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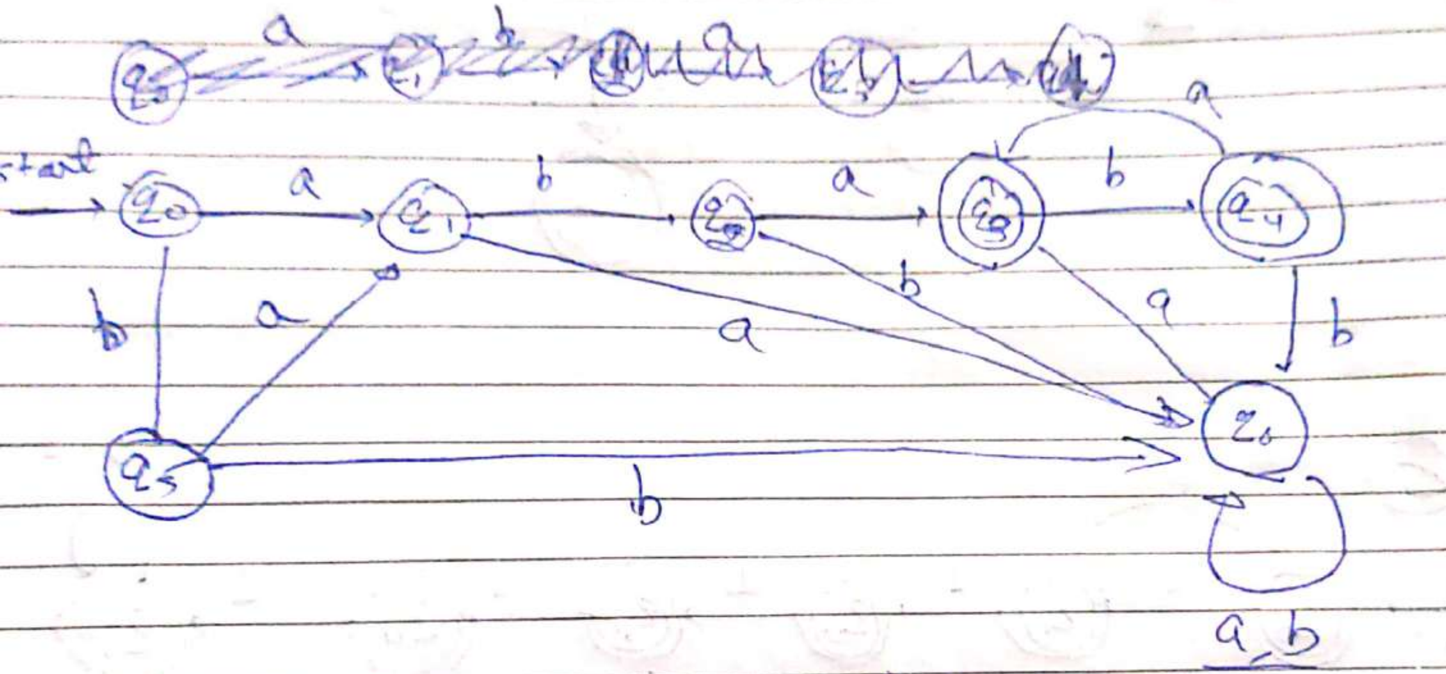
CS-340 Assignment-1

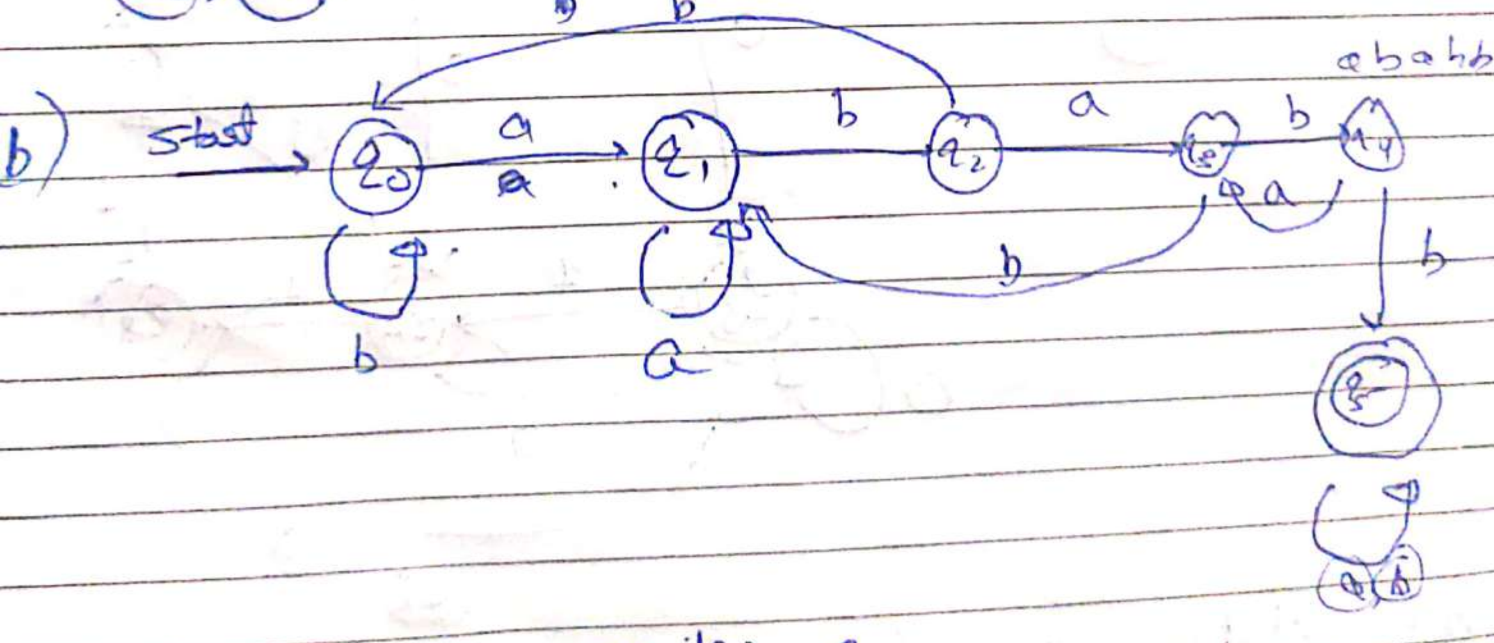
Question 1

(a) A = {x ∈ {a,b}* | x alternates between a and b and has at least 2 a's}



• q_3, q_4 are accept states

(b)



accept-state: q_5

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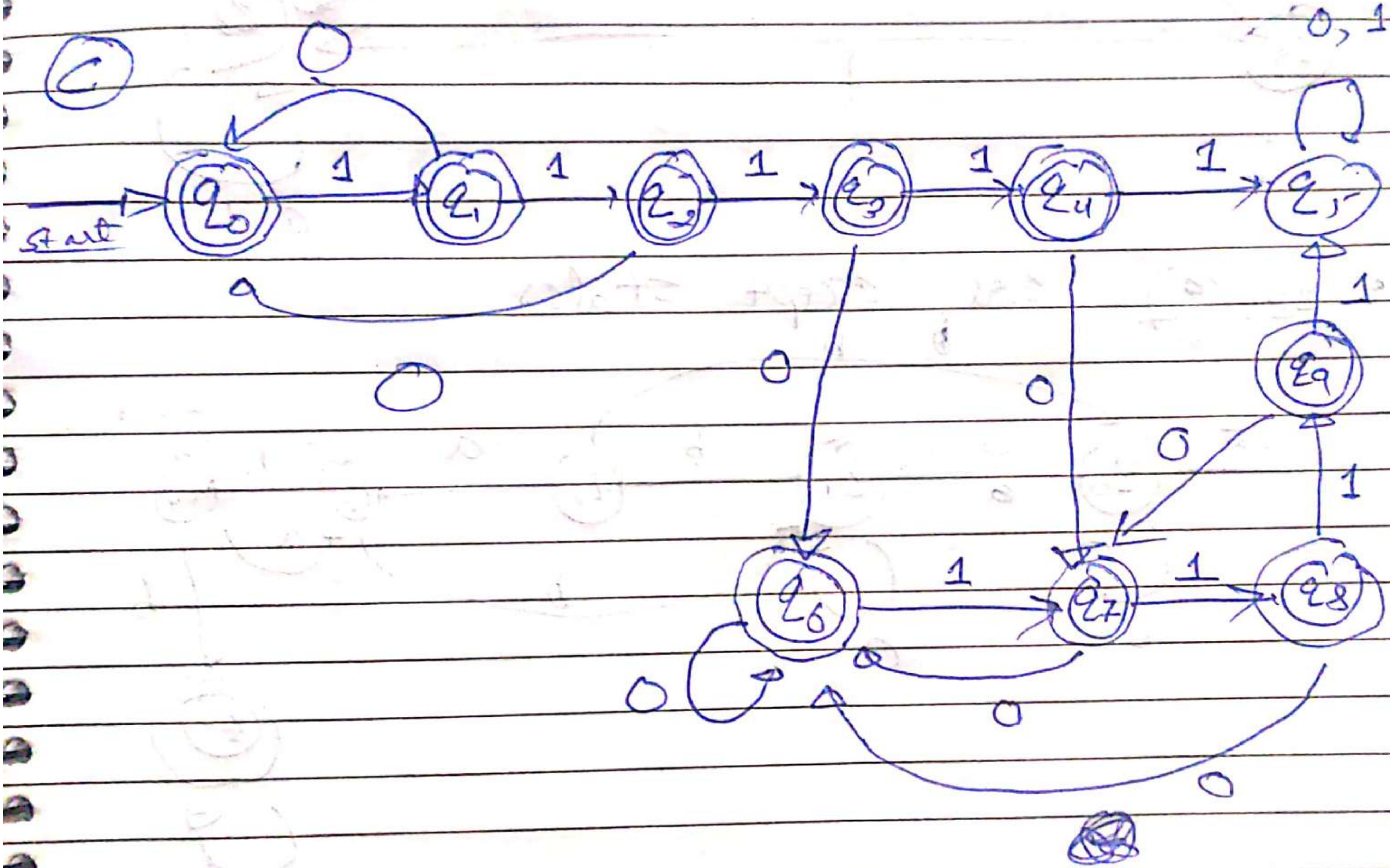
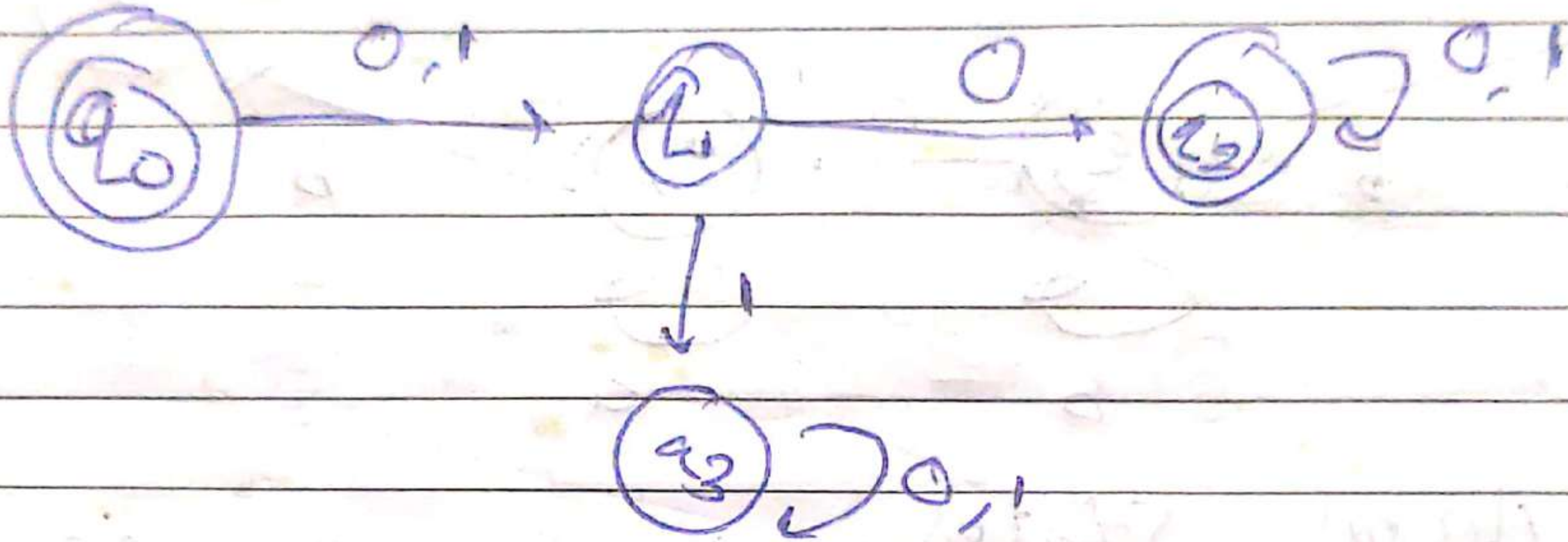


All states accepted except q_5

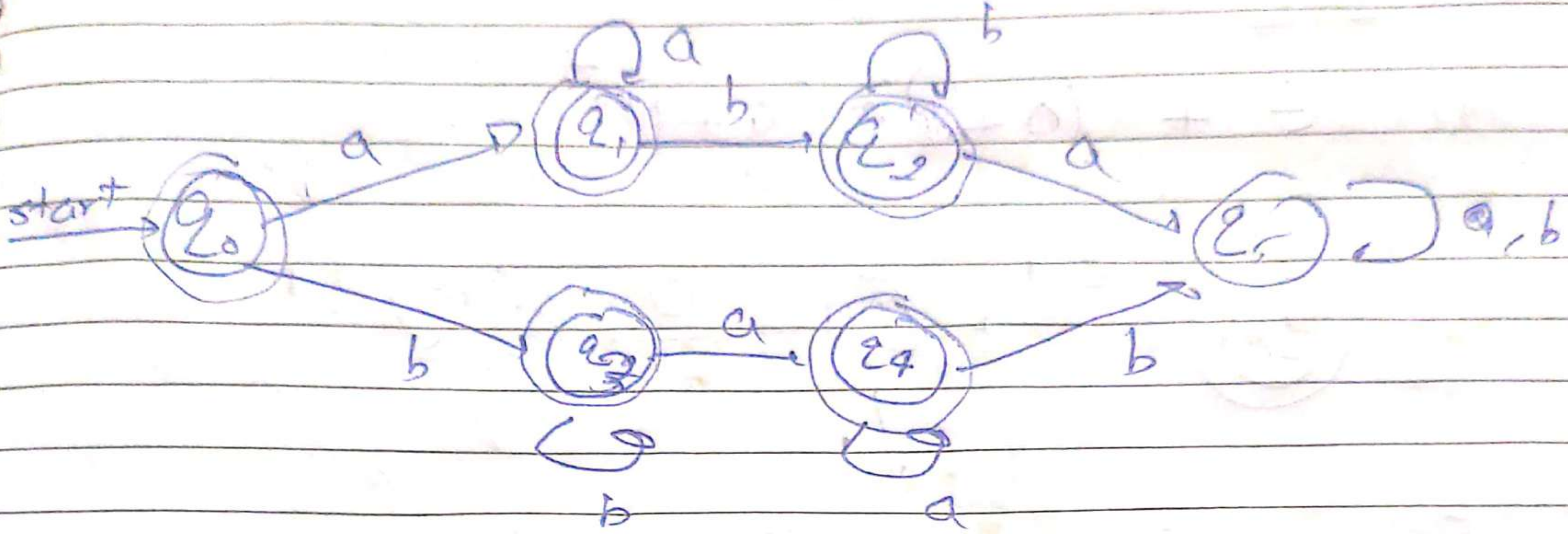
Question - 2

(a) $\epsilon + (0+1)0(0+1)^*$



Accept States : q_0 and q_2

(b) $(a^* b^*) \cup (b^+ a^*)$



Accept states: q_0, q_1, q_2, q_3, q_4

[Q-3] We know that if we are able to design an NFA for $F(A, B)$, it will be regular.

Let us define:

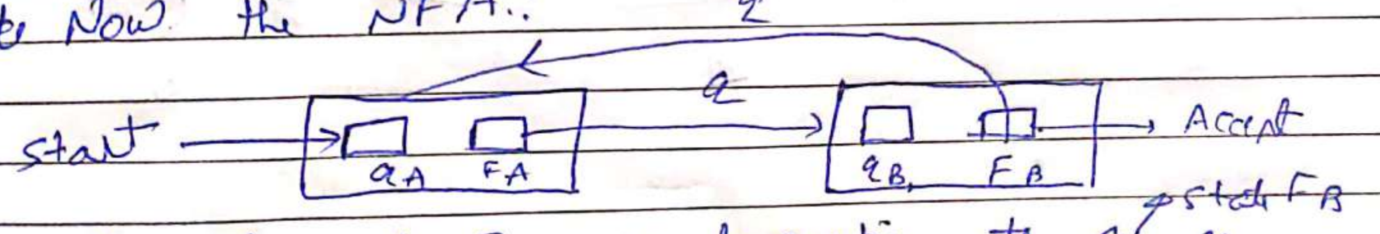
- $D_A = (Q_A, \Sigma, \delta_A, q_A, F_A)$ which accepts Language A.
- Similarly $D_B = (Q_B, \Sigma, \delta_B, q_B, F_B)$ be the DFA that accepts Language B.

Let us consider NFA(N)

$N = (Q, \Sigma, \delta, q, F)$ ~~which~~ is where

- $Q = Q_A \cup Q_B$
- $q = q_A$
- $F = F_B$

Now the NFA:

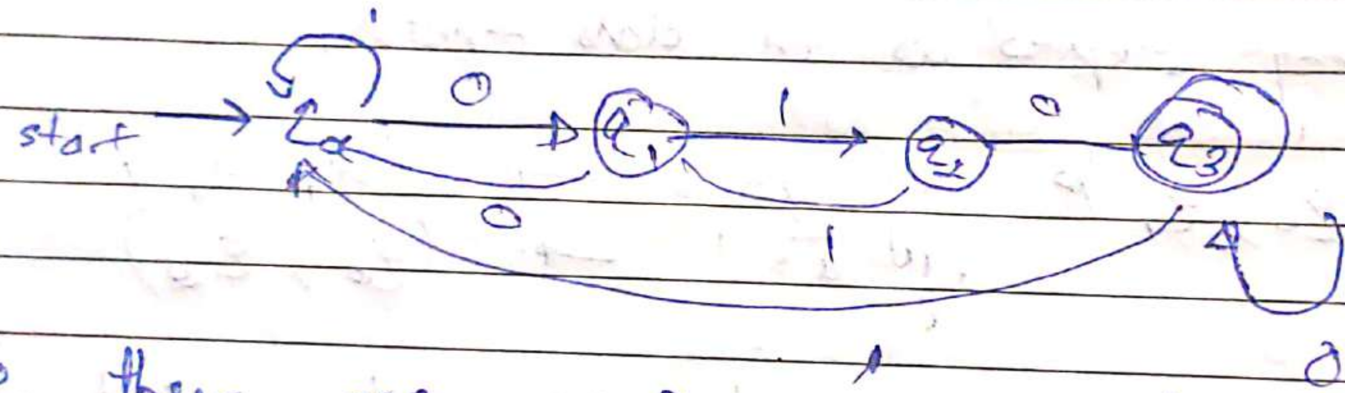


- When at state F_A, we transition to q_B as we have found a_i in the string.
- If we reach end of string, this becomes the accepted state or else we move to q_A state.

Thus N accepts $f(A, B)$, so it is regular.

Question : 4

Firstly we observe that the states q_4, q_5, q_6, q_7 can never be reached, thus we remove them and the DFA becomes :



• So, their are now no unreachable states now

• Now, we make a table and mark the pair {p, q} if $p \in F$ and $q \notin F$ or vice versa

$q_3 \in F$ and $\{q_0, q_1, q_2\} \notin F$

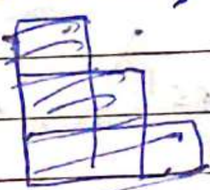
So table formed is

	0	1	2
1			
2			
3	x	x	x

• Now, following step-3 as in class-notes.

→ $\{q_0, q_1\}$ if $a=0$ → $\{q_1, q_0\}$
if $a=1$ → (q_0, q_3)

$\{q_1, q_0\}$ or $\{q_0, q_3\}$ are not marked, so $\{q_0, q_1\}$ will not be marked.



→ $\{q_0, q_2\}$ if $a=0$ $\{q_1, q_3\}$

$\{q_1, q_3\}$ is marked so we mark $\{q_0, q_2\}$

Table:

	0	1	2
1			
2	x		
3	x	x	x

→ Similarly $\{q_1, q_2\}$ can be marked if $a=0$ as $\{q_0, q_3\}$ is marked

	0	1	2
1			
2	x	x	
3	x	x	x

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Now Again iterating the table.

→ {q0, q1} if a = 1 {q0, q3}

Now {q0, q3} is marked, so we mark {q0, q1}

✓			1
✓	✓		2
✓	✓	✓	3

• Now we cannot find two states which are equivalent, so the given DFA is in minimized state after removing the unreachable state.

Ans