BLG 311E – FORMAL LANGUAGES AND AUTOMATA
SPRING 2017
HOMEWORK 5

1. Consider the regular expression (aVb)*abb(aVb)*.

- **a.** Construct and draw the NFA accepting the regular expression.
- **b.** Construct and draw the DFA for this NFA.
- **c.** Reduce the DFA if necessary.

2. Consider the following state transition diagram of DFA in Moore model.

	a	b	c	Output
q0	q1	q7	q7	1
q1	q2	q3	q4	0
q2	q2	q5	q7	0
q3	q6	q3	q7	0
q4	q3	q2	q7	0
q5	q1	q7	q7	1
q6	q1	q7	q7	1
q7	q7	q7	q7	0

$K = \{q0, q1, q2, q3, q4, q5, q6, q7\}$
$F = \{q0, q5, q6\}$
$s = \{q0\}$
$\sum = \{a, b, c\}$

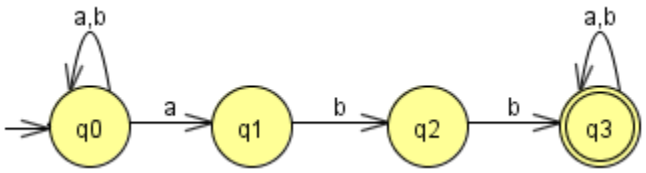
- **a.** Reduce the table if necessary. Draw the state transition diagram of the (reduced) DFA.
- **b.** Which ones of the following regular expressions are accepted by this DFA?
  - i. L(M) = {a[(b V ca)b* a V (a V cb)a*b]}*
  - ii. L(M) ={a[(b V ca)b* a V (a V cb)a*b]}$^{+}$
  - iii. L(M) = {a[(b V c)b a V (a V cb)ab]}*

IMPORTANT: You must do this homework **by hand** and **submit it using the box in the department secretariat**.

SOLUTIONS:

1.

a.

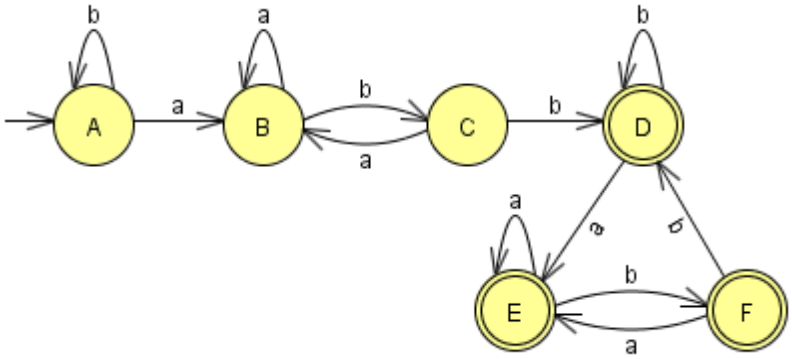


b. $q_0 = A$

$\delta(A,a) = \delta(\{q_0\},a) = \{q_0,q_1\} = B$
$\delta(A,b) = \delta(\{q_0\},b) = \{q_0\} = A$
$\delta(B,a) = \delta(\{q_0,q_1\},a) = \{q_0,q_1\} = B$
$\delta(B,b) = \delta(\{q_0,q_1\},b) = \{q_0,q_2\} = C$
$\delta(C,a) = \delta(\{q_0,q_2\},a) = \{q_0,q_1\} = B$
$\delta(C,b) = \delta(\{q_0,q_2\},b) = \{q_0,q_3\} = D$
$\delta(D,a) = \delta(\{q_0,q_3\},a) = \{q_0,q_1,q_3\} = E$
$\delta(D,b) = \delta(\{q_0,q_3\},b) = \{q_0,q_3\} = D$
$\delta(E,a) = \delta(\{q_0,q_1,q_3\},a) = \{q_0,q_1,q_3\} = E$
$\delta(E,b) = \delta(\{q_0,q_1,q_3\},b) = \{q_0,q_2,q_3\} = F$
$\delta(F,a) = \delta(\{q_0,q_2,q_3\},a) = \{q_0,q_1,q_3\} = E$
$\delta(F,b) = \delta(\{q_0,q_2,q_3\},b) = \{q_0,q_3\} = D$

	a	b
A	B/0	A/0
B	B/0	C/0
C	B/0	D/1
D	E/1	D/1
E	E/1	F/1
F	E/1	D/1

$s_0 = A$ and $F = \{D, E, F\}$



c.

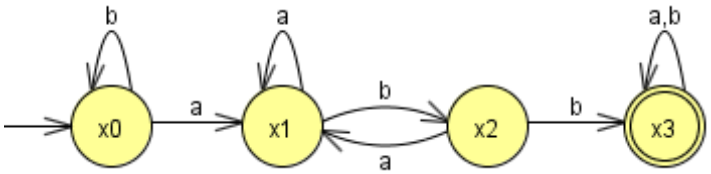
	A	B	C	D	E	F
B	A-C X					
C	X	X				
D	X	X	X			
E	X	X	X	D-F **OK**		
F	X	X	X	**OK**	D-F **OK**	

D,E and F are equivalent states

$X_0 = \{A\}$, $X_1 = \{B\}$, $X_2 = \{C\}$ and $X_3 = \{D,E,F\}$

	a	b
$\mathbf{X_0}$	$X_1/0$	$X_0/0$
$\mathbf{X_1}$	$X_1/0$	$X_2/0$
$\mathbf{X_2}$	$X_1/0$	$X_3/1$
$\mathbf{X_3}$	$X_3/1$	$X_3/1$

$s_0 = X_0$ and $F = \{X_3\}$



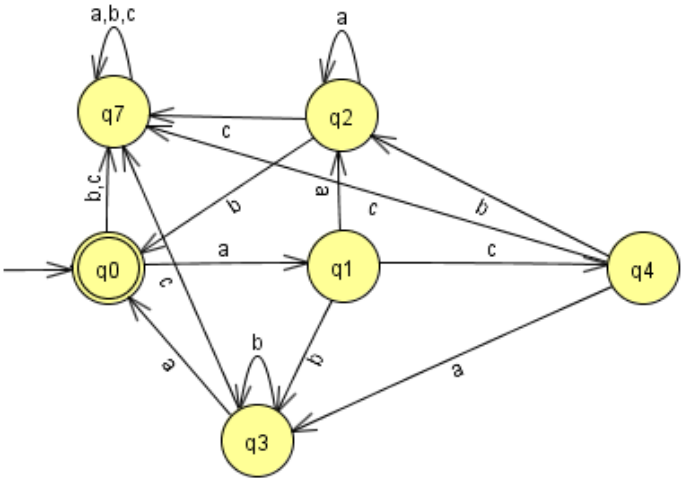
2.

a.

	q0	q1	q2	q3	q4	q5	q6	q7
q1	X							
q2	X	q3-q5 q4-q7 X						
q3	X	q2-q6 q4-q7 X	q2-q6 q3-q5 X					
q4	X	q2-q3 q4-q7 X	q2-q3 q2-q5 X	q2-q3 q3-q6 X				
q5	**OK**	X	X	X	X			
q6	**OK**	X	X	X	X	**OK**		
q7	X	q2-q7 q3-q7 X q4-q7	q5-q7 X	q6-q7 X	q2-q7 q3-q7 X	X	X	

- q0, q5 and q6 are equivalent states.

	a	b	c	Output
q0	q1	q7	q7	1
q1	q2	q3	q4	0
q2	q2	q0	q7	0
q3	q0	q3	q7	0
q4	q3	q2	q7	0
q7	q7	q7	q7	0



b. Regular expression of this automaton: L(M) = {a[(b V ca)b* a V (a V cb)a*b]}*. So first expression is correct.

Second expression does not contain empty string (Λ). So it is wrong.

Third expression is also wrong (e.g., “acba” is contained in this expression, however it is not recognized by the automaton)