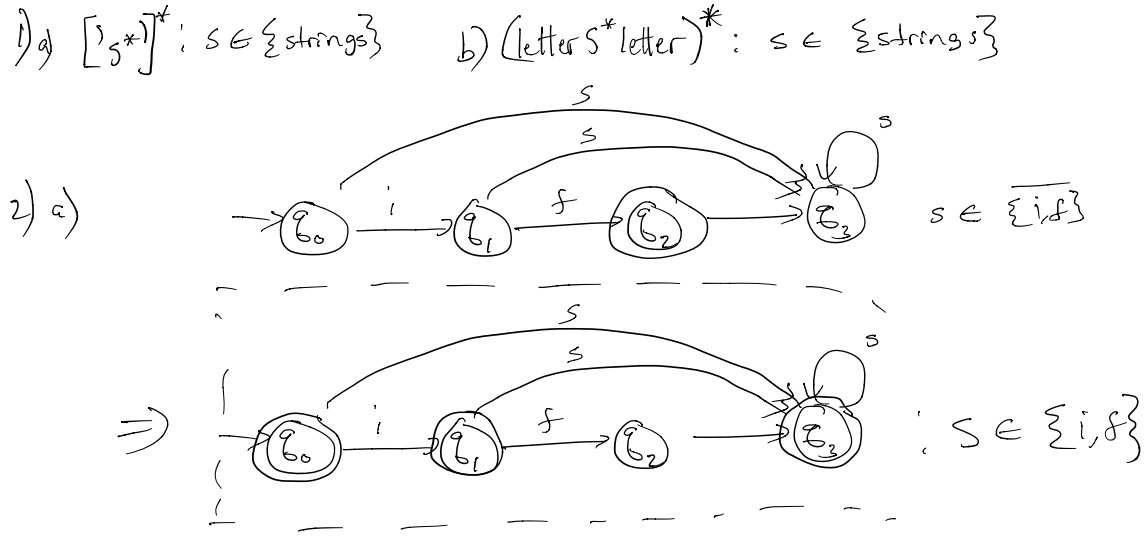
Ayodele, David
HW 1

1. (6 points) Construct regular expressions for the following languages.
   a) Strings with an even number of quotes. That is, `'abc', abc''dd, aa'a'a'a'` are legal strings while `'a, 'a'a'ab'a'` are illegal strings. $\Sigma = \{a, b, '\}$.
   b) Strings with an even number of letters. That is, ϵ, `ab, bbba, aaaaaa` are legal strings while `a, aba` are illegal strings. $\Sigma = \{a, b\}$.
2. (6 points) Construct DFAs for the following languages.
   a) All strings that is not the string `if`. $\Sigma = \{i, f\}$.
   b) Strings where not all letters in the alphabet Σ appear on the string. That is, ϵ, `abab, bccb, a` are legal strings while `abc, bbcaba` are illegal strings. $\Sigma = \{a, b, c\}$.
3. (6 points) Using the McNaughton-Yamada-Thompson Algorithm, construct an NFA from the regular expression ($\Sigma = \{0, 1\}$):

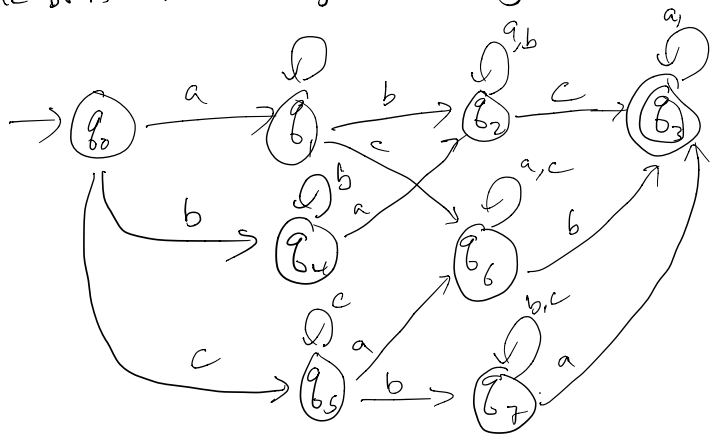
$$0((0|1)^*1)^*1$$

   a) Draw a state graph for the NFA.
   b) Construct the state transition table for the NFA taking into consideration ϵ-closures (up to Step 3 of alogrithm on slides).
4. (12 points) Convert the above NFA to a DFA.
   a) Construct the state transition table for the DFA, starting from the start state.
   b) Draw the state graph for the DFA.
   c) If necessary, minimize the state graph for the DFA.

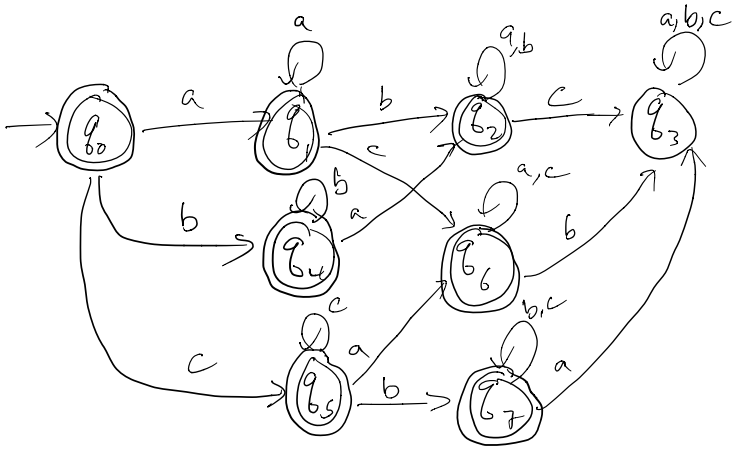


2) The DFA for all strings containing {a, b, c} is as follows:

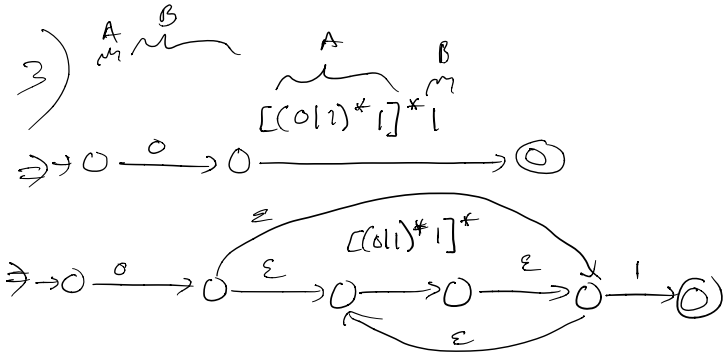
b)

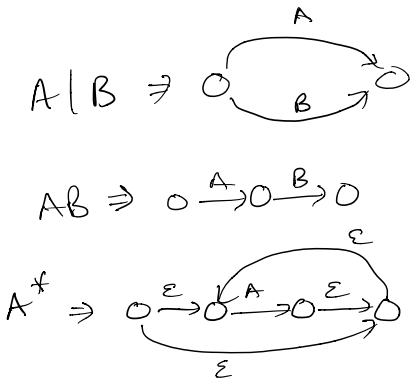


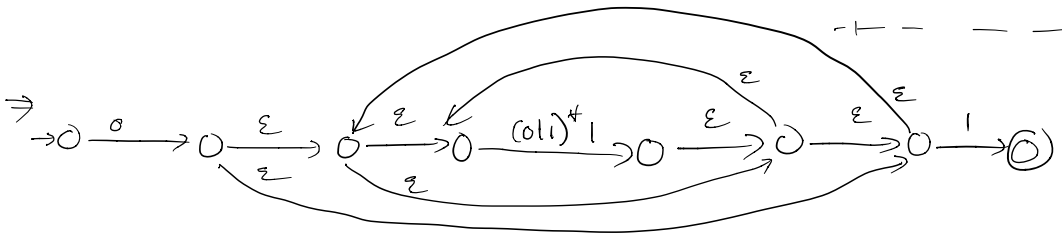
Hence the DFA for strings not containing {a, b, c} is:



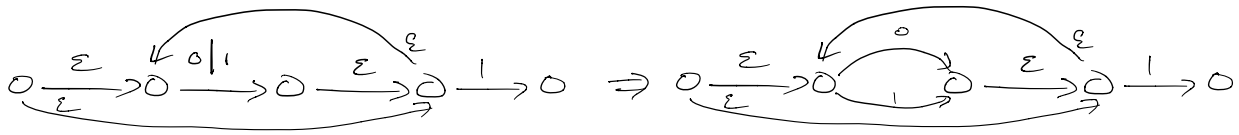
3)



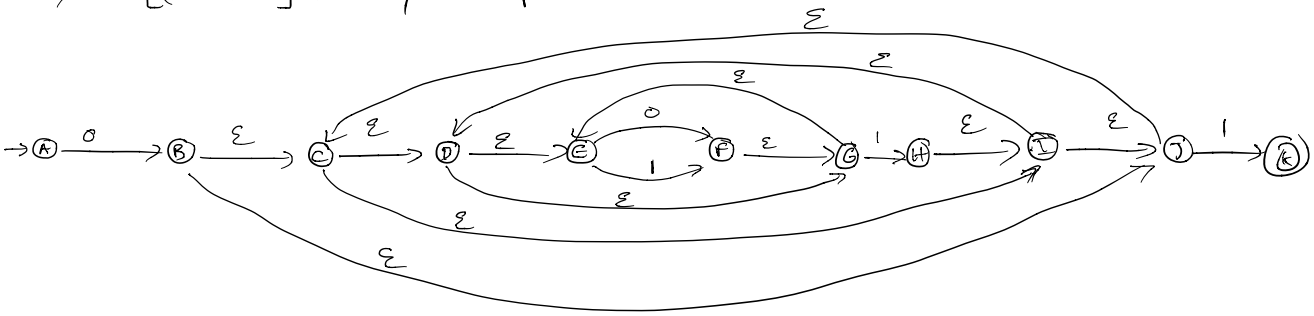




$(0|1)^*1$ may be represented as follows:



$\Rightarrow 0[(0|1)^*1]^*1$ may be represented as:



b)

	ε	0	1
A		B	
B	CJ		
C	DI		
D	EG		
E		F	F
F	G		
G	E		H
H	I		
I	J		
J	C		K
K			

$\Rightarrow$

	ε	0	1
A		B	
B	CJDEGI		
C	DIEGJ		
D	EG		
E		F	F
F	GE		
G	E		H
H	IDEGJC		
I	JDEGC		
J	CIGG		K
K			

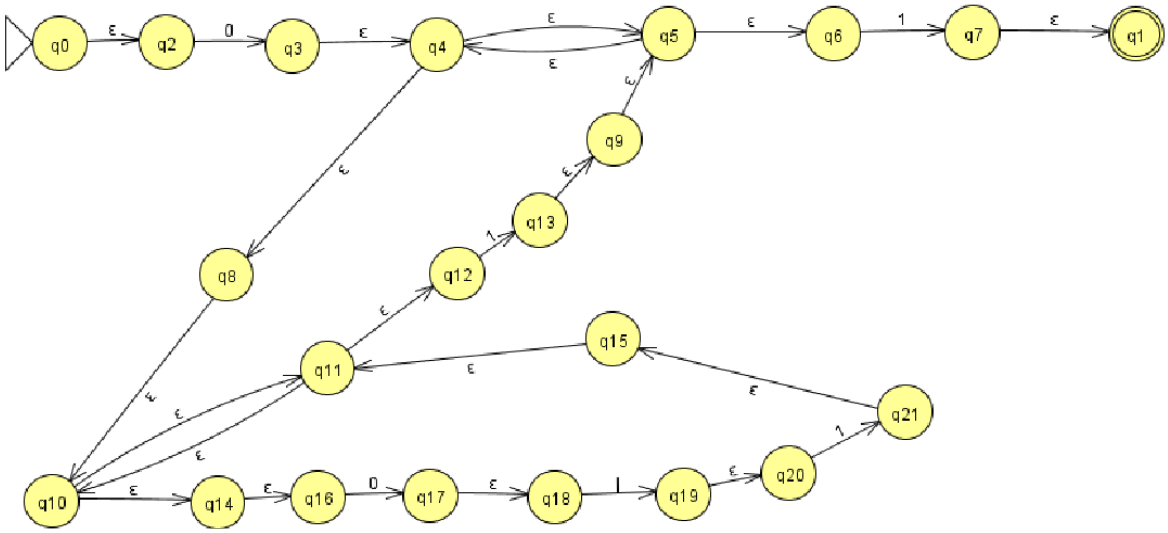
⇒

	ε	0	1
A		B	
B	CJDEGI	F	HK
C	DIEGJ	F	HK
D	EG	F	H
E		F	F
F	GE	F	H
G	E	F	H
H	IDEGJC	F	HK
I	JDEGC	F	HK
J	CIEG	F	HK
K			

4)

	ε	0	1
q_0	q_2		
q_1			
q_2		q_3	
q_3	q_4		
q_4	$q_5\ q_8$		
q_5	$q_4\ q_6$		
q_6			q_7
q_7	q_1		
q_8	q_{10}		
q_9			
q_{10}	$q_{11}\ q_{14}$		
q_{11}	q_{12}		
q_{12}			q_{13}
q_{13}	q_9		
q_{14}	q_{16}		
q_{15}	q_{11}		
q_{16}		q_{17}	
q_{17}	q_{18}		
q_{18}			q_{19}
q_{19}	q_{20}		
q_{20}			q_{21}
q_{21}	q_{15}		

4) b), c)


q0
ε
q2
0
q3
ε
q4
ε
ε
q5
ε
q6
1
q7
ε
q1
q9
ε
q13
1
q12
ε
q8
q15
q11
ε
ε
ε
ε
q21
1
q10
ε
q14
ε
q16
0
q17
ε
q18
1
q19
ε
q20