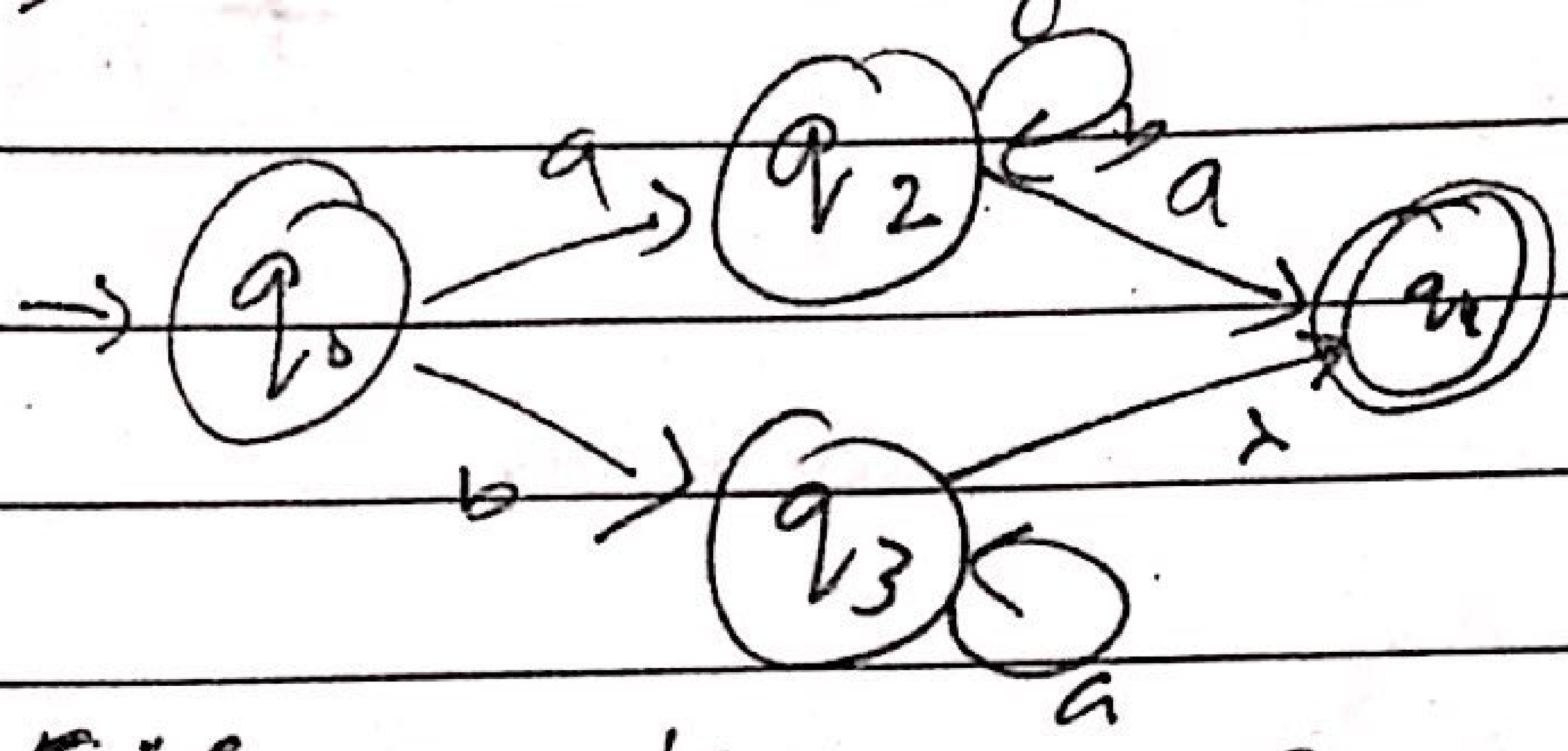
ASSIGNMENT # 2.

K21-4512 SEC - J.

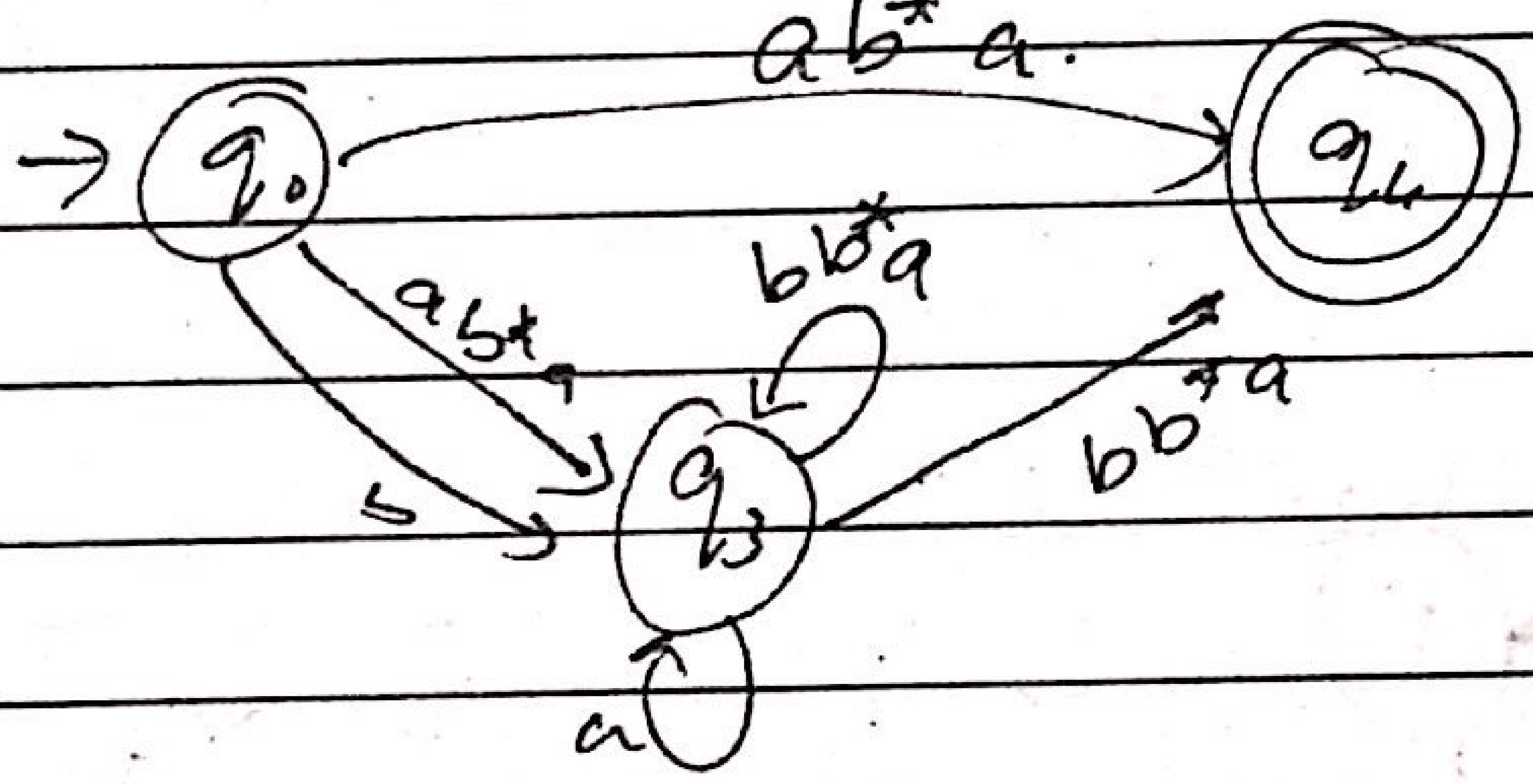
Q no: 1.

(a)

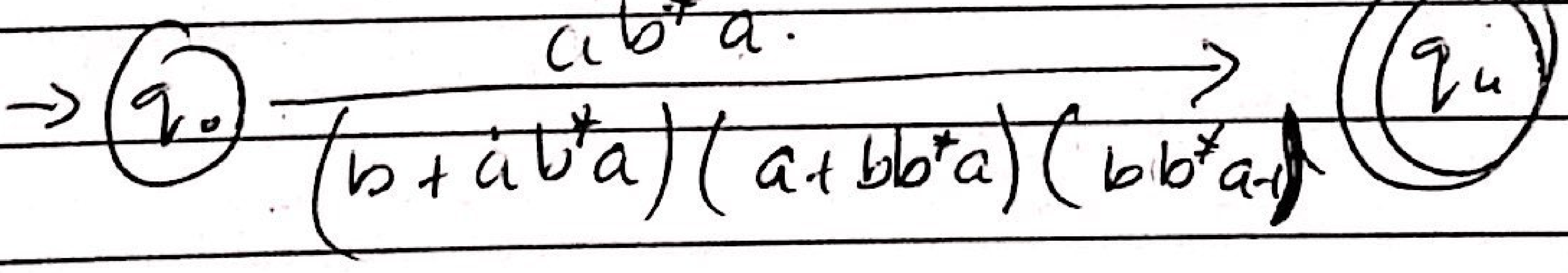
(i) ⇒ Eliminating q_1 state.



⇒ Eliminating q_2 state.



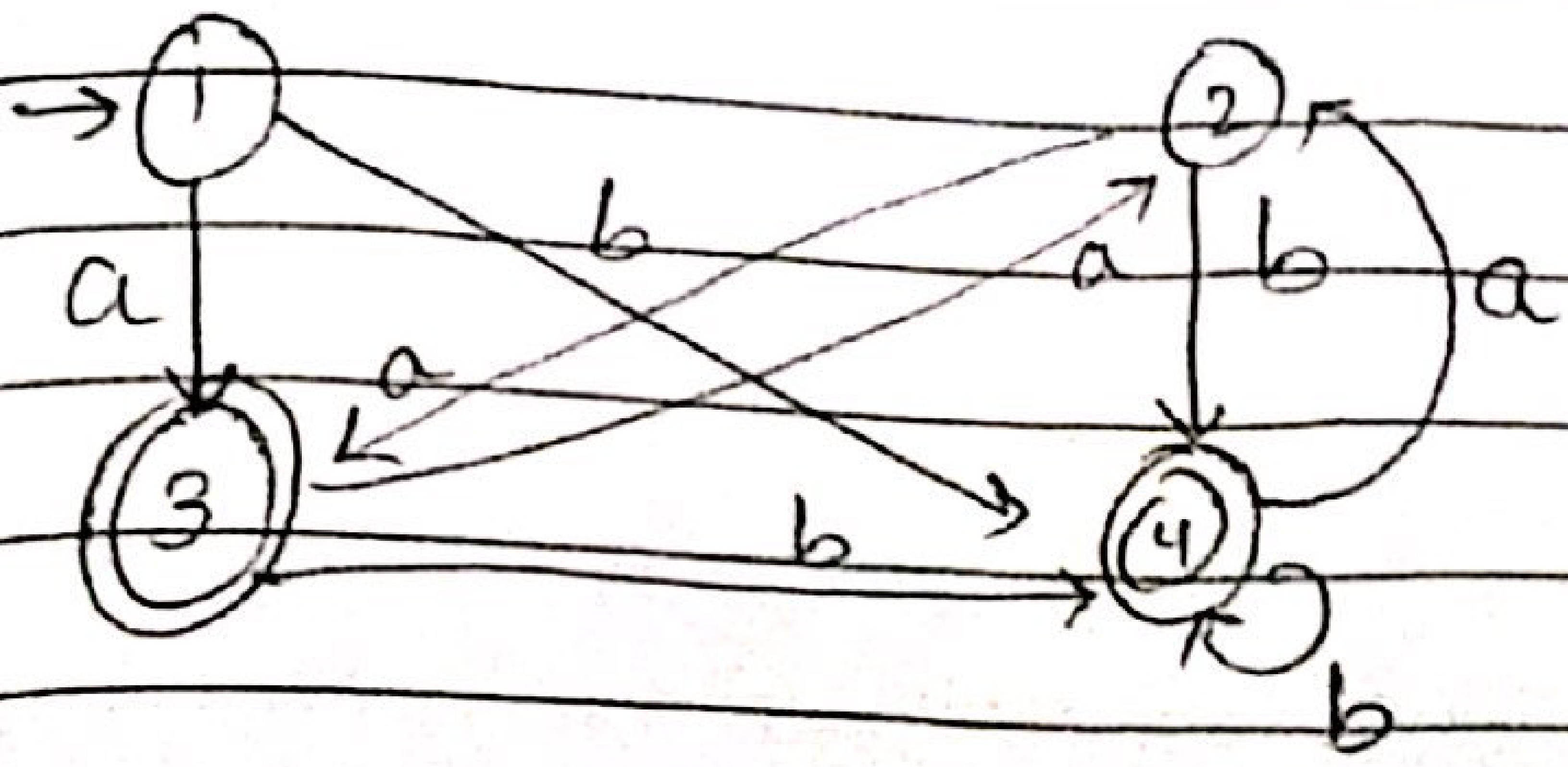
⇒ Eliminating q_3 State



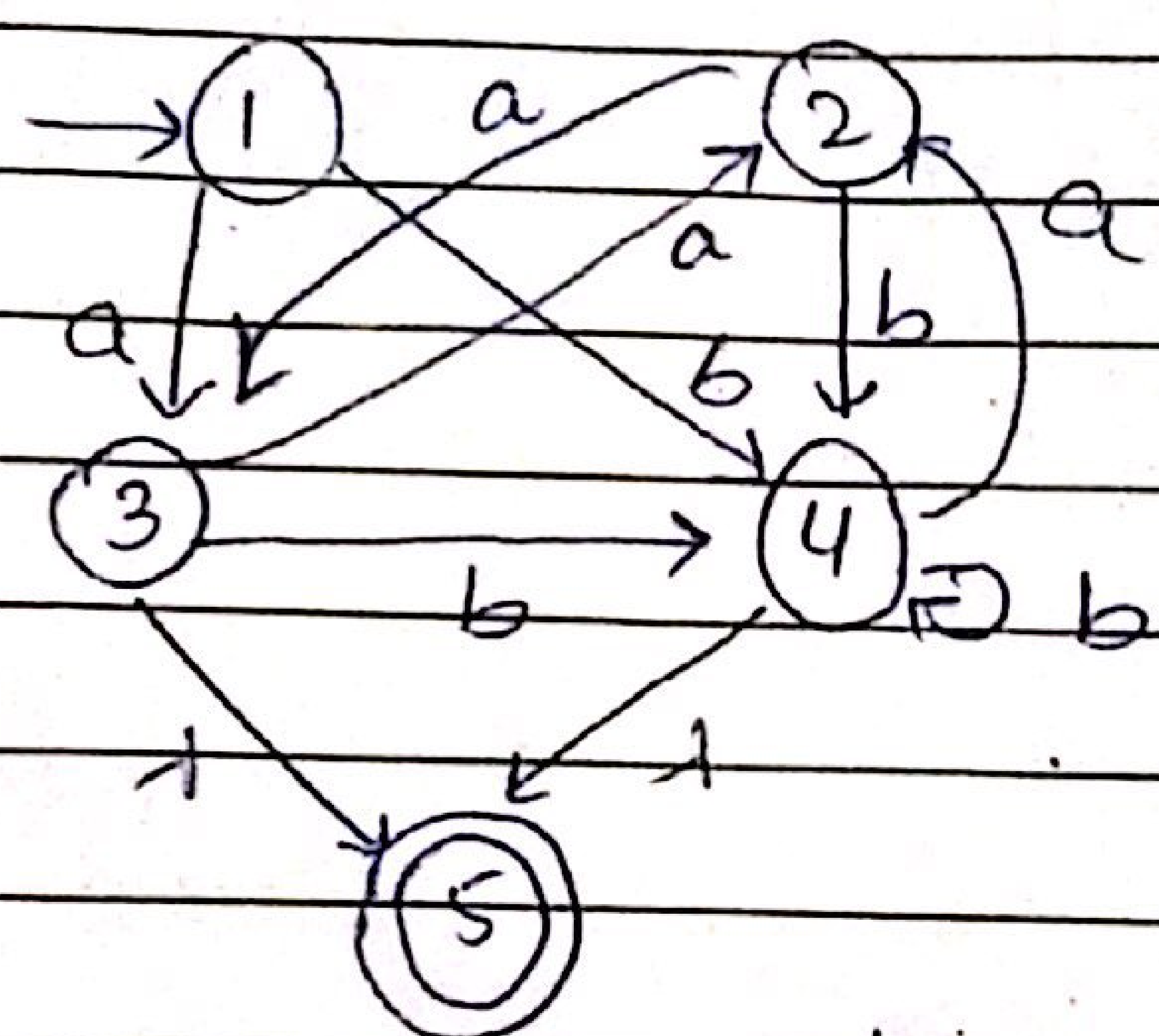
$$ab^*a + (b+ab^*a)(a+bb^*a)^*(bb^*a)$$

Date:

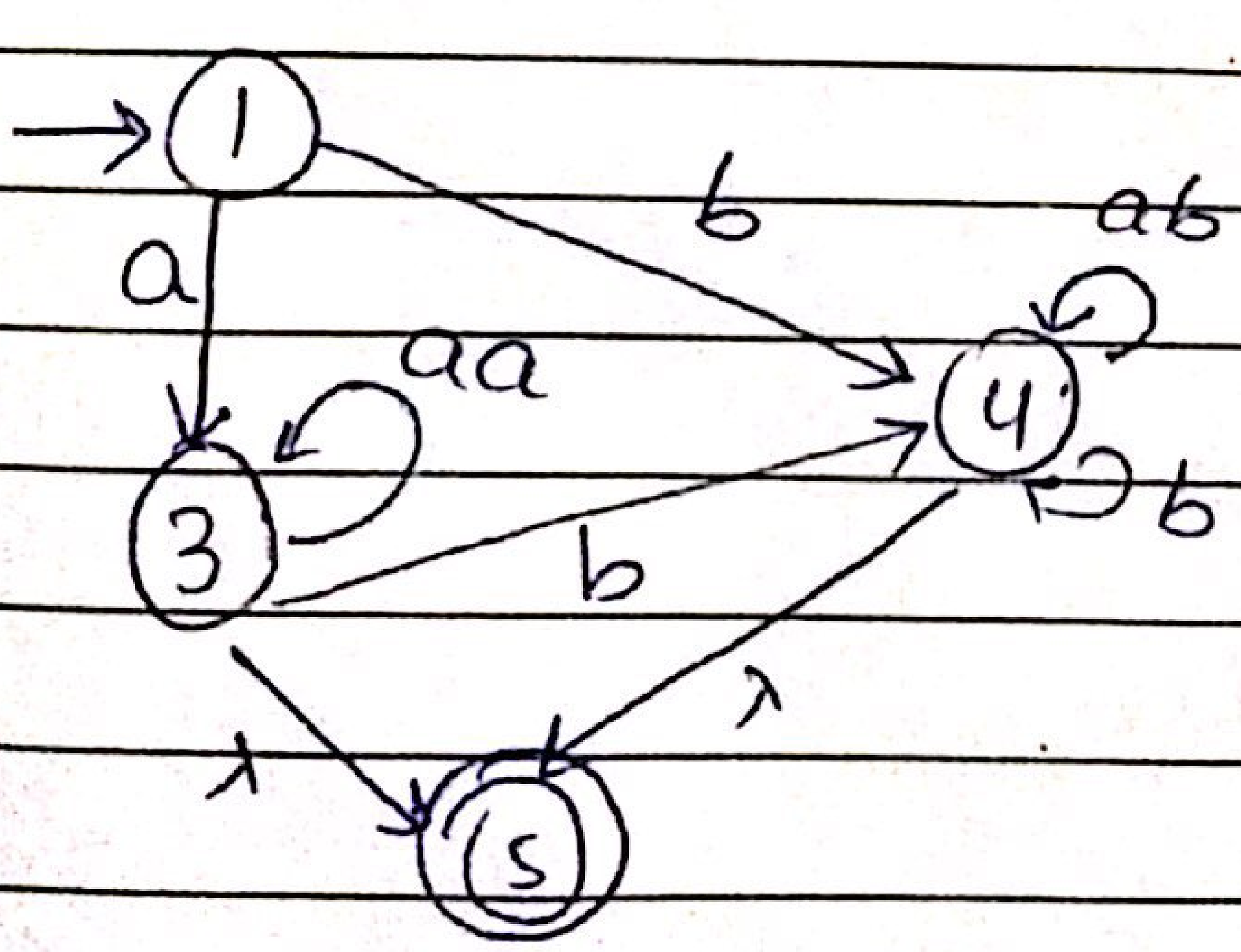
11



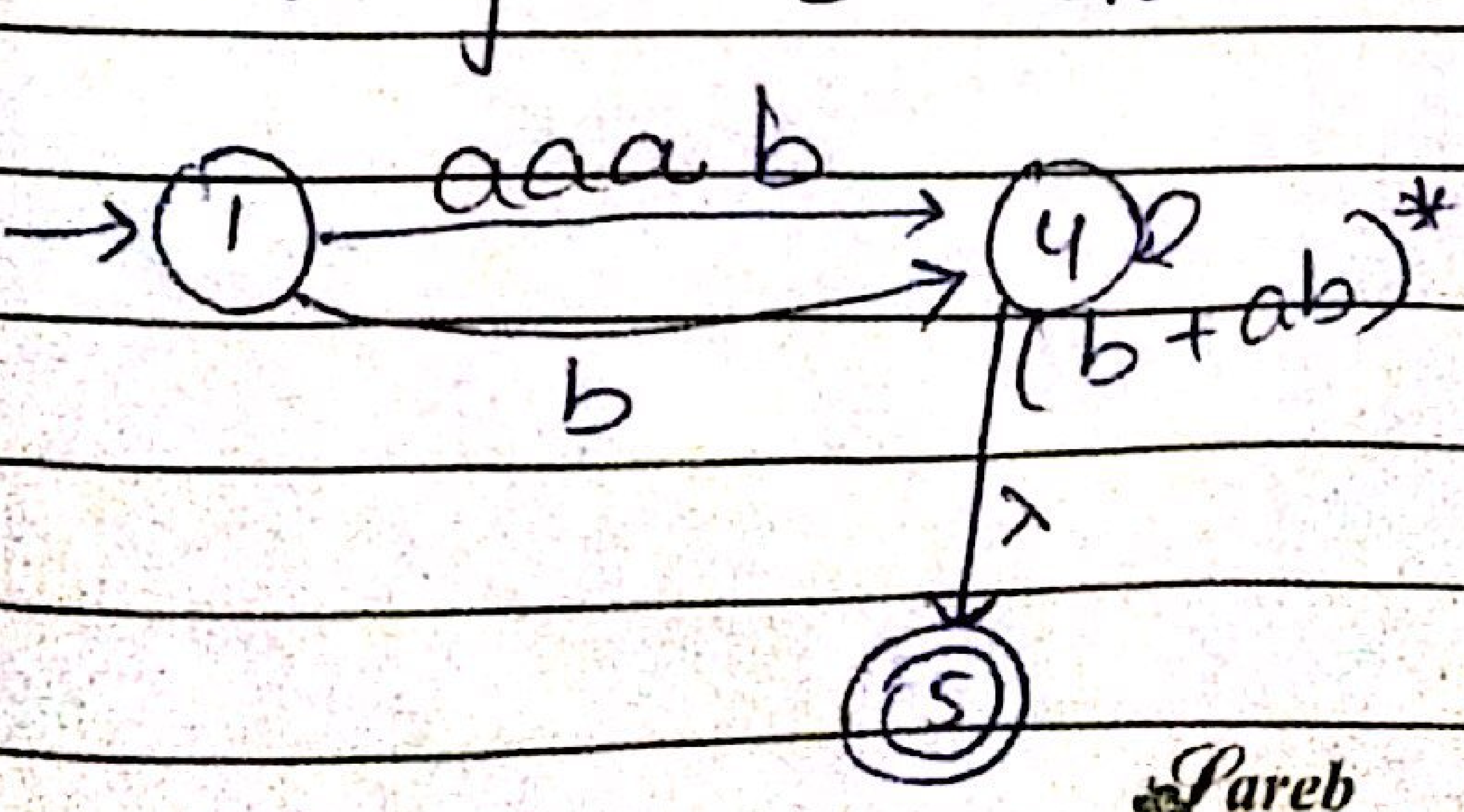
⇒ Introducing new final states to make the previous final states into normal states.



⇒ Eliminating 2nd state.

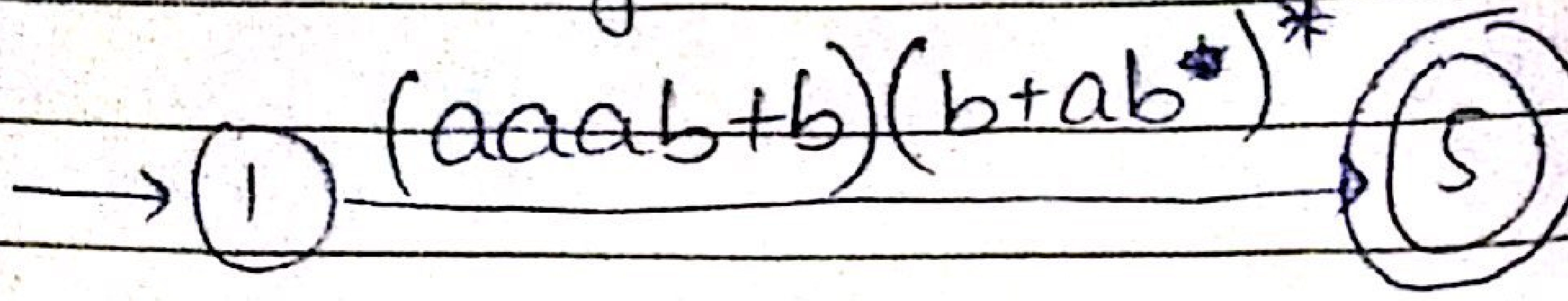


⇒ Eliminating 3rd State



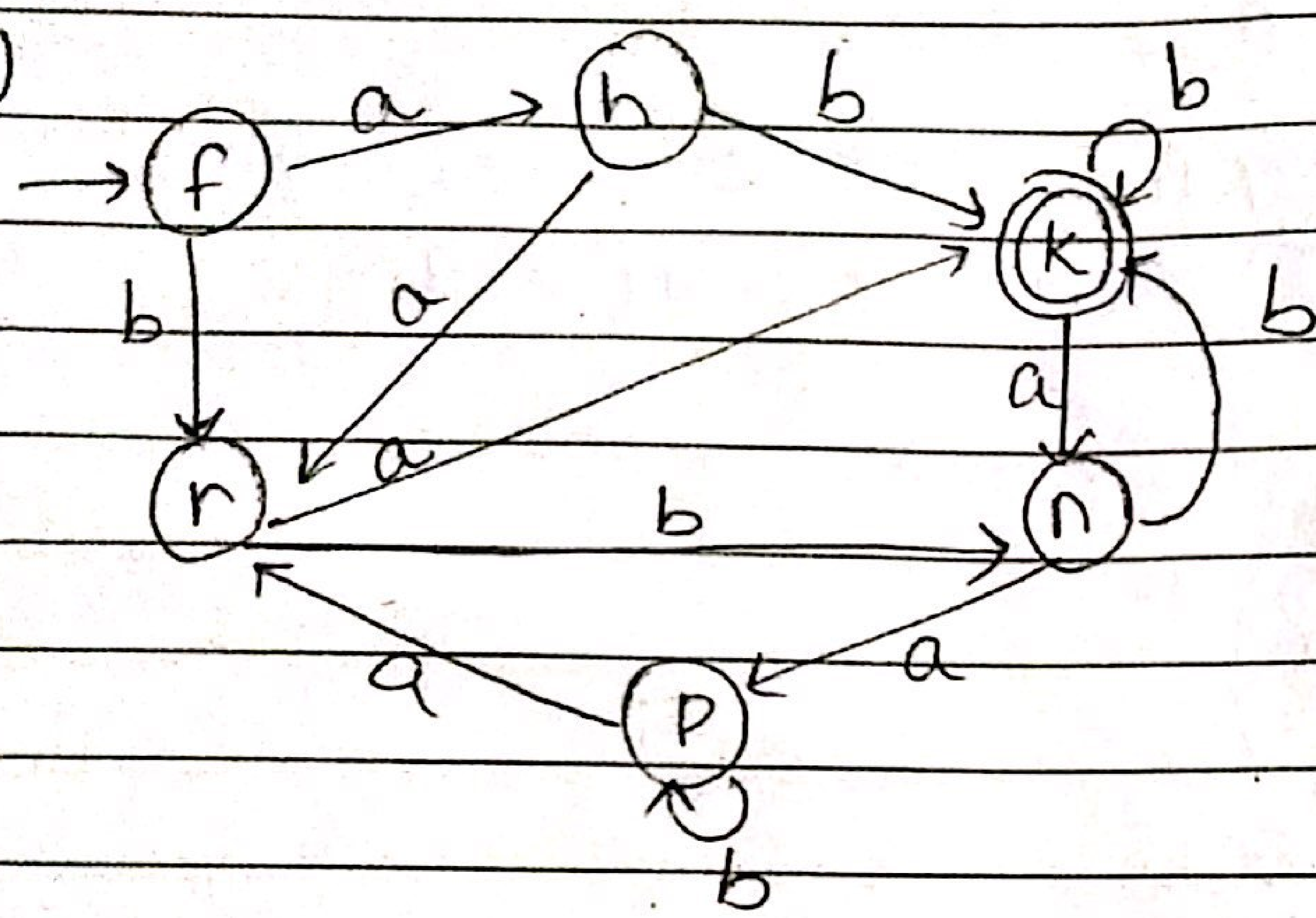
Date:

⇒ Eliminating 4th State.

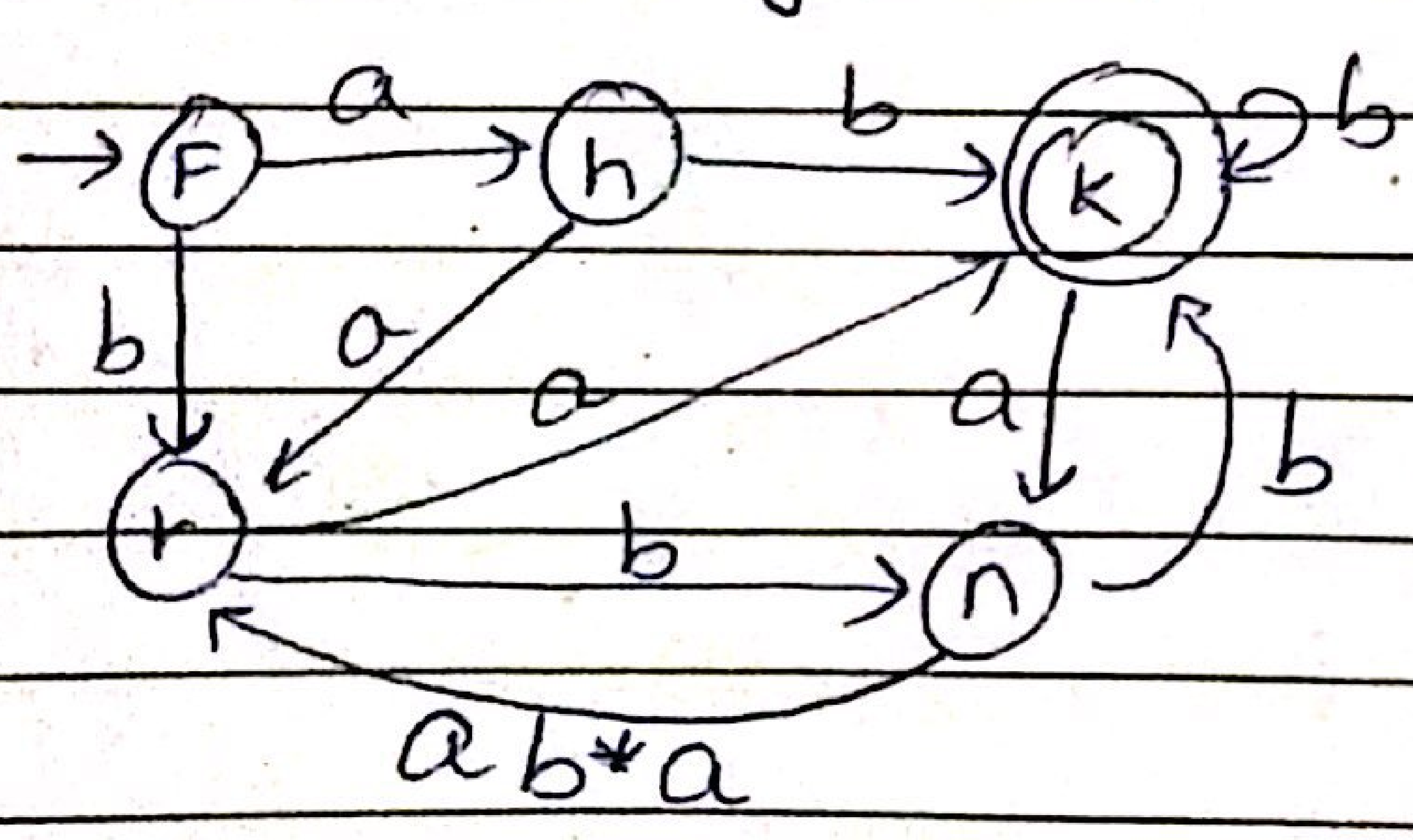


RE ⇒ $(aaab+b)(b+ab)^*$

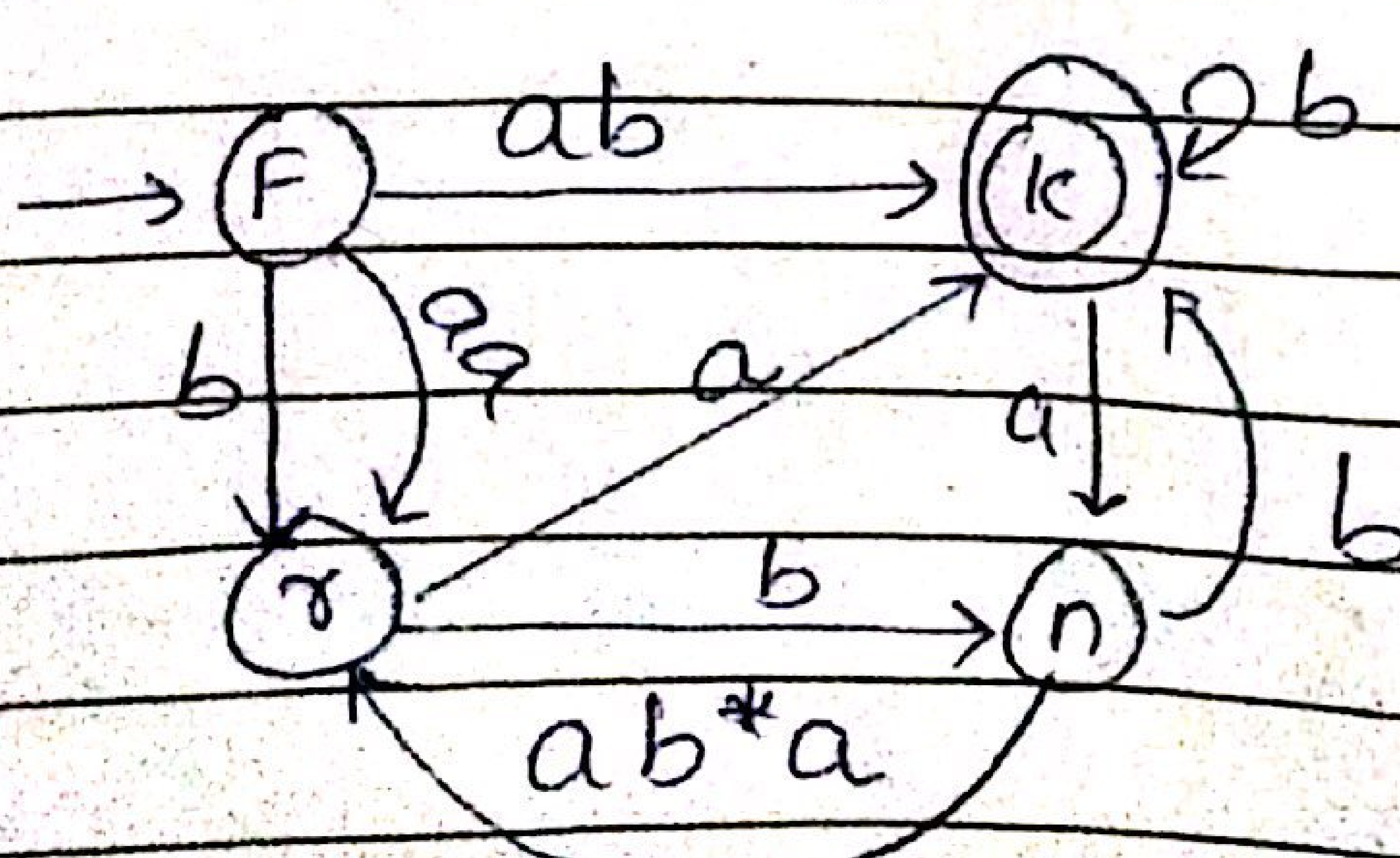
(iii)



⇒ Eliminating P State

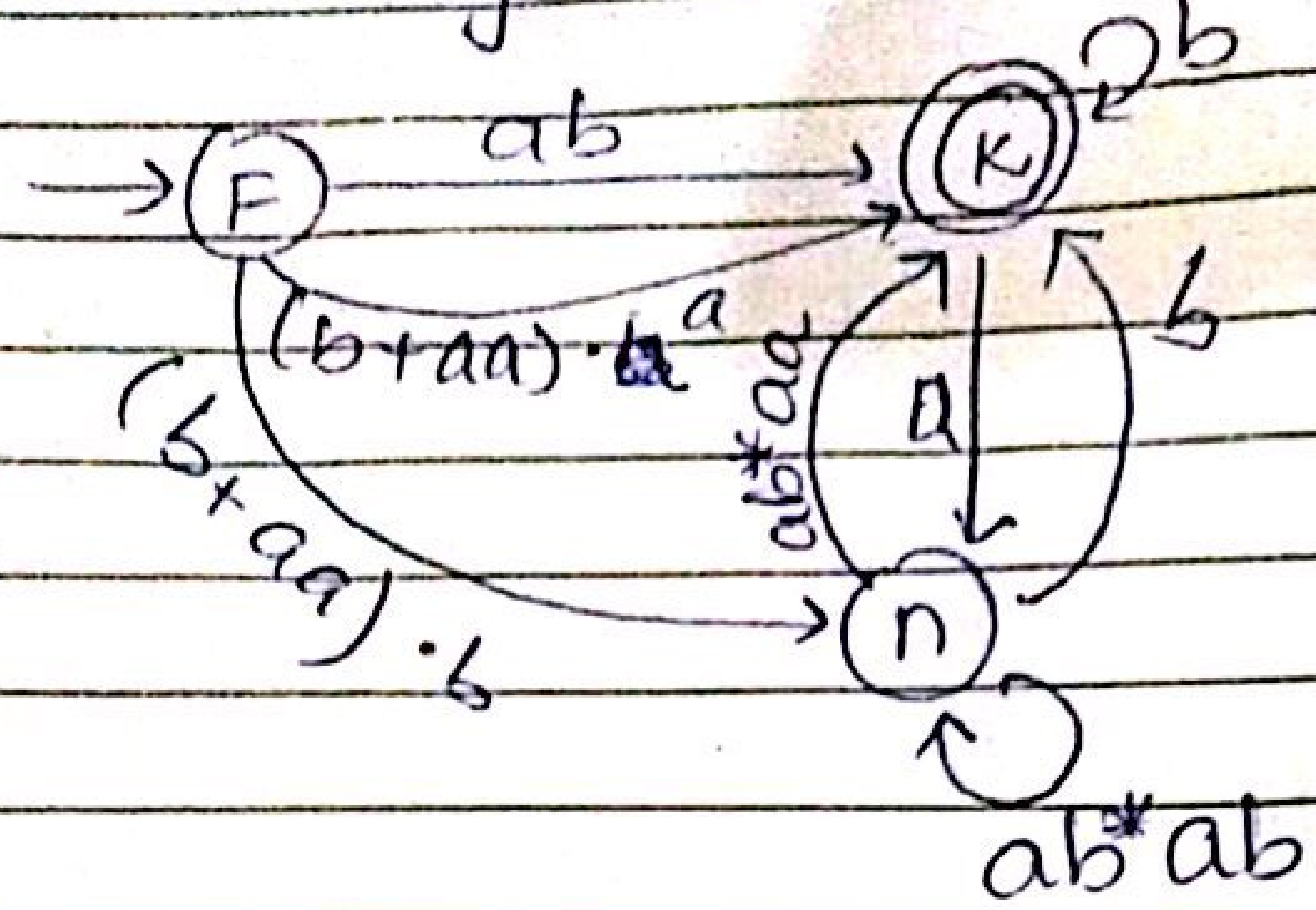


⇒ Eliminating h State

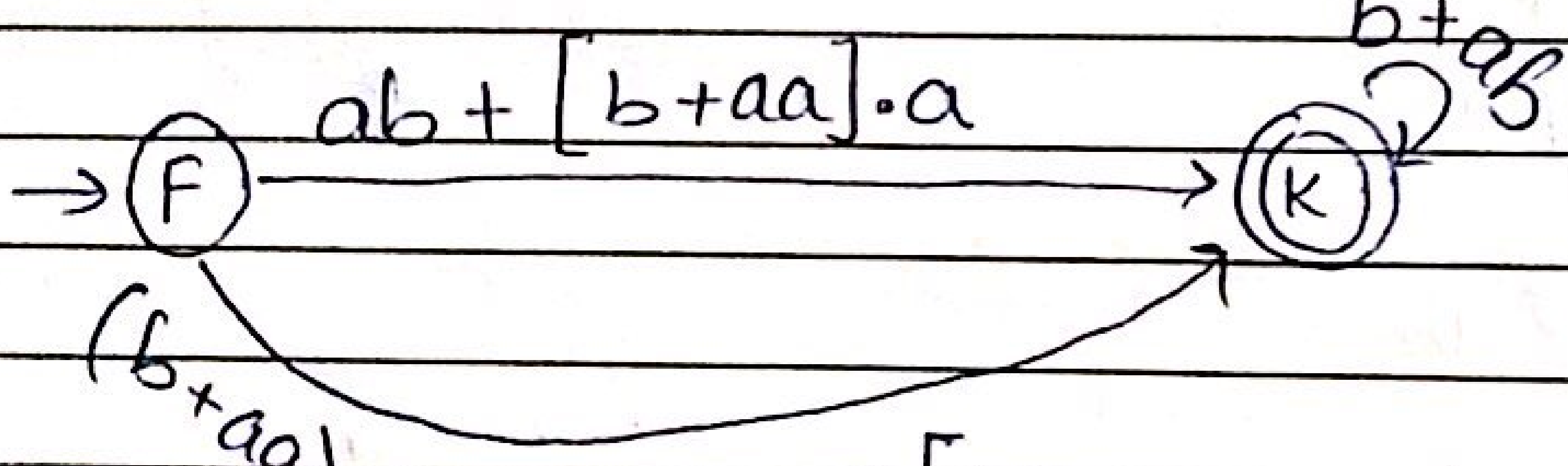


Date:

Eliminating r.



Eliminating ~~B~~ n



$(b+aa)\cdot b\,(ab^*ab)^*\,[\cancel{(ab^*aa\,b^*) + (b}$

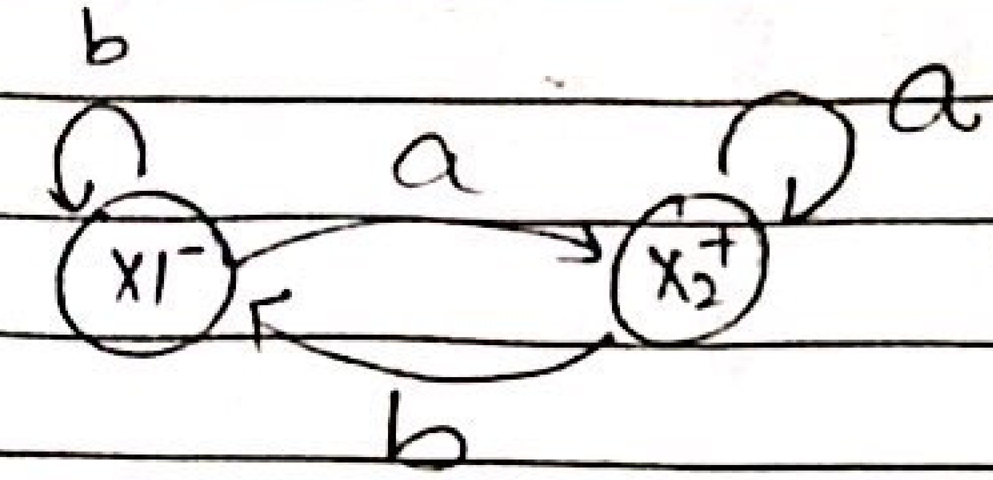
$(ab^*aa+b)\cdot(b^*a\,(ab^*ab)^*\cdot$
$(ab^*aa+b))^*.$

$ab+(b+aa)a+(b+aa)b(ab^*ab)^*(ab^*aa+b)\cdot$
$(b^*a(ab^*ab)^*(ab^*aa+b))^*$

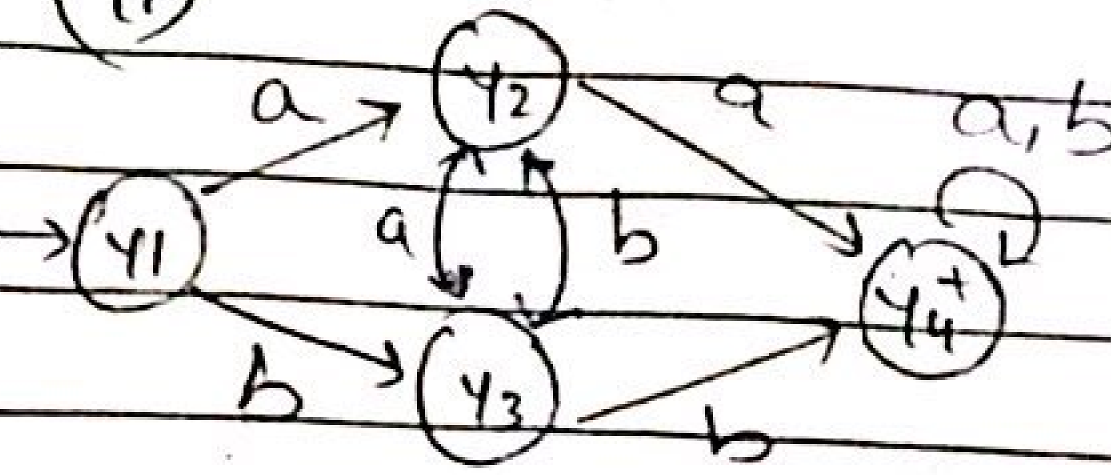
Date:

(b)

(i)

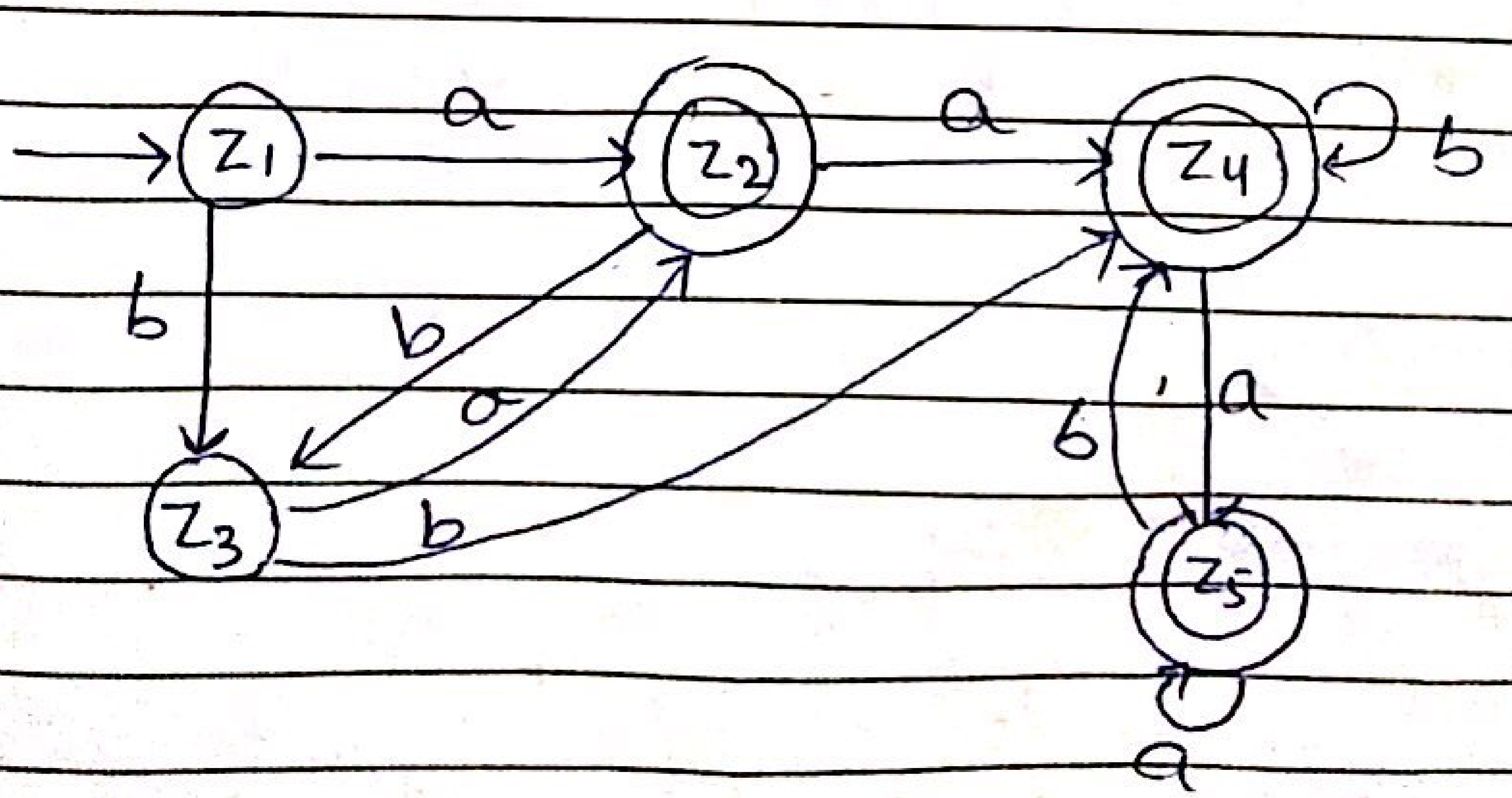


(ii)



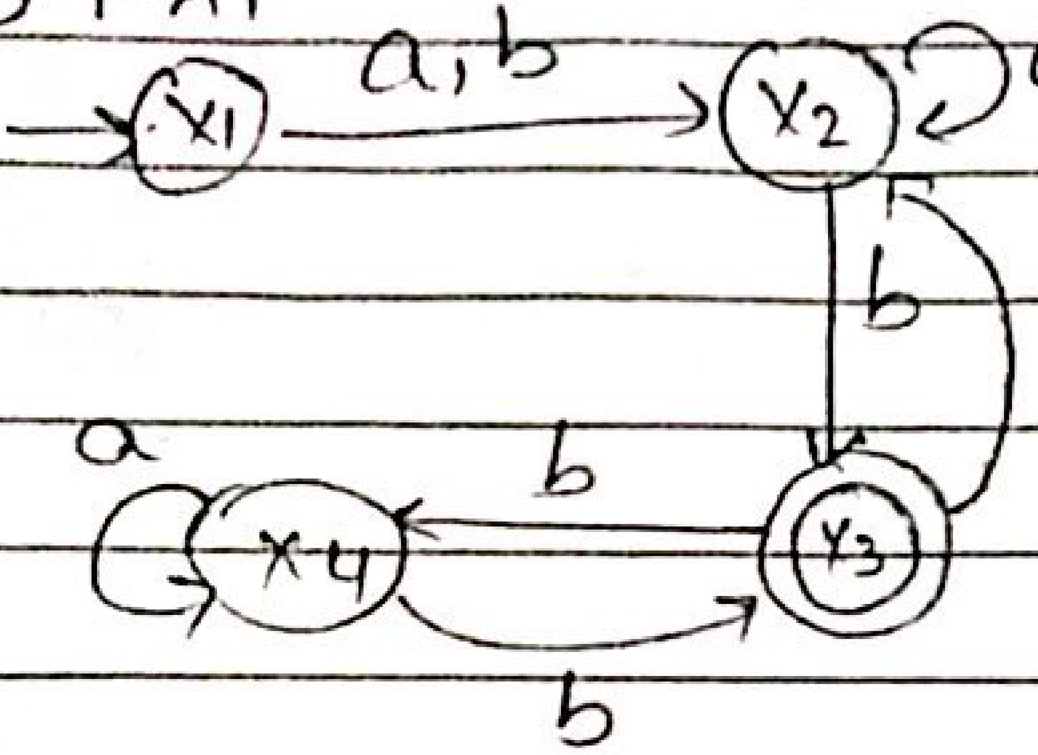
States	a	b
$\rightarrow \{X_1, Y_1\} = Z_1$	$\{X_2, Y_2\} = Z_2^+$	$\{X_1, Y_3\} = Z_3$
$\{X_2, Y_2\} = Z_2^+$	$\{X_2, Y_4\} = Z_4$	$\{X_1, Y_3\} = Z_3$
$\{X_1, Y_3\} = Z_3$	$\{X_2, Y_2\} = Z_2$	$\{X_1, Y_4\} = Z_4$
$\{X_1, Y_4\} = Z_4^+$	$\{X_2, Y_4\} = Z_5$	$\{X_1, Y_4\} = Z_4$
$\{X_2, Y_4\} = Z_5^+$	$\{X_2, Y_4\} = Z_5$	$\{X_1, Y_4\} = Z_4$

⇒ Union FA.

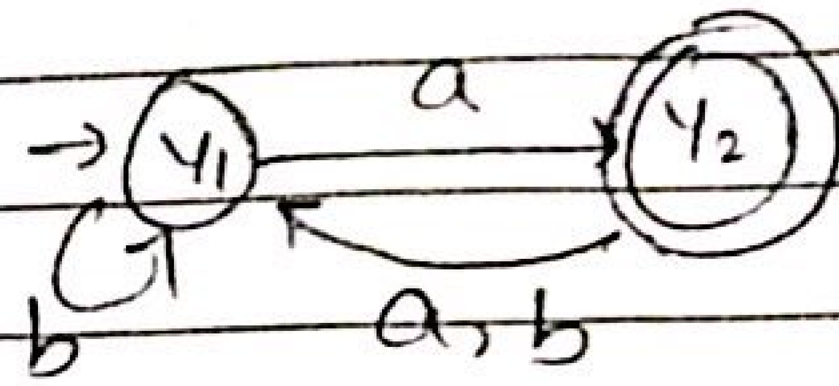


(C)

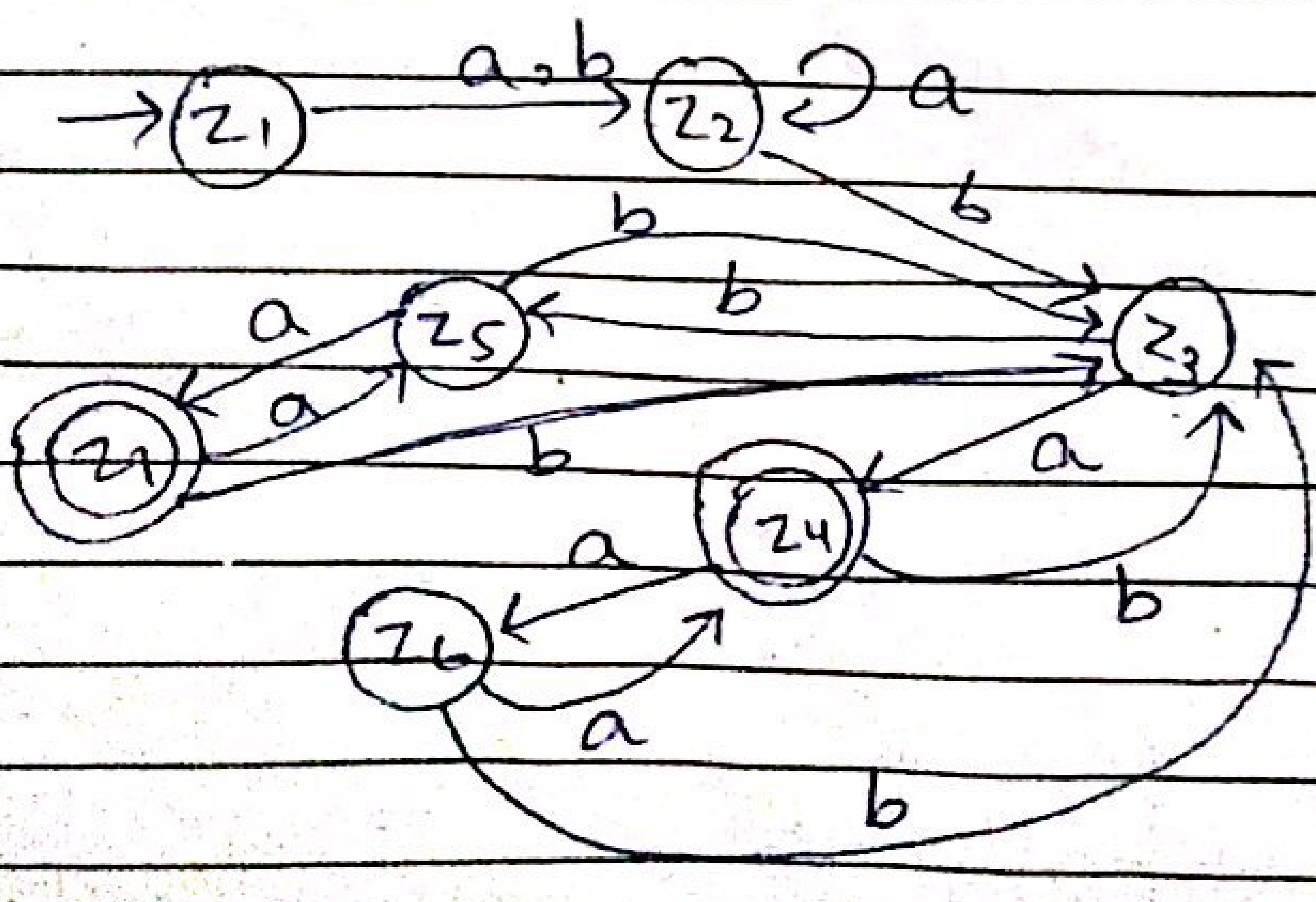
(i) FA_1



(ii) FA_2.



States	a	b
$\to X_1 = Z_1$	$X_2 = Z_2$	$X_2 = Z_2$
$X_2 = Z_2$	$X_2 = Z_2$	$(X_3, Y_1) = Z_3$
$(X_3, Y_1) = Z_3$	$(X_2, Y_2) = Z_4$	$(X_4, Y_1) = Z_5$
$(X_2, Y_2) = Z_4{}^{+}$	$(X_2, Y_1) = Z_6$	$(X_3, Y_1) = Z_3$
$(X_4, Y_1) = Z_5$	$(X_4, Y_2) = Z_7$	$(X_3, Y_1) = Z_3$
$(X_2, Y_1) = Z_6$	$(X_2, Y_2) = Z_4$	$(X_3, Y_1) = Z_3$
$(X_4, Y_2) = Z_7{}^{+}$	$(X_4, Y_1) = Z_5$	$(X_3, Y_1) = Z_3$



d)

PROBABILISTIC KLEENE THEOREM:-

The paper discusses a probabilistic counterpart of kleene's theorem, which relates to the equivalence of rational and recognizable languages in the free monoids. The author aims to represent quantitative properties of words using expressions and automata. ~~The au~~ and further proves that expressions can capture two-way probabilistic automata, and automata with pebbles which can be considered as a probabilistic ~~auto~~ generalization of xpath.

In this paper, we introduced a probabilistic kleene theorem for both classical and extended probabilistic automata, which include two-way navigation and pebbles. Our work serves as a starting point for developing a probabilistic version of xpath and extending our result to probabilistic tree automata. We also pose the question of whether our technique can be applied to obtain ω-expressions for probabilistic B"uchi automata, which have recieved significant attention. In addition, there have been recent efforts to charaterize probabilistic automata using monadic second-order logic, and exploring alternative characterizations that utilize a transitive-closure operator could be a fruitful avenue for future research.

A KLEENE THEOREM FOR [illegible]
AUTOMATA :-

The paper introduces timed regular expressions which are a more advanced form of a regular expressions that can be used to describe the sets of dens-time, discrete-value signals. The authors demonstrate that this formalism is as expressive as Alur and Dill's timed automata, and they do so by outlining a process for translating expressions into automata and vice versa. Additionally, the authors expand their findings to include-regular expressions, based on Buchi's theorem.

Q no : 2
(a)

DFA MINIMIZATIONS :-

States	a	b	c
→ 1	3	4	2
2	5	5	5
3	6	7	7
4	7	7	5
5	+11	+8	2
6	+9	+10	3
7	+10	+11	4
8	+11	5	7
9	+10	6	7
10	+9	7	7
11	+11	7	7

Groups G_1 = {1, 2, 3, 4, 5, 6, 7} G_2 = {8, 9, 10, 11}

(1,2)	(1,3)	(1,4)	(1,5)	(1,6)	(1,7)
1,a => 3	1,a => 3	1,a => 3	1,a => 3	1,a => 3	1,a => 3
2,a => 5	3,a => 6	2,a => 7	5,a => 11	6,a => 9	7,a => 10
1,b => 4	1,b => 4	1,b => 4	1,b => 4	1,b => 4	1,b => 4
2,b => 5	3,b => 7	4,b => 7	5,b => 8	6,b => 10	7,b => 11
1,C => 2	1,C => 2	1,C => 2	1,C => 2	1,C => 2	1,C => 2
2,C => 5	3,C => 7	4,C => 5	5,C => 2	6,C => 3	7,C => 4
(Merged)	(Merged)	(Merged)	(Cannot Merge)	(Cannot Merge)	(Cannot Merge)

Merge 1 => {1, 2, 3, 4} {5, 6, 7} {8, 9, 10, 11}

(1,2)	(1,3)	(1,4)	(2,3,4)
1,a => 3	1,a => 3	1,a => 3	(2,a) => 5 ; (2,C) => 5
2,a => 5	3,a => 6	4,a => 7	(3,a) => 6 ; (3,C) => 7
1,b => 4	1,b => 4	1,b => 4	(4,a) => 7 ; (4,C) => 5
2,b => 5	3,b => 7	4,b => 7	(2,b) => 5
1,C => 2	1,C => 2	1,C => 2	(3,b) => 7
2,C => 5	3,C => 7	4,C => 5	(4,b) => 7
(cannot Merge)	(cannot Merge)	(cannot Merge)	(Can Merge)

Merge 2 => {1} {2, 3, 4} {5, 6, 7} {8, 9, 10, 11}

(8,9)	(8,10)	(8,11)	(9,10)	(9,11)	(10,11)
8,a => 11 ✓	8,a => 11	8,a => 11	9,a => 10	9,a => 10	10,a => 9
9,a => 10	10,a => 9	11,a => 11	10,a => 9	11,a => 11	11,a => 11
8,b => 5	8,b => 5	8,b => 5	9,b => 6	9,b => 6	10,b => 7
9,b => 6	10,b => 7	11,b => 7	10,b => 7	11,b => 7	11,b => 7
8,C => 7	8,C => 7	8,C => 7	9,C => 7	9,C => 7	10,C => 7
9,C => 7	10,C => 7	11,C => 7	10,C => 7	11,C => 7	11,C = 7
Can Merge	Can Merge	Can Merge	Can Merge.	Can Merge.	Can Merge

for 5,6,7

5, a ⇒ 11 , 5, b ⇒ 8 ; 5, c ⇒ 2

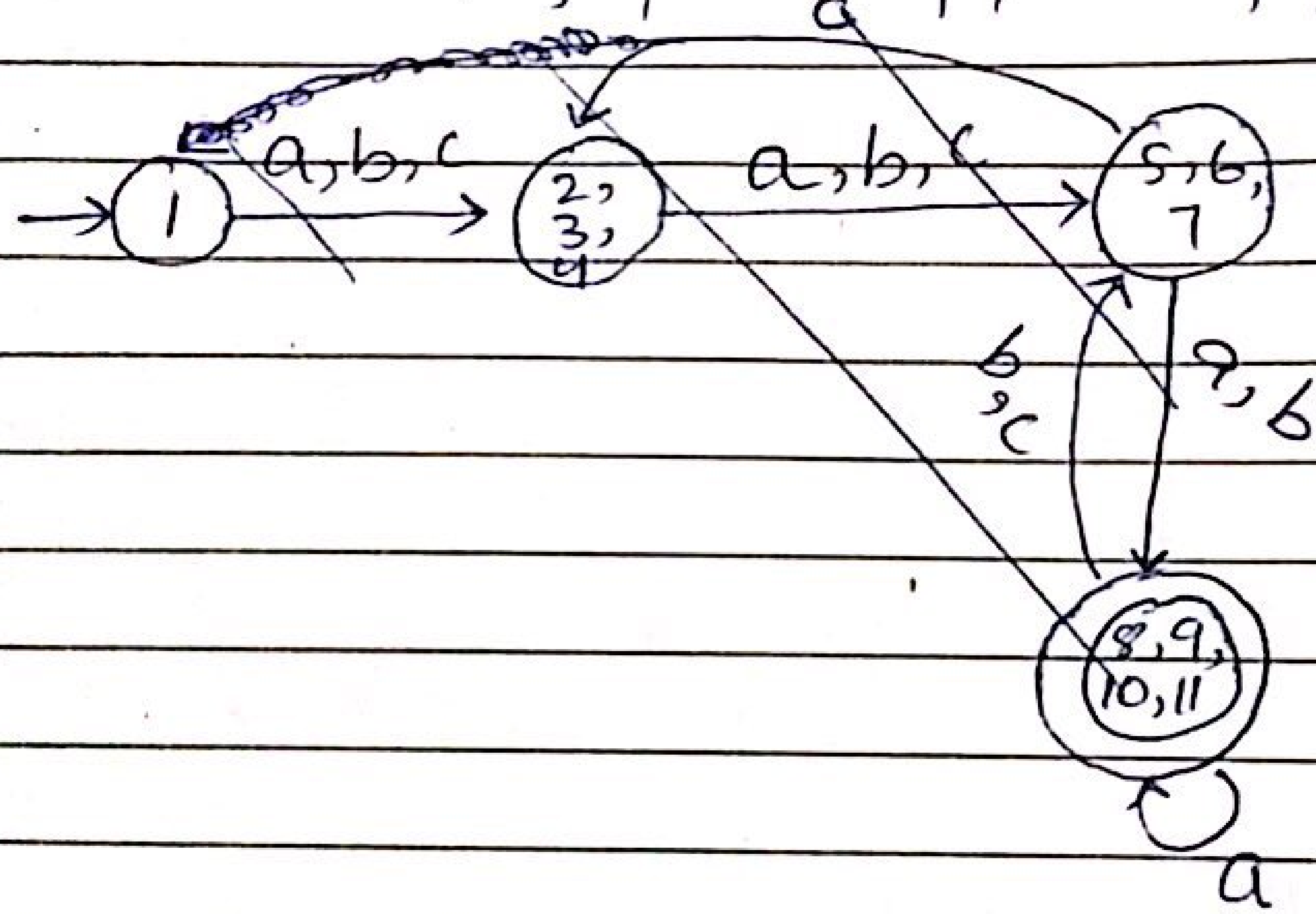
6, a ⇒ 9 , 6, b ⇒ 10 ; 6, c ⇒ 3

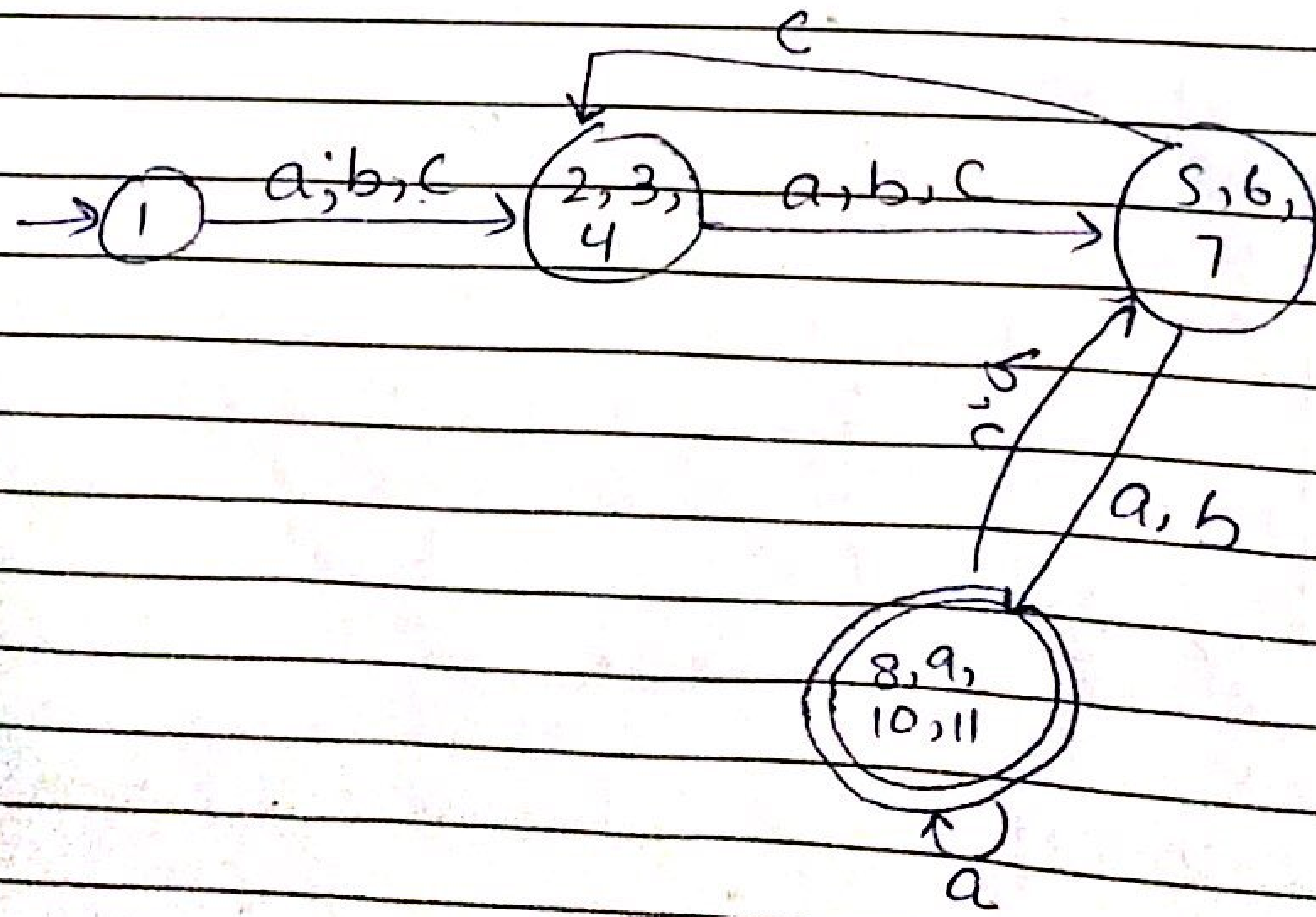
7, a ⇒ 10 , 7, b ⇒ 11 ; 7, c ⇒ 4

Date:

therefore ;

Groups = {1} {2, 3, 4} {5, 6, 7} {8, 9, 10, 11}





Q no: 3

1.

a) $L_1 = \{ 0^i 1^j 2^k \mid i, j, k >= 0$
and either $i = j$ or $i = k$

$\Sigma = \{ \lambda, 2, 1, 012, 01, 02, 0001122 \ldots \}$

$$\underset{x}{0}\,\underbrace{011}_{y}\,\underset{z}{2}$$

when $y = 0$ $(i = 1, k = 1, j = 0)$

02 ✓

when $y = 1$ $(i = 2, j = 2, k = 1)$

00112 ✓

when $y = 2$.

0 011011 2 $i \neq j$ or $i \neq k$ (failed)

Date:

b) $L_2 = \{ w \in \{0,1,2\}^+ \quad 0's = 2's$

$\xi = \{ 012, 0112, 00122, 001122 \ldots \}$

$\underset{x}{0}\underbrace{0011}_{y}2\underbrace{22}_{z}$

y = 0
022 $\quad \therefore 0's \neq 2's$ (failed)

Q)

(c) $L_3 = \{ 0^n 1^m \mid n \leq m \}$

$\xi = \{ \lambda, 1, 01, 11, 011, 0011, 0111 \ldots \}$

~~00111~~ $\quad \underset{x}{0}\underbrace{01}_{y}1\underset{z}{1}$

y = 0
01
y = 1
00111
y = 2
0011011 1 $\quad$ failed!

(d) $L_4 = \{ w \in \{0,1\}^* \mid w$ has more 1's than 0's

$\xi = \{ 1, 011, 00111 \ldots \}$

$\underset{x}{0}\underbrace{00111}_{y}\underset{z}{1}$

Date:

when $y = 0$

01 (failed) $(0 \nless 1)$

(e) $L_5 = \{ 0^{n^2} \mid n \geq 0 \}$

$\{ 0, 0000 \ldots \}$

$$\underset{x}{0}\,\underbrace{00}_{y}\,\underset{z}{0}$$

when $y = 0$

00 (failed)