

COMP 455
Models of Languages and Computation
Spring 2019
Homework 7
Due Tuesday, April 9, 2019

1. Problem 3.5.1 (a), from the text, page 148. Hint: Try expressing this language as the union of two other context-free languages.

2. Using theorems 3.5.2 and 3.5.3 in the text, or the pumping lemma game for context-free languages, show that the following language is not context-free: $\{wcwcw : w \in \{a, b\}^*\}$. Hint: Let L be the specified language. Try intersecting L with $a^*ca^*ca^*$. If L is context-free, this intersection should also be context-free. Show that this intersection is not context-free. Consider a string of the form $a^nc^na^nc^na^n$ for a large value of n . Show that this string is in the intersection, but if the string is “pumped” as in the pumping theorem, for the right choice of i you obtain a string that is not in the intersection.

3. Show that the following language is context-free, or else show that it is not. $\{a^mba^nbap : m = n \text{ or } n = p \text{ or } m = p\}$. Hint: Express this language as the union of three other languages.

For this homework you may work in groups of up to four people and groups are encouraged to turn in only one paper with everyone’s names in the group on it. This will make the work of the grader easier.