CMSC 451 SPRING 2003 HOMEWORK #2

DUE: April 8 in class.

1) [25%] Using the pumping lemma for regular languages, prove that the language \( \{0^j \mid j \text{ is a prime number}\} \) is not regular.

2) [25%] Using the pumping lemma for regular languages, prove that the language \( \{0^j 1^j \mid j \text{ is a non negative integer}\} \) is not regular.

3) [25%] Using the pumping lemma for regular languages, prove that the language \( \{0^j 1^k \mid j, k \text{ are non negative integers and there exists an integer greater than 1 such that that very same integer divides both } j \text{ and } k\} \) is not regular. You may use the fact that for every integer t there exists a prime that is greater than or equal to t.

4) [25%] Let G be a context-free grammar, \( G = (V, T, P, S) \), with start symbol S, set of nonterminal symbols (variables) \( V = \{S\} \), set of terminal symbols \( T = \{0, 1\} \), and set of productions \( P = \{ S \rightarrow \epsilon, S \rightarrow 0, S \rightarrow 1, S \rightarrow 0S0, S \rightarrow 1S1 \} \). Describe \( L(G) \), the language generated by G. Then prove that the language that you described is \( L(G) \).