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Paper # Theory of Automata

Semester # 6th

Department # Computer Science

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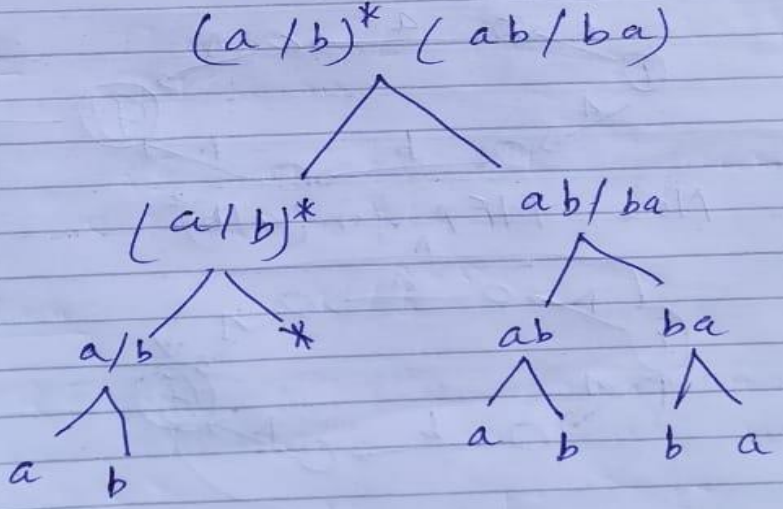
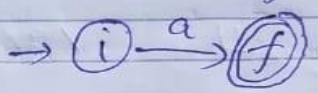
Q No 1 Parse the given RE into its individual / Atomic symbols and then design an NFA.

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

Parsing

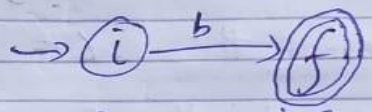


NFA for a



(i)

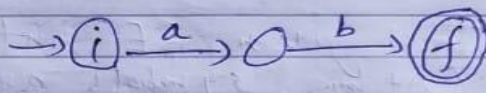
NFA for b



(ii)

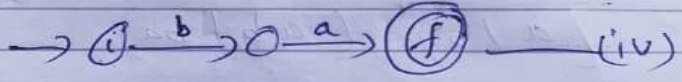
Now NFA for ab

Combine equ. (i) and (ii)



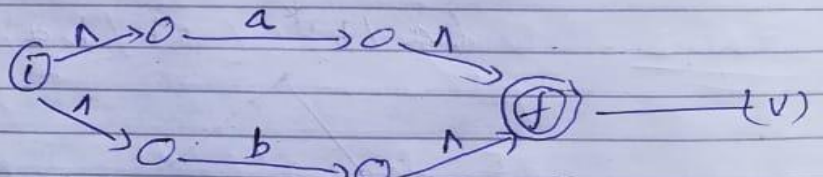
(iii)

Now NFA for ba



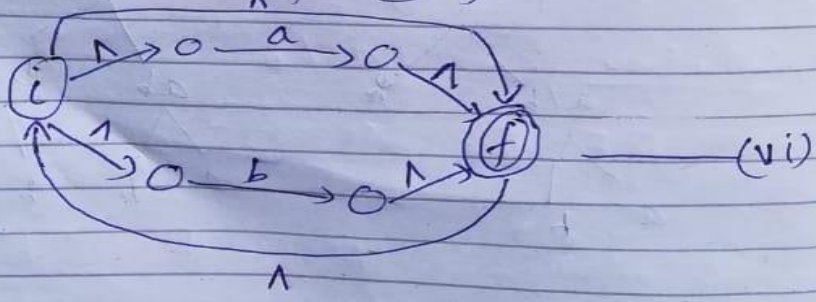
(iv)

Now NFA for a/b



(v)

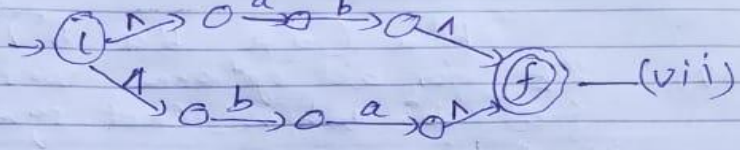
Now NFA for (a/b)*



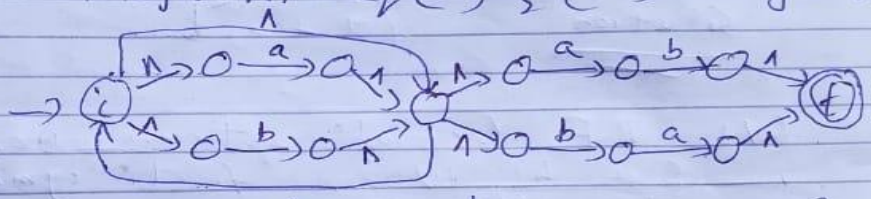
(vi)

NFA for (ab / ba)

Combine eqn (iii) & (iv)



Major NFA eq (vi) & (vii) we get.



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

Q No 2 Design RE for each of the following.

(i) RE for all the optional words over { a b }.

Solution :- $(a/b)^*$

(ii) RE for all the optional words over { a b } with an even number of "a's"

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

(iii) RE for all the optional words over {a b} with an odd number number of "a's".

$$b^*a\,(b^*a\;\;b^*a\;\;b^*)^*$$

(iv) RE for all optional words over {a b} where last symbol must be "b"

Solution

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

(v) RE for all optional words over {a b} where first symbol must be "b"

Solution:-

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

Q No 3

(a) Prove that

$$(a/b)^* != a^* b^*$$

Solution :-

$$(a/b)^* != a^* b^*$$

$$LHS = (a/b)^*$$

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

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

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

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

$$RHS = a^* b^*$$

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

$$a^* b^* = \{\Lambda, a, ab, b, ba \ldots\}$$

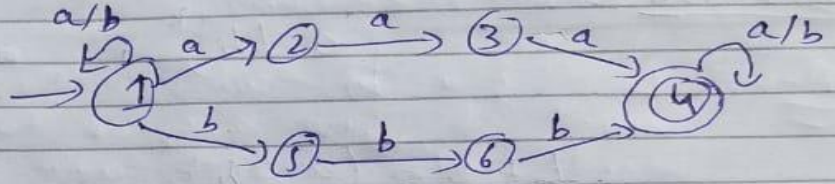
Hence proved

$$(a/b)^* != a^* b^*$$

Q No 4 Design NFA for the following without parsing

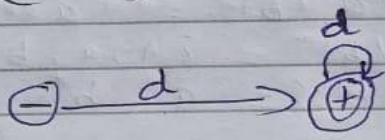
(ii) $(a/b)^*(aaa/bbb)(a/b)^*$

$RE = (a/b)^*(aaa/bbb)(a/b)^*$



{ aaa bbb aaabb aaabbb ... }

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



Q No 3

(b) Derive language descriptions (statements) for the following RE.

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

Language for words over {a b} which starts with "aa" or "ab" or "bb" followed by b and ends with any letter.

(II) $(a|b)^* b(a|b)\ a|b$

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

(III) $(a|b)^* (aa|bb)$

Ans Z $L = \{a\ b\}$ where last symbol must be two a's or two b's string must ~~start~~ end with "aa" or "bb".

(IV) $(aa|bb)(a|b)^*$

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