CSci 4607 Fall 2003
Problem Set 1: Formal grammars

Problem 1. Give an unambiguous grammar that generates the same language as

$$S \to SS \mid (S) \mid ()$$

Draw the parse tree for $()()()$ in your grammar.

Problem 2. Write a BNF grammar that defines an integer number. Negative integer numbers are preceded by the minus sign. A non-zero number may not start with a zero. -0 is not a valid number.

Problem 3. Give the finite-state automata and the regular grammar for:

1. All strings over $\{0, 1\}$ containing the string 010.
2. All strings over $\{0, 1\}$ which do not contain the string 010.

Problem 4 Write unambiguous grammar that describes arithmetic expressions over one-letter variables (a, b, c, etc.) which use $*, /, +$, binary $-$, and parentheses (do not include unary $-$, as in $-x$). Some valid expressions include: a, $x+y$, $a+b+c$, $(m+n)*k$, $m+n*k$. The latter expression should be parsed according to the usual precedence rules (i.e. as the sum of the following: m and the product of n and k).

Draw parse trees for the following expressions:

1. $(x * y) + b/(a + c)$
2. $a + b * c - d$

Problem 5. Construct the push-down automaton for the context-free grammar

$$S \to 0S0 \mid 1S1 \mid 0 \mid 1$$

Is it possible to describe this language by a regular grammar? Briefly explain your answer.