CSE 355: Intro to Theoretical Computer Science
Recitation #4 (20 pts)

1. [5 pts] Write the formal description of each set described by the regular expression below. Assume alphabet $\Sigma = \{0, 1\}$.

Example: $(0 \cup 1)^*00(0 \cup 1)^*11(0 \cup 1)^*$

Answer: L = {xy |where x contains substring 00 and y contains substring 11}

A) 1^*01^*

Answer: L = { contains only one zero}

B) $(\Sigma\Sigma\Sigma)^*$

Answer: L = { contains a string which is divisible by 3}

C) $(0\Sigma^*0) \cup (1\Sigma^*1) \cup 0 \cup 1$

Answer: L = { starts and ends with the same sequence}

D) $0^* \cup 1^*$

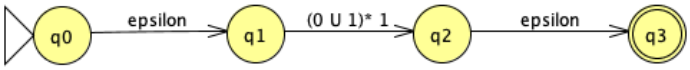
Answer: L = { contains any number of zeros or any number of ones}

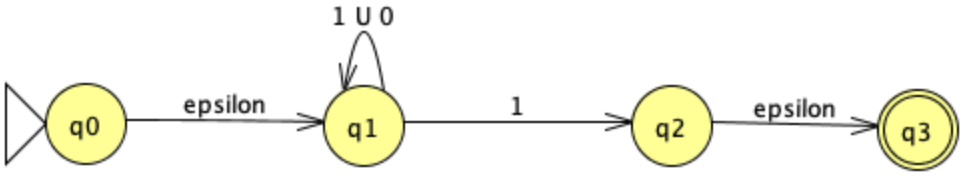
E) $(10)^+(\Sigma \cup \varepsilon)$

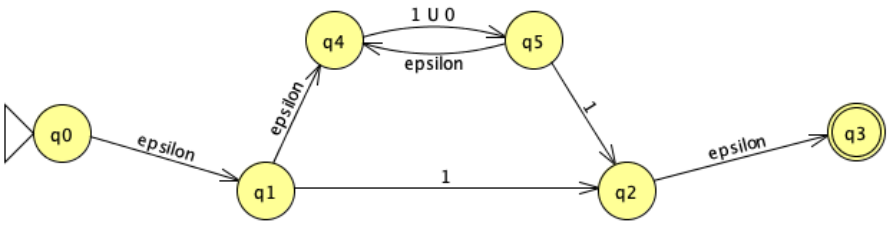
Answer: L = { contains at least one sequence of 10}

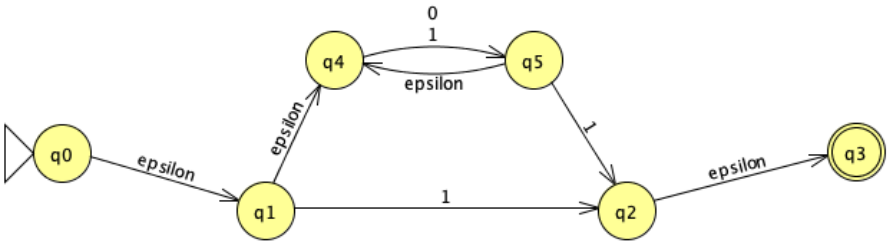
2. [5 pts] Let $\Sigma = \{0, 1\}$, use the procedure describe in class to convert the following RE into an NFA. Show step-by-step construction and no simplification.

$$(0 \cup 1)^*1$$


q0
epsilon
q1
(0 U 1)* 1
q2
epsilon
q3

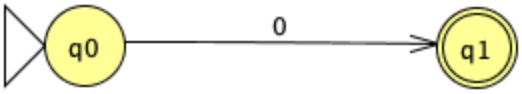

1 U 0
q0
epsilon
q1
1
q2
epsilon
q3

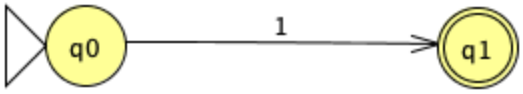

q4
1 U 0
q5
epsilon
epsilon
1
q0
epsilon
q1
1
q2
epsilon
q3

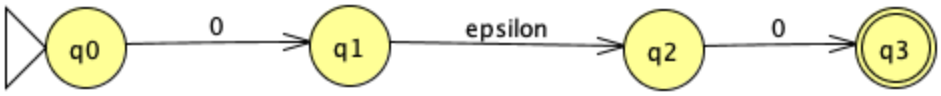


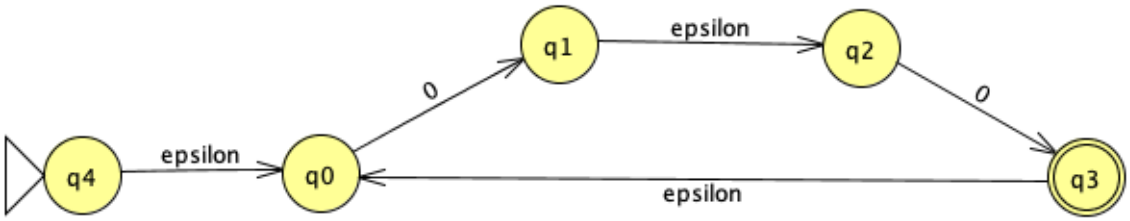
3. [5 pts] Use the procedure described in Lemma 1.55 (textbook pp.88) to convert the following RE into an NFA. Show step-by-step construction.

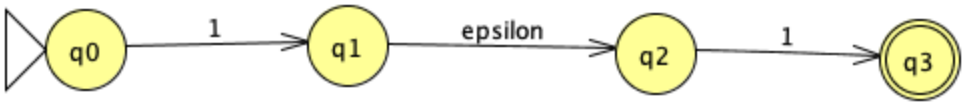
$$(((00)^*(11)) \cup 01)^*$$

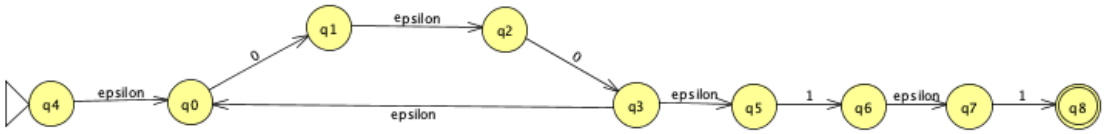


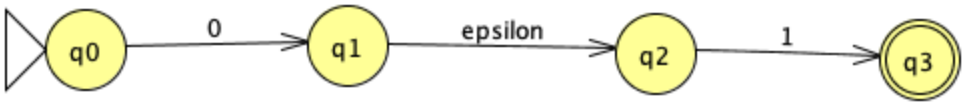

q0
1
q1

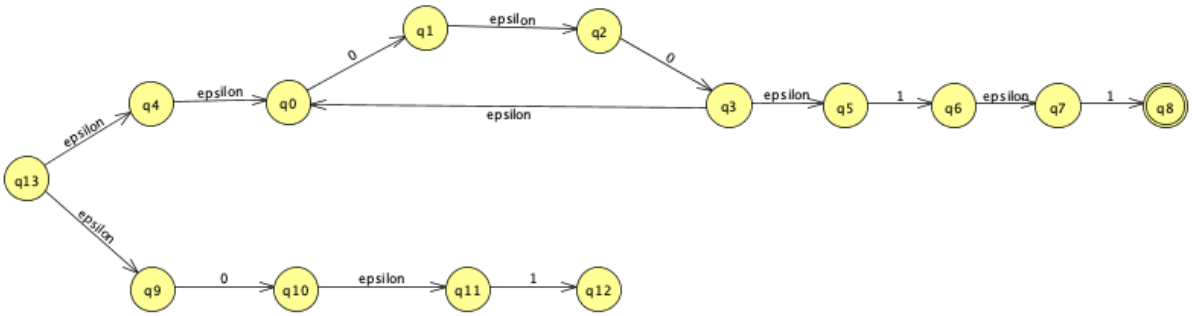

q0
0
q1
epsilon
q2
0
q3

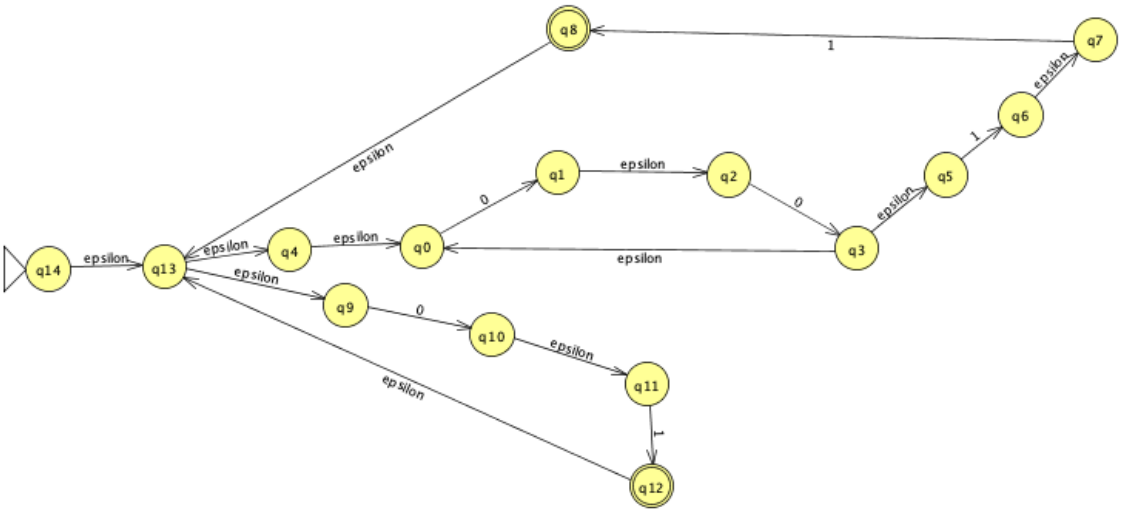

q1
epsilon
q2
0
0
q4
epsilon
q0
q3
epsilon


q0
1
q1
epsilon
q2
1
q3

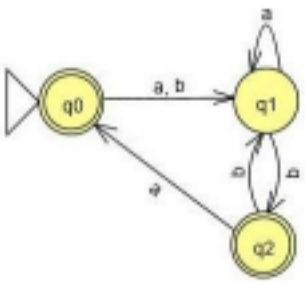

q4
epsilon
q0
0
q1
epsilon
q2
0
q3
epsilon
epsilon
q5
1
q6
epsilon
q7
1
q8

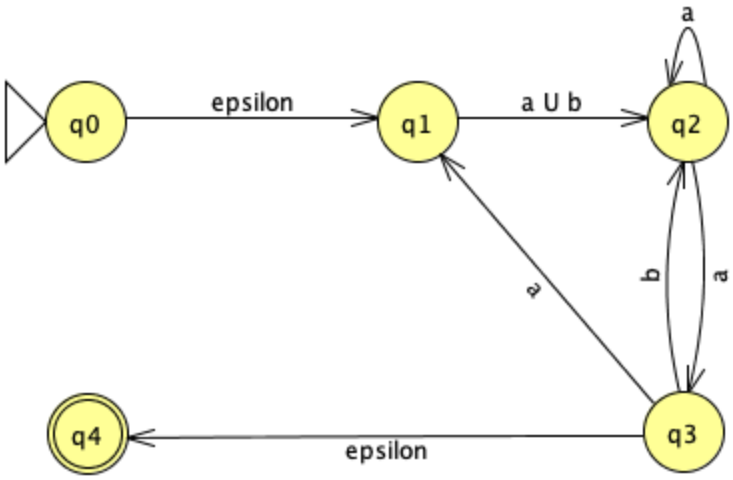

q0
0
q1
epsilon
q2
1
q3

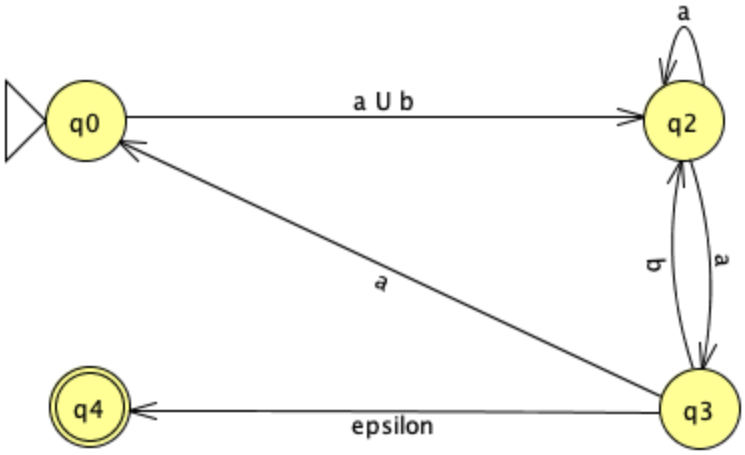


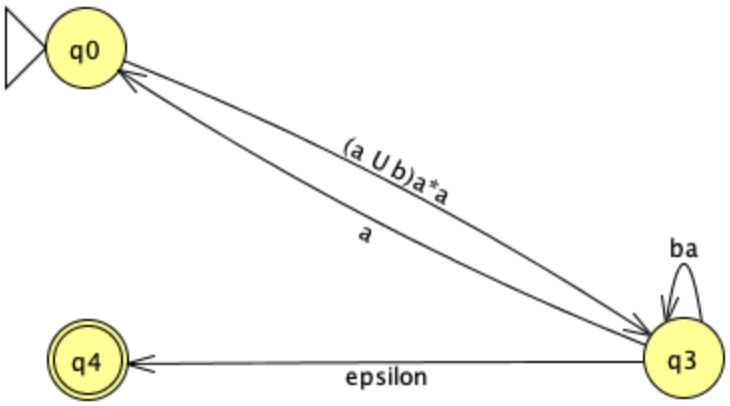


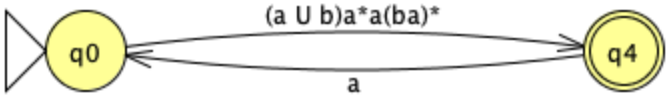
4. [5 pts] Use the procedure described in Lemma 1.60 (textbook pp.90) to convert the following DFA into a regular expression. Eliminate states in the order of q_2, q_0 and q_1. Assume alphabet $\Sigma = \{a, b\}$.




a
q0
epsilon
q1
a U b
q2
a
b
a
q4
epsilon
q3


a
q0
a U b
q2
a
q
a
q4
epsilon
q3


q0
(a U b)a*a
a
ba
q4
epsilon
q3


q0
(a U b)a*a(ba)*
a
q4