

CS350 – Lab 10

Due Date: April 18

Purpose: We have seen some of the properties and limits of context free languages. The purpose of this lab is for you to prove some additional properties of context free languages and also prove that some languages are not context free.

Knowledge: This lab will help you become familiar with the following content knowledge:

- How to use prove closure properties of context free languages.
- How to use the context free pumping lemma to show that a language is not context free.

Task: Follow the steps in this lab carefully to complete the assignments.

Assignment 1:

A homomorphism is a substitution in which single letters in a string are replaced with new strings. For example here is a homomorphism h :

$$h(a) = ab$$

$$h(b) = bb$$

Then $h(aba) = abbbab$.

Show that context free languages are closed under homomorphisms.

Criteria for Success: You have a clear proof on why a homomorphism applied to each of the strings of a context free language would give another context free language.

Assignment 2:

Use the context free pumping lemma to show each of the following languages is not regular. The notation $n_a(w)$ indicates the number of a's in the string w .

1. $L = \{a^n b^j c^k \mid k > n, k > j\}$

2. $L = \{w \in \{a, b, c\}^* \mid n_a(w) + n_b(w) = 2n_c(w), n_a(w) = n_b(w)\}$

Criteria for Success: You have a full context pumping lemma proof for each language.

Written answers may be submitted in Canvas or on paper for grading.