Final Examination, Ling549/CSE477, Fall 1997, December 11, 1997

Please return your examination to my office (Room 555 Moore) or to my mailbox at IRCS by NO LATER THAN THURSDAY, DEC 18.

Problem 1: 20 points, 10 points each for (a) and (b)

$L = \{w | w \epsilon \{a, b\}^*$, w contains even number of a's and even number of b's (zero is even)$\}$

(a) Give a finite state grammar G for L, i.e., $L(G) = L$.

(b) Give a finite state automaton M for L, i.e., $L(M) = L$.

Problem 2: 15 points

Convert the following CFG into a Chomsky Binary Normal Form

$S \rightarrow SaA|SA|b$

$A \rightarrow Ad|ASa|aS|c$

Problem 3: 15 points

Let G be a CFG whose production rules are

$S \rightarrow SbS$

$S \rightarrow a$

Show that G is an ambiguous grammar. Is $L(G)$, the language of G, ambiguous or unambiguous? Justify your answer.

Problem 4: 20 points

Let $L = \{a^i b^j c^{max(i,j)} | i \geq 1, j \geq 1\}$

Is L a context-free language? If so, give a context-free grammar for L. If not, show that L is not a context-free language.

Problem 5: 30 points

Construct a pushdown automaton M which recognizes exactly the language for the context-free grammar G given by the productions

$A \rightarrow aAC$

$A \rightarrow aB/bAB$

$B \rightarrow b$

$C \rightarrow c$

Verify your construction by taking a couple of strings in L and a couple of strings not in L. Hint: Note that G is already in the Greibach Normal Form.