

Homework #7

#1. (10 Points) Use the pumping lemma for CFL's to show $L = \{a^i b^j a^i b^j \mid i, j \geq 0\}$ is not a CFL.

#2. (10 Points) Consider the following 2 languages:

$$L_1 = \{a^n b^{2n} c^m \mid n, m \geq 0\}$$

$$L_2 = \{a^n b^m c^{2m} \mid n, m > 0\}$$

a) Show that each of these languages is context-free.

b) Is $L_1 \cap L_2$ context-free? Justify your answer.

#3. (20 Points) Convert the following grammar to Chomsky Normal Form

$$S \rightarrow A \mid A B a \mid A b A$$

$$A \rightarrow A a \mid \varepsilon$$

$$B \rightarrow B b \mid BC$$

$$C \rightarrow C B \mid C A \mid b B$$

#4. (10 Points) Let G be a grammar in Chomsky Normal Form. Fill in the following table.

w	w	length(derivation)	max depth(tree)	min depth(tree)
ε	0	1	1	1
A_1	1	1	1	1
$a_1 a_2$	2	3	2	2
$a_1 a_2 a_3$	3	5	3	3
$a_1 a_2 a_3 a_4$				
$a_1 a_2 a_3 a_4 a_5$				
$a_1 a_2 a_3 \dots a_n$	n			

#5. Post to the Module 7 Topics, applications of

a) Chomsky Normal Form

b) Greibach Normal Form