

CSE 322 Spring 2010

Homework Assignment #5

Due Date: Friday, May 21 (at the *beginning* of class)

1. (16 points) Consider the CFG G_2 on page 101 in the textbook. For each of the following strings, state whether or not the string is in $L(G_2)$. If it is not in $L(G_2)$, explain why. If it is in $L(G_2)$, give a parse tree and a leftmost derivation for the string (see page 106 for a definition of leftmost derivation):
 - a. the boy touches the flower
 - b. girl sees boy
 - c. the girl touches with a flower
 - d. the boy sees the girl with a girl
2. (20 points) Problem 2.27 in the textbook, both parts.
3. (20 points) Show that context-free languages are closed under the regular operations as well as the reversal operator, i.e., if L_1 and L_2 are any two context-free languages such that $L_1 = L(G_1)$ and $L_2 = L(G_2)$ for two CFGs G_1 and G_2 , show that the following languages are also context-free:
 - a. $L_1 \cup L_2$
 - b. $L_1 \circ L_2$ (“ \circ ” denotes concatenation)
 - c. L_1^*
 - d. L_1^R (“ R ” denotes string reversal)
4. (24 points) Give CFGs that generate the following languages:
 - a. $\{w \in \{0,1\}^* \mid w \text{ starts with 1 and has odd length}\}$
 - b. $\{0^i 10^j 10^k \mid i = j \text{ or } i = k \text{ for } i, j, k \geq 0\}$
 - c. $\{w \in \{0,1\}^* \mid \text{the number of 0s in } w \text{ is two times the number of 1s in } w\}$Try this for practice but you don't need to turn it in:
The complement of the language $\{0^n 1^n \mid n \geq 0\}$
5. (20 points) Give informal descriptions and state diagrams of pushdown automata (PDA) for the languages in 4 (b) and 4 (c) above (see Example 2.18 in the text for an example of an informal description). Note: Do not use the construction for converting CFGs to PDAs (Lemma 2.21 in the text) for this exercise – construct the PDA directly by thinking of an algorithm for accepting the language.