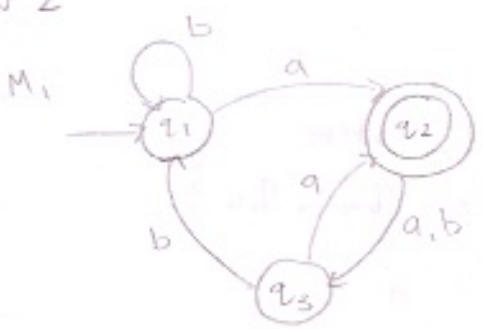
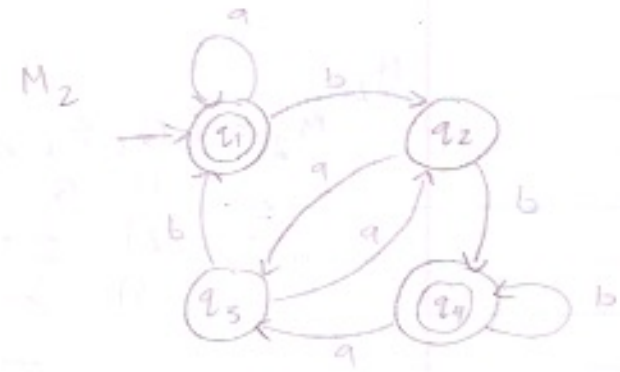
Lynne Diep
CMPS 130
lytdiep@ucsc.edu

HW 2

1.1





a) Start State:
M_1: q_1
M_2: q_1

b) set of start state
M_1: $\{q_2\}$
M_2: $\{q_1, q_4\}$
ones with double circles

c) Sequence of states does the machine go through on input aabb
M_1: q_1, q_2, q_3, q_1, q_1
M_2: q_1, q_1, q_1, q_2, q_4

d) Accept aabb
M_1: no
M_2: yes

e) accept string ε
M_1: no
M_2: yes

1.2 Give formal description of machines M_1, M_2

Q: finite set, states
Σ: finite set, alphabet
$\delta : Q \times \Sigma \to Q$ transition function
$q_0 \in Q$ start state
$F \subseteq Q$ set of accept states

M_1:

$M_1 = (Q, \Sigma, \delta, q_1, F)$ where

1) $Q = \{q_1, q_2, q_3\}$
2) $\Sigma = \{a, b\}$
3) δ is described as:

	a	b
q_1	q_2	q_1
q_2	q_3	q_3
q_3	q_2	q_1

4) q_1 is start state
5) Set of accept states $F = \{q_2\}$

M_2:

$M_2 = (Q, \Sigma, \delta, q_2, F)$ where

1) $Q = \{q_1, q_2, q_3, q_4\}$
2) $\Sigma = \{a, b\}$
3) δ is described as

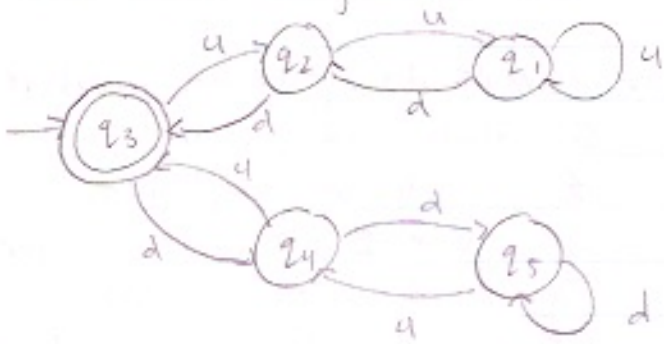
	a	b
q_1	q_1	q_2
q_2	q_3	q_4
q_3	q_2	q_1
q_4	q_3	q_4

4) start state : q_1
5) Accept states $F = \{q_1, q_4\}$

1.3 Formal description of a DFA M is $(\{q_1, q_2, q_3, q_4, q_5\}, \{u, d\}, \delta, q_3, \{q_3\})$

	u	d
q_1	q_1	q_2
q_2	q_1	q_3
q_3	q_2	q_4
q_4	q_3	q_5
q_5	q_4	q_5

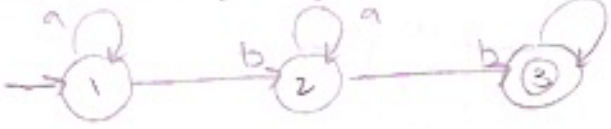
Give state diagram:

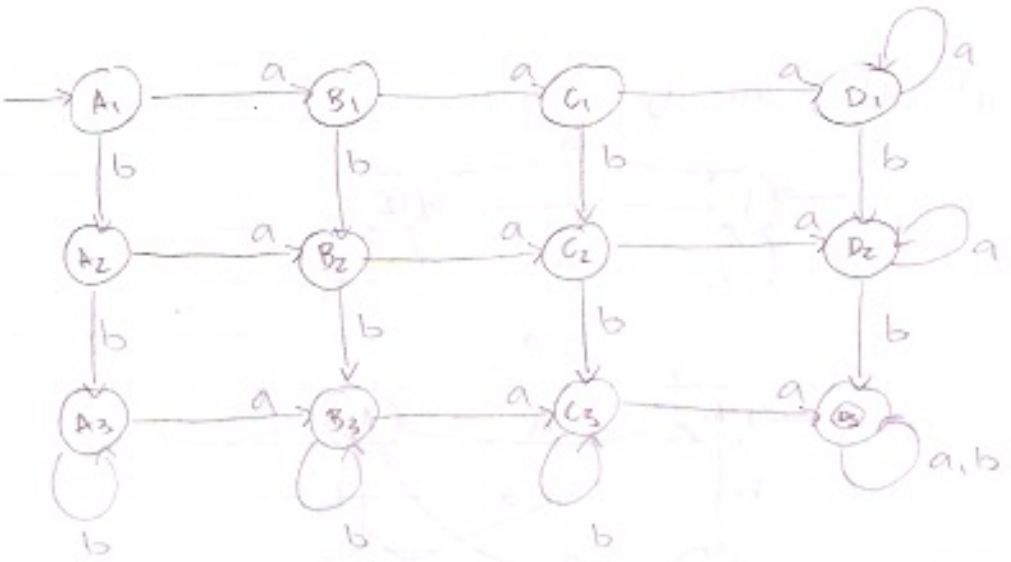


1.4 a) $\{w \mid w$ has at least 3 a's and at least 2 b's$\}$

i) at least 3 a's

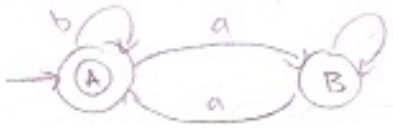
ii) at least 2 b's



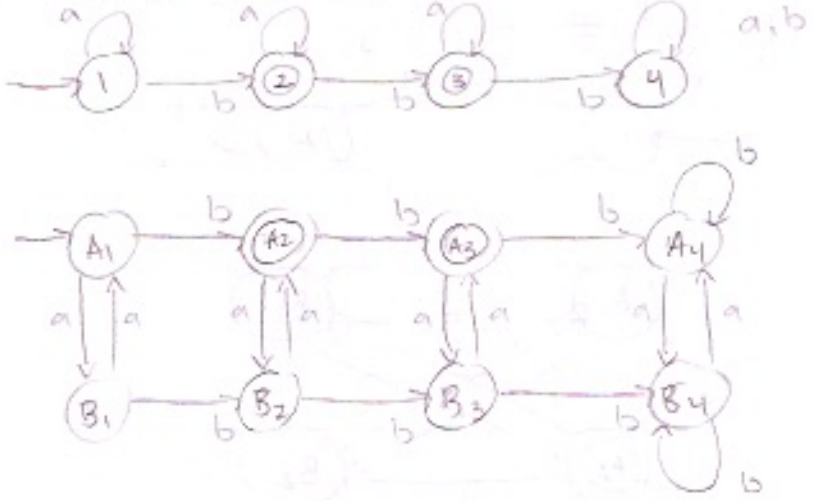


c) {w|w has an even number of a's and one or two b's}

i) Even # of a's



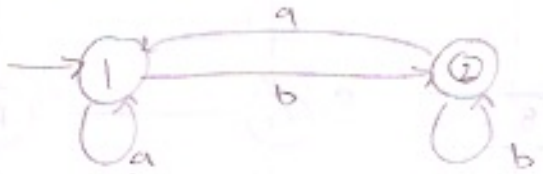
ii) one or two b's

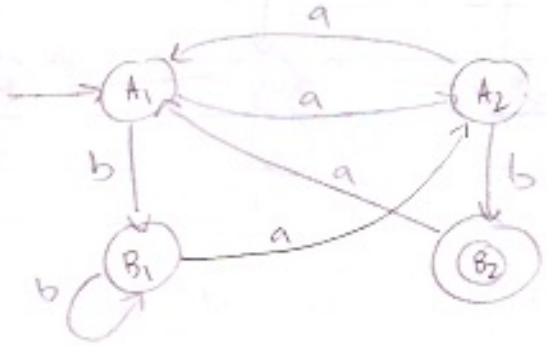


f) {w|w has an odd number of a's and ends with b}

i) odd # of a's

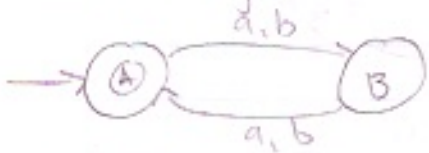
ii) ends with b



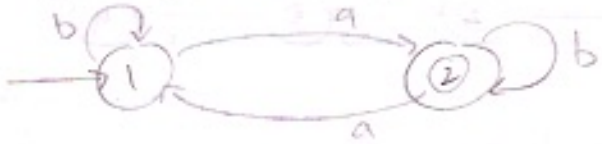


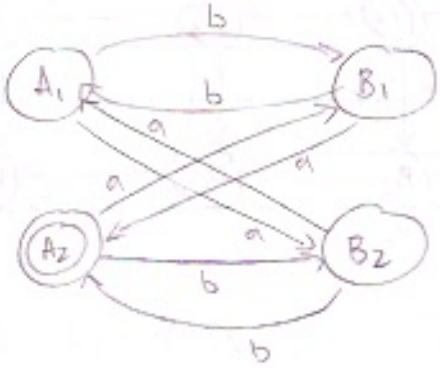
g) {w|w has even length and an odd number of a's}

i) even length



ii) odd # of a's



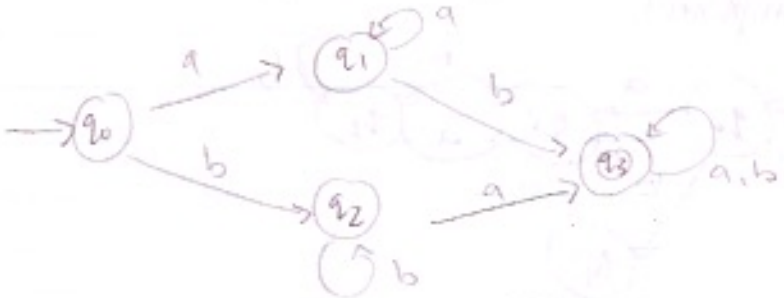


1.5 c) $\{w \mid w$ contains neither the substrings ab nor ba$\}$

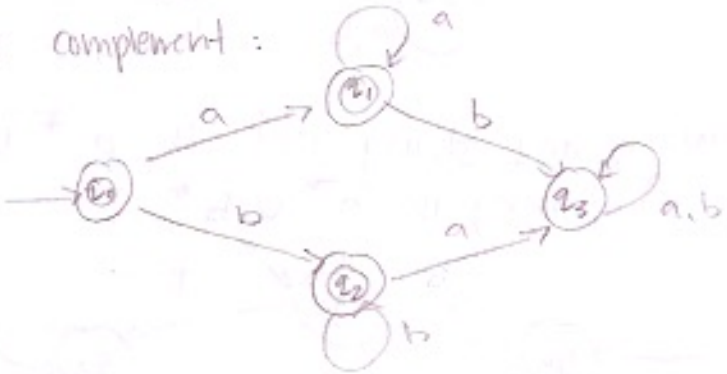
Take complement

i) contains substring ab

ii) contains substring ba



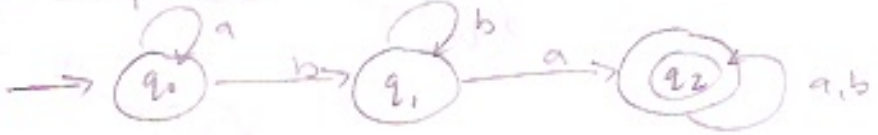
Take complement:



d) $\{w \mid w$ is any string not in $a^* b^*\}$

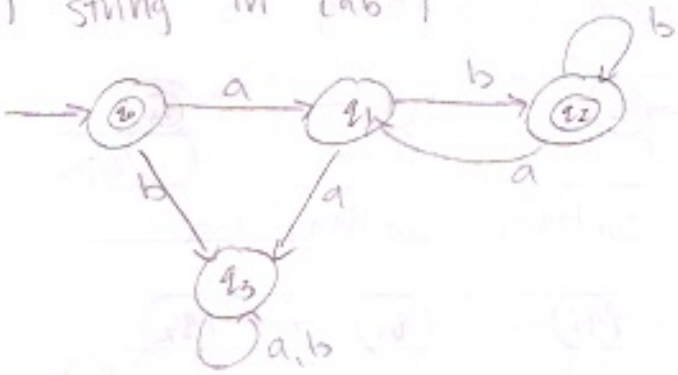
i) any string in $a^* b^*$

Take complement

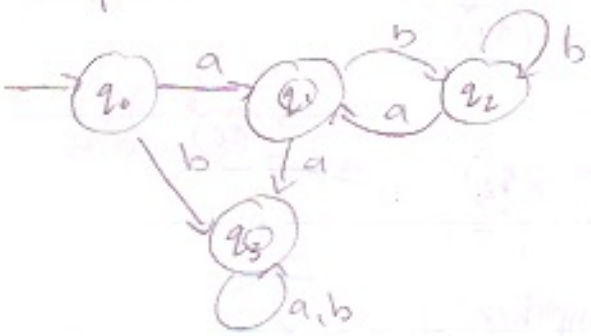


e) {w | w is any string not in $(ab^+)^*$}

i) string in $(ab^+)^*$

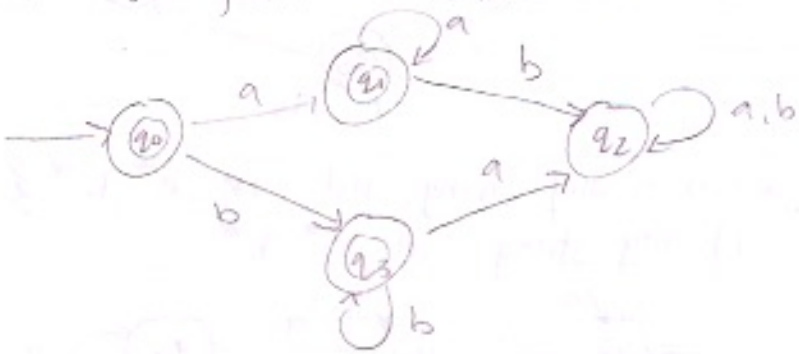


Take complement:

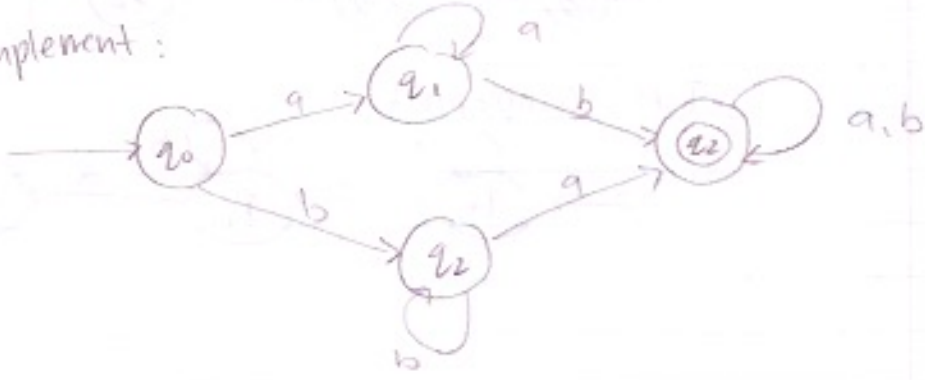


f) {w | w is any string not in $a^* \cup b^*$}

i) string in $a^* \cup b^*$

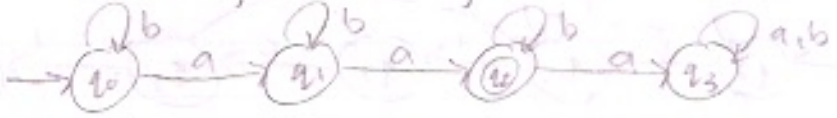


Take complement:



g) {w | w is any string that doesn't contain exactly 2 a's}

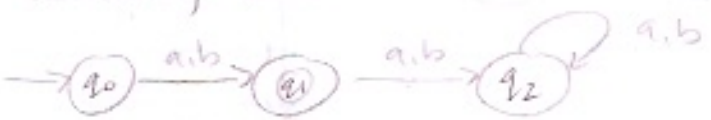
i) string containing exactly 2 a's



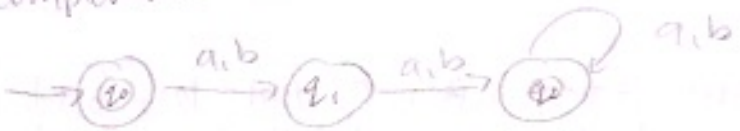
Take complement:

h) {w | w is any string except a and b}

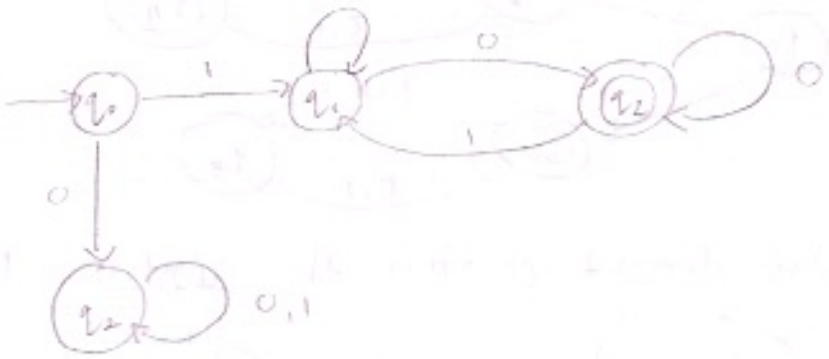
i) string with a and b



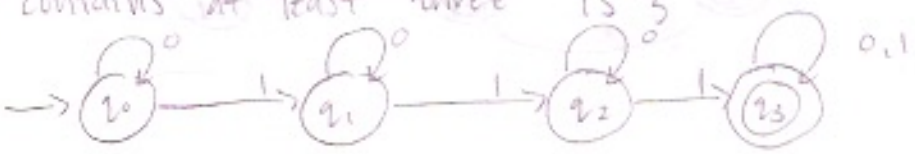
take complement:



1.6 a) {w | w begins with a 1 and ends with a 0}

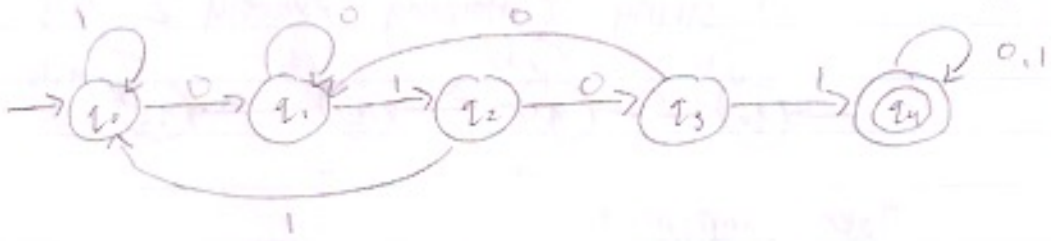


b) {w | w contains at least three 1s}

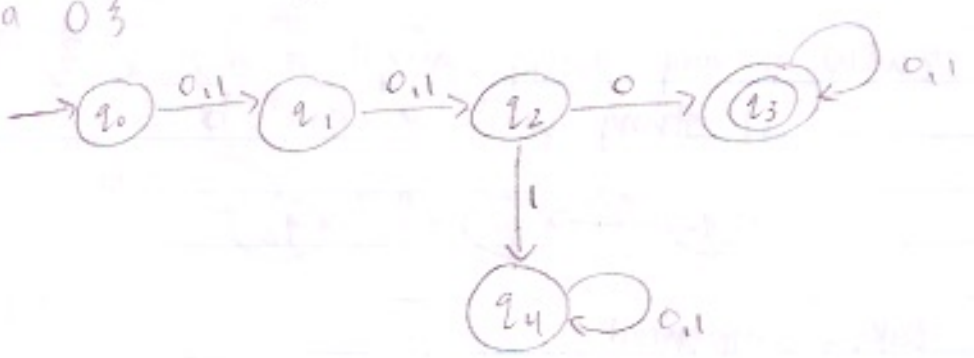


c) {w | w contains the substring 0101}

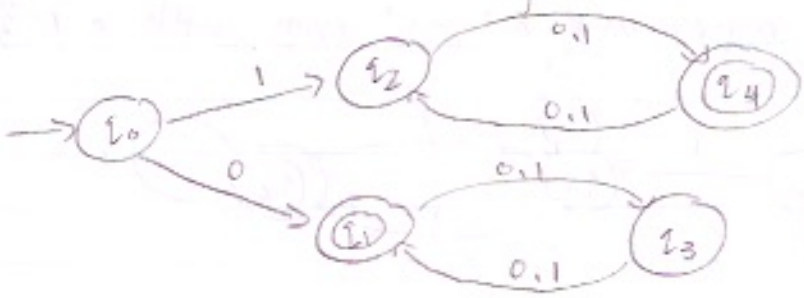
i.e. $w = x0101y$ for some x and y



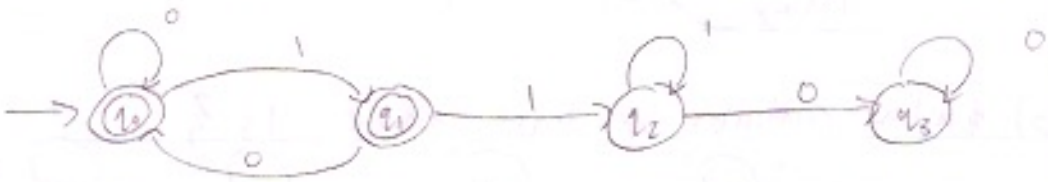
d) {w | w has length at least 3 and its third symbol is a 0}



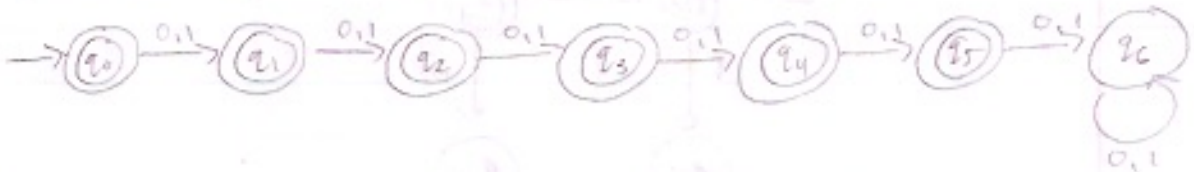
e) {w | w starts with 0 and has odd length, or starts with 1 and has even length}



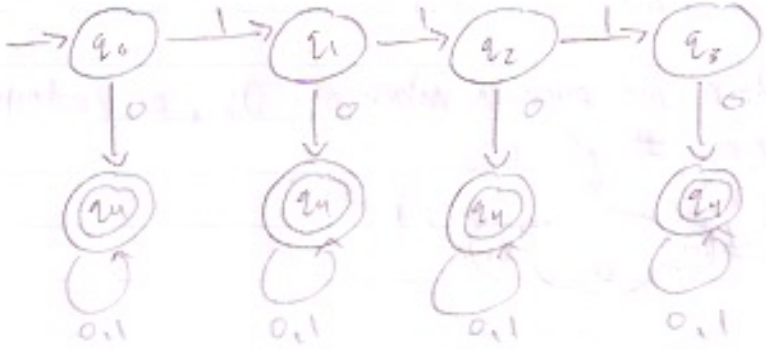
f) {w | w doesn't contain the substring 110}



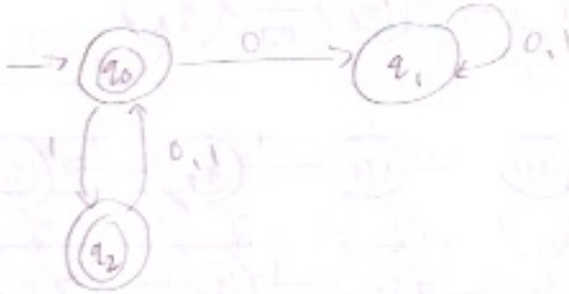
g) {w | the length of w is at most 5}



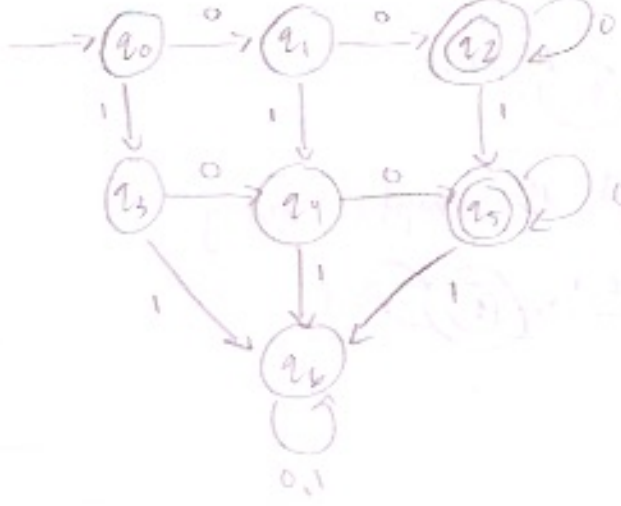
h) {w | w is any string except 11 and 111}



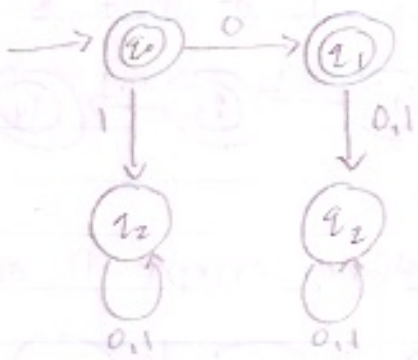
i) {w | every odd position of w is a 1}



j) {w | w contains at least two 0's and at most one 1}



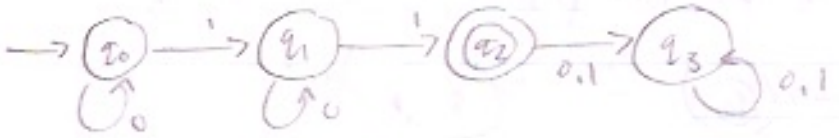
k) $\{\varepsilon, 0\}$



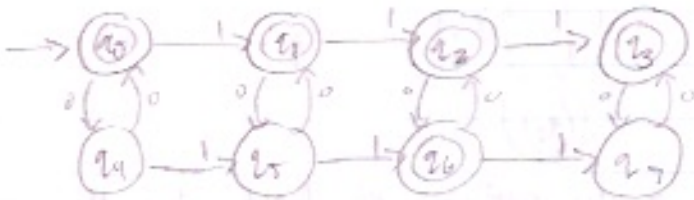
l) $\{w | w$ contains an even number of 0s, or contains exactly two 1's$\}$

i) even # of 0's

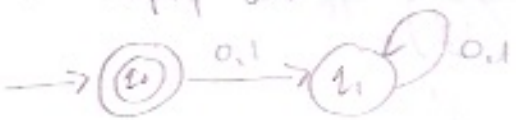
ii) exactly two 1's



Combine:



m) The empty set



n) All strings except the empty string