Weekly Proof Questions (Sections 2.1, 2.2)
Assigned: 2/5/2015
Due: 2/12/2015

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) $\{w \mid w = w^R$, namely w is a palindrome$\}$
b) {w | w contains at least three 1s }
c) {w | the length of w is odd and its middle symbol is 0}
d) {w | w 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) Show that context-free languages are closed under the following regular operations: union, concatenation and star.

6) Create a unambiguous context-free grammar over the alphabet {a, b, c} that generates the language $L = \{a^i b^j c^k \mid i > j\}$. Explain why your grammar is unambiguous.

7) Create a PDA for the language in question #6.