CS 3530: Assignment 2d

Fall 2023

Example 2.18 (10 points)

Problem

The example from the book creates a PDA for the language $\{ww^R | w \in \{0,1\}^*\}$. Figure 2.19 shows the PDA diagram. Use the grammar construction from Lemma 2.27 to construct a context-free grammar for this language. Only the grammar created from this construction process will be allowed for credit.

Solution

$$Aq1q4 \rightarrow Aq2q3$$
$$Aq2q3 \rightarrow 0Aq2q30$$
$$Aq2q3 \rightarrow 1Aq2q31$$
$$Aq2q3 \rightarrow Aq5q5$$
$$Aq(x)q(x) \rightarrow \varepsilon //where x = x$$

Problem 2.23 (10 points)

Problem

Let $D = \{xy : x, y \in \{0,1\}^* \text{ and } |x| = |y| \text{ but } x \neq y\}$. Show that D is a context-free language.

Hint: How do we show that a language is context-free?

Solution

Showing a CFG which generates the language, hence proving it is context free

$$S \rightarrow AB|BA$$
$$A \rightarrow 0|0A0|0A1|1A0|1A1|1$$
$$B \rightarrow 0|0B0|0B1|1B0|1B1|1$$