

# Written Assignment 2

## Due February 9, 2006

This assignment asks you to prepare written answers to questions on context-free grammars. Each of the questions has a short answer. You may discuss this assignment with other students and work on the problems together. However, your write-up should be your own individual work. Remember that written assignments are to be turned in either at the start of lecture or in the CS164 homework box in 283 Soda by 12:30 PM on the due date.

***Please write your name, your account name, your TA's name, and your section time on your homework!*** We need this information so that we can give you credit for the assignment and so that we can return it to you.

1. Let  $L$  be the language consisting of all palindromes over the alphabet  $\Sigma = \{a, b\}$ . That is,  $L$  consists of all sequences of  $a$ 's and  $b$ 's that read the same forward or backward. For example,  $aba \in L$  and  $aabbbaa \in L$ , but  $abb \notin L$ . The empty string is in  $L$ .

Write a context-free grammar for the language  $L$ .

2. Consider the following grammar:

$$\begin{aligned} S &\rightarrow aSb \\ S &\rightarrow aS \\ S &\rightarrow \epsilon \end{aligned}$$

- (a) Give a one-sentence description of the language generated by this grammar.
  - (b) Show that this grammar is ambiguous by giving a string that can be parsed in two different ways. Draw both parse trees.
  - (c) Give an unambiguous grammar that accepts the same language as the grammar above.
3. Using the context-free grammar for Cool given in Section 11 of the Cool manual, draw a parse tree for the following expression.

```
if not x = 0 then
  y <- z + 2 * x + 1
else
  y <- z <- 0
fi
```

Note that the context-free grammar by itself is ambiguous, so you will need to use the precedence rules in Section 11.1 to get the correct tree.

4. Give an example of a grammar that is  $LL(2)$  but not  $LL(1)$ .