COS 487, October 8, 2003
Due: October 15, 2003

Homework Set 4

When you submit your solutions, please write down your e-mail address on the first page.

Problem 1: 2.14

Problem 2: 2.17

Problem 3: Let M be a non-deterministic finite automaton. Prove that there exists a regular grammar G such that $L(G) = L(M)$.

Problem 4: Give an explicit context free grammar for the language L which consists of all the binary string w with strictly more 1's than 0's. Prove that your construction works.

Problem 5: Let $L_1 = \{a^i b^j c^j | i, j \geq 0 \text{ and } \ i \neq j\}$. Show that L_1 is a language that satisfies the three conditions in the basic pumping lemma given in Theorem 2.19.

Problem 6: (A) Prove the following statement:

Ogden's Lemma For any CFL L, there exists an integer $p > 0$ such that the following is true: if $w \in L$ is a string with at least p characters "marked," then w can be written as $w = uvxyz$ satisfying the following conditions:

(a) $uv^i xy^i z \in L$ for all $i \geq 0$,

(b) v and y together have at least one marked character, and

(c) vxy has at most p marked characters.

(B) Use Ogden's Lemma to show that the language L_1 (as defined in Problem 5) is not a CFL.