Exercise 6.4.

In the proof given in Example 6.4 using the pumping lemma, the contradiction was obtained in each case by considering the string vw^0xy^0z.

Would it have been possible instead to use vw^2xy^2z in each case? If so, give the proof in at least one case; if not, explain why not.

Exercise 6.3.

In the pumping-lemma proof in Example 6.4, give some examples of choices of strings $u \in L$ with $|u| \geq n$ that would not work.

Exercise 6.2.

In each case below, show using the pumping lemma that the given language is not a CFL.

a. $L = \{a^i b^j c^k \mid i < j < k\}$

b. $L = \{a^{2^i} \mid i \geq 0\}$

d. $L = \{a^i b^{2i} a^i \mid i \geq 0\}$

e. $L = \{s \in \{a, b, c\}^* \mid n_a(s) = \max\{n_b(s), n_c(s)\}\ \}$

g. $L = \{a^i b^j a^i b^{i+j} \mid i, j \geq 0\}$

Exercise 6.5.

For each case below, decide whether the given language is a CFL, and prove your answer.

a. $L = \{a^i b^j a^j b^i \mid i, j \geq 0\}$

c. $L = \{scs \mid s \in \{a, b\}^*\}$

d. $L = \{sts \mid s, t \in \{a, b\}^* \text{ en } |s| \geq 1\}$

g. $L =$ the set of non-balanced strings of parentheses

Exercise 6.12.

a. Show that if L is a CFL and F is finite, $L - F$ is a CFL.

b. Show that if L is not a CFL and F is finite, $L - F$ is not a CFL.

c. Show that if L is not a CFL and F is finite, $L \cup F$ is not a CFL.

Exercise 6.13.

For each part below, say whether the statement is true or false, and give reasons for your answer.

a. Show that if L is a CFL and F is regular, $L - F$ is a CFL.

b. Show that if L is not a CFL and F is regular, $L - F$ is not a CFL.

c. Show that if L is not a CFL and F is regular, $L \cup F$ is not a CFL.

Theorem 6.13.

If L_1 is a context-free language and L_2 is a regular language, then $L_1 \cap L_2$ is a CFL.

Exercise 6.8.

Show that if L_1 is a DCFL and L_2 is regular, then $L_1 \cap L_2$ is a DCFL.