Rajat Sethi – CPSC 3500 – ASG 7

Diagram

Description automatically generated

2a.) For any context-free language, there exists a context-free grammar that can create it. With that original CFG, replace every instance of the terminal characters with some arbitrary non-terminal character (Using the example, let’s say 0 = X and 1 = Y). The production rules of those new non-terminal characters will then produce terminal characters based on the homomorphism (Using example, X 🡪 00 and Y 🡪 11).

2b.) Imagine a non-context-free language with alphabet {0, 1}. A context-free language Lf could exist with these homomorphisms.

f(0) = ε

f(1) = ε

3.) Since the order of characters {0, 1, 2} is arbitrary, there exists no consistent pattern to the strings in the language. According to the Pumping Lemma, since there is no pattern to the strings, the language is not context-free.

4a.)

4b.) For any 2-PDA, the strings can be accepted with both stacks empty. As such, instead of having an accept state at the end of the 1st 2-PDA, an ε-transition can lead to the start of the next 2-PDA. Therefore, 2-PDAs are closed under concatenation, just like normal PDAs.