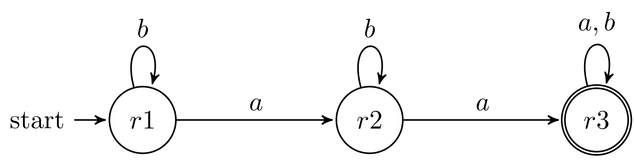
Roxanne Dewing
[redacted]
CSC 320 A01
Dr. Kapron
May 24, 2018

Homework 1–CSC 320 Summer 2018

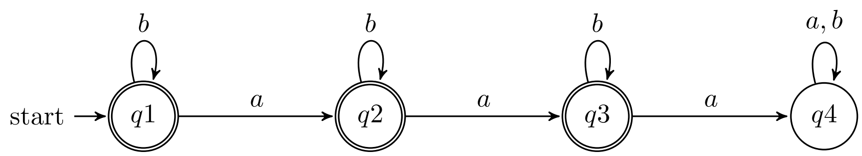
Due by conneX submission at 11:55pm on Sunday May 20

1. (20 MARKS) Let L_1 be the set of strings over $\{a, b\}^*$ that contain at least two a's and L_2 be the set of strings over $\{a, b\}^*$ that contain at most two a's.

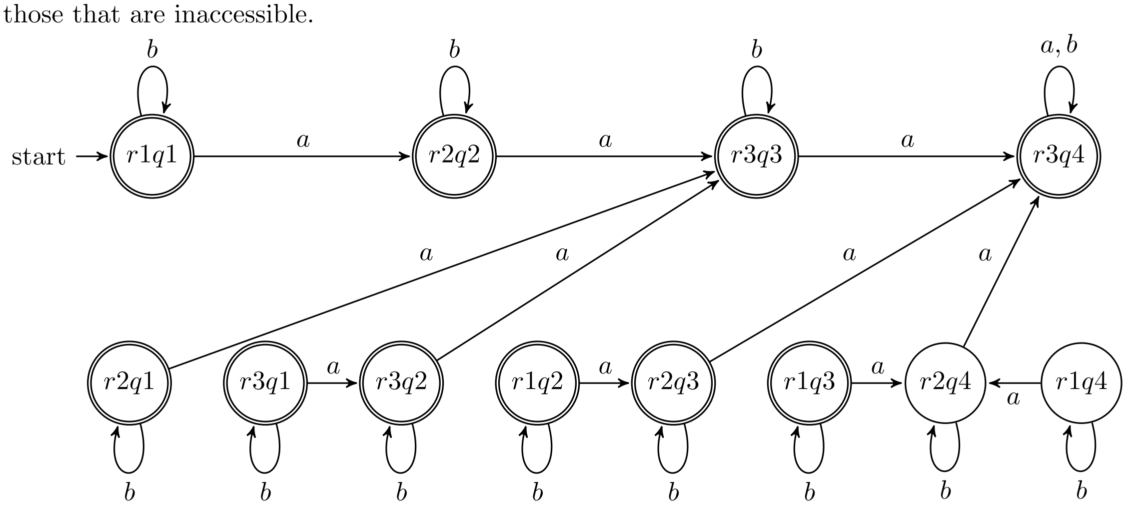
   (a) Give a DFA for L_1



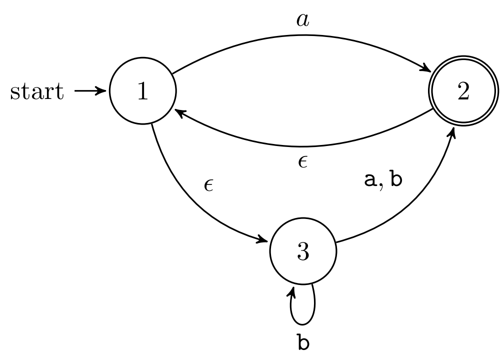
   (b) Give a DFA for L_2

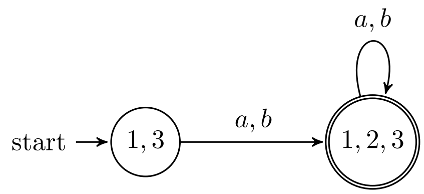


   (c) Using the product construction shown in class, give a DFA for $L_1 \cup L_2$. Show all states, even those that are inaccessible.



2. (20 MARKS) Use the construction given in class to convert the following NFA to a DFA. Give a transition table *and* a transition diagram for the resulting DFA.



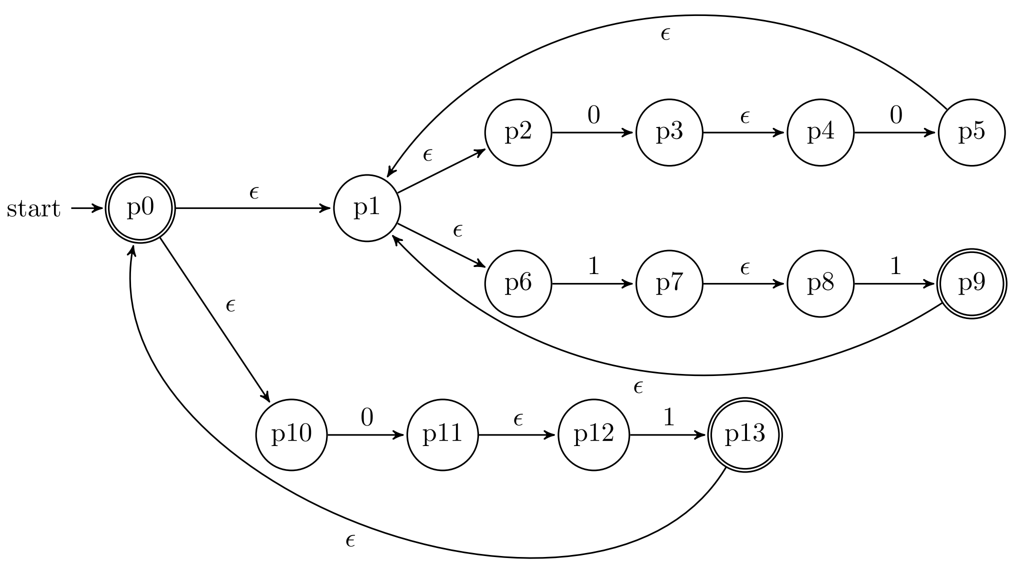
Transition Diagram: 

Transition table:

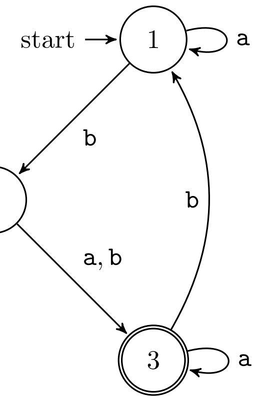
	a	b
1, 3	1, 2, 3	1, 2, 3
1, 2, 3	1, 2, 3	1, 2, 3

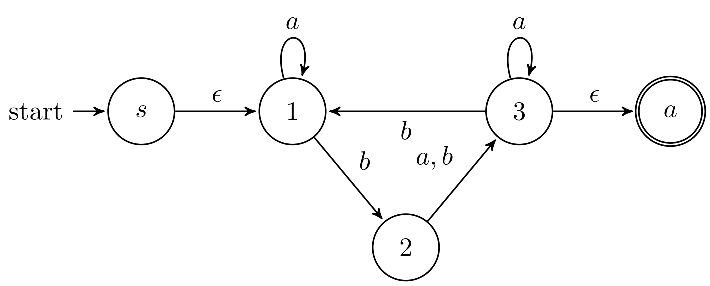
3. (20 Marks) Use the procedure given in class to convert the following regular expression to an NFA

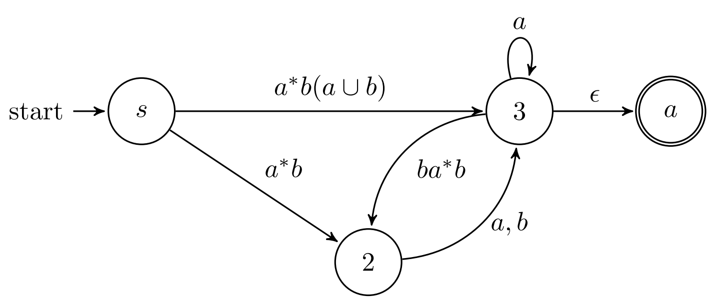
$$(((\mathtt{00})^*(\mathtt{11})) \cup \mathtt{01})^*$$

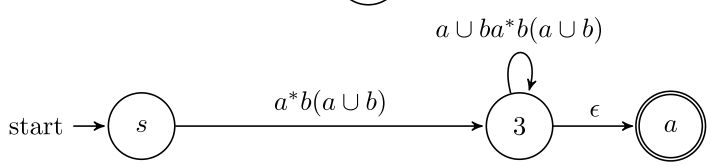


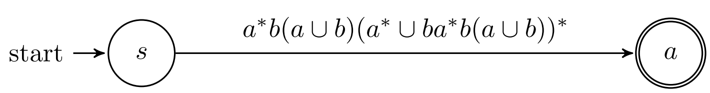
4. (20 Marks) Use the procedure given in class to convert the following DFA to a regular expression











Regular Expression: $a^*b(a \cup b)(a^* \cup ba^*b(a \cup b))^*$

5. (20 Marks) For languages A and B, define the *interleave* of A and B to be the language

$$\{w \mid w = a_1b_1 \ldots a_kb_k \text{ where } a_1 \ldots a_k \in A,\ b_1 \ldots b_k \in B,\ \text{and } a_i, b_i \in \Sigma, 1 \le i \le k\}$$

Give a construction that shows that the regular languages are closed under the mix operation.

Let $M_1 = (Q_1, \Sigma, \delta_1, q_1, F_1)$ and $a \in M_1$. Let $M_2 = (Q_2, \Sigma, \delta_2, q_2, F_2)$ and $b \in M_2$. We define the resulting interleave DFA $M = (Q, \Sigma, \delta, q_0, F)$ to be a DfA such that:

1. Q defined as $Q = \{0, 1\} \times Q_1 \times Q_2$
2. Σ defined as
3. δ defined as
- If q = (0, a, b) then $\delta(\sigma, q) = (1, \delta_1(\sigma, q), b)$
- If q = (1, a, b) then $\delta(\sigma, q) = (0, q, \delta_2(\sigma, b))$
4. q defined as $(0, q_1, q_2)$
5. $F = (0, a, b)|a \in M_1, b \in M_2$

This construction shows that regular languages are closed under the mix operation. We use the state to determine what the last symbol of the word was, and we only accept if we have seen a complete word from A then B.