CS 3530: Assignment 2c

Fall 2022

Exercise 2.6b (10 points)

Problem

Give context-free grammars generating the following languages.

b. The complement of the language $\{a^n b^n : n \geq 0\}$.

Hint: The set of CFL is not closed under complement, so there is no generic operation to find the complement grammar. Examine the structure of strings in the complement language then create a grammar that will generate all of them.

For all CFGs, describe the role that each rule performs as well as giving the actual rule.

Solution

L = $L_1 U L_2$

S => $S_1 | S_2$

S_1 => $aS_1b|T|U$

S_2 => $RbaR$

T => aT|a

U => Ub|a

R => RR|a|b|e

Exercise 2.9(modified) (10 points)

Problem

In a previous assignment, you created a context-free grammar that generates the language

$$A = \{a^i b^j c^k | i = j \text{ or } j = k \text{ where } i, j, k \geq 0\}.$$

Create a pushdown automaton that accepts strings from this language by applying the construction algorithm from Lemma 2.21 to your grammar. Only PDAs that follow this construction will be accepted as solutions.

Solution