

2024-01-01

THEORY OF AUTOMATA

Assignment # 01

Date 24/12/2022
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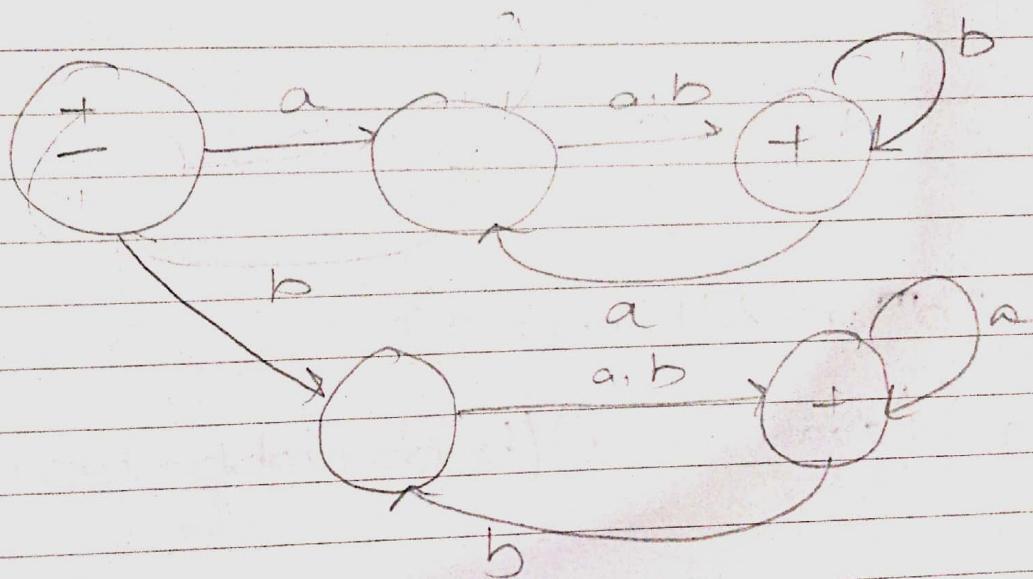
$$L_1 = \{a^n b^m : (n+m) \text{ is even}\}$$

Regular Expression:

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

all odd all even

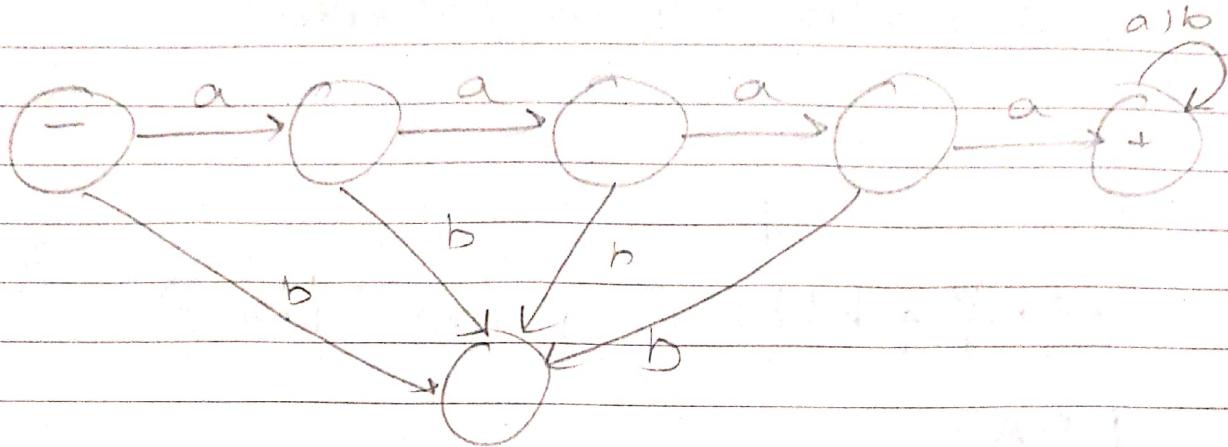
DFA :-



$$L_2: \{a^n b^m, n \geq 4, m \leq 3\}$$

$$aaaaa^+.(bbb + bb + b + \lambda)$$

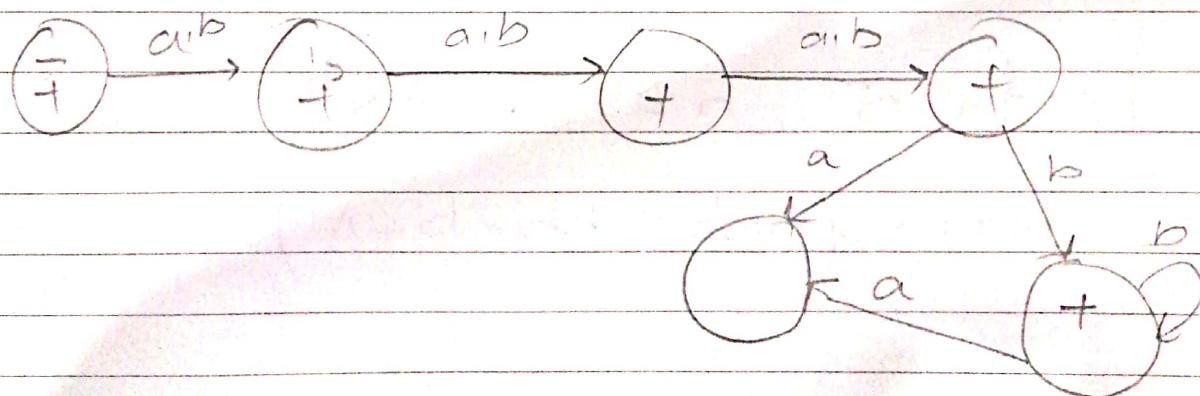
DFA:



$$L_3 = \{a^n b^m : n \leq 4, m \leq 4\}$$

$$\lambda + \{(aaa + aa + a)(bbb + bbb + bb + b)\}$$

DFA:



aaa b abbbb

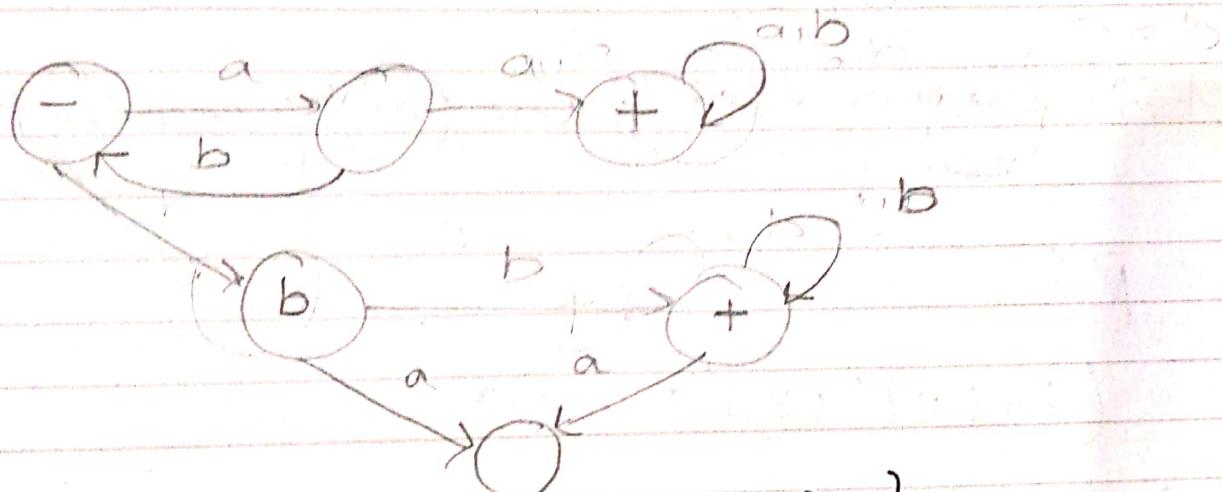
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$$L_4 = \{ a^n b^m : n \geq 1, m \geq 1, nm \geq 3 \}$$

RE:

$$(a^*(aa)^+ b^*(bb)^+) + \begin{cases} \{aab, abbb\} & n=3, m=1 \\ & m=3, n=1 \\ n \geq 2, m \geq 2 & \end{cases}$$

DFA:

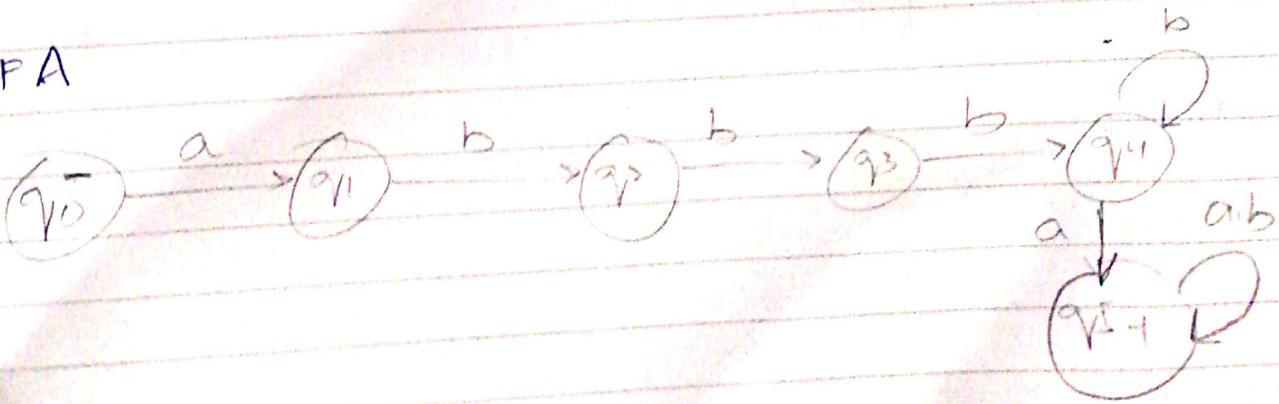


$$L_5 = \{ ab^n w : n \geq 3, w \in \{a,b\}^+ \}$$

RE

$$abb b^+ (a+b)^+$$

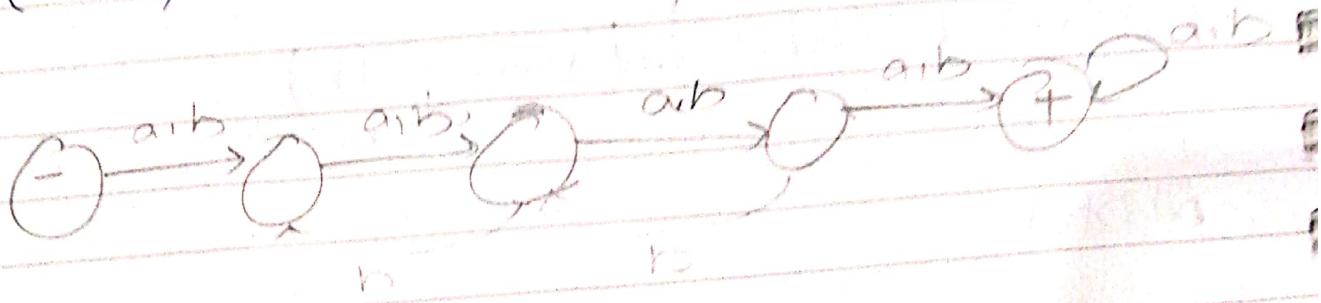
DFA



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$L_6 = \{vwv : v, w \in \{a, b\}^*, |v| = 2\}$

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

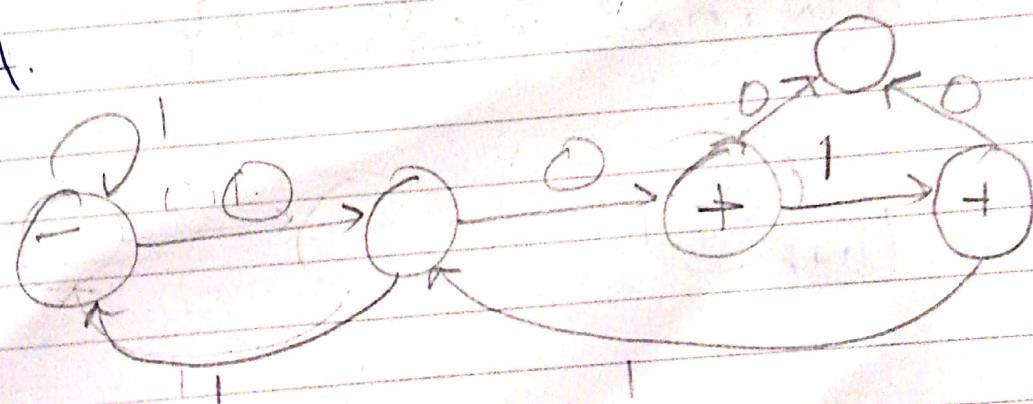


L_7 = having exactly one pair of consecutive zeroes.

RE^r

$$(1+01)^*00(1+10)^*$$

DFA.

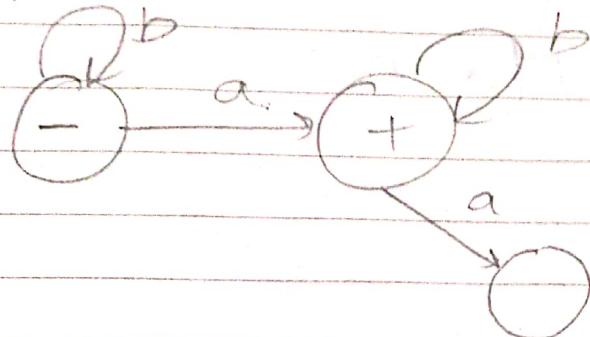


L_8 = having exactly one a

RE:

$$b^* a b^*$$

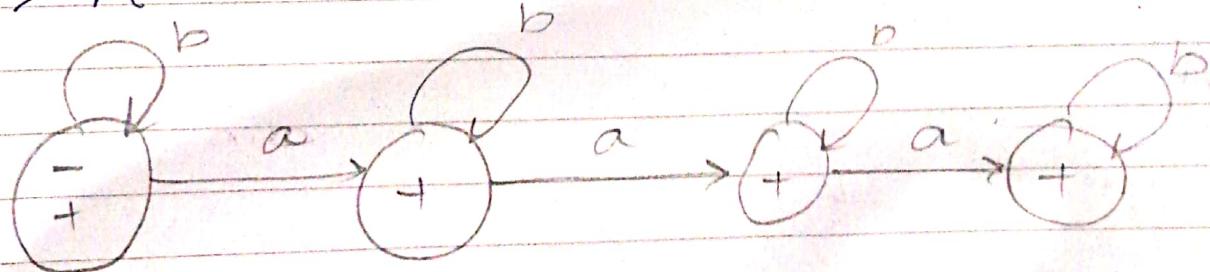
DFA



L_9 = string containing no more than 3 a's

$$\lambda + b^* (a + aa + aaa) b^*$$

DFA



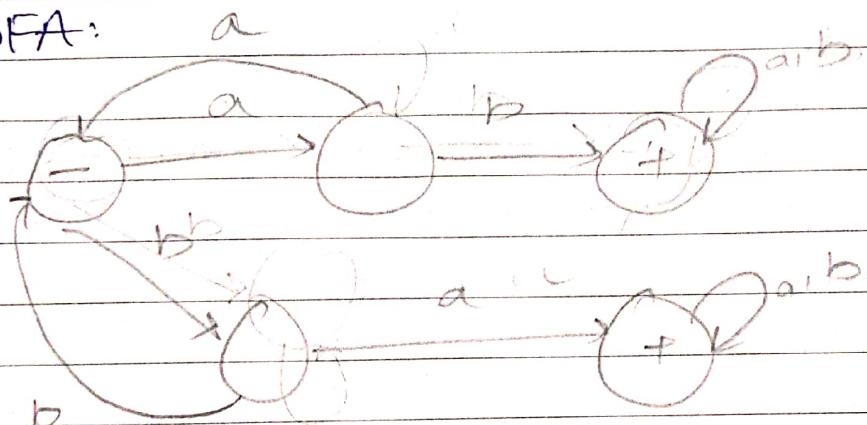
L_{10} = all strings that contain at least one occurrence of each symbol in alphabet:

RE:

$$(a+b)^*$$

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

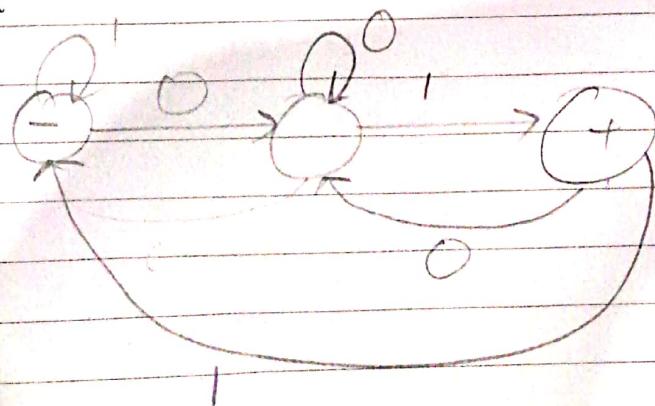
DFA:



L_{11} = all strings ending in 01

$$RE \quad (0+1)^* 01.$$

DFA:



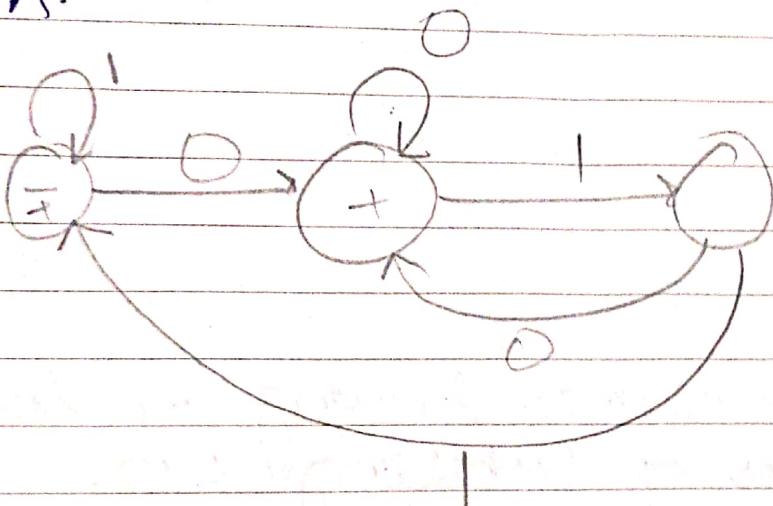
00, 11, 10

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L12 = all strings not ending in 0,)

RE $(0+1)^* (00+11+10) + \lambda$

DFA:



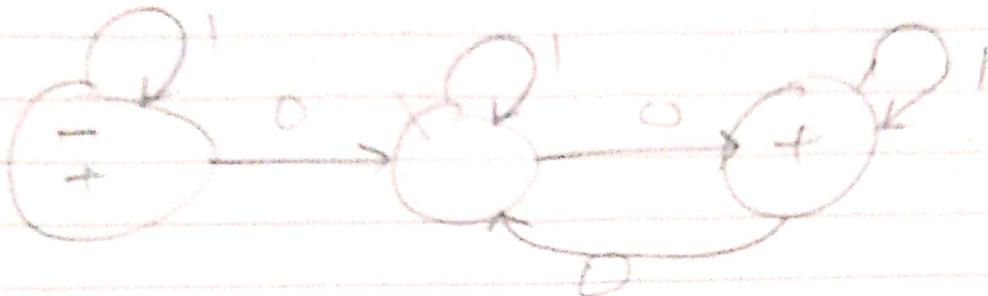
L13 = all strings containing even number of zeroes

100010

$((\lambda \times 0 \times 0)^*)^*$

$1^* + (1^* 0 1^* 0)^* 1^*$

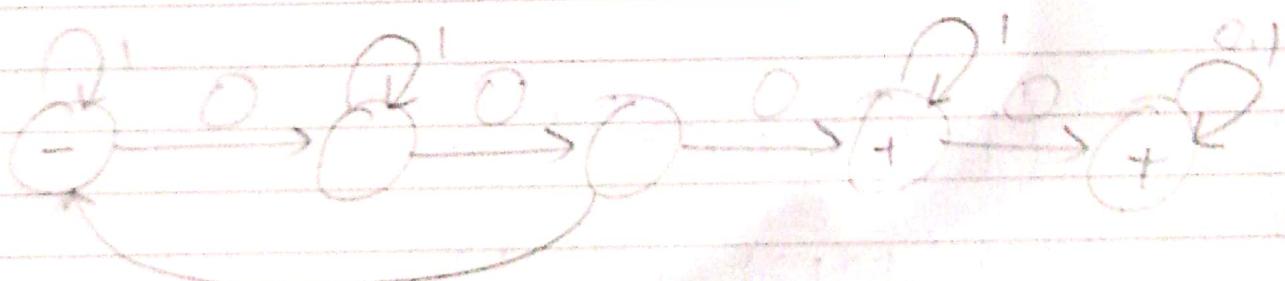
DFA:



L_4 = all substrings strings having at least -
(two occurrences of substring 00).

RE

$$(0+1)^*(00)^*(0+1)^*(00)^*(0+1)^*$$

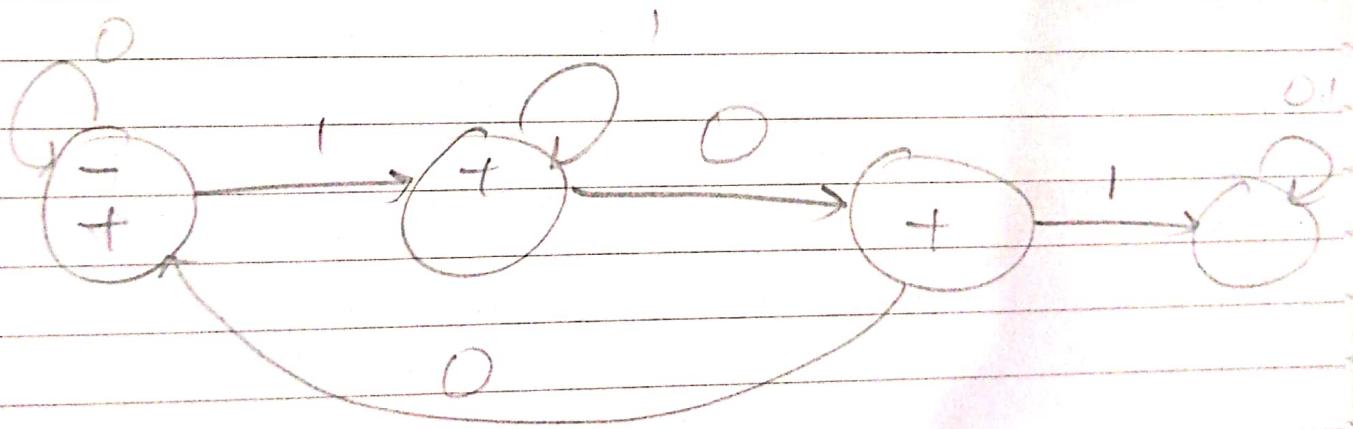


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LIS = all strings not containing 101.

R.E:

$$0^* 1^* (0+00+000+1)^*$$



λ,

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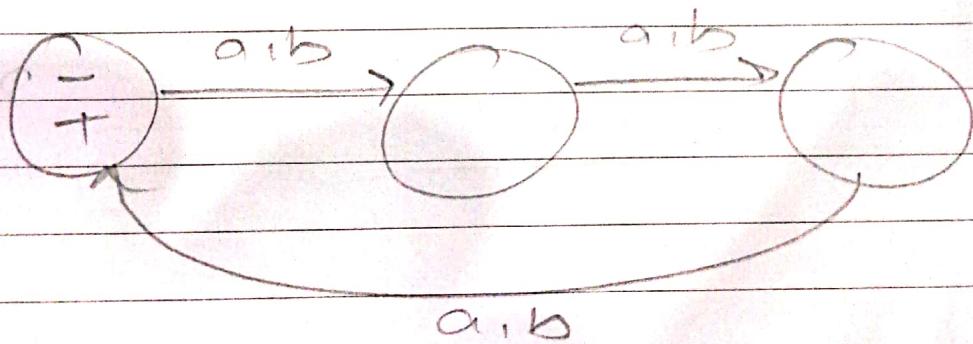
L16: $\{w : |w| \bmod 3 = 0\}$

$a^n b^m$

$n = 3, m = 0, 1, 2, 3, \dots$

$m = 3, n = 0, 1, 2, 3, \dots$

~~$(aabab)^*$~~ + ~~$(babbb)^*$~~
 $\{(a+b)(a+b)(a+b)\}^*$

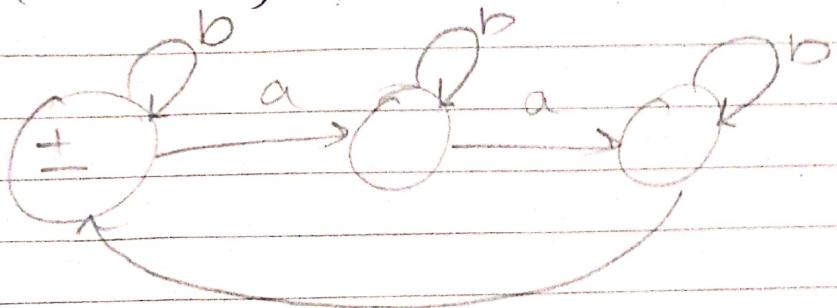


$$L_7 = \{w : n_a(w) \bmod 3 = 0\}$$

n_a = no of a's

RE

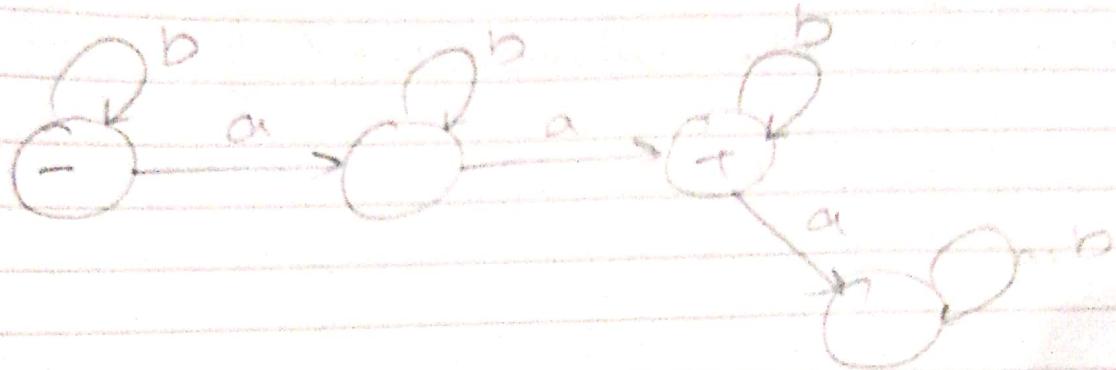
$$(aa^* - b)^* \{b^* a b^* a b^* a b^*\}^* + a + b$$



Q8: The language of all strings containing exactly two a's.

$$\{b^* a b^* a b^*\}$$

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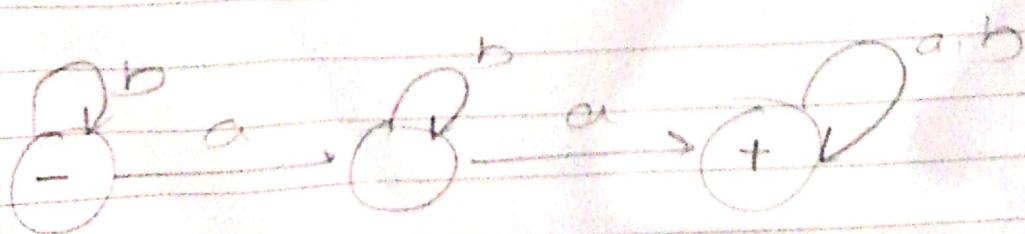


$L_9 = \text{The language of all strings containing at least two } a\text{'s}$

RE:

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

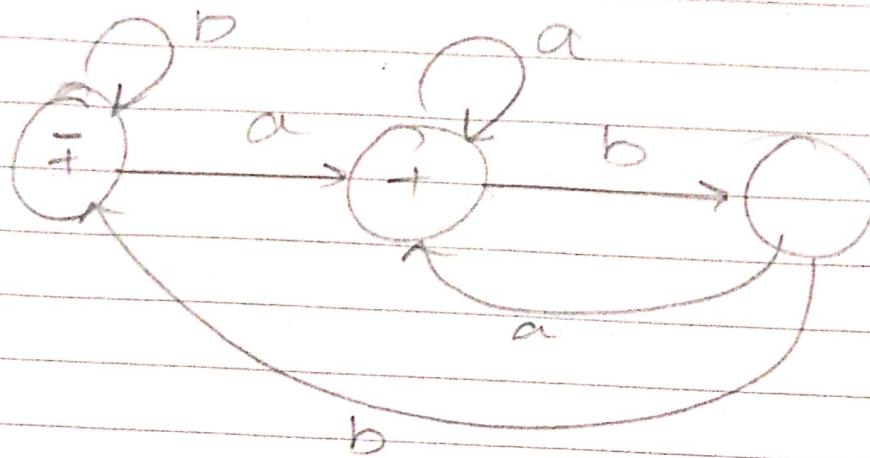
$$\begin{aligned} & (a+b)^* a + (a+b)^* a a (a+b)^* \\ & (a+b)^* a a + (a+b)^* \\ & (b^* a b^* a b^*)^* + \end{aligned}$$



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L_{20} = The language of all strings that do not end with ab .

$$(a+b)^* (aa + bb + ba)$$



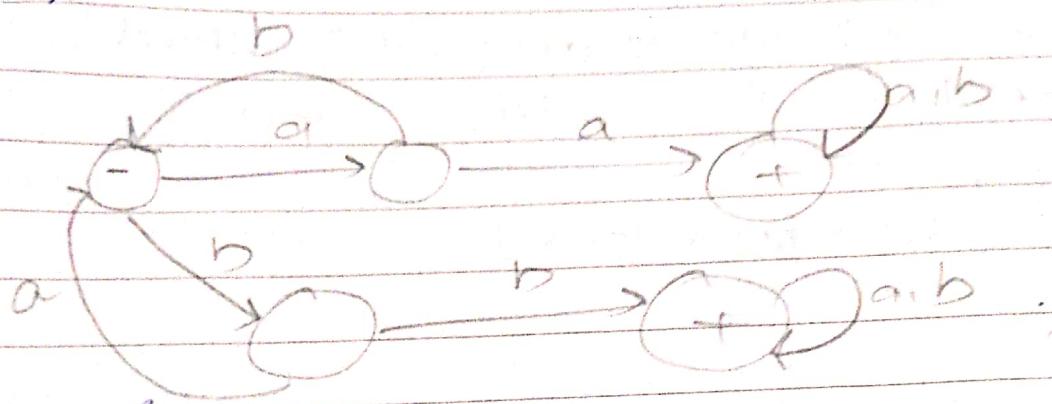
L_{21} = The language of all strings that begin or end with aa or bb.

RE

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

$$\{(aa+bb)(a+b)^*\} + \{(a+b)^*(aa+bb)\}.$$

DFA



(23): number the language of all strings not containing substring ~~ab~~. aa.

RE:

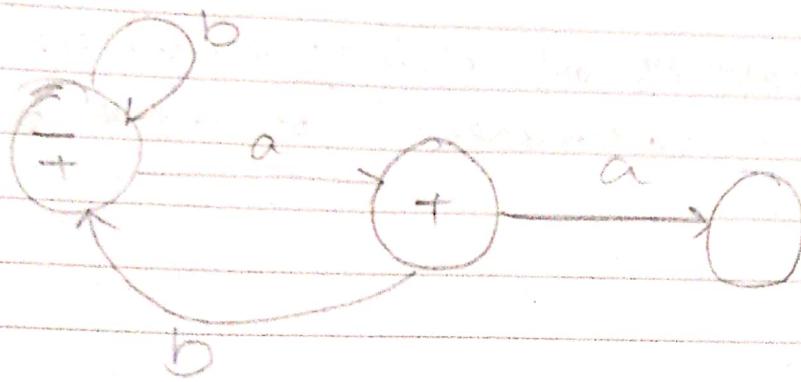
$$(ab + ab + ba)^*$$

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

$$\alpha^* (b + ba)^* b^* : (ab + bb + ba)^* + (a + b)$$

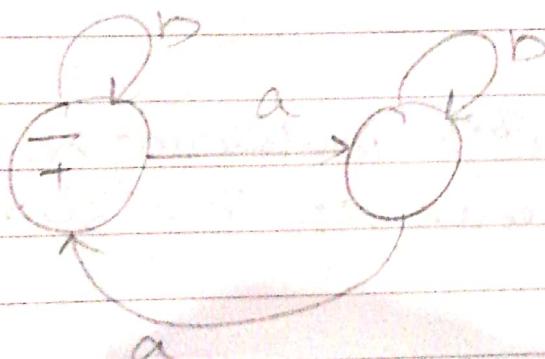
babbaba

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L23: The language of all strings in which the number of 'a's is even.

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

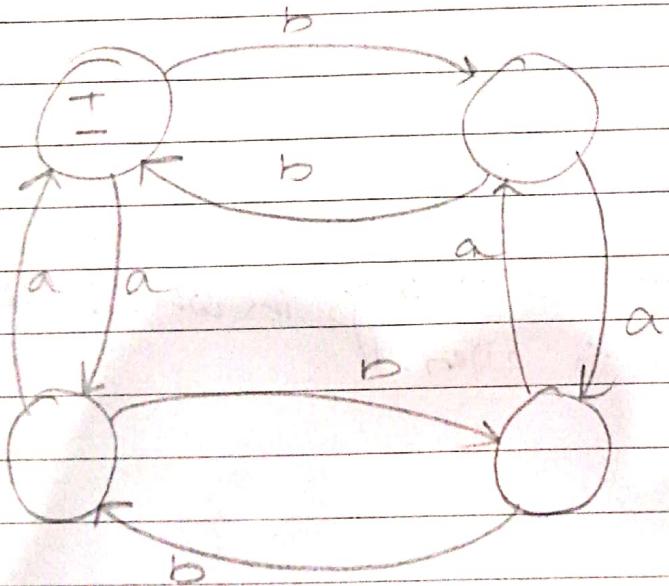


L24: The language of all strings in which both the number of a's & b's are even.

RE:

$$\{aa+bb + (ab+ba)(aa+bb)^* (ab+ba)\}^*$$

DFA

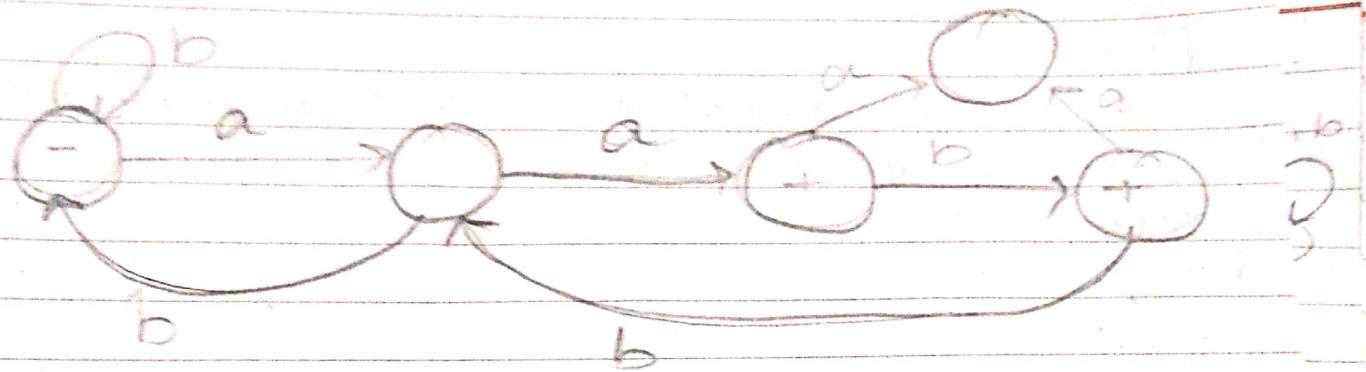


L25: The language of all strings containing no more than one occurrence of the string aa

RE:

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

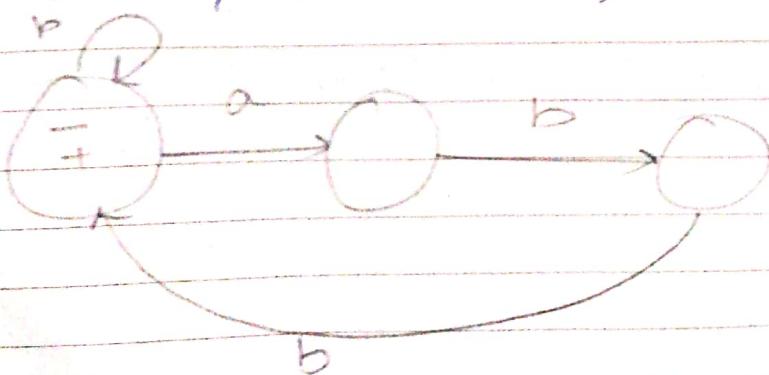
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L₂₆: The language of all strings in which every a (if there are any) is followed immediately by bb.

RE:

$$(abb)(b+abb)^*$$

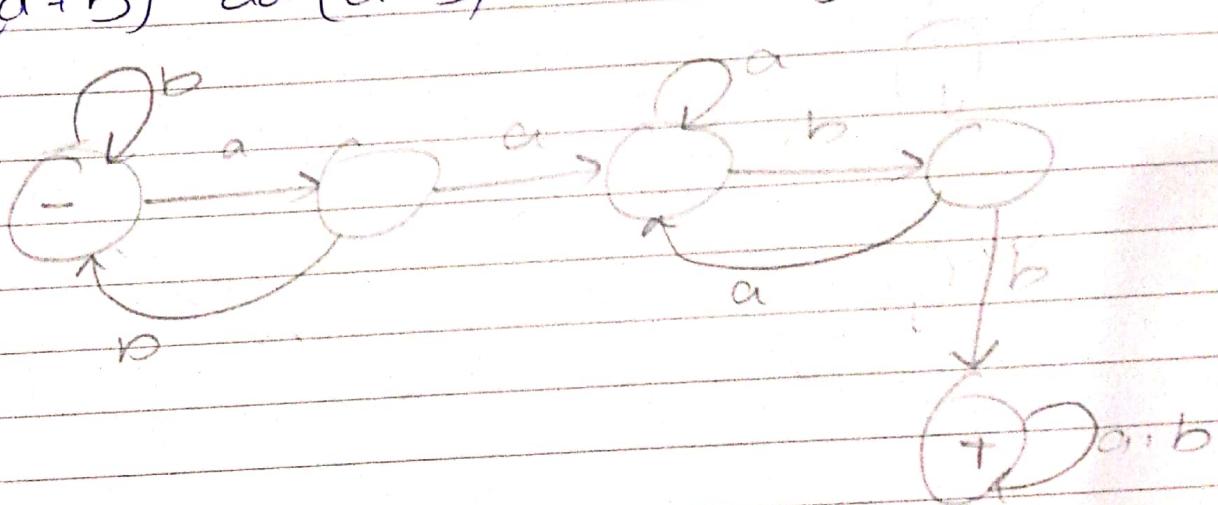


L27:

The language of all strings containing both bb and aa as substrings

RE:

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



L28: The language of all strings containing both aba and bab as substrings.

RE:

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

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