



**Name :** Maryam Masood

**Roll :** 22i-1169

**Subject :** TOA

**Section :** C

**Submitted to :** -

### (Question: 01)

- (a) Provide a recursive definition of language having all strings with length multiple of 2.

$$\Sigma = \{a, b\}$$

Step 1:

$\epsilon$ ,  $aa$ ,  $bb$ ,  $ab$  and  $ba$  are the only possibilities

Step 2:

If  $x$  belongs to this language then  $x^*$  also belongs to this language.

Step 3:

No strings except those constructed above are allowed to be in the language

- (b) Provide recursive definition of odd palindrome.

$$\Sigma = \{a, b\}$$

Step 1: Base Case  $a, b$

Step 2: if  $x$  and  $y$  belong to the language then  $xyx$  and  $yxy$  also belong to the language.

Step 3: No strings except those constructed above are allowed to be in the language.

- (c) Give recursive definition of the language where every string starts and ends on the same double letter.

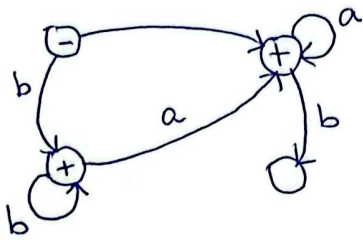
Step 1: Base Case  $aa$  and  $bb$  are in language  $L$ .

Step 2:  $aA(S)a$  and  $bB(S)b$  are in  $L$ , where  $S$  belongs to  $\Sigma^*$

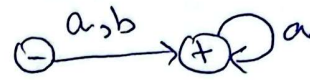
Step 3: No strings except those constructed above are allowed to be in the language.

## (Question:02)

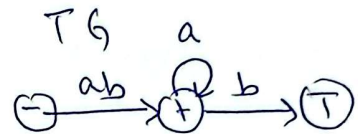
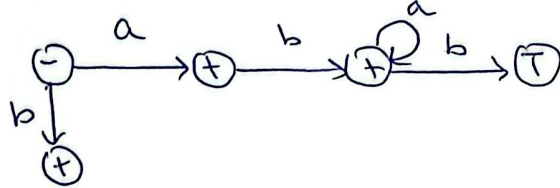
(i)  $b^*a^*$   
FA



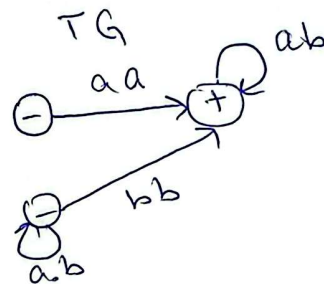
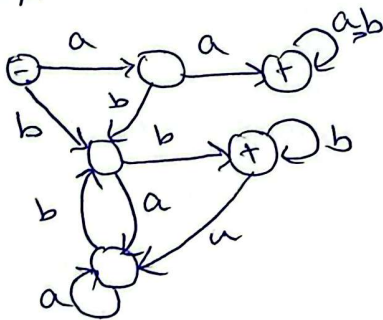
TG



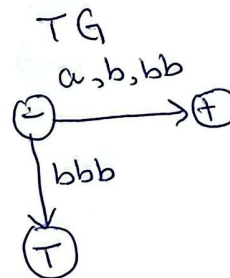
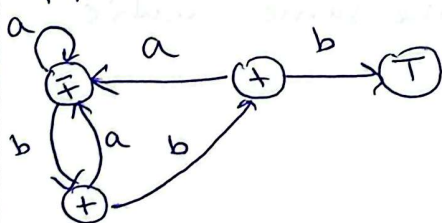
(ii)  $b^*a^* + b^*a^*b + a^*ba^*$



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

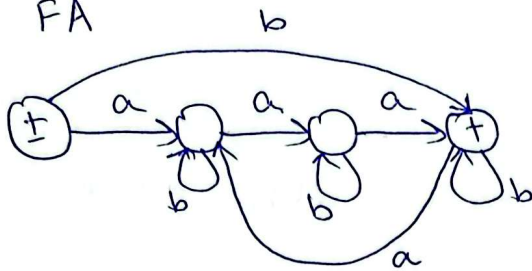


(iv)  $(a+ba+bba)^*(b+bb+^)$   
FA

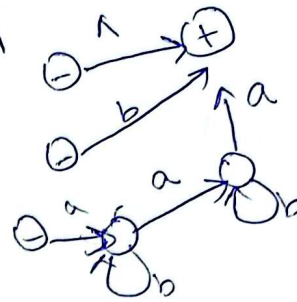


$$b^+ + (b^*ab^*ab^*a)^*$$

FA

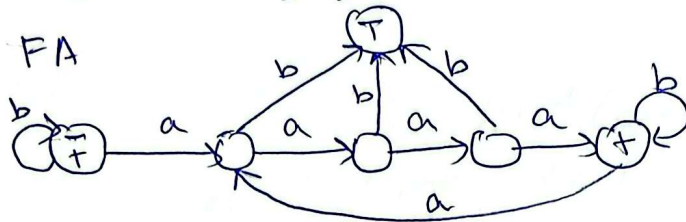


TG

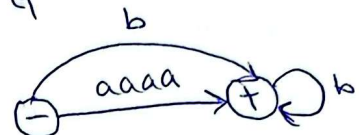


(vi)  $(b^*(aaaa)^*)^*$

FA

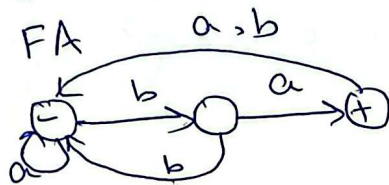


TG

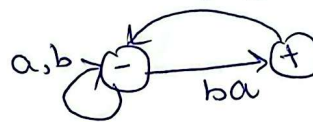


(vii)  $(a+b)^*ba$

FA

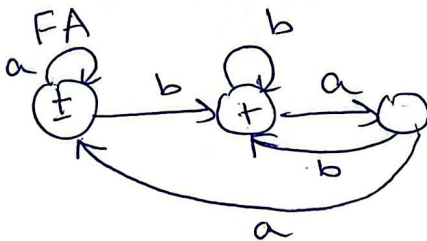


TG

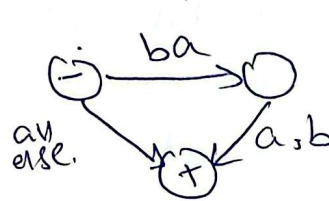


(viii)  $(a+b)^*b^+ + (a+b)^*aa^+ + a^*$

FA



TG





### (Question: 03)

(a)

Expression 1:  $((a+bb)^*aa)^*$

\* generates the strings that start with either 'a' or 'bb'

\* Strings end with 'aa'

\* Null  $\epsilon$  accepted

Expression 2:  $\epsilon + (a+bb)^*aa$

\* generates strings that start with 'a' or 'bb' and end with 'aa'

\* Null  $\epsilon$  accepted.

Thus both expressions define the same language & hence they are equal.

(b)

Expression 1:  $a(ba+ab)^*b$

\* generates strings containing all combinations of 'a' / 'ba' starting with 'a' and ending on 'b'

Expression 2:  $aa^*b(aa^*b)^*$

\* generates strings with all possible combinations of 'a' and 'b', starting with 'a' and ending with 'b'

Thus, both expressions define the <sup>same</sup> language and hence they both are equal.

