

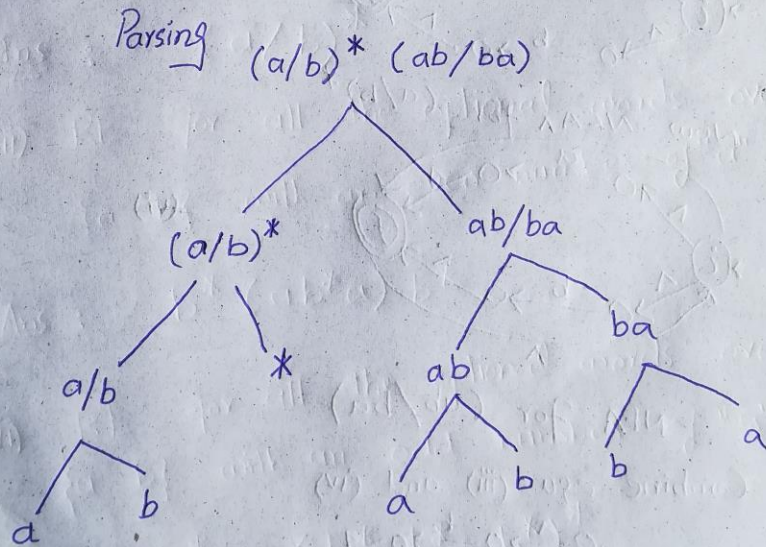
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Subject # Theory of Automata  
Semester # 6th  
Department # BS(CS)  
Date # 24 June, 2020

Q1) Parse the given RE into individual / Atomic symbols and then the design an NFA.

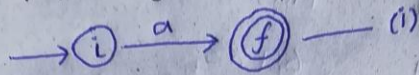
$(a/b)^* (ab/ba)$

Parsing

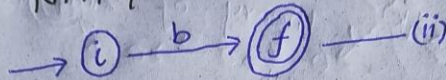


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NFA for A

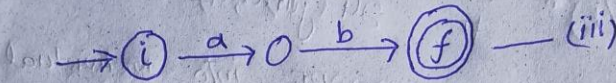


NFA for b

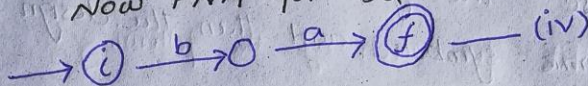


Now NFA for ~~AB~~ ab

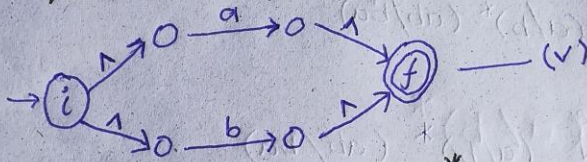
Combine equation (i) and (ii)



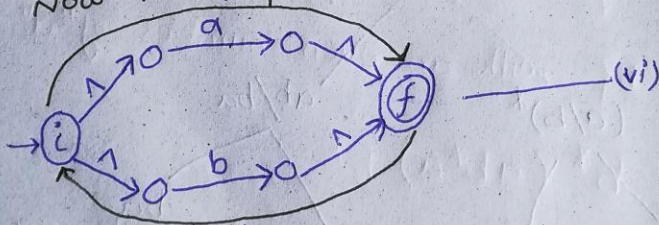
Now NFA for ba



Now NFA for a/b

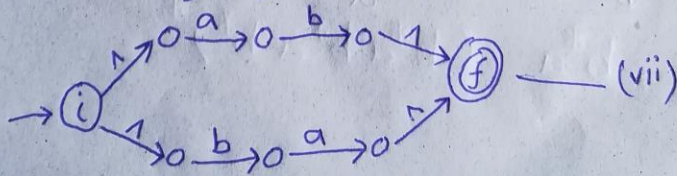


Now NFA for  $(a/b)^*$



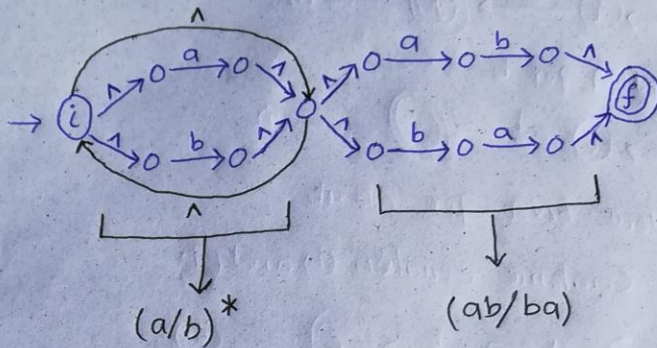
NFA for  $(ab/ba)$

Combine equ (iii) and (iv)



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Major NFA of (vi) { (vii) we get



Q2) Design RE for each of the following

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

Ans :  $(a/b)^*$

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

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

(iii) RE for all the optional words over  $\{a, b\}$  with an odd number of "a"

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

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

Ans  $(a+b)^* b$

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

Ans  $b(a+b)^*$

Q3) (a). Prove that

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

Ans:

for

$$(a/b)^*$$

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

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

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

$\vdots$   
 $\vdots$   
So

$$(a/b)^* = \{\Lambda, a, b, aa, ab, \dots\} \rightarrow \textcircled{1}$$

for

$$a^* b^*$$

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

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

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

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

$$a^* b^* = \{^1, a, ab, b, ba, \dots\} \text{ --- (2)}$$

That

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

b) Derive language description (statement) for the following RE.

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

Ans language for words over  $\{a, b\}$  which starts with "aa" or "ab" or "ba", or "bb" followed by b ends with any letter.

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

Ans  $L = \{a, b\}$  where strings start with any letter followed by b and ends with "aa" or "ab", or "ba" or "bb"

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

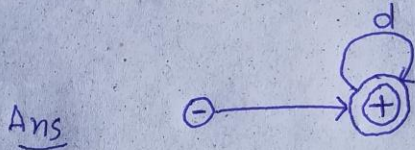
Ans  $L = \{a, b\}$  where last symbols must be two a's or two b's string must end with "aa" or "bb"

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

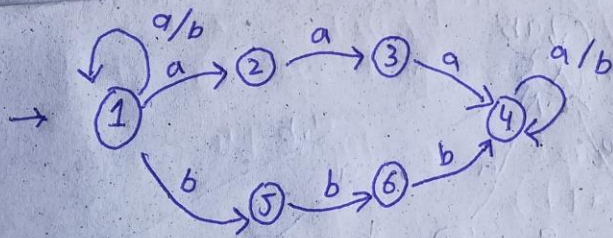
Ans:  $L = \{a, b\}$  where first symbol must be "aa" or "bb" string must start with "aa" or "bb"

Q4) Design NFA for the following with out parsing

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



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



{ aaa bbb aaaabb aaabbb