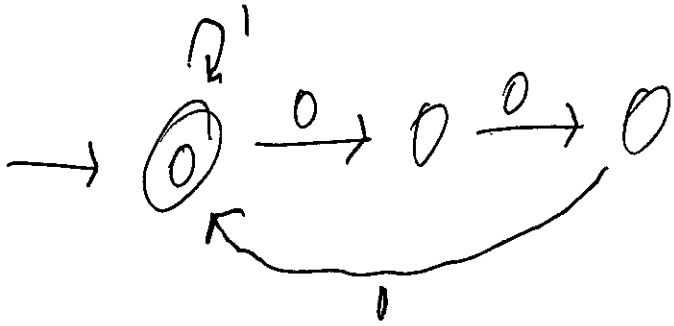
CSCI 338, First Midterm – February 10th, 2016

Name Sample Solutions Covered in Class

Question One. 15 points. Draw a state diagram for a **3-state** NFA that recognizes 1*(0011*)*.



Question Two. 15 points. Consider the DFA below.

(a) What is Q?

$Q = \{s_0, s_1, s_2\}$

(b) What is Σ?

$\Sigma = \{0, 1\}$

(c) What is δ?

δ	0	1
s_0	s_1	s_0
s_1	s_1	s_2
s_2	s_1	s_2

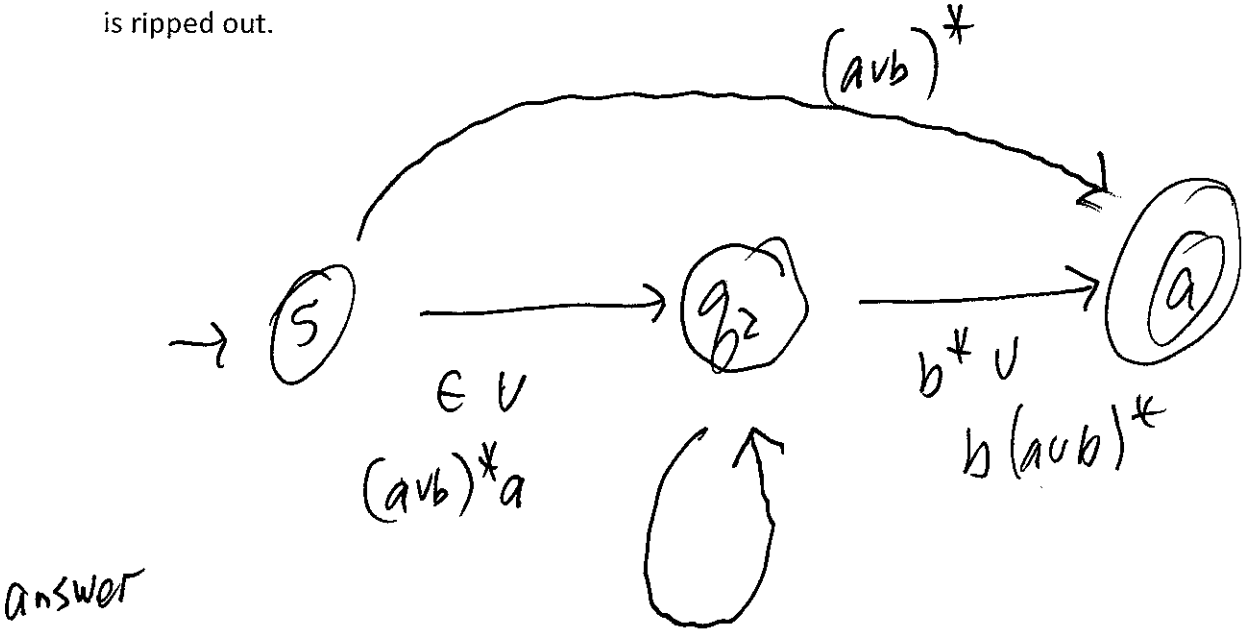
(d) What is q_0?

s_0

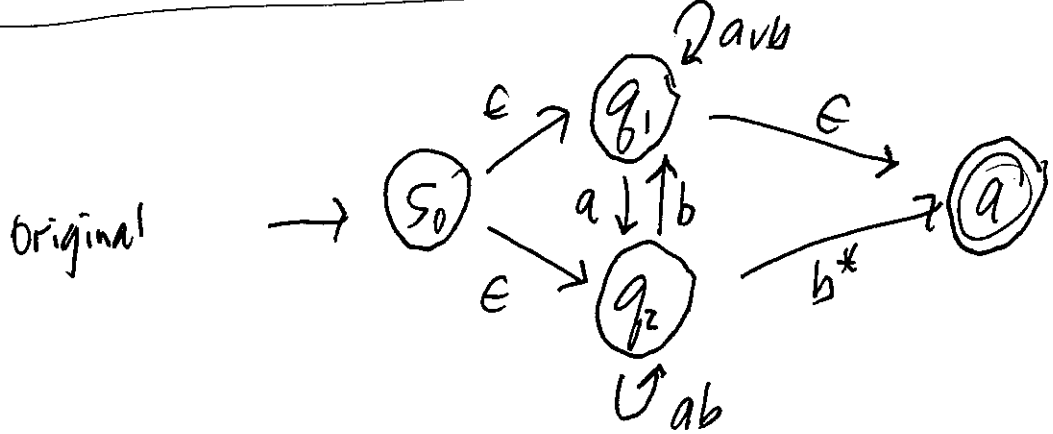
(e) What is F?

$F = \{s_0, s_1\}$

Question Three. 20 points. Consider the GNFA below. Show the resulting GNFA when state q_1 is ripped out.



answer

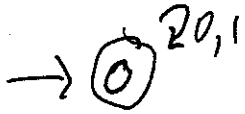


Question Four. 10 points. Consider converting an NFA that has 5 states to a DFA.

(a) What is the maximum number of states that the DFA could have?

2^5

(b) What is the minimum number of states that the DFA could have?



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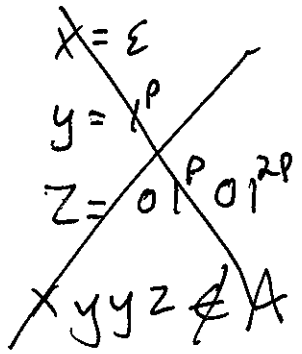
Question Five. 15 points. Use the pumping lemma to show that language A = {w | $1^m01^n01^{m+n}$} where m, n >= 1.

P $\quad S = 1^p 0 1^p 0 1^{2p} \quad S \in A \quad |S| \geq P$

$S = xyz \quad |xy| \leq p \quad |y| > 0 \quad y = 1^i$

$xyyz = 1^{p+i} 0 1^p 0 1^{2p}$



Question Six. 10 points. Write a regular expression that captures A = {w | w contains exactly three a's} over Σ = {a, b}.

$b^* a b^* a b^* a b^*$

Question Seven. 15 points. Consider NFAs NFA_1 and NFA_2. NFA_1 has n_1 states (including f_1 accept states) and t_1 transitions. NFA_2 has n_2 states (including f_2 accept states) and t_2 transitions.

(a) Consider NFA_3, that is constructed to recognize $NFA_1 \cup NFA_2$ (union) using the construction technique in the book. How many **total states** will NFA_3 have?

$n_1 + n_2 + 1$

(b) How many **transitions** will NFA_3 have?

$t_1 + t_2 + 2$

(c) Consider NFA_4, that is constructed to recognize $NFA_1 \cdot NFA_2$ (concatenation) using the construction technique in the book. How many **accept states** will NFA_4 have?

f_2

(d) Have many **transitions** will NFA_4 have?

$t_1 + t_2 + f_1$