

Homework 7
Cpt S 317, Spring 2017
Due Date: April 12, 2017

Total points: 39

Some problems in this homework have similar ones solved in the starred exercises. So please take a look at the solutions for the starred exercises from the book's website.

For grammars, by default, assume that the variable S is the start variable unless otherwise specified.

1. (16 points)

Eliminate ϵ productions, unit productions, useless symbols and then rewrite the resulting grammar in the Chomsky Normal Form (in that order) for the following two input grammars:

a) $S \Rightarrow aAa \mid bBB \mid \epsilon$

$A \Rightarrow C$

$B \Rightarrow S \mid A$

$C \Rightarrow S \mid \epsilon$

b) $S \Rightarrow aAA \mid bBB \mid \epsilon$

$A \Rightarrow AC \mid a$

$B \Rightarrow CB \mid bb$

$$C \Rightarrow CDE \mid \epsilon$$

$$D \Rightarrow A \mid B \mid ab$$

2. (5 points) (from Exercise 7.1.6.)

Design a CNF grammar for the set of strings of balanced parenthesis. It is your choice to either start or not start from any particular non-CNF grammar.

3. (18 points) (from Exercise 7.2.1: parts (b), (e) and (f))

Using the pumping lemma for CFLs, show that the following languages are *not* context-free:

a) $L = \{ a^n b^n c^i \mid i \leq n \text{ and } i, n \geq 0 \}$

b) $L = \{ a^n b^n c^i \mid n \leq i \leq 2n \text{ and } i, n \geq 0 \}$

c) $L = \{ ww^R w \mid w \text{ is a string of 0s and 1s} \}$