Theory of Automata

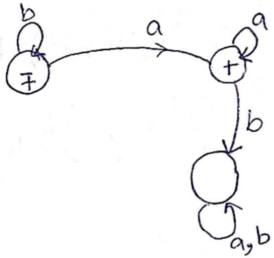
Assignment 1

Question 1:

1. words that donot have ab

Regular Expression: $b^* a^*$

Finite Automata:

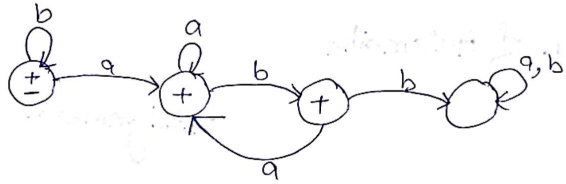


Transition Graph:

ii) strings that donot have abb

RE : $b^* (a + ab)^*$

FA :

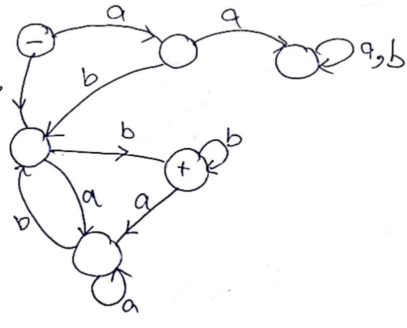


TG :

iii) words that start with aa or end with bb

RE : $aa(a+b)^* + (a+b)^* bb$

FA :



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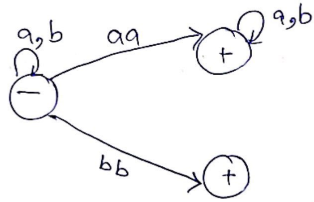
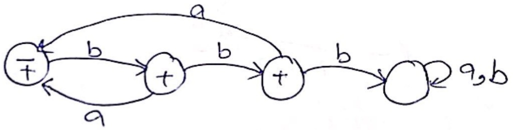
TG :



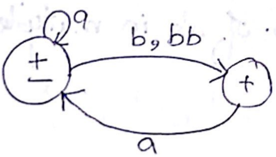
iv) words where b is never trippled

RE : $(\lambda + b + bb)(a + ab + abb)^*$

FA :



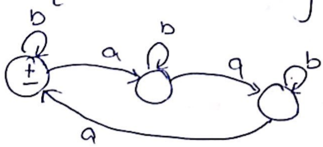
TG :



v) words in which total no. of a's divisible by 3.

RE : $b^* [a b^* a b^* a b^*]^*$

FA :



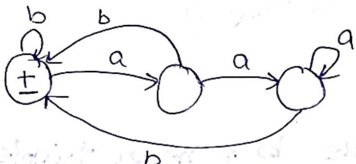
TG :

same as FA

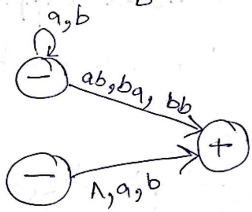
vi) strings that never end on aa

RE $(a + \Lambda + b) + [(a+b)^* (ab + ba + bb)]$

FA :



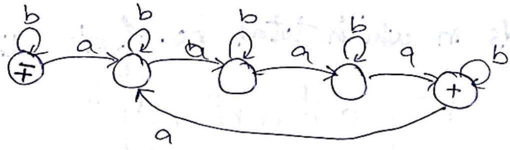
TG :



vii) strings having no. of a's in multiple of 4

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

FA :



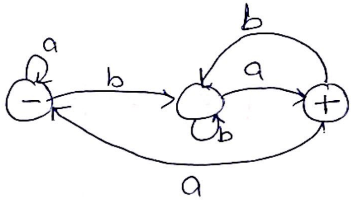
TG :

same as FA

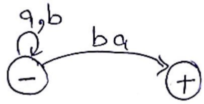
viii) strings that end with ba

RE : $(a+b)^* ba$

FA :



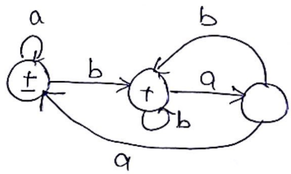
TG :



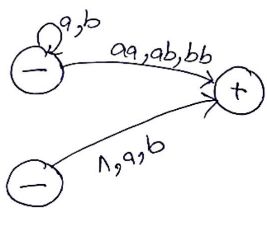
ix) Strings never end on ba

RE : $(\Lambda + a + b) + [(a+b)^* (aa + ab + bb)]$

FA :



TG :

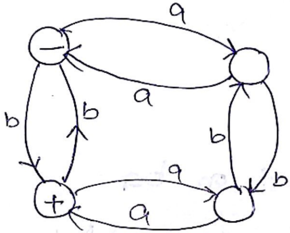


x) even a's and odd b's

RE: $\left[aa + bb + (ab + ba)(aa + bb)^* (ab + ba) \right]^* b$

$\left[aa + bb + (ab + ba)(aa + bb)^* (ab + ba) \right]^*$

FA:



TG:

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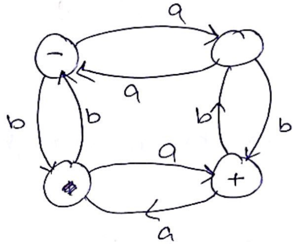
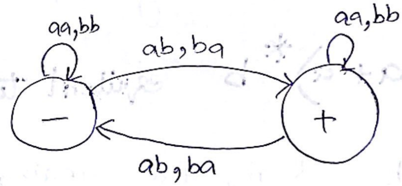
xi) Strings containg odd no. of a's & b's

RE : $[aa + bb + (ab + ba)(aa + bb)^* (ab + ba)]^* (ab + ba) [aa + bb + (ab + ba)(aa + bb)^* (ab + ba)]^*$

FA



TG =



Question 2:

1- $((a+bb)^*aa)^*$ equilent to $\Lambda + (a+bb)^*aa$

$((a+bb)^*aa)^* = \{\Lambda, aa, bbaa, aaa, bbaaa, \ldots\}$

$\Lambda + (a+bb)^*aa = \{\Lambda, aa, bbaa, aaa, bbaaa, \ldots\}$

Both Regular Expressions generate the words that either start with 'a' or 'bb' and ends with 'aa' and also contain the null string.

11- $a(ba+a)^*b$ equilent to $aa^*b(aa^*b)^*$

$a(ba+a)^*b = \{ab, aab, abab, aaab, \ldots\}$

$aa^*b(aa^*b)^* = \{ab, aab, abab, aaab, \ldots\}$

Both Regular Expressions generate strings that start with 'a' and with 'b' and contain all possible combinations in between except 'bb'.

Question 3

i- strings having length multiple of 3

Step 1:

$\{\Lambda, aaa, aab, aba, abb, baa, bab, bba, bbb\}$

belongs to string with length multiple of 3.

Step 2:

If x belongs to the language and y belongs to the language then xy also belongs to the language.

Step 3:

All the strings not constructed using above 2 steps are not in this language.

ii- odd palindrome

Step 1:

{a, b} belong to the languge of odd palindrome

Step 2:

if x belongs to the language then axa and bxb also belong to the language.

Step 3:

All strings not constructed using the above 2 rules are not part of the language.

iii) Even numbers

Step 1: 0 is in even

Step 2 : if x is in Even, then X+2 and X−2 are also in Even

Step 3: All strings not constructed using above 2 rules is not part of Even.

Proof 14 is Even:

Using Rule 1 : $0 \in$ Even

Using Rule 2 : $(x=0)$, $0+2 = 2 \in$ Even

$(x=2)$: $2+2=4 \in$ Even

$(x=4)$: $4+2=6 \in$ Even

$(x=6)$: $6+2=8 \in$ Even

$(x=8)$: $8+2=10 \in$ Even

$(x=10)$: $10+2=12 \in$ Even

$(x=12)$: $12+2=14 \in$ Even

Hence proved 14 is in Even.