

Homework 6

Return by: Monday, November 6

1. (40 points) Use the pumping lemma to prove that the following languages are not context-free.

(a) $L = \{a^n : n \text{ is prime}\}$ (A prime number is divided only by itself and 1.)

(b) $L = \{a^n b^j : n \leq j^2\}$

(c) $L = \{a^n b^j c^k : k = jn\}$

(d) $L = \{w : n_a(w) < n_b(w) < n_c(w)\}$

2. (15 points) Which of the following languages are context-free? Give short explanations.

(a) $L = \{a^n w w^R a^n : n \geq 0, w \in \{a, b\}^*\}$

(b) $L = \{a^n b^j a^n b^j : n, j \geq 0\}$

(c) $L = \{a^n b^j a^j b^n : n, j \geq 0\}$

(d) $L = \{a^n b^n c^j : n \leq j\}$

3. (15 points) Problem 4, page 227.

4. (15 points) Problem 17, page 227.

5. (15 points) Problem 2, page 244.