

## 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.

- $L = \{a^i b^j c^k \mid i < j < k\}$
- $L = \{x \in \{a, b\}^* \mid n_b(x) = n_a(x)^2\}$
- $L = \{a^n b^{2n} a^n \mid n \geq 0\}$
- $L = \{x \in \{a, b, c\}^* \mid n_a(x) = \max\{n_b(x), n_c(x)\}\}$
- $L = \{a^n b^m a^n b^{n+m} \mid m, n \geq 0\}$

**Problem 4.** (20 pts.) Decide in each case whether the given language is a CFL, and prove your answer.

- $L = \{a^n b^m a^m b^n \mid m, n \geq 0\}$
- $L = \{xayb \mid x, y \in \{a, b\}^* \text{ and } |x| = |y|\}$
- $L = \{xcx \mid x \in \{a, b\}^*\}$
- $L = \{xyx \mid x, y \in \{a, b\}^* \text{ and } |x| \geq 1\}$
- $L = \{x \in \{a, b\}^* \mid n_a(x) < n_b(x) < 2n_a(x)\}$

**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.

- $L = \{x \in \{a, b\}^* \mid n_a(x) = 10n_b(x)\}$
- $L =$  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.