Cat - 1

14) b) converting Regular Expression to DFA

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

Given regular Expression

$r = (a+b)^* b(a+b)$

It is of the form $r = r_1 * r_2$

where

$r_1 = (a+b)^*$

$r_2 = b(a+b)$

ır

~~$r_1 =$~~

NFA for $r_1 = (a+b)^*$

It is in the form $r_1 = (r_2)^*$

$r_3 = a+b$.

It is in the form

$r_3 = r_4 + r_5$

$r_4 = a$

$r_5 = b$.

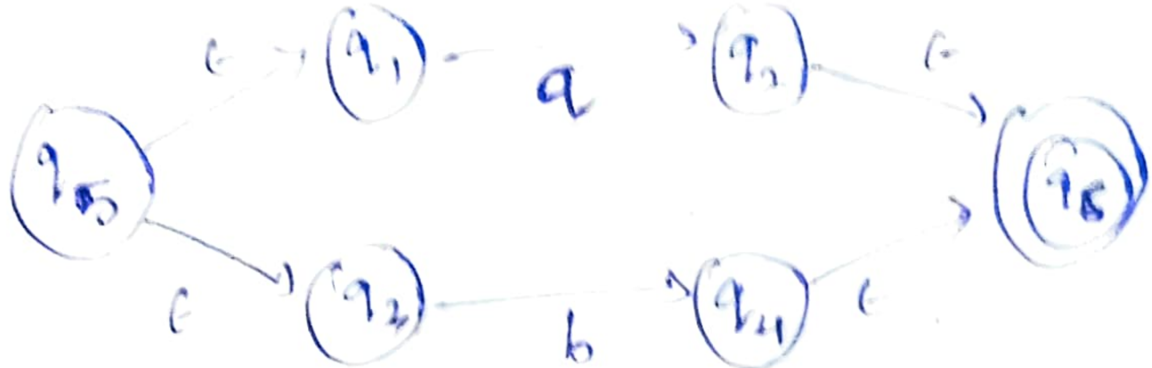
NFA for $r_4 = a$

$$q_1 \xrightarrow{a} q_2$$

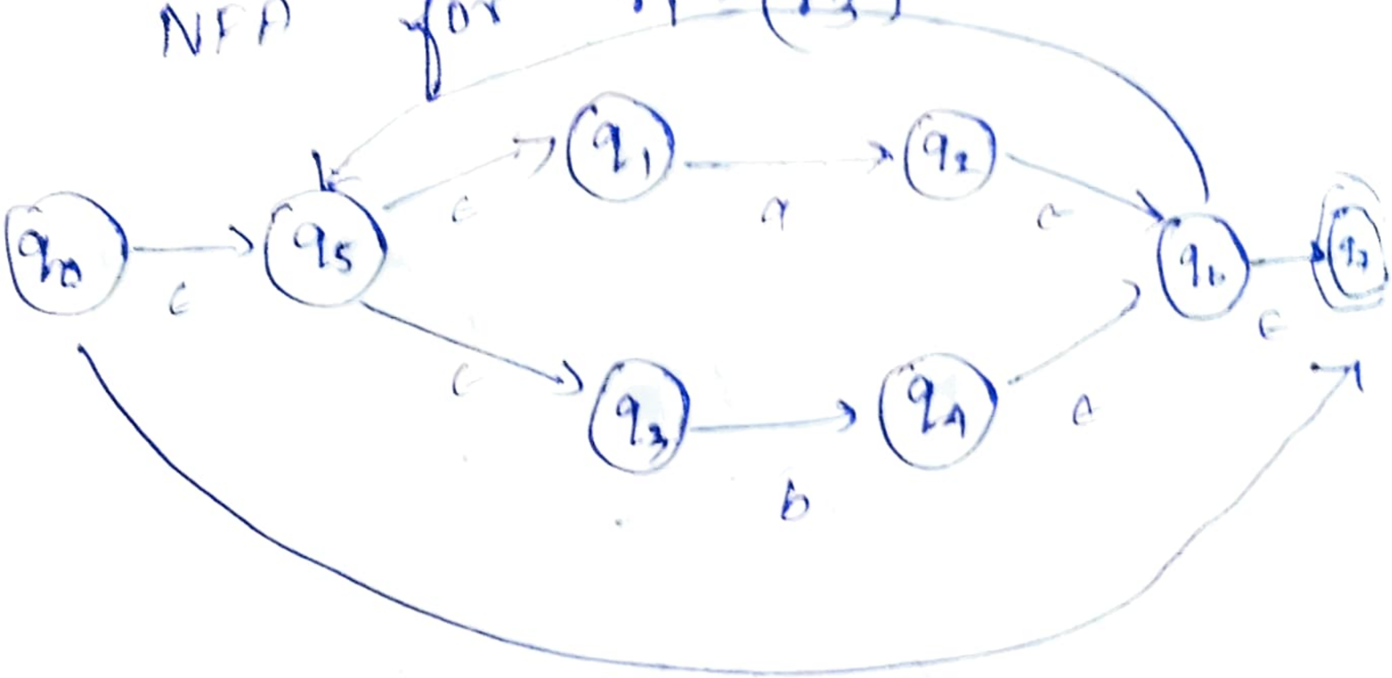
NFA for $r_5 = b$.

$$q_3 \xrightarrow{b} q_4$$

NFA for $r_3 = r_4 + r_5$



NFA for $r_1 = (r_3)^*$



$r_2 = b(a+b)$

It is in the form

$r_2 = r_6 r_7$

$r_6 = b$

$r_7 = a+b$

r_7 is in the form $r_7 = r_8 + r_9$

$r_8 = a$

$r_9 = b.$

NFA for $r_6 = b$

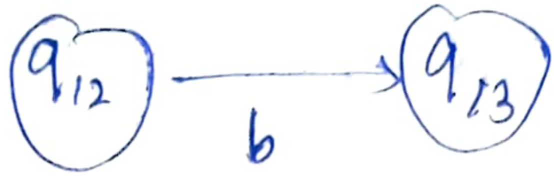
$$q_8 \xrightarrow{b} q_9$$

NFA for $r_7 = r_8 + r_9$

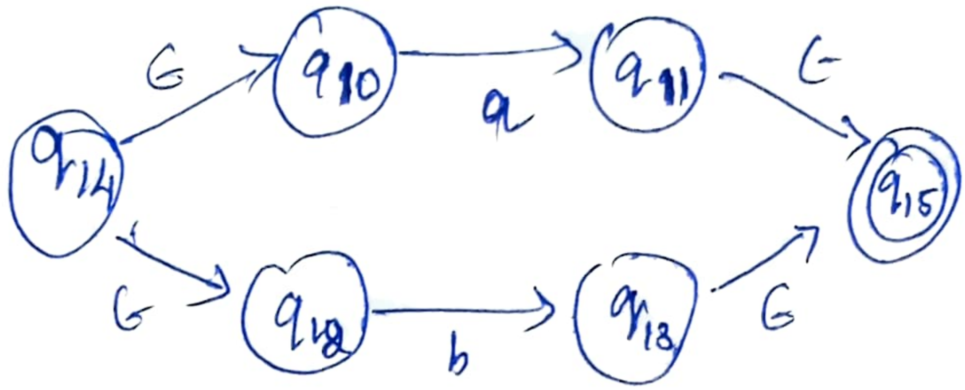
NFA for r_8

$$q_{10} \xrightarrow{a} q_{11}$$

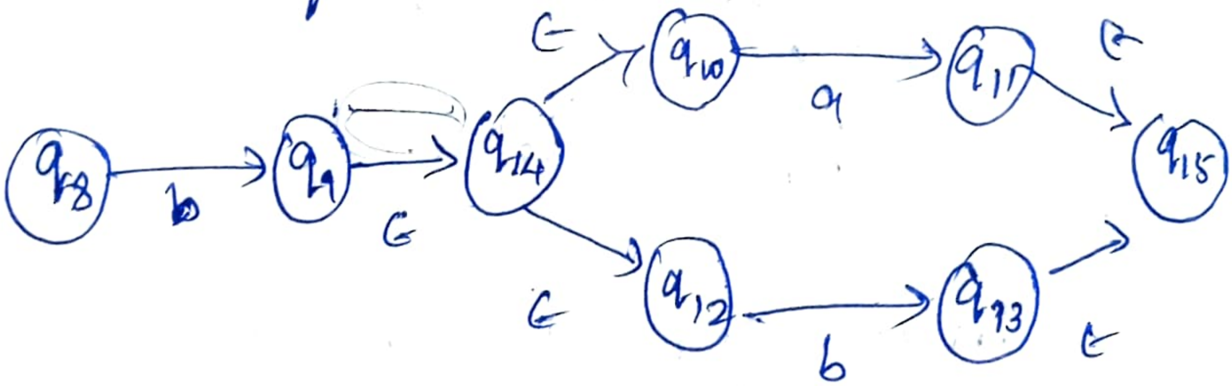
NFA for r9



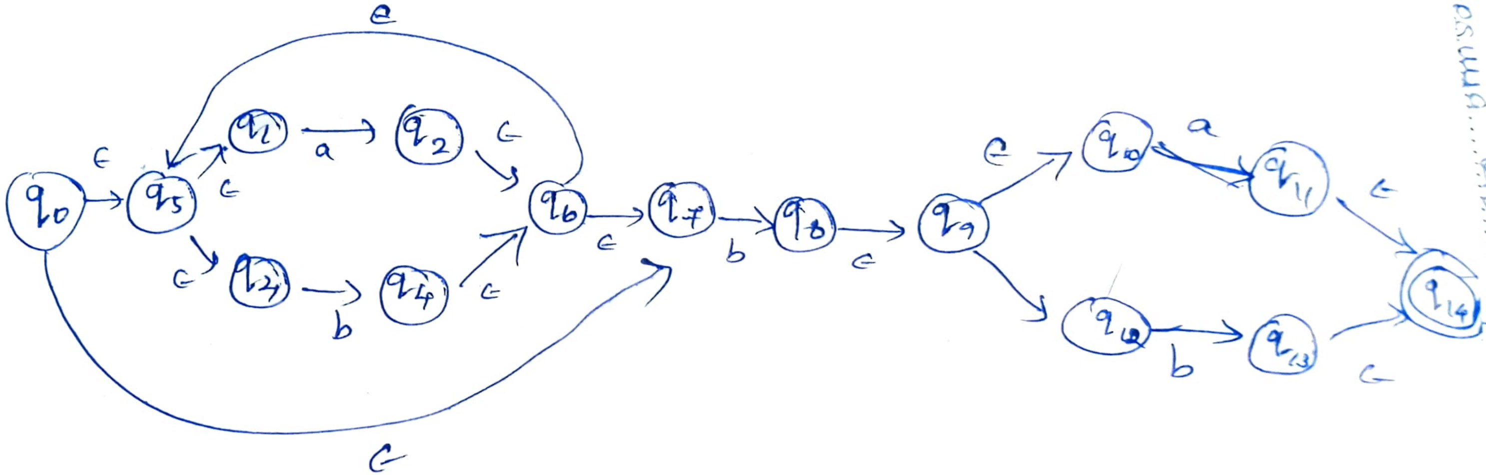
NFA for r7



NFA for r8 = r6 r7



NFA for $r = r_1 r_2$



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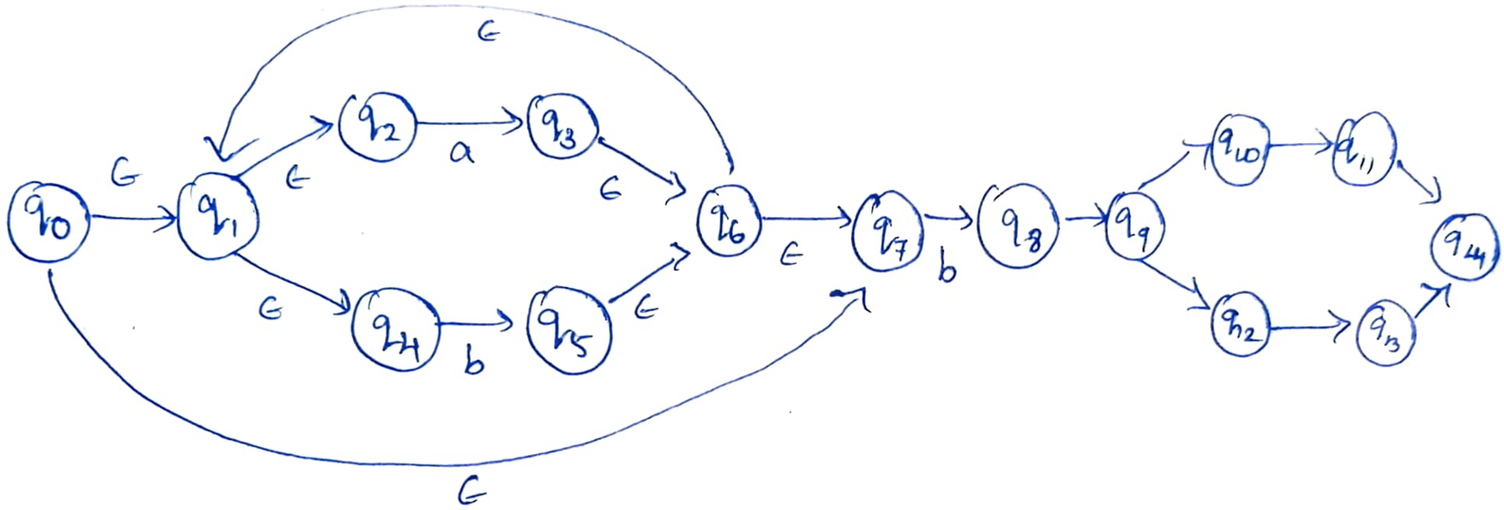
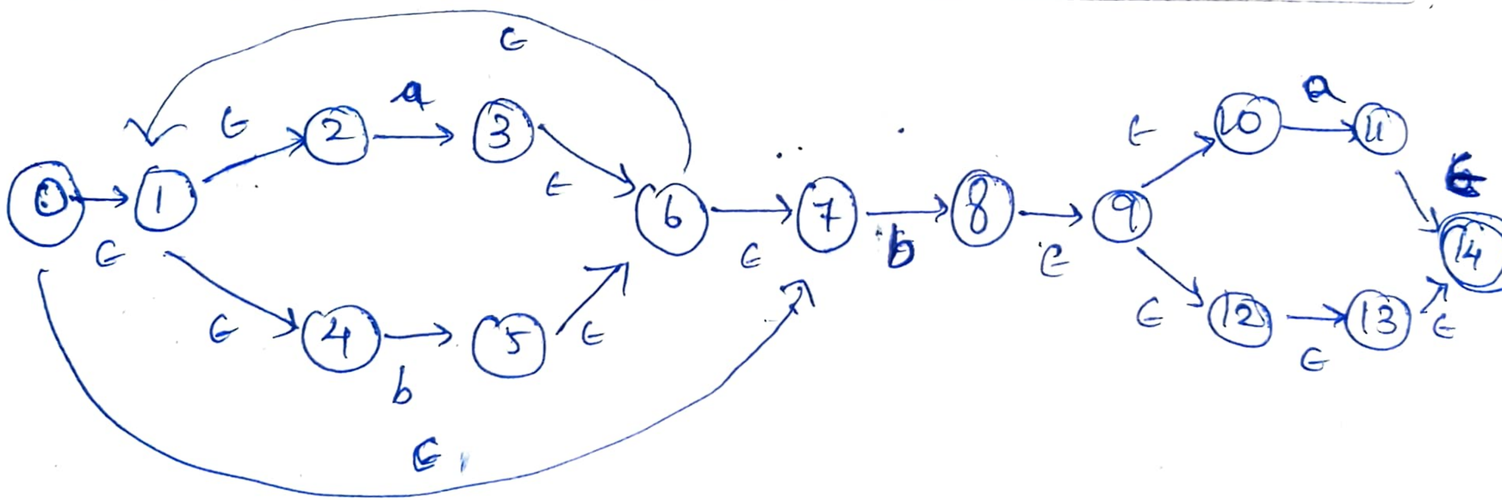


q0
q1
q2
q3
q4
q5
q6
q7
q8
q9
q10
q11
q12
q13
q14
a
b
b
ε



0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
a
b
b
a
ε

The start state of DFA is ε-closure(0)

ε-closure(0) = {0, 1, 2, 4, 7} = A

Input symbol (a, b)

ε-closure (move (A, a))

= ε-closure (move({0, 1, 2, 4, 7}, a)

= ε-closure (3)

ε-closure (3) = {3, 6, 7, 1, 2, 4}

= {1, 2, 3, 4, 6, 7} = B

$\boxed{\text{DTrans}[A, a] = B}$

ε-closure (more (A, b))

= ε-closure (more {0, 1, 2, 4, 7}, b)

= ε-closure (5, 8)

ε-closure (5, 8) = {5, 6, 7, 1, 2, 4, 8, 9, 10, 12}

= {1, 2, 4, 5, 6, 7, 8, 9, 10, 12} = C

$\boxed{\text{DTrans}[A, b] = C}$

ϵ-closure (move (B, a)).

$= \epsilon$-closure (move({1, 2, 3, 4, 6, 7}), a)

$= \epsilon$-closure (3).

ϵ-closure (3) = B.

$\boxed{\text{DTrans [B, a] = B}}$

ϵ-closure (move (B, b))

$= \epsilon$-closure (move({1, 2, 3, 4, 6, 7}), b)

$= \epsilon$-closure (5, 8)

ϵ-closure (5, 8) = C.

$\boxed{\text{DTrans [B, b] = C.}}$

ϵ.closure (move (C, a))

ϵ-closure(move({1, 2, 4, 5, 6, 7, 8, 9, 10, 12}), a)

= ϵ.closure (3, 11)

ϵ-closure (3, 11) = {3, 6, 7, 1, 2, 4, 11, 14}

= {1, 2, 3, 4, 6, 7, 11, 14} = D.

DTrans [C, a] = D.

ϵ closure (move (C, b))

ϵ-closure(move({1, 2, 4, 5, 6, 7, 8, 9, 10, 12}), b)

= ϵ-closure (5, 8, 13)

ϵ-closure (5, 8, 13) = {5, 6, 1, 2, 4, 7, 8, 9, 10, 12, 13, 14}

~~13, 14~~

{1, 2, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14} = E

DTrans [C, b] = E

more

ϵ_closure((D, a))

ϵ_closure(more{1, 2, 3, 4, 6, 7, 11, 14}), a)

ϵ_closure(3) =

ϵ_closure(3) = B

$\boxed{\text{DTrans}[D, a] = B.}$

ϵ_closure(more(D, b))

ϵ_closure(more{1, 2, 3, 4, 6, 7, 4, 14}), b

ϵ_closure(5, 8)

ϵ_closure(5, 8) = C

$\boxed{\text{DTrans}[D, b] = C.}$

ϵ-closure (move (E, a))

ϵ-closure (move ({1, 2, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14}), a)

ϵ-closure (3, 11)

ϵ-closure (3, 11) = D.

$\boxed{\text{DTrans [E, a] = D}}$

ϵ-closure (move (E, b))

ϵ-closure (move ({1, 2, 4, 5, 6, 7, 8, 9, 10, 12, 13, 14}), b)

ϵ-closure (5, 8, 13)

ϵ-closure (5, 8, 13) = E

$\boxed{\text{DTrans [E, b] = E}}$

Transition Table for DFA:

State	Input symbol a	Input symbol b
A	B	C
B	B	C
C	D	E
D*	B	C
E*	D	E