

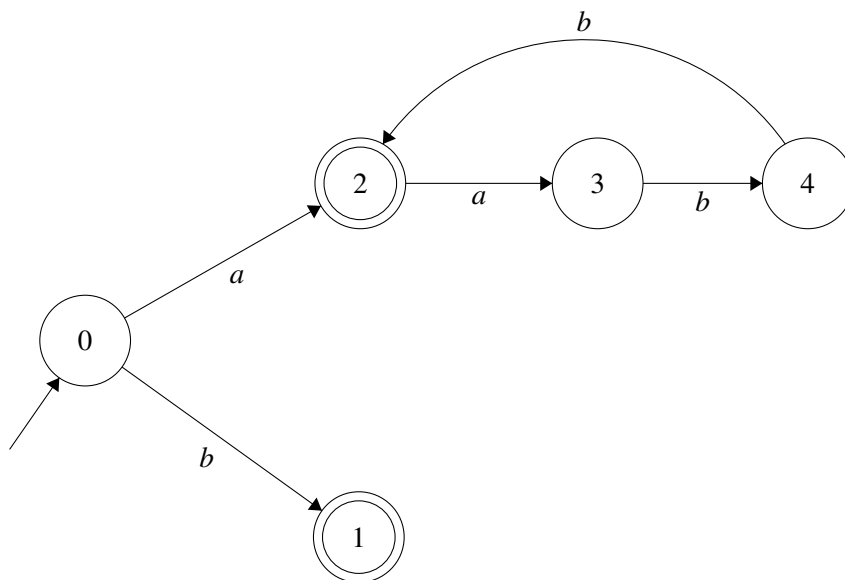
CSci 423 Homework 3

Due: 12:30 pm, Thursday, 10/3/19

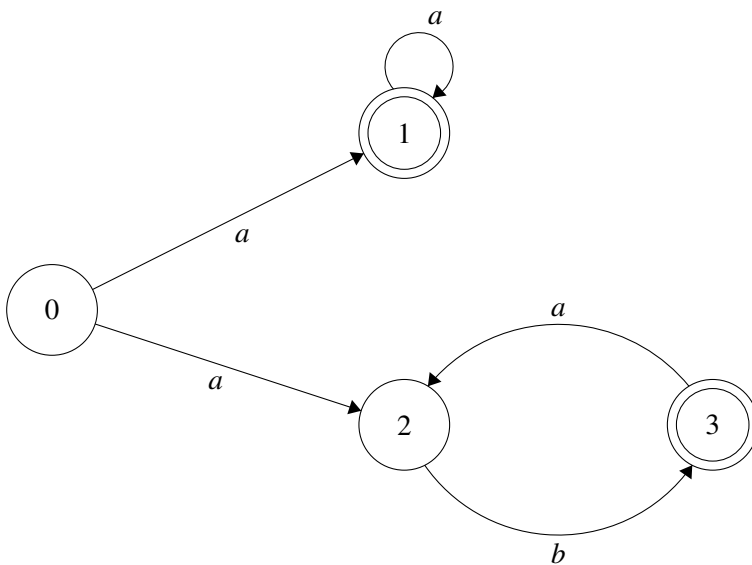
My name

1. (2, 2, 2 points) Let $\Sigma = \{a, b\}$. Draw state diagrams for NFAs that accept the following regular languages (given in the forms of regular expressions). Your NFAs should use states as few as possible. Also, note that the “+” operator means one or more repetitions of the pattern.

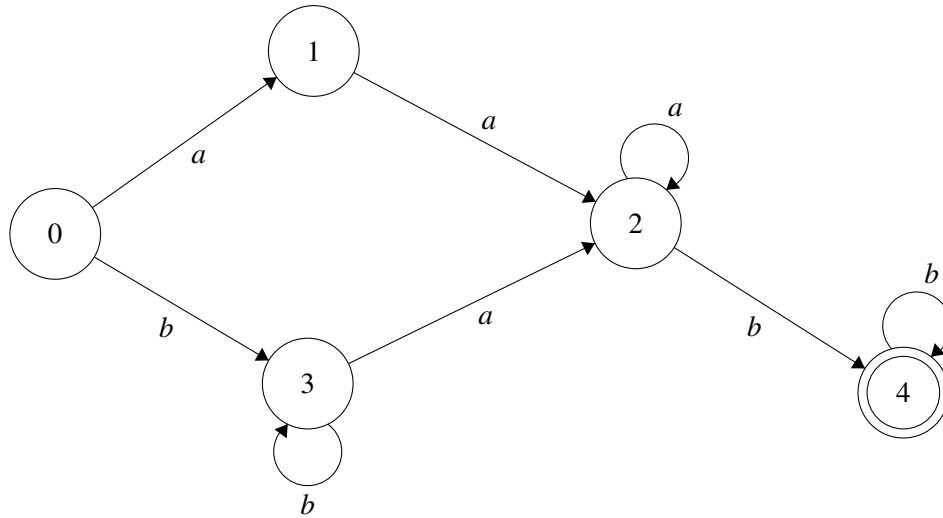
(a) $a(abb)^* \cup b$



(b) $a^+ \cup (ab)^+$



(c) $(a \cup b^+)a^+b^+$



Collaborators: Ethan Young, Will Elliot and Yang Zhang

2. (5 points) Let R_1 and R_2 be any regular expressions. For each identity below, decide True or False.

- (a) $(R_1 \cup R_2)^* = R_1^* \cup R_2^*$
- (b) $(R_1 R_2 \cup R_1)^* R_1 = R_1 (R_2 R_1 \cup R_1)^*$
- (c) $(R_1 R_2 \cup R_1)^* R_1 R_2 = (R_1 R_1^* R_2)^*$
- (d) $(R_1 \cup R_2)^* R_2 = (R_1^* R_2)^*$
- (e) $R_2 (R_1 R_2 \cup R_2)^* R_1 = R_1 R_1^* R_2 (R_1 R_1^* R_2)^*$

Soultion:

- (a) F
- (b) T
- (c) F
- (d) F
- (e) F

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3. (3, 5 points) Regular expressions and languages.

- (a) Let $L_1 = \{w \in \{0, 1\}^* \mid w \text{ has no pair of consecutive zeros}\}$. Give a simple regular expression for L_1 .
- (b) Let $L_2 = \{w \in \{0, 1\}^* \mid w \text{ does not have } 101 \text{ as a substring}\}$. Give a simple regular expression for L_2 .

Solution:

- (a) $(1^+0)^* \cup (01^*)^* \cup (1^+01^*)^*$
- (b) $(0^*1^*0^+0^+1^*)^*0^* \cup 0^*1^* \cup 1^*0^*$

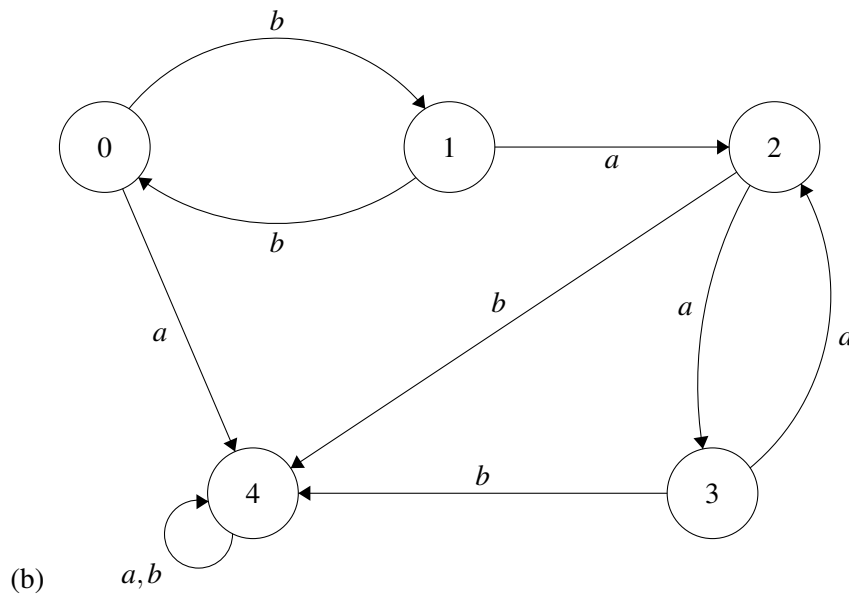
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4. (3, 3 points) Let $\Sigma = \{a, b\}$. Let D be a language of strings that contain an even number of a 's and an odd number of b 's and do not contain the substring ab .

- (a) Given a simple regular expression for D .
 (b) Draw the state diagram for the DFA with no more than five states.

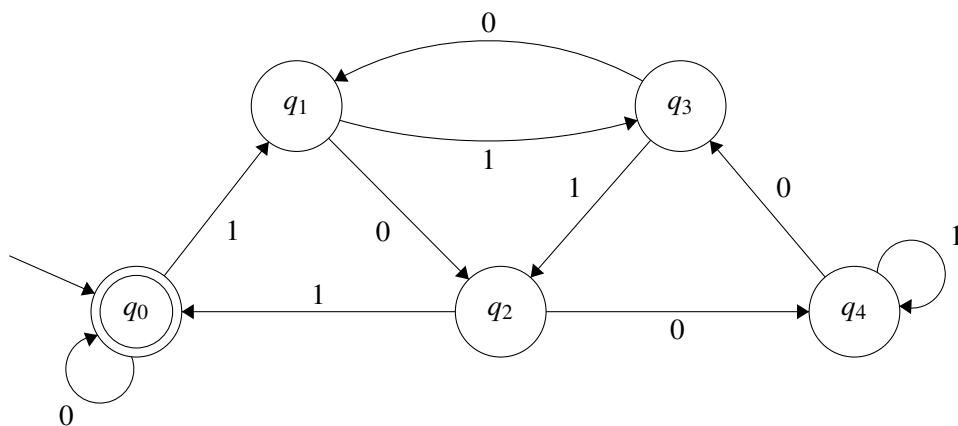
Solution

- (a) $b(bb)^*(aa)^*$



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5. (5 points) Let $A = \{w \in \{0, 1\}^* \mid w \text{ is a binary number that is a multiple of } 5\}$. Prove that A is regular by giving the state diagram of a DFA that accepts A .



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