Homework 8

Cpt S 317, Spring 2017

Due Date: April 26, 2017 (Wednesday)

Total points: 38

For questions that ask you for a Turing Machine (TM) design in this homework:

Give your answer in the form of a state diagram. Your design should be for a basic form of the TM (i.e., single tape, single track, no storage), following a similar design representation as in TM's lecture notes slide #8 and as was done in class.

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1. (18 points) Let:

   $L_1 = \{ a^n b^{2n} c^m \mid m, n \geq 1\}$

   $L_2 = \{ a^n b^m c^{2m} \mid m, n \geq 1\}$

   a) Give CFGs for L_1 and L_2.

   b) Is $L_1 \bigcap L_2$ a CFL? Justify your answer.

   c) Using the CFG designed for L_1 as a template, design another CFG for the language (denoted as L_{pref}) of all strings that are prefixes of the strings in L_1 — i.e.,

   $$L_{pref} = \{x \mid x \text{ is a prefix of a string in } L_1\}$$

   Note, by this definition, each string in L_1 will generate multiple strings in L_{pref}. For example, the string *abbcc* which is in L_1 will generate the following list of strings in L_{pref}: {ϵ, *a*, *ab*, *abb*, *abbc*, *abbcc*}.

2. (7 points) Design a Turing Machine for the language of strings of the form: $a^n b^n c^m$, where $m \geq n$, and $m, n \geq 0$.

   Answer the question either in the form of a state machine (preferred), or provide an English language step-by-step pseudocode describing the main logic of your TM design.

3. (7 points) Exercise 8.2.3 part a. Give the answer in the form of a state diagram.

4. (6 points) Exercise 8.2.5 part b. Give the answer in the form of a state diagram.