CS46, Swarthmore College, Spring 2014
Homework 5 (due 3 March)
Your Name(s) Here

This assignment consists of two parts: a written homework and a programming portion.

Part 1: Written homework

1. Sipser 2.16: Show that the class of context free languages is closed under the regular operations union, concatenation, and star.

2. Sipser 2.44: If A and B are languages, define $A \diamond B = \{xy | x \in A \text{ and } y \in B \text{ and } |x| = |y|\}$. Show that if A and B are regular languages, then $A \diamond B$ is a CFL.

3. Sipser 2.6d: Give a context-free grammar that generates the following language: $\{x_1\#x_2\#\cdots\#x_k | k \geq 1$, each $x_i \in \{a,b\}^*$ and for some i and $j, x_i = x_j^R\}$. Note that i and j are not necessarily distinct and that any palindrome x_i satisfies $x_i = x_j^R$ and that $|x_i|$ can be zero for any i.

4. Sipser 2.30d: Use the pumping lemma for context free languages to show the following language is not context free: $\{x_1\#x_2\#\cdots\#x_k | k \geq 2$, each $x_i \in \{a,b\}^*$ and $x_i = x_j$ for some $i \neq j\}$.

Part 2: Programming Exercise

Read the section on Chomsky Normal Form Grammars (CNF Grammars) on pages 108-111 before attempting this part. Write a parser that determines if a string w is accepted by a CNF Grammar. Your program should take a CNF grammar and file containing test strings as input and determine if each string can be generated by the grammar. See the lab notes for examples.