w)$)

Problem 3: (2 pts) Find a context-free grammar that generates the language

$L = \{a^n w w^R b^n: w \in \{a, b\}^*, n \geq 1\}$

Problem 4: (2 pts) Define what one might mean by properly nested parenthesis structures involving two kinds of parentheses, () and [ ]. Intuitively, properly nested strings in this situation are [()], ([[ ]])([]) but not ([)] or ((]. Using your definition, give a context-free grammar for generating all properly nested parentheses.

Problem 5: (2 pts) Write a context-free grammar for $L = \{a^n b^{n+1}: n \geq 0\}$, and then convert it to GNF.

Problem 6: (2 pts) Show that the following grammar is ambiguous:
S → aSbS | bSaS | λ