Rajat Sethi – CPSC 3500 – Assignment 9

A picture containing text

Description automatically generated

2. Adding blanks only serves to reduce the size of a string in the tape. This can be simulated by manipulating the head of the string and changing the characters to match the new head.

3. The TM enters an infinite loop that can either go left or right in the tape when it reads an empty cell. The only exit out of the loop occurs when the TM reads a non-empty cell, where it will immediately halt.

4. The algorithm will be recursive with the following function header.

Boolean func(String regEx, int regIndex=0, String curString=””)

It will iterate through every character of the RegEx and add on characters that show up to the “curString” variable.

If an “or” operator appears, then the function will use recursion to add both options to curString and continue with the RegEx for both options. It will look something like:

curString1 = curString + option1; //Assume that nested stars and ors have been accounted

curString2 = curString + option2;

newIndex = (index after option2);

return func(regEx, newIndex, curString1) || func(regEx, newIndex, curString2);

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If a kleene star appears, then the function will use recursion again, this time with four options, 0 repeats, 1 repeats, 2 repeats, and 3 repeats (In-case that its 0\*, which will require 3 repeats for the substring 000). It will look something like:

curString1 = curString;

curString2 = curString + option;

curString3 = curString + option + option;

curString4 = curString + option + option + option;

newIndex = (index after option)

return func(regEx, newIndex, curString1) || func(regEx, newIndex, curString2) || func(regEx, newIndex, curString3) || func(regEx, newIndex, curString4)

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If a substring of 000 is found, then it will return true, else return false. The idea is to check every distinct string (where Kleene stars end after 3 repeats), and brute force it. The runtime will be O(n \* k), since it goes through the RegEx once and recursion only multiplies the runtime by a constant (i.e. a Kleene star makes the runtime O(4n), so k = 4).