Regular expression (RE) -:

Regular expressions consist of constants, which denote sets of strings, and operator symbols, which denote operations over these sets.

The rules defining regular expression can be summarized as follows: -

1) **Ø** is a regular expression and denotes the empty set.
2) **ϵ** is a regular expression and denotes the set **{ϵ}**.
3) For all **a ϵ T**, a is a regular expression and denotes the set **{a}**.
4) If **r, s** are regular expressions denoting the languages L_r and L_s then: -
    a. **(r) + (s)** is RE denotes $L_r \cup L_s$.
    b. **(r). (s)** is RE denotes $L_r . L_s$.
    c. **(r)*** is RE denotes L_r

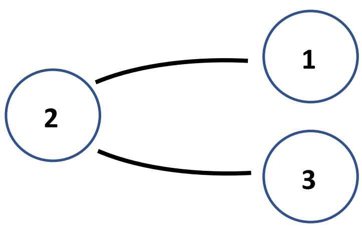
Example /

(a + b)* ba (ba)*

Graph: -

A graph, denoted G= (V, E), consists of a finite set of vertices (or node) V and a set of pairs of vertices ***E*** called ***edges***, this graph is **known undirected graph.**

Example /



V= {1,2,3}

E= { (1,2), (2,3)}

A path in a graph is a sequence of vertices v_1, v_2, ….. v_k, $k \geq 1$, such there edge (v_i, v_{i+1}) for each i, $1 \leq i \leq k$, the length of the path is k-1.

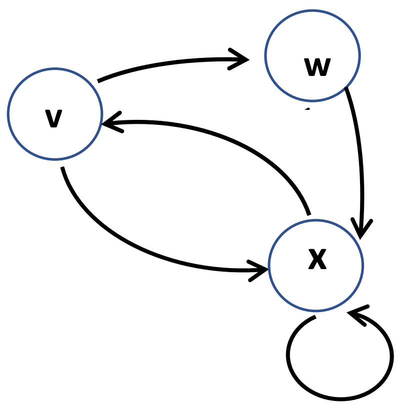
For example, 1,2,3 is a path of length 2.

A directed graph, also denoted **G= (V, E),** consists of a finite set of vertices **V** and a set of pairs of vertices **E** called **arcs**.

Example /

he graph G=(V,E) where ,

V_1= {v, w, x} and E_1= { (v, w), (v, x), (w, x), (x, v), (x, x) }.



A path in a directed graph is a sequences of vertices v_1 , v_2,….. v_k , $k \geq 1$,

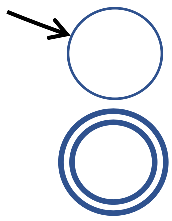
Such that $v_i \rightarrow v_{i+1}$, is an arc for each i , $1 \leq i \leq k$.

If **v** → **w** is an arc, we say **v** is **predecessor** of **w** and **w** is **successor** of **v**.

Transition graph to RE:-

The transition graph consists of:-

1. Nodes.
2. Directly labeled edge
3. Initial state denoted as:
4. Final state denoted as:

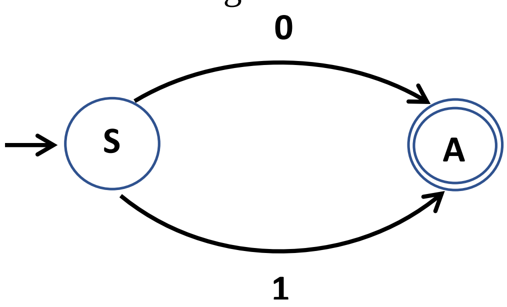


Example1 /

Draw the transition graph for the following RE= 0+1

Answer/

Transition graph is

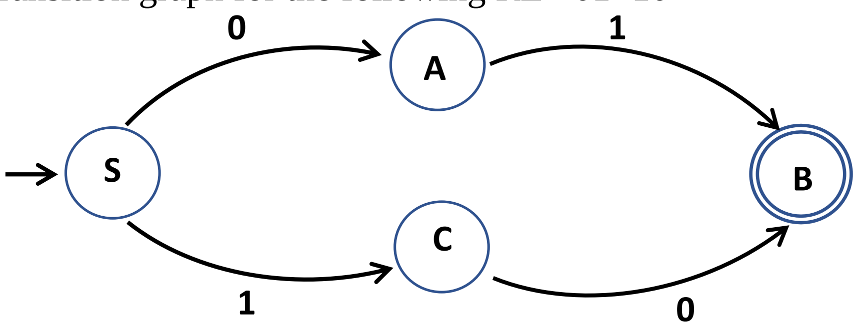


The production is P={ S → 0/1 }

Example2/

Draw the transition graph for the following RE= 01+10

Answer/

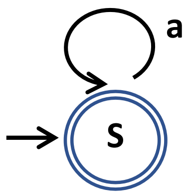


The production is P={ S → 0A/1C, A → 1, C → 0

Example3 /

Draw the transition graph for the following RE= a*

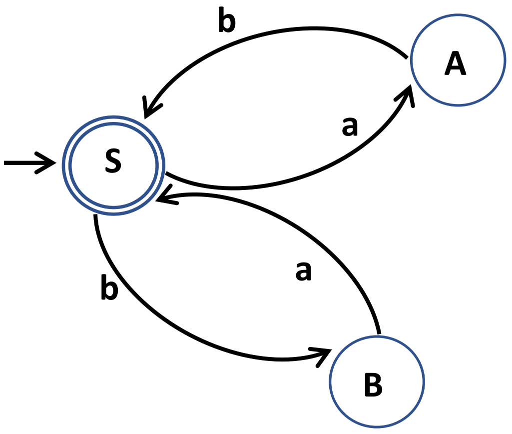
Answer/



Example4 /

Draw the transition graph for the following RE= (ab+ba)*

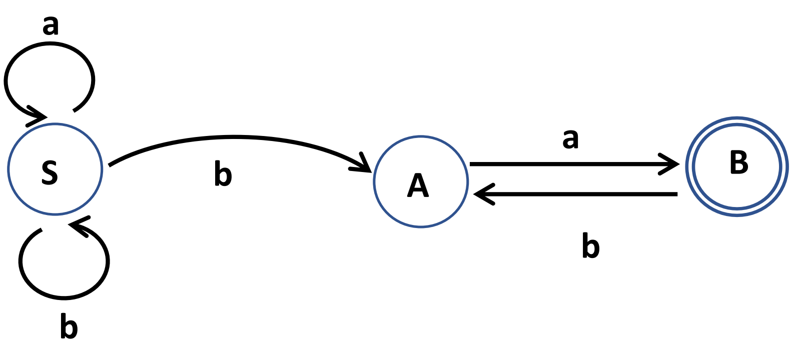
Answer/



Example5 /

Draw the transition graph for the following RE= (a+b)* ba (ba)*

Answer/



Examples5 /

1. RE= (a+b)

   Words= { a,b }
2. RE= (a+b)(a+b)

   Words= { aa, ab, ba, bb }
3. RE= (a+b)(a+b)(a+b)

   Words= { aaa, abb, aba, … }
4. RE= a* = {a,aa,aaa,aaaa,…..}

Examples6/

5. language: alphabet (a,b)

   All the words must start with b

Answer/

b(a+b)*

Note/

ba* ≠ (ba)*

Examples6/

At least one a

Answer

(a+b)* a (a+b)*

At least two a's

Answer/

(a+b)* a (a+b)* a (a+b)*

H.W/

Draw the transition graph for the following: -

1. RE= 0 0* 1
2. RE= (a+b)* abb
3. RE= ((abc)* (cba)*)*
4. RE= a. (ba+b)* + b
5. RE= 0*10*1(0+1)*
6. Exactly two a’s?
7. At least one a or at least one b?