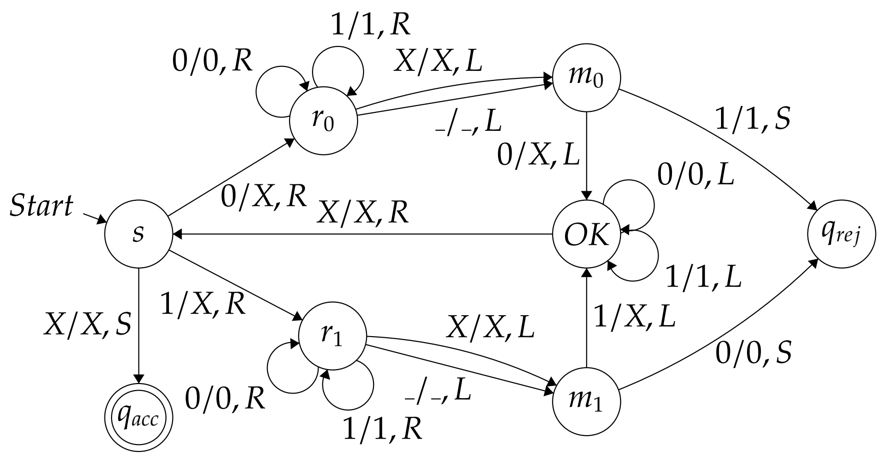
CSE396, Spring 2019 Problem Set 8 Due Thu. 4/18, 11:59pm

Reading. Next Tuesday's lecture will bridge from Chapter 3 to Chapter 4, covering the algorithms for decidable problems in section 4.1. It will also cover the handout https://cse.buffalo.edu/~regan/cse396/UTMRAMsimulator.pdf, which you should just *skim* and compare to what the text says about random-access machines at the end of Chapter 3. Then Thursday's lecture will get into undecidable languages and the rest of Chapter 4.

Reminder that Prelim II is in class period on **Thursday, April 25** and this homework is back to being due on Thursdays.

Homework—part online and all *individual work*—due **Thu.** 4/18, 11:59pm.

(1) Using *TopHat*, the "Worksheet" titled **Spr'19 HW8.1**. There are 10 questions, each worth 2 points, for 20 total; some but not all have explanations. All are unique-answer questions with 1 attempt given, and all concern the same Turing machine given here too:



(2) With $\Sigma = \{a, b, c\}$, define $A = \{wc^m w^R : w \in \{a, b\}^*,\ m = |w|, m \geq 1\}$. Draw an arc-node diagram *with helpful comments* of a deterministic 1-tape Turing machine M that decides the language A. Our policy is that we will tolerate some inexactness in the diagram (minor deductions only) if the overall strategy of the machine is described in clear detail. You may be able to "re-use" some features of the above TM.

Then also *without* drawing an arc-node diagram for a two-tape machine M_2, explain how such an M_2 could solve the problem faster than your M does. Describe M_2 in words that are detailed enough to explain where M_2 violates the condition(s) to be a PDA—which it cannot be since A is not a CFL. (12 + 9 = 21 pts.)

(3) Let $E = \{a^n b^n c^n : n \geq 1\}$, which was talked about in class as a non-CFL except that now we have $n \geq 1$. Find two DCFLs A and B such that $A \cap B = E$. Design on paper a DPDA M_A such that $L(M_A) = A$, using the notation of a two-tape Turing machine. Then describe in prose how a DPDA M_B such that $L(M_B) = B$ works—using words like "push" and "pop"—but don't draw a diagram.

Deduce that both the classes of DCFLs and of CFLs are not closed under intersection. (18 + 6 + 6 = 30 pts. total, for 71 points total on the set)