Q1. Factorial is the product of all positive integers less than or equal to a given positive integer and denoted by that integer and an exclamation point. Define the factorial in aspects of the following Automata Methods/Languages.

i. Recursive Language ii. Descriptive Language

- **Defining the language $\{a^n b^n\}$, n=1,2,3,… , of strings defined over Σ={a,b}**

Step 1:

ab is in $\{a^n b^n\}$

Step 2:

if x is in $\{a^n b^n\}$, then axb is in $\{a^n b^n\}$

Step 3:

No strings except those constructed in above, are allowed to be in $\{a^n b^n\}$

Descriptive Language

- Example: The language **factorial**, of strings defined over Σ={1,2,3,4,5,6,7,8,9} *i.e.*

  {1,2,6,24,120,…}
- Example: The language **FACTORIAL**, of strings defined over Σ={a}, as

  $\{a^{n!} : n=1,2,3,\ldots\}$, can be written as

  {a,aa,aaaaaa,…}. It is to be noted that the language FACTORIAL can be defined over any single letter alphabet.

The Language ODD LENGTH defined over $\boldsymbol{\Sigma = \{a, b\}}$, can be written as

$$\boldsymbol{L = \{\lambda, a, b, aaa, aab, baa, bab, bbb, \ldots\}}$$

Define the following methods/languages on the above given descriptive language.

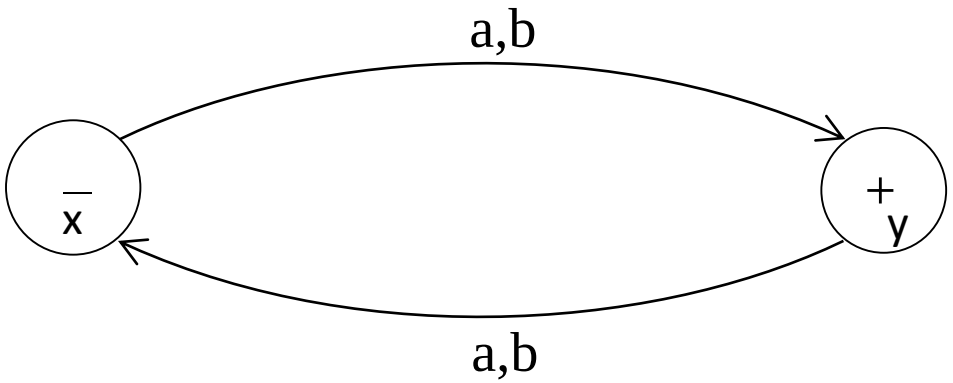
i. Regular Expression
ii. FA: Transition Diagram
iii. FA: Transition Table

- Now consider another language L, of odd length, defined over Σ = {a, b}, then it's regular expression may be

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

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

FA: Transition Diagram



FA Transition Table

OLD STATE	NEW STATE	
	Reading a	Reading b
X	Y	Y
Y	X	X