Some other questions are :-

1. $(a/b)^{*} \cdot (c/d)^{*} ad$.
2. $(a/b)^{*} ab$
3. $ba(a/b)^{*} ab$
4. $(a+b)^{*} + (a \cdot c)^{*}$.

Conversion from Regular Expression to DFA without NFA.

$\Rightarrow (a+b)^* + (a \cdot c)^*$

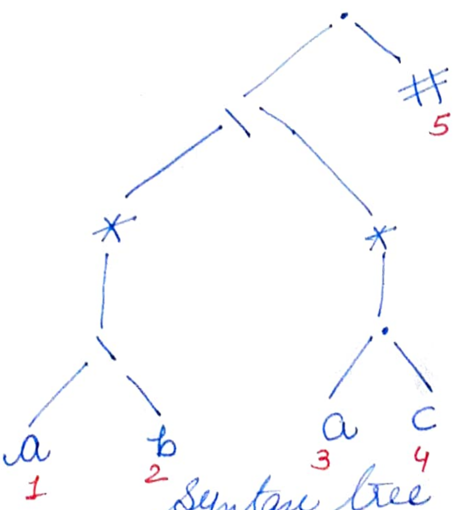
We may convert a regular expression into a DFA (without creating a NFA).

Firstly, we augmented Regular expression by given RE,

$r \to r(\#)$.

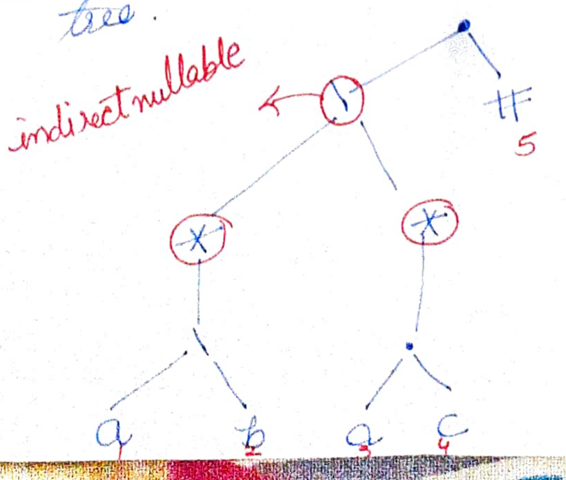
Augmented Regular Expression $\Rightarrow (a+b)^* + (a \cdot c)^* \#$

Step-1 Convert regular expression $(a+b)^* + (ac)^* \#$ into ST. and also give label for each leaf node.

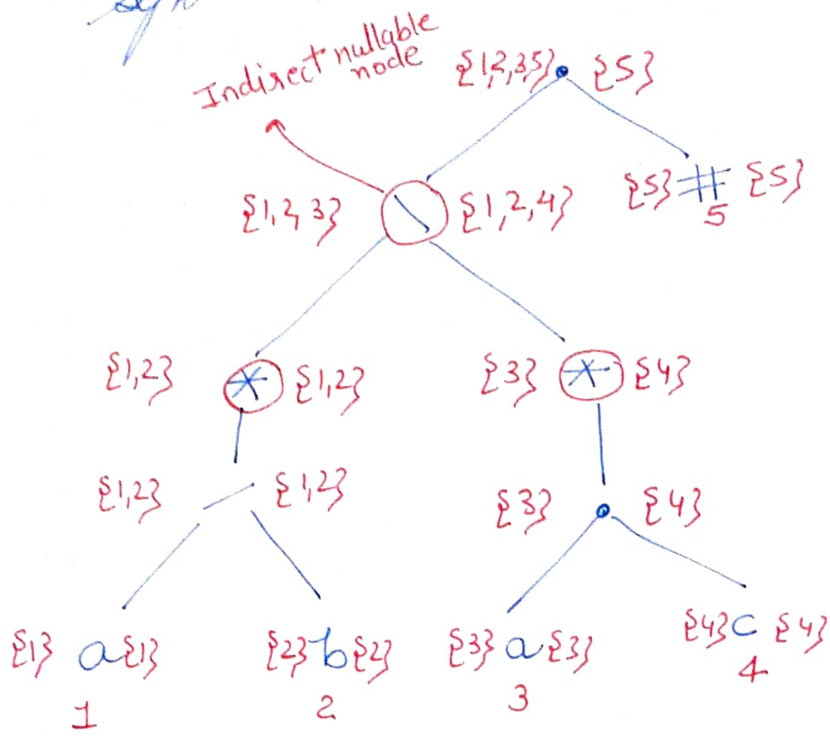


Syntax tree

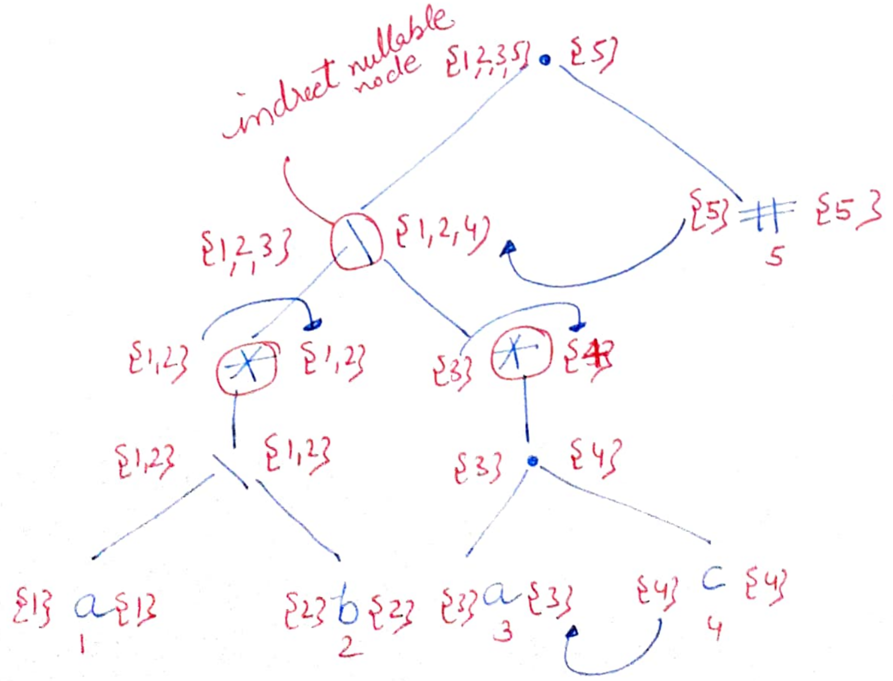
Step-2 Calculate nullable node from constructed Syntax tree.



Step-3 Calculate firstpos and lastpos for constructed syntax tree.



Step-4 Now, Calculate followpos for constructed syntax tree :- followpos table will be constructed (create) by using (• and *) only.



followpos table

position	followpos
1	{1, 2, 5}
2	{1, 2, 5}
3	{4}
4	{3, 5}
5	---

Now, constructed DFA by using constructed syntax tree and followpos table.

Always start from top.

So, initial state is {1,2,3,5}

State A = {1, 2, 3, 5}

Transition $\delta(A, a)$ and $\delta(A, b)$ and $\delta(A, c)$

- $\delta(A, a)$ = followpos(1) $\cup$ followpos(3)
  = {1,2,5} $\cup$ {4}
  = {1, 2, 4, 5} — B

- $\delta(A, b)$ = followpos(2)
  = {1, 2, 5} — C

- $\delta(A, c)$ = no move

State B = {1, 2, 4, 5}

Transition $\delta(B, a)$ and $\delta(B, b)$ & $\delta(B, c)$

- $\delta(B, a)$ = followpos(1)
  = {1, 2, 5} — C

- $\delta(B, b)$ = followpos(2)
  = {1, 2, 5} — C

- $\delta(B, c)$ = followpos(4)
  = {3, 5} — D

4

State C = {1, 2, 5}

Transition $\delta(C, a)$, $\delta(C, b)$ and $\delta(C, c)$

- $\delta(C, a)$ = followpos(1)
  = {1, 2, 5} — C

- $\delta(C, b)$ = followpos(2)
  = {1, 2, 5} — C

- $\delta(C, c)$ = no moves.

State D = {3, 5}

Transition $\delta(D, a)$, $\delta(D, b)$ & $\delta(D, c)$

- $\delta(D, a)$ = followpos(3)
  = {4} — E

- $\delta(D, b)$ = no moves

- $\delta(D, c)$ = no moves.

State E = {4}

Transition $\delta(E, a)$, $\delta(E, b)$, & $\delta(E, c)$

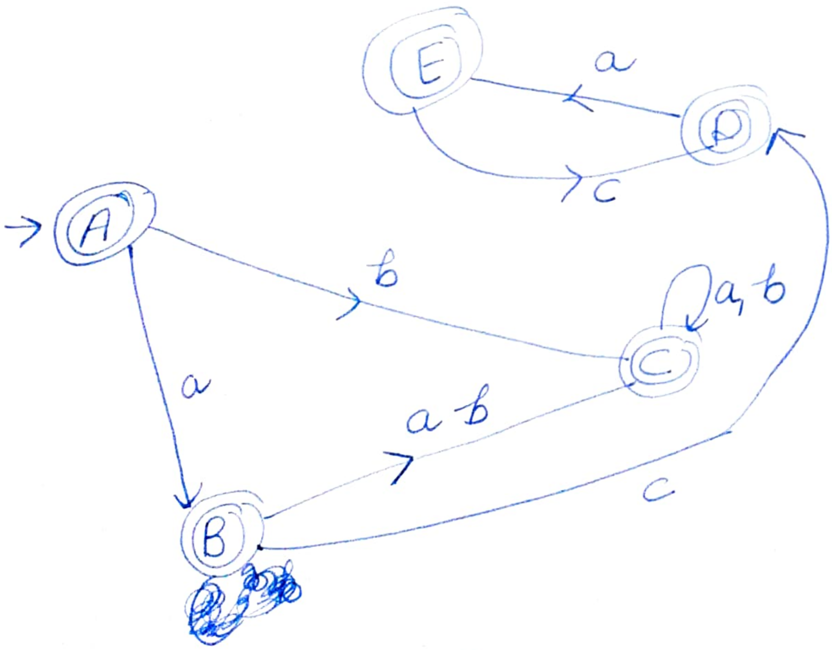
- $\delta(E, a)$ = no moves
- $\delta(E, b)$ = no moves.
- $\delta(E, c)$ = followpos(4)
  = {3, 5} — D

5

Transition Table

State Q	Input a	b	c
A = {1, 2, 3, 5}	B	C	∅
B = {1, 2, 4, 5}	C	C	D
C = {1, 2, 5}	C	C	∅
D = {3, 5}	E	∅	∅
E = {4}	∅	∅	D

5 is present in A, B, C, D. So, A, B, C, D are final states.



Transition Digram

⇒ $ba(a+b)^*ab$

we may convert a regular expression into a DFA without creating a NFA.

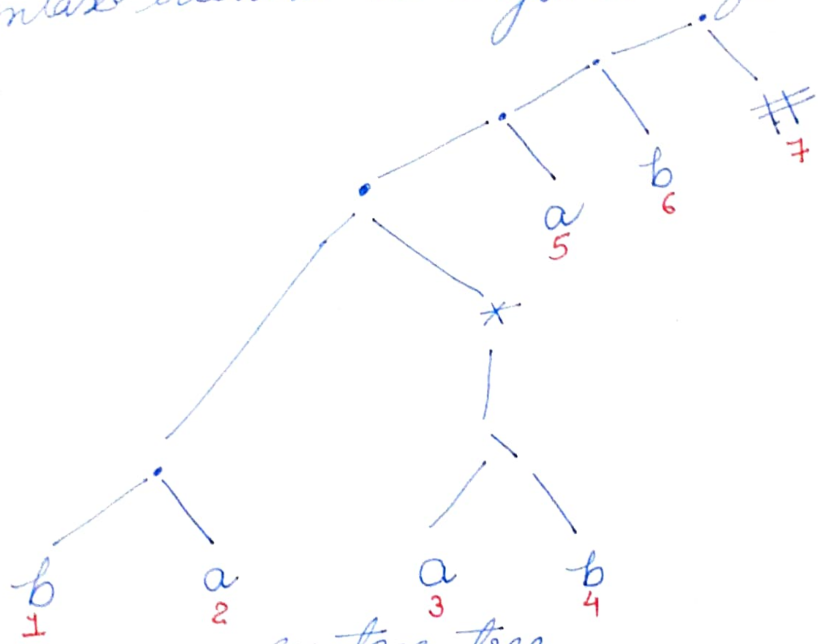
Firstly, we augmented regular expression by given RE.

$r \rightarrow r(\#)$

augmented regular expression $[ba(a+b)^*ab]\#$

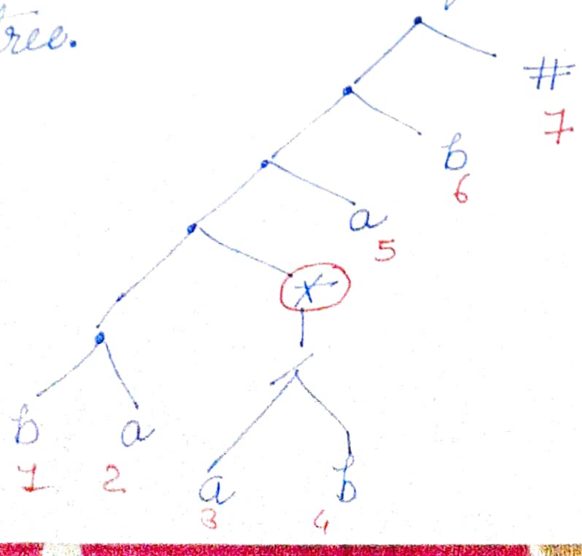
$ba(a+b)^*ab\#$

Step-1 Convert regular expression $ba(a+b)^*ab\#$ into syntax tree and also give label for each leaf node.



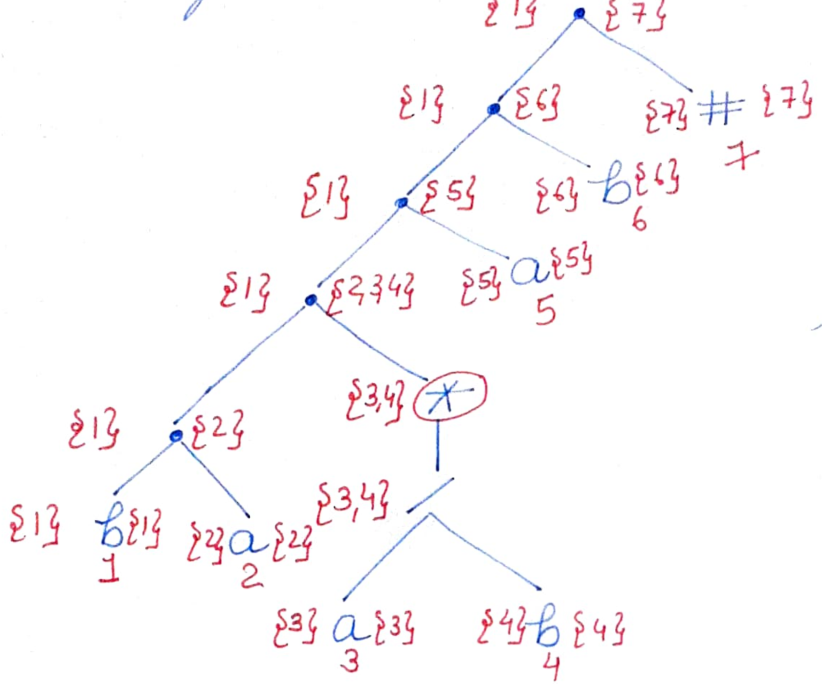
syntax tree

Step-2 Calculate nullable node from constructed syntax tree.



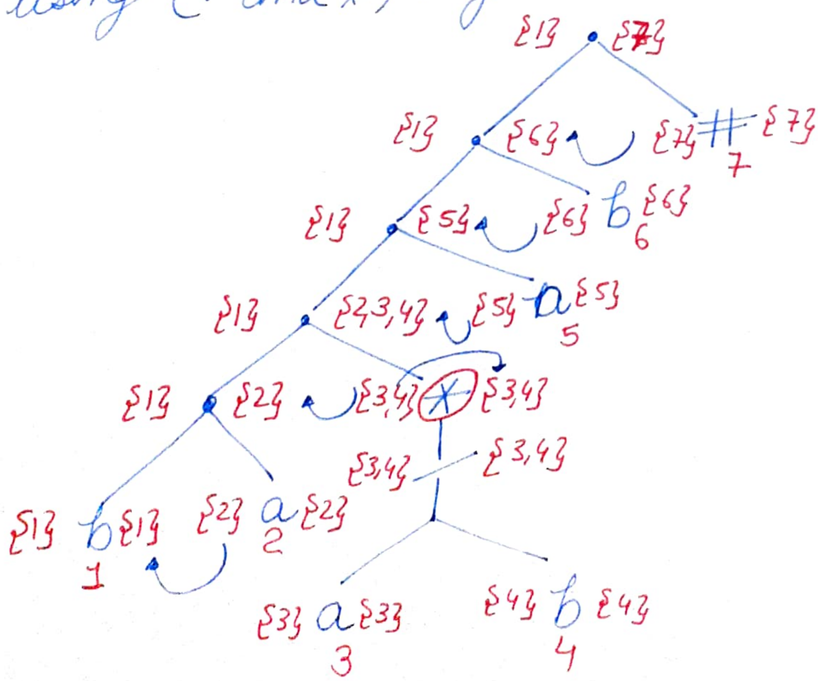
(7)

Step-3 Calculate firstpos and lastpos for constructed syntax tree.



syntax tree

Step-4 Calculate followpos for constructed syntax tree. followpos table will be constructed (create) by using (· and *) only.



followpos table

position	followpos
1	2
2	3, 4, 5
3	3, 4, 5
4	3, 4, 5
5	6
6	7
7	------

Now, constructed DFA by using constructed syntax tree and followpos table.

→ Always start from top.

So, initial state is $\{1\}$

⇒ State $A = \{1\}$

Transition $\delta(A, a)$ and $\delta(A, b)$

- $\delta(A, a)$ = no moves.
- $\delta(A, b)$ = followpos(2)
  $= \{3, 4, 5\}$ --- B

⇒ State $B = \{3, 4, 5\}$

Transition $\delta(B, a)$ and $\delta(B, b)$

- $\delta(B, a)$ = followpos(3) ∪ followpos(5)
  $= \{3, 4, 5\} \cup \{6\}$
  $= \{3, 4, 5, 6\}$ --- C
- $\delta(B, b)$ = followpos(4)
  $= \{3, 4, 5\}$ --- B

⇒ State $C = \{3, 4, 5, 6\}$

Transition $\delta(C, a)$ and $\delta(C, b)$.

- $\delta(C, a)$ = followpos(3) ∪ followpos(5)
  $= \{3, 4, 5\} \cup \{6\}$
  $= \{3, 4, 5, 6\}$ --- C
- $\delta(C, b)$ = followpos(4) ∪ followpos(6)
  $= \{3, 4, 5\} \cup \{7\}$
  $= \{3, 4, 5, 7\}$ --- D

⇒ State $D = \{3, 4, 5, 7\}$

Transition $\delta(D, a)$ and $\delta(D, b)$

- $\delta(D, a)$ = followpos(3) ∪ followpos(5)
  $= \{3, 4, 5\} \cup \{6\}$
  $= \{3, 4, 5, 6\}$ --- C
- $\delta(D, b)$ = followpos(4)
  $= \{3, 4, 5\}$ --- B

Transition Table

State Q.	Input a	Input b
→A = {1}	φ	B
B = {3, 4, 5}	C	B
C = {3, 4, 5, 6}	C	D
D = {3, 4, 5, 7}	C	B

7 present in D so, D is final state

Transition Digram