CS46, Swarthmore College, Spring 2018
Lab 3 (due Wednesday 14 February)
Name: YOUR NAME(S) HERE

Part 1: Automata Tutor

There is nothing to write in the LaTeX document for the first part of this assignment. Submit your solutions online. If you are using a late day for this part, you must hand write your solutions or typeset your solutions in LaTeX and/or graphviz dot notation. Hand written late solutions must be delivered to my office before 8am Friday to count as one late day.

Part 2: Written homework

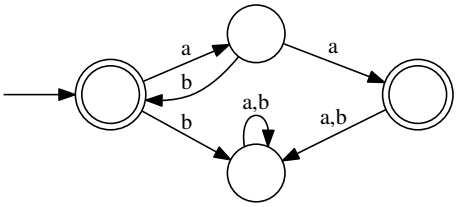
1. For each of the following regular expressions over $\Sigma = \{a, b\}$, explain in English what language they describe. Briefly describe your thought process for arriving at your solution.

   (a) $b^*a(b^*a^*)^*b(b^*a^*)^*$

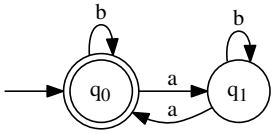
   (b) $(b \cup abb^*)^*(a \cup \varepsilon)$

   (c) $(b(a \cup b))^*(b \cup \varepsilon)$

2. Give regular expressions for the languages recognized by the machines M_1 and M_2 below. (Hint: use Lemma 1.60)



(a) M_1



(b) M_2

3. Let R and S be regular expressions. Prove or disprove the following "identities". To prove the identity, argue that a string on in the language defined on the left hand side is in the language defined on the right hand side, and vice versa. To disprove the identity, give a small counter example string with real examples of regular expressions for R and S.

   (a) $(R^*)^* = R^*$

   (b) $(R \cup S)^* = R^* \cup S^*$

   (c) $(R^*S^*)^* = (R \cup S)^*$

4. This problem has two parts.

   (a) Using proof by contradiction and the pumping lemma for regular languages, show that the language $L_1 = \{w \mid w = a^n b a^m, m > n \geq 0\}$ is not regular.

   (b) Show $L_2 = \{w \mid w = a^n a^m, m > n \geq 0\}$ is regular.