Homework 6

Due Date: Wednesday, March 12, 2008.

There is a possible 56 points for this homework assignment.

Problem 1. (6 pts.) Exercise 3.13 on page 112 of the text.

Problem 2. (4 pts.) Exercise 3.37, part a only, on page 116 of the text.

Problem 3. (20 pts.) In each case, show using the pumping lemma that the given language is not a CFL.
   a) \( L = \{a^ib^jc^k | i < j < k \} \)
   b) \( L = \{x \in \{a, b\}^* | \mathsf{mb}(x) = n_a(x)^2 \} \)
   c) \( L = \{a^nb^2na^n | n \geq 0 \} \)
   d) \( L = \{x \in \{a, b, c\}^* | n_a(x) = \max\{n_b(x), n_c(x)\} \} \)
   e) \( L = \{a^nb^ma^n b^n+m | m, n \geq 0 \} \)

Problem 4. (20 pts.) Decide in each case whether the given language is a CFL, and prove your answer.
   a) \( L = \{a^n b^m a^m b^n | m, n \geq 0 \} \)
   b) \( L = \{xayb | x, y \in \{a, b\}^* \text{ and } |x| = |y| \} \)
   c) \( L = \{xcx | x \in \{a, b\}^* \} \)
   d) \( L = \{xyx | x, y \in \{a, b\}^* \text{ and } |x| \geq 1 \} \)
   e) \( L = \{x \in \{a, b\}^* | n_a(x) < n_b(x) < 2n_a(x) \} \)

Problem 5. (6 pts.) For these two languages, just provide a Yes (if it is a CFL) or No, it is not answer along with a one sentence justification.
   a) \( L = \{x \in \{a, b\}^* | n_a(x) = 10n_b(x) \} \)
   b) \( L = \) the set of non-balanced parenthesis.

Problem 6. (5 pts. Extra Credit) Exercise 3.31 on page 115 in the text.

Problem 7. (5 pts. Extra Credit) Exercise 3.32 on page 115 in the text.