CS 3530: Assignment 3a

Fall 2014

Problems

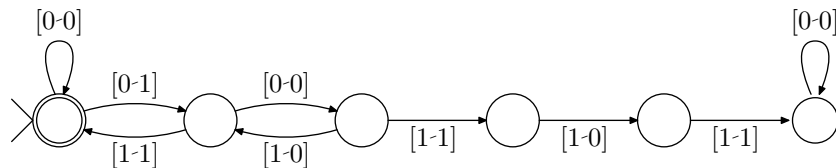## Problem 1.33 (10 points)

Problem

Let

$$\Sigma_2 = \left\{ \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \begin{bmatrix} 1 \\ 1 \end{bmatrix} \right\}.$$

Here, Σ_2 contains all columns of 0s and 1s of height two. A string of symbols in Σ_2 gives two rows of 0s and 1s. Consider each row to be a binary number and let

$$C = \{ w \in \Sigma_2^* : \text{ the bottom row of } w \text{ is three times the top row} \}$$

For example, $\begin{bmatrix} 0 \\ 0 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \end{bmatrix} \in C$, but $\begin{bmatrix} 0 \\ 1 \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} \notin C$. Show that C is regular. (You may assume the result claimed in Problem 1.31.)

Solution

Problem 1.46c (10 points)

Problem

Prove that the following languages are not regular. You may use the pumping lemma and the closure of the class of regular languages under union, intersection, and complement.

c. $L = \{ w : w \in \{0, 1\}^* \text{ is not a palindrome} \}$[1]

Solution

L is infinite Assume L is regular string $s = 0^n 1 0^n$
split s into s=xyz where:
1. $xy^i z \in L$(for each $i >= 0$)
2. $|y| > 0$
3. $|xy| <= n$

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[1]A **palindrome** is a string that reads the same forward and backward.