

COT 4210 Homework #2: Context Free Grammars
Due Date: Monday June 6, 2011 (in class)

1) Give parse trees and derivations for the following two strings

a) $a + a + a$

b) $((a))$

in the CFG G_4 defined below:

$$E \rightarrow E + T \mid T$$

$$T \rightarrow T \times F \mid F$$

$$F \rightarrow (E) \mid a$$

2) Give context free grammars that generates the following languages with the alphabet $\{0,1\}$:

a) $\{w \mid w = w^R, \text{ namely } w \text{ is a palindrome}\}$

b) $\{w \mid w \text{ contains at least three 1s}\}$

c) $\{w \mid \text{the length of } w \text{ is odd and its middle symbol is 0}\}$

d) $\{w \mid w \text{ contains more 1s than 0s}\}$

For each grammar, briefly justify why it generates the desired language.

3) Give an informal description and state diagram of a PDA that accepts the language in question 2 part d.

4) Convert the following CFG into an equivalent CFG in Chomsky normal form, using the algorithm shown in class.

$$A \rightarrow BAB \mid B \mid \varepsilon$$

$$B \rightarrow 00 \mid \varepsilon$$

5) Use the pumping lemma to show that the following language is not context free:

$$\{0^n \# 0^{2n} \# 0^{3n} \mid n \geq 0\}$$