MOHAIMENUR RAHMAN
19-40338-1
Section-O

Q-1

(a) Formal Definition of DFA D1 -

$D1 = (Q, \Sigma, \delta, q_0, F)$ where

$Q = \{a_1, a_2, a_3, a_4, a_5\}$

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

$q_0 = a_1$

$F = \{a_1, a_2, a_3\}$

δ as -

δ	0	1
a_1	a_2	a_3
a_2	a_2	a_4
a_3	a_5	a_3
a_4	a_2	a_4
a_5	a_5	a_3

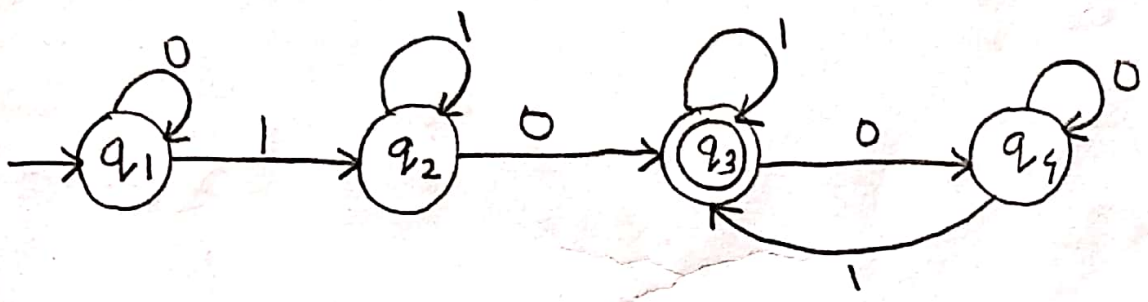
(b) Language A1 for D1,

$A1 = \{w | w$ starts and ends with same symbol $\}$

Q-2

$A2(m) = \{w \mid w$ ends with 1 and contain the substring $10\}$

(a) The state diagram for language A2



(b) Formal Definition of DFA D2 -

$D_2 = (Q, \Sigma, \delta, q_0, F)$ where

$Q = \{q_1, q_2, q_3, q_4\}$

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

$q_0 = q_1$

$F = \{q_3\}$

δ as -

δ	0	1
q_1	q_1	q_2
q_2	q_3	q_2
q_3	q_4	q_3
q_4	q_4	q_3

Q-3

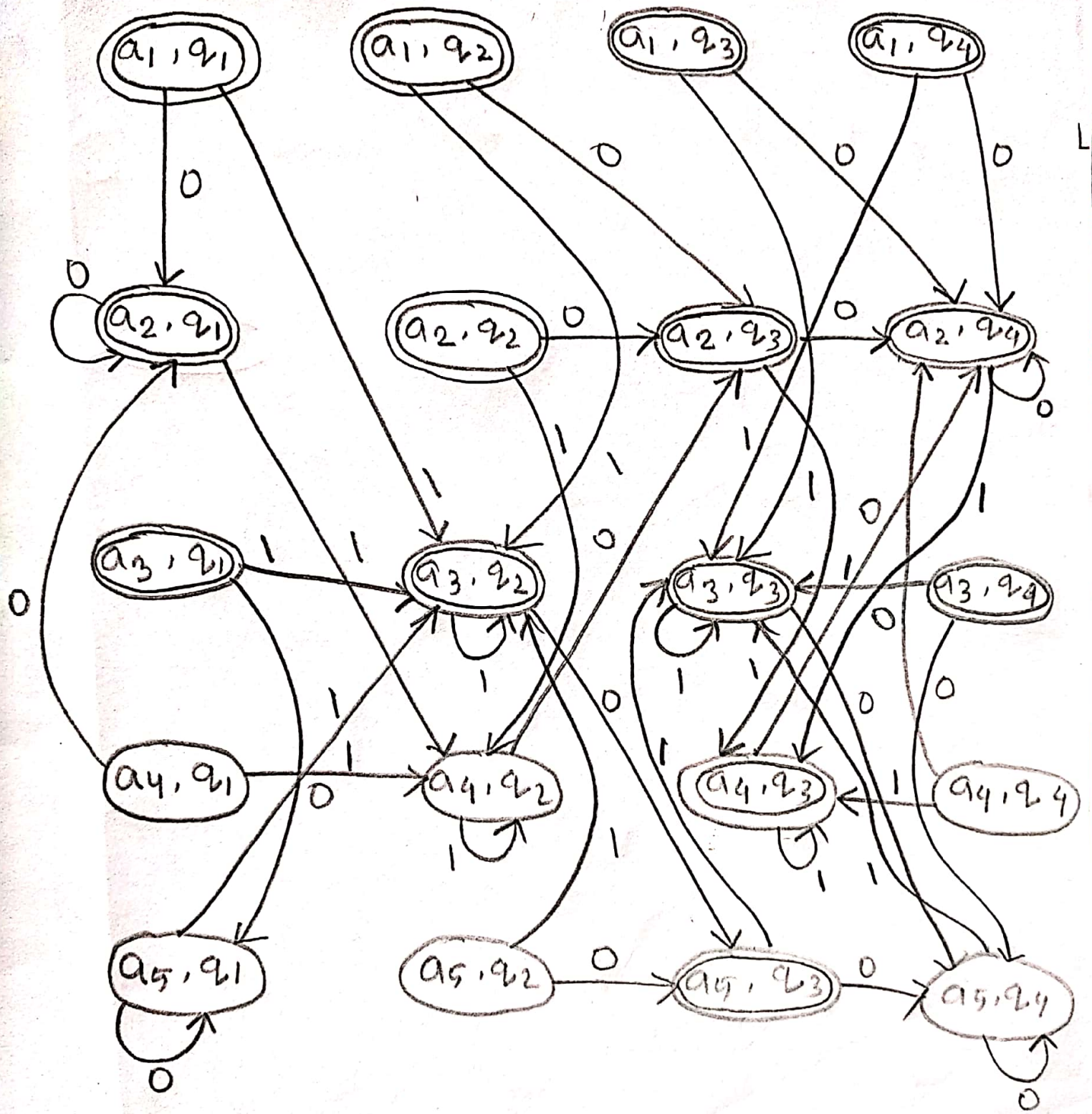
Perform the regular operation union (U) for the DFAs D_1 and D_2

(a) The Transition table and mark the start and final states.

δ	0	1
→ (a_1, q_1)	(a_2, q_1)	(a_3, q_2)
(a_1, q_2)	(a_2, q_3)	(a_3, q_2)
(a_1, q_3)	(a_2, q_4)	(a_3, q_3)
(a_1, q_4)	(a_2, q_4)	(a_3, q_3)
(a_2, q_1)	(a_2, q_1)	(a_4, q_2)
(a_2, q_2)	(a_2, q_3)	(a_4, q_2)
(a_2, q_3)	(a_2, q_4)	(a_4, q_3)
(a_2, q_4)	(a_2, q_4)	(a_4, q_3)
(a_3, q_1)	(a_5, q_1)	(a_3, q_2)
(a_3, q_2)	(a_5, q_3)	(a_3, q_2)
(a_3, q_3)	(a_5, q_4)	(a_3, q_3)
(a_3, q_4)	(a_5, q_4)	(a_3, q_3)
(a_4, q_1)	(a_2, q_1)	(a_4, q_2)
(a_4, q_2)	(a_2, q_3)	(a_4, q_2)
(a_4, q_3)	(a_2, q_4)	(a_4, q_3)
(a_4, q_4)	(a_2, q_4)	(a_4, q_3)
(a_5, q_1)	(a_5, q_1)	(a_3, q_2)
(a_5, q_2)	(a_5, q_3)	(a_3, q_2)
(a_5, q_3)	(a_5, q_4)	(a_3, q_3)
(a_5, q_4)	(a_5, q_4)	(a_3, q_3)

Transition Table

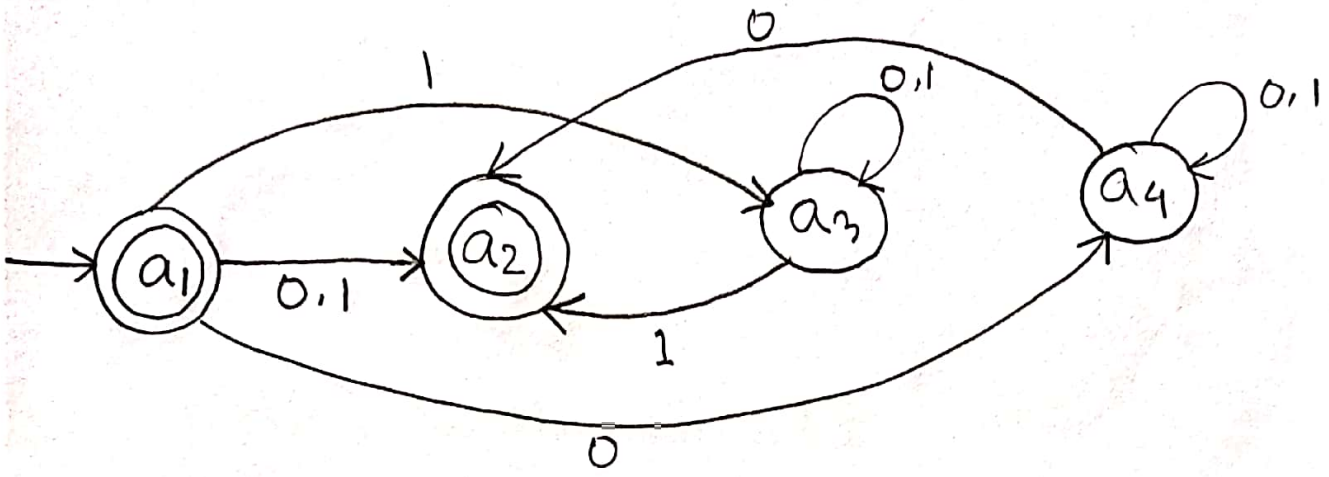
(b) The state diagram from the tranition Table



Q-4

Consider the language A1 for NFA N1 where $\Sigma = \{0, 1\}$

(a) The state diagram for the language A1



(b) formal Definition of NFA - N1

$N_1 = (Q, \Sigma, \delta, q_0, F)$

$Q = \{a_1, a_2, a_3, a_4\}$

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

$q_0 = a_1$

$F = \{a_1, a_2\}$

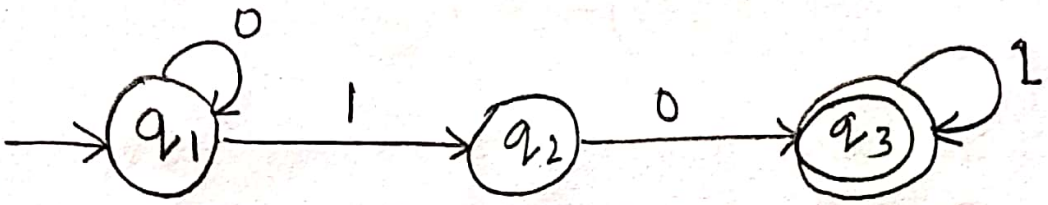
δ - as

δ	0	1
a_1	(a_2, a_4)	(a_2, a_3)
a_2	ϕ	ϕ
a_3	(a_3)	(a_2, a_3)
a_4	(a_2, a_4)	(a_4)

Q-5

$A3(m) = \{ w | w$ ends with 1 and cointain the substring $10 \}$

(a) The state Diagram of the language A3



(b) Formal Definition of NFA N3 -

$N3 = \{ Q, \Sigma, \delta, q_0, F \}$

$Q = \{ q_1, q_2, q_3 \}$

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

$q_0 = q_1$

$F = \{ q_3 \}$

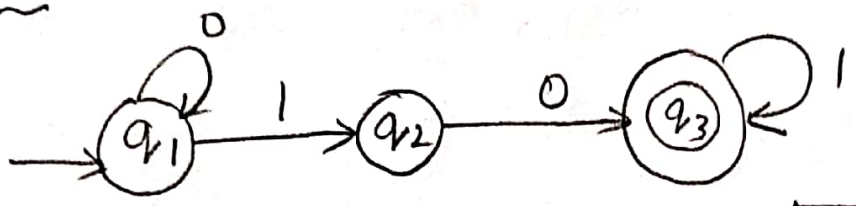
δ as -

δ	0	1
q_1	q_1	q_2
q_2	q_3	ϕ
q_3	ϕ	q_3

Q-6

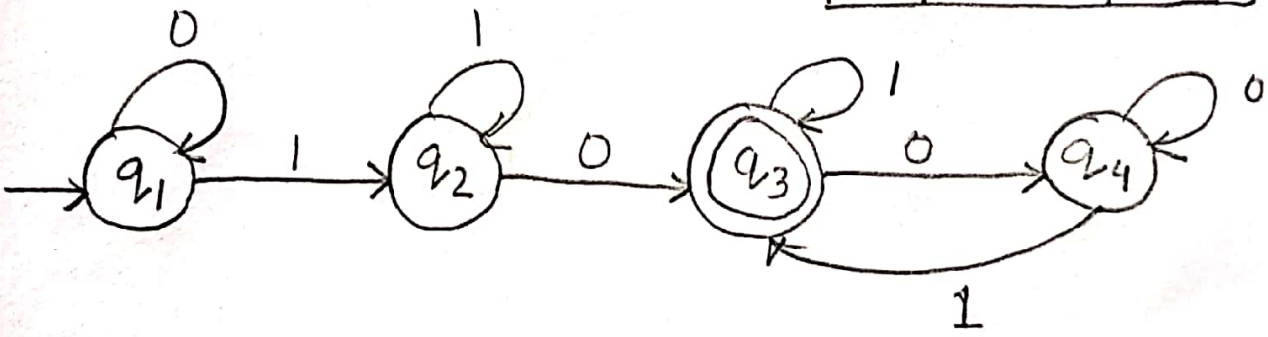
NFA N3 to its equivalent DFA

NFA



δ	0	1
q_1	q_1	q_2
q_2	q_3	ϕ
q_3	ϕ	q_3

DFA

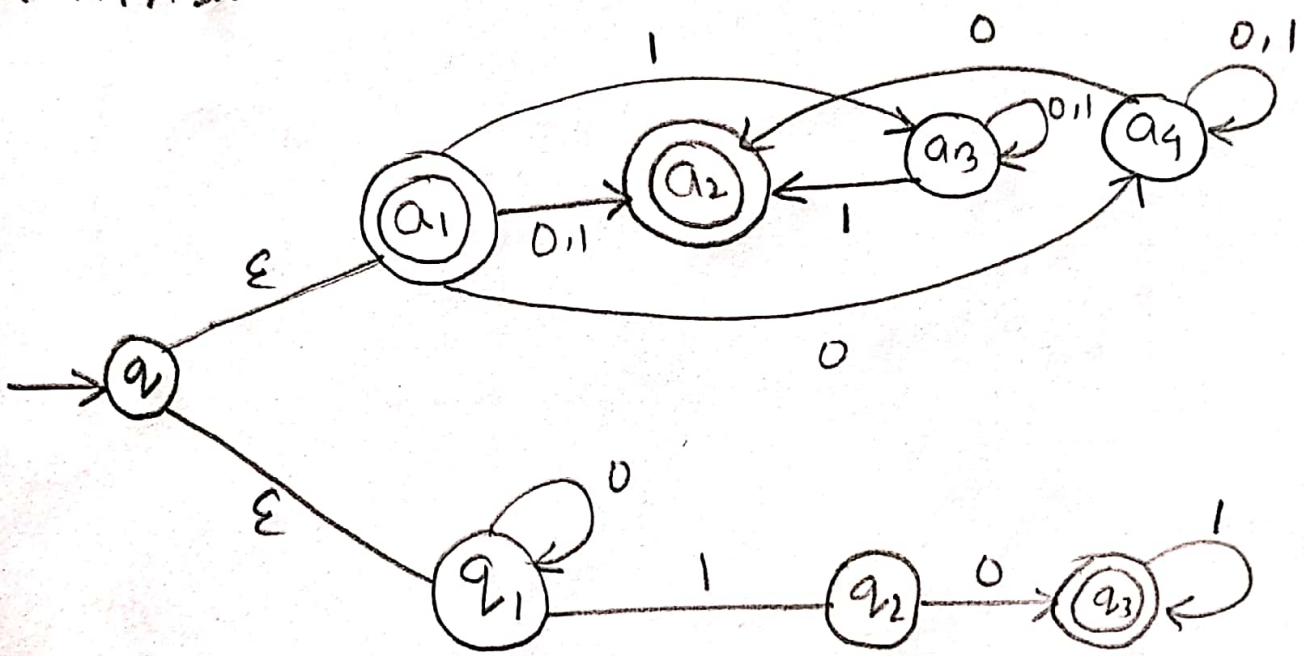


δ	0	1
q_1	q_1	q_2
q_2	q_3	q_2
q_3	q_4	q_3
q_4	q_4	q_3

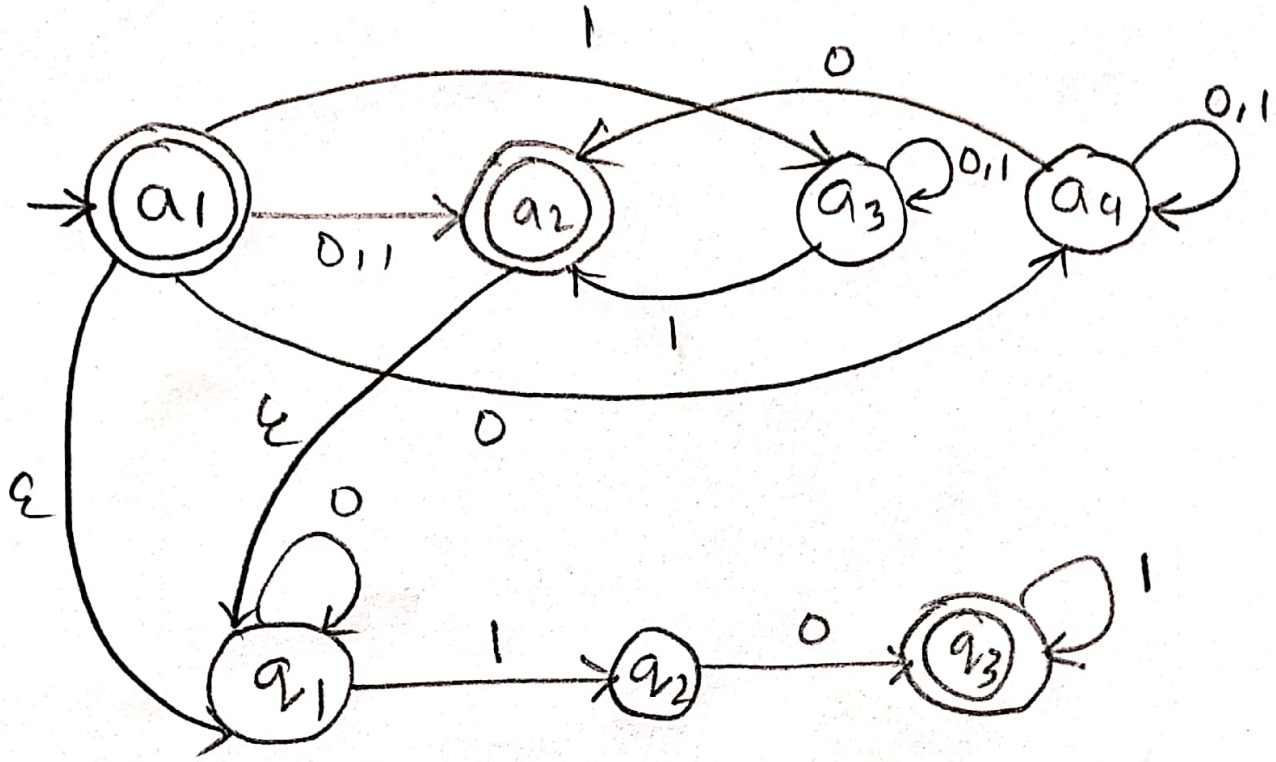
Q-7

Perform the following regular operations on the NFAs N1 and N3

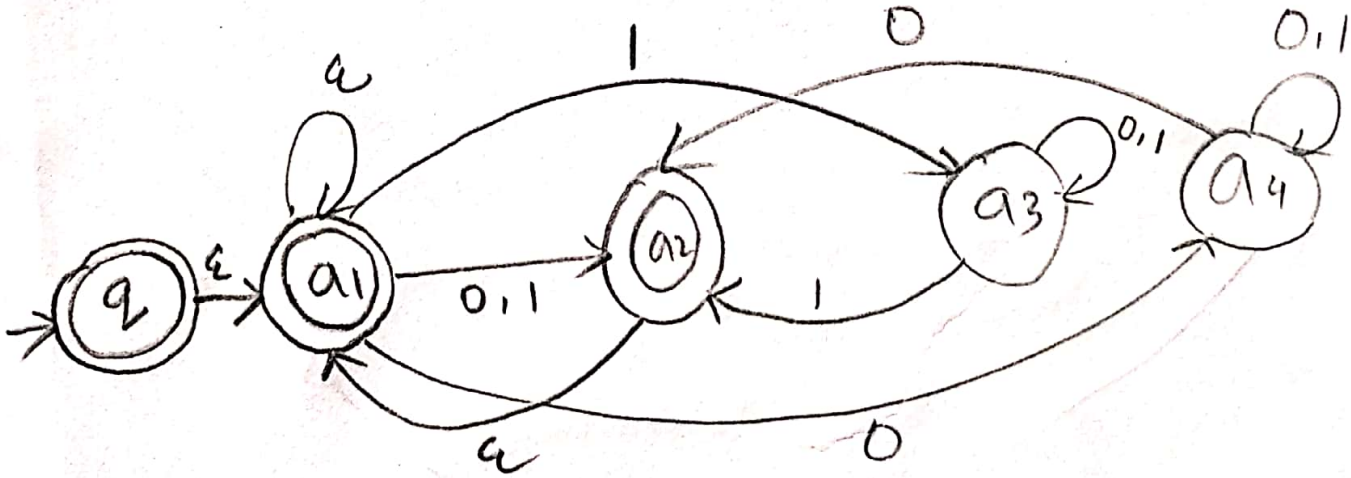
(a) The state diagram for the union of the NFAs N1 and N3.



(b) The state diagram for the concatenation of the NFAs N1 followed by N3



(c) The state diagram for the start of the NFA N1



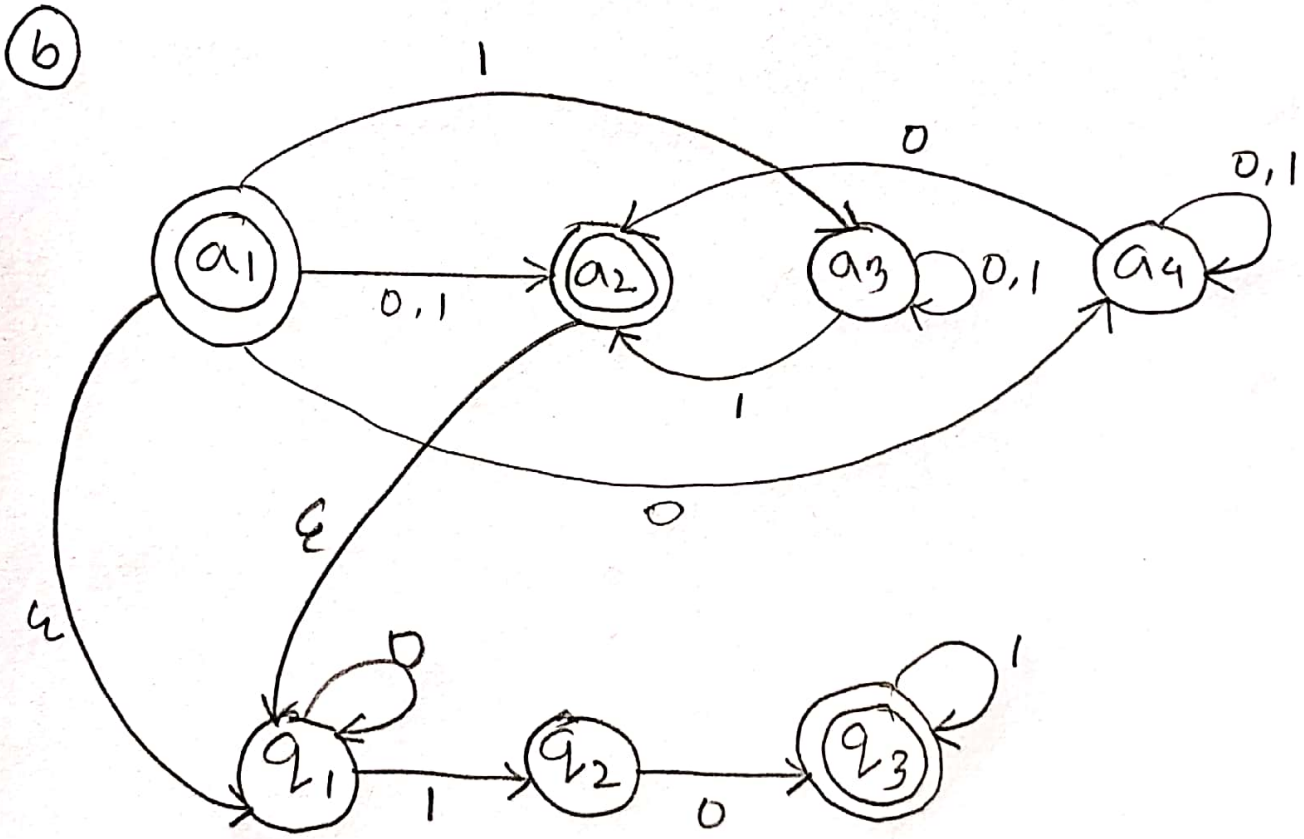
Q-8

(a) ID - 19-40338-1

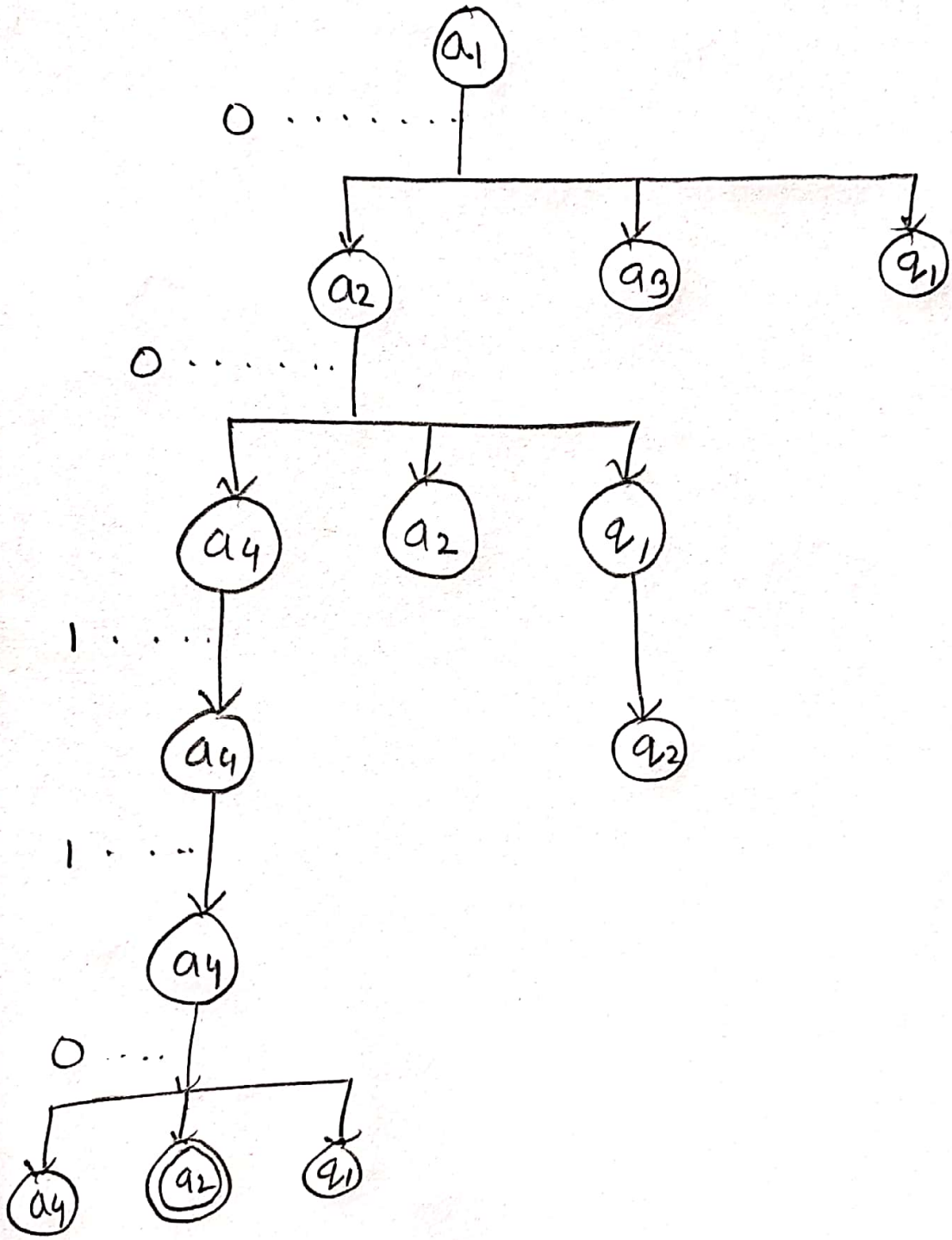
4%2	0%2	3%2	3%2	8%2
0	0	1	1	0

0 0 1 1 0

(b)



00110



So, the string is rejected.