Homework 4: CFGs and PDAs

CS 390 - Spring 2009

Assigned: February 24, 2009
Due: March 10, 2009

1. Do problem 2.1 from the book.
2. Write a CFG for the language of strings over $\{0,1\}$ such that every string's length is even and at least three, and the string has more 1's than 0's.
3. Write a CFG for the language $L = \{0^n 1^n | n \geq 0\}$.
4. For each of the following languages, create a PDA (non-deterministic) that recognizes it.
   a. $L = \{0^n 1^n | n \geq 0\}$
   b. $L = \{a^i b^j c^k d^l | i + l = j + k\}$
   c. $L =$ the set of arithmetic expressions that can be constructed with multiplication '*', addition '+', the variable 'x', the trigonometric function sin, and parentheses for grouping.
5. Convert the following CFG G to a PDA using the method we learned in class. A good example is on page 118 of your book (e.g., 2.25).

   $G = (V, \Sigma, P, S)$, where the production set P is

   $$S \rightarrow XY$$
   $$X \rightarrow 0X1|\varepsilon$$
   $$Y \rightarrow 1Y0|\varepsilon$$

   $\Sigma = \{0,1\}$

   $V = \{S, X, Y\}$

6. For each of the following languages, using the pumping lemma to prove that they are not context-free.

   a. $L = \{a^n b^n a^n b^n | n \geq 0\}$

   b. $L = \{a^i b a^j b a^k | k \geq j \geq i\}$

7. Convert the following PDA into an equivalent CFG. Use the method that we proved in class. The basic three steps are also outlined for you at the top of page 120 in your book.