

THEORY OF AUTOMATA

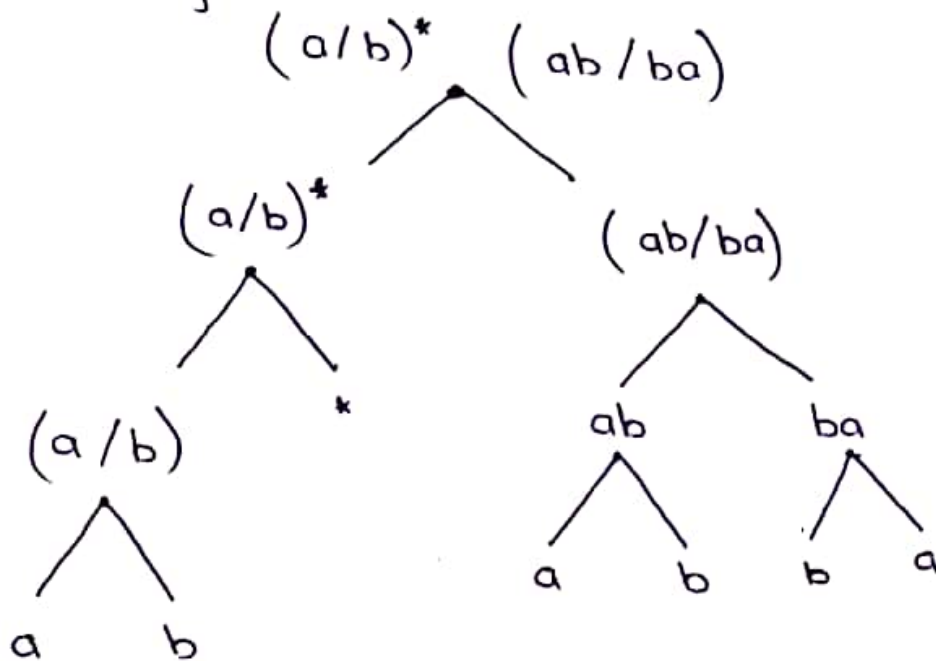
Q1:

Parse the given RE into its individual/Automatic symbols and then design an NFA.

$$(a/b)^* (ab/ba)$$

Answer:

Parsing :-



→ NFA for AS a;



⇒ NFA for AS b;



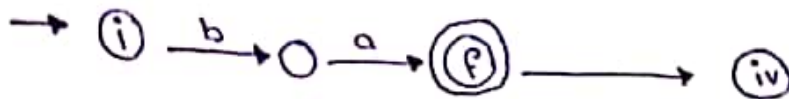
⇒ Now NFA for ab:

Combine i & ii

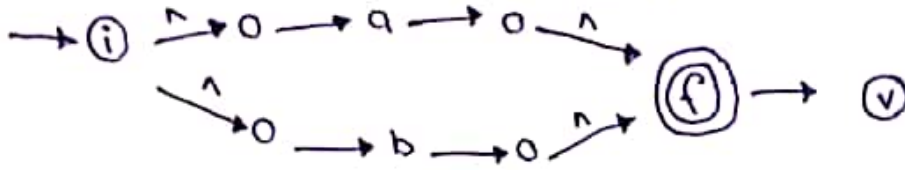
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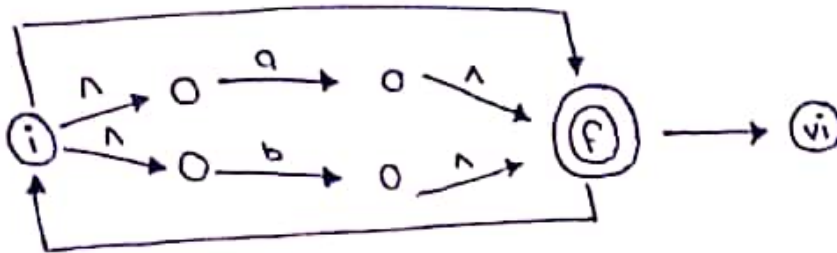
=> Now NFA for ba :-



Now, NFA for a/b :-

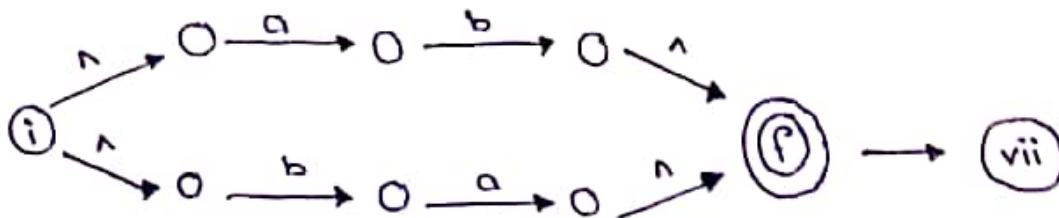


=> Now, NFA Λ for (a/b)\*

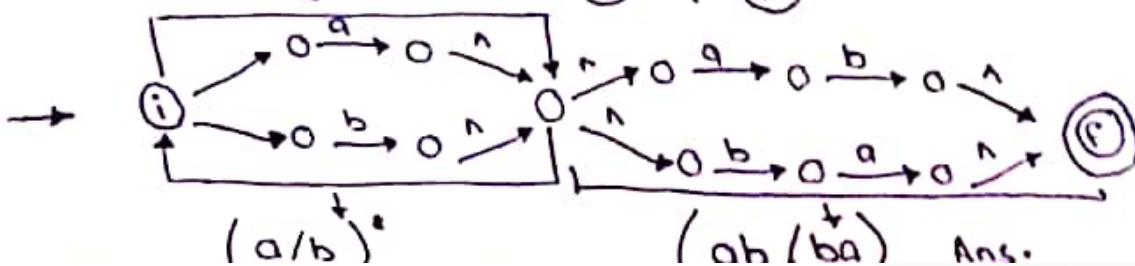


=> NFA for (ab/ba)

combining (iii) & (iv)



Major NFA: (vi) & (vii)



THEORY OF AUTOMATAQ2

Design RE for each of the following.

i) RE for all the optional word over  $\{a, b\}$

Ans:-

$$(a/b)^*$$

ii) RE for all the optional word over  $\{a, b\}$  with an even number

Ans:-  $b^* (ab^* a) + b^* / \text{OR } (aa + b)^*$

iii) RE for all optional word over  $\{a, b\}$  with an odd number for "a"

Ans:-  $b^* a (b^* a b^* a b^*)^*$

iv) RE for all the optional word over  $\{a, b\}$  where last symbol must be "b"

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

v) RE for all the optional word over  $\{a, b\}$  where first symbol must be "b"

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

THEORY OF AUTOMATAQ3: a)

Prove that :-

$$(a/b)^* \neq a^* b^*$$

Sol:-  $(a/b)^* \neq a^* b^*$

for  $a^* b^*$

$$a^0 b^0 = 1 = \Lambda$$

$$a^1 b^0 = a$$

$$a^1 b^1 = ab$$

$$a^0 b^1 = b$$

$$a^* b^* = \{\Lambda, a, ab, b, b \dots\} \rightarrow \textcircled{i}$$

for  $(a/b)^*$

$$(a/b)^0 = \Lambda$$

$$(a/b)^1 = a \text{ or } b \text{ or } ab$$

$$(a/b)^2 = aa, ab, ba, bb, \dots$$

So,

$$(a/b)^* = \{\Lambda, a, b, aa, ab, \dots\}$$

$$\downarrow$$

$$\textcircled{ii}$$

that

$$a^* b^* \neq (a/b)^*$$

OR

$$(a/b)^* \neq a^* b^* \text{ Ans.}$$

THEORY OF AUTOMATAQ3 b:

Derive language descriptions (statements) for the following RE

$$i) (a/b) (a/b) b (a/b)^*$$

Ans: Language for word over  $\{a, b\}$  which starts with "aa" or "ba" followed by b & end with any letter.

$$ii) (a/b)^* b (a/b) (a/b)$$

$L = \{a, b\}$  where string starts with any letter followed by "b" & end with "aa" or bb

$$iii) (a/b)^* (aa/bb)$$

$L = \{a, b\}$  where last word must be two "a"s or two "b"s

$$iv) (aa/bb) (a/b)^*$$

$L = \{a, b\}$  where first symbol must be aa bb string must start with "aa" or "bb"

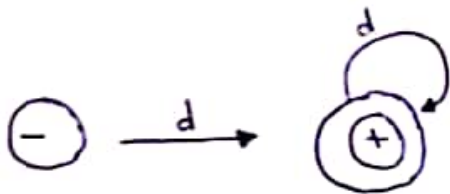
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Q4 a:

Design NFA for the following without Parsing

i)  $(+/-) d^+$

Ans:-



ii)  $(a/b)^+ (aaa/bbb) (a/b)^+$

Ans:-

