29 Oct, 2025

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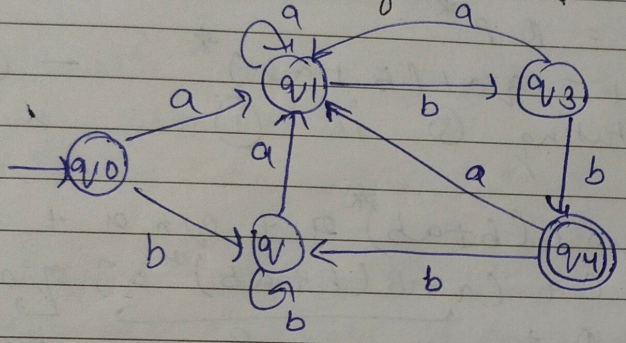
ASSIGNMENT - 2.
TOC

Ques-1) Minimization of DFA :-



State	a	b
q_0	q_1	q_2
q_1	q_1	q_3
q_2	q_1	q_2
q_3	q_1	q_4
q_4	q_1	q_2

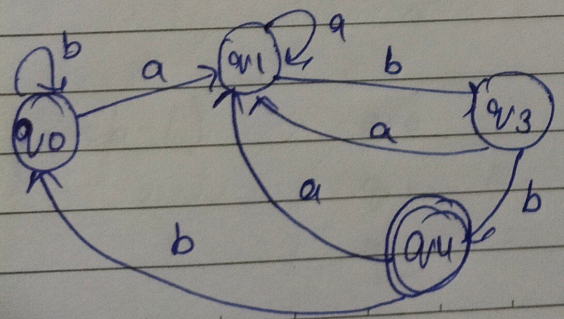
→ Non-final state :-

State	a	b
q_0	q_1	q_2
q_1	q_1	q_3
q_2	q_1	q_2
q_3	q_1	q_4

→ Here q_0 & q_2 have same outgoing so, we remove one of them.

→ q_0 is initial state so we can't remove it.

→ There we remove q_2 & q_0 in place of q_2.



final st
State
q_4

2) Conve

→ A
A →
B →
C →
D →

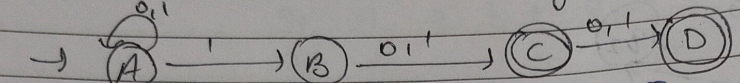
3)

DELTA Notebook

final state :-

State	a	b
q_4	q_1	q_2

2) Convert a NFA to Regular Expression.



$A \rightarrow A\cdot0 + A\cdot1 + \varepsilon \rightarrow (1)$

$B \rightarrow A\cdot1 \rightarrow (2)$

$C \rightarrow B\cdot0 + B\cdot1 \rightarrow (3)$

$D \rightarrow C\cdot0 + C\cdot1 \rightarrow (4)$

By Arden's Method

$A \rightarrow A(0+1) + \varepsilon$

$R = Q + RP$

$\Rightarrow R = QP^*$

$A = \varepsilon + (0+1)^* \rightarrow (5)$

putting (5) in (2)

$B \rightarrow (0+1)^*1 \rightarrow (6)$

putting (6) in (3)

$C \rightarrow (0+1)^*1\cdot0 + (0+1)^*1\cdot1$

$C \rightarrow (0+1)^*1(0+1) \quad — (7)$

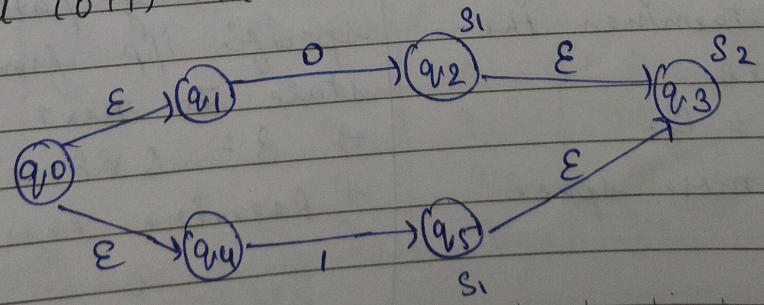
putting (7) in (1)

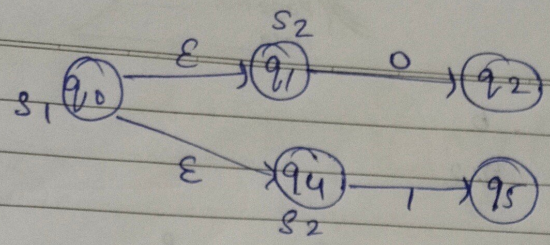
$D \rightarrow C\cdot0 + C\cdot1$

$D \rightarrow (0+1)^*1(0+1)\cdot0 + (0+1)^*1(0+1)\cdot1$

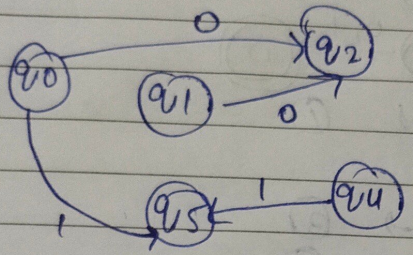
$D \rightarrow (0+1)^*1(0+1)(0+1)$

3) Convert $(0+1)^*1(0+1)$ to ε-NFA.

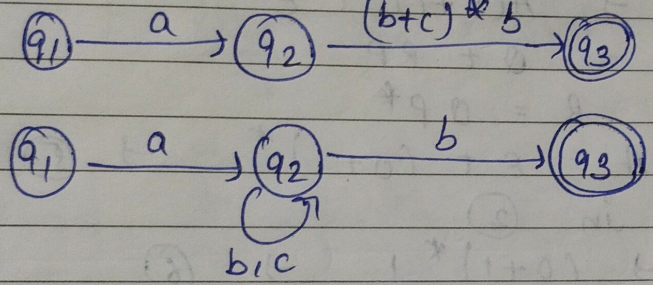




6)



4) R.E to F.A. $a(b+c)^*b$

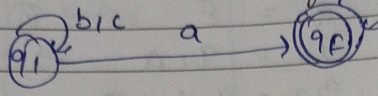


7)

5)

DFA	NFA.
↳ DFA is hard to Construct	↳ Easy to Construct Comparitively.
↳ Backtracking is possible	↳ Backtracking not possible
↳ A FA having a fixed no. of state & each i/p symbol uniquely determines the next state.	↳ A F.A in which there exist many path from specific i/p from current state to next state.
↳ $\delta : Q \times \Sigma = Q$.	↳ $\delta : Q \times \Sigma = 2Q$.
↳ Requires more space	↳ Require less space.

6) $\Sigma = \{a, b, c\}$ exactly one "a"



$q_1 \Rightarrow q_1 b + q_1 c + \epsilon$

$q_F = q_1 a + q_F b + q_F c$

$q_1 = q_1 (b+c) + \epsilon$

$R = Qp^* \Rightarrow q_1 = \epsilon (b+c)^*$

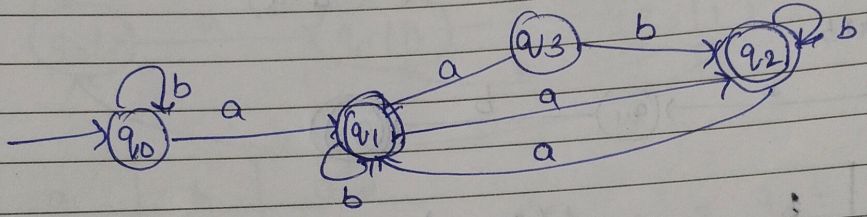
$q_F = q_F (b+c) + q_1 a$

$q_F = q_F (b+c) + (b+c)^* a$

$R = Q p^*$

$q_F = (b+c)^* a (b+c)^*$ //

7)



State	a	b
q_0	q_1	q_0
q_1	q_2	q_1
q_2	q_1	q_2
q_3	q_1	q_2

q_3 is unreachable state.

Non-final:

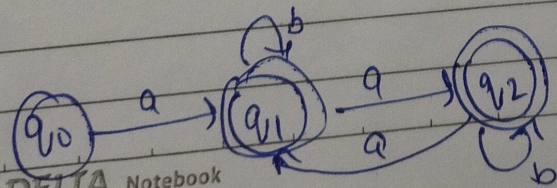
	a	b
q_0	q_1	q_0

final :-

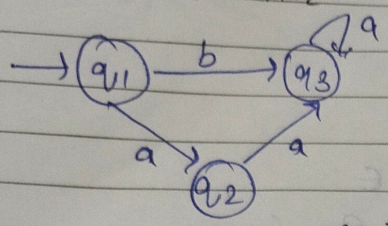
	a	b
q_1	q_2	q_1
q_2	q_1	q_2

Combined state

	a	b
q_0	q_1	q_0
q_1	q_2	q_1
q_2	q_1	q_2



8) DFA to R.E.



$q_1 = \epsilon \rightarrow (1)$

$q_2 = q_1 a \rightarrow (2)$

$q_3 = q_1 b + q_2 a + q_3 a \rightarrow (3)$

putting (1) & (2) in (3)

$q_3 = b + q_1 a \cdot a + q_3 a$

$q_3 = b + b \cdot a \cdot a + q_3 \cdot a$

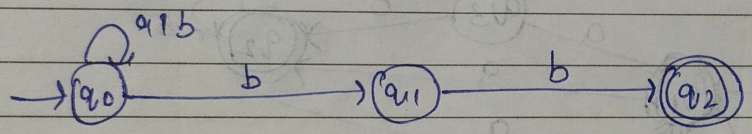
$q_3 = b(\epsilon + a \cdot a) + q_3 a$

$R = q_3 , Q = (\epsilon + a \cdot a) , P = b.$

$R = Q \cdot P^*$

$q_3 = b^* (\epsilon + a \cdot a)$

9)



	a	b
q_0	q_1	$q_0 q_1$
q_1	–	q_2
q_2	–	–

$\delta(q_0, a) = q_0$

$\delta(q_0, b) = q_0 q_1$

$\delta(q_1, a) = \phi$

$\delta(q_1, b) = q_2$

$\delta(q_2, a) = \phi$

$\delta(q_2, b) = \phi$

$\delta([q_0 q_1], a) = \delta(q_0, a) \cup \delta(q_1, a) = q_0 \cup \phi = q_0$

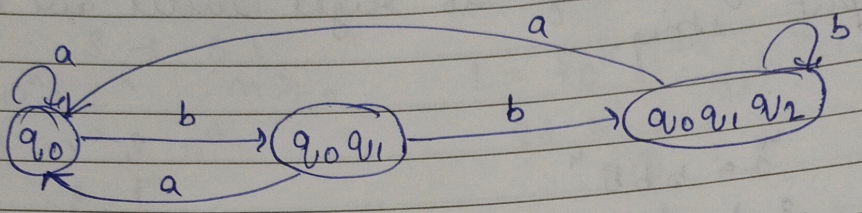
$\delta([q_0 q_1], b) = q_0 q_1 q_2$

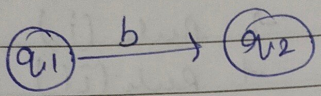
$\delta([q_0 q_1 q_2], a) = q_0 \cup \phi = q_0$

$\delta([q_0 q_1 q_2], b) = q_0 q_1 q_2$

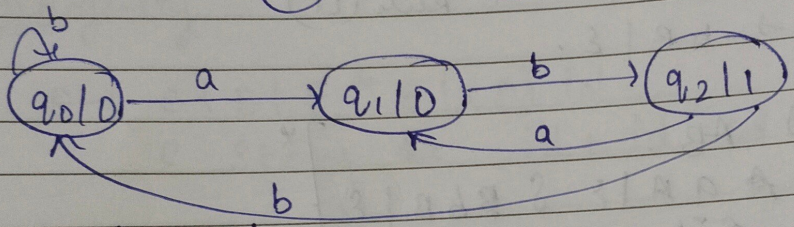
10)

	a	b
q_0	q_0	$q_0 q_1$
q_1	–	q_2
q_2	–	–
$q_0 q_1$	q_0	$q_0 q_1 q_2$
$q_0 q_1 q_2$	q_0	$q_0 q_1 q_2$





10)



	a	b	O/P
q_0	q_1	q_0	0
q_1	q_1	q_2	0
q_2	q_1	q_0	1

O/P

$\delta'(q_0, a) = q_1 = 0$

$\delta'(q_0, b) = q_0 = 0$

$\delta'(q_1, a) = q_1 = 0$

$\delta'(q_1, b) = q_2 = 1$

$\delta'(q_2, a) = q_1 = 0$

$\delta'(q_2, b) = q_0 = 0$

States / Σ	a		b	
	State	O/P	State	O/P
q_0	q_1	0	q_0	0
q_1	q_1	0	q_2	1
q_2	q_1	0	q_0	0