

CSCI 340 — Homework 9

Professor Killian

Due: April 7, 2019 @ 11:59PM

1. Consider the grammar for the language $L = \{ a^n b^n \}$
 - (a) (5pts) Chomsky-ize this grammar
 - (b) (5pts) Find all derivation trees that **do not** have self-embedded non-terminals
2. (5pts) Why does the pumping lemma argument **not** show the language PALINDROME is not context free? Show how v and y can be found such that $w = uv^nxy^nz$ are also in PALINDROME no matter what w is.
3. (5pts) How would you go about proving the following theorem?
If L is a language over the one-letter alphabet $\Sigma = \{ a \}$ and L can be shown to be non-regular using the pumping lemma for regular languages, then L can be shown to be non-context-free using the pumping lemma for context-free languages.
4. (4pt) Using (1) the theorems on slides 2, 5, and 7; (2) a little ingenuity; and (3) the recursive definition of regular languages – provide a new proof that all regular languages are context-free
5. (2pt ea) Find CFGs for the following languages:
 - (a) All words that start with a or are of the form $a^n b^n$
 - (b) All words in EVEN-EVEN*
 - (c) All words that start with ODD-PALINDROME and end with EVEN-PALINDROME
6. (4pt) Find a CFG for $a^x b^y a^z$ where $x + z = y$
7. (2pt ea) Which of the following are context-free?
 - (a) $\text{EQUAL} \cap \{ a^n b^n a^n \}$
 - (b) $\text{EVEN-EVEN}' \cap \text{PALINDROME}$
 - (c) $\{ a^n b^n \}' \cap \text{PALINDROME}$