Recently we have studied context-free languages. The basic skills you should practice are: writing a CFG for a given language and proving that the CFG is correct, finding a CNF for a given CFG, and proving that a given language is not context-free using the pumping lemma. This assignment, due Wednesday 2009 May 6 at 5:00 PM, is just a start; for more practice see the homework assignments and miscellaneous exercises at the back of our textbook.

A. Do Problem 5.3 on page 306.

B. Give a CNF grammar equivalent to the one you found in the previous problem. (That is, find a CNF grammar that produces the same language, except for the ϵ string.)

C. Do Problem 75 on page 335.

D. Prove that CFLs are closed under union.

E. Give CFGs for $A = \{a^m b^n c^n : m, n \geq 0\}$ and $C = \{a^n b^n c^m : m, n \geq 0\}$. Prove that CFLs are not closed under intersection.

F. Are CFLs closed under complementation? (Hint: Problems D and E.)

G. Are CFLs closed under concatenation?

H. Prove that $A = \{a^i b^j c^k : 0 \leq i \leq j \leq k\}$ is not context-free.