APPLICATION OF GRAPH COLOR (EDGE COLOR) BY PARSE TREE

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Abstract - Graph coloring problem is one of the most popular areas in the field of graph theory and has a long and illustrious history. In a graph coloring, each edge of the graph is colored in such a manner that no two adjacent edges have the same color. So far there are several techniques are presented for edge coloring. In this paper, we propose an paper based on the parse tree, to color all the edges of the given graph with the minimum number of colors and we provide the explanation for the proposed paper. This paper helps us to determine the chromatic number of any graph.

Key Words: Parse tree, Edge coloring, Chromatic

I.INTRODUCTION

Graph coloring is one of the most important concepts in graph theory and is used in many real time applications in various fields. Various coloring methods are available and can be used on requirement basis. The proper coloring of a graph is the coloring of the vertices and edges with minimal number of colors such that no two vertices should have the same color. The minimum number of colors is called as the chromatic number and the graph is called properly colored graph. Many real – world situations can conveniently be described by means of a diagram consisting of a set of points together with lines joining certain pairs of these points. For example, the points could represent people with lines joining pair of friends. Notice that in such diagrams one is mainly interested in whether or not two given points are joined by a line; the manner in which they are joined is immaterial. A mathematical abstraction of situations of this type gives rise to the concept of graph . A k-edge colouring of a loop less graph G is an assignment of k colours,1,2,…,k, to the edges of G. The colouring is proper if no two distinct adjacent edges have the same colour.

A graph is a set of vertices and edges, the vertices being denoted by set V and edges by set E . Graph coloring has been studied as an algorithmic problem since the early 1970s. The first result about graph coloring deals almost exclusively with planar graphs in the form of the coloring of maps. Graph coloring problem belongs to the class of combinatorial optimization problem and studied due to its lot of application in the area of data science, networking, register allocation and many more. There are many types of coloring such as vertex coloring, edge coloring, total coloring, fractional coloring etc. A graph is said to be k – colorable if it can be colored by using k – colors and its chromatic number is k and the graph is called k – chromatic graph . An edge coloring of a graph is a proper coloring of the edges, which means an assignment of colors to edges so that no vertex is incident to edges of the same color. An edge coloring of a graph with k colors is called a k – edge coloring. The smallest number of colors needed for an edge coloring of a graph G is the edge chromatic number and it is denoted by $\chi'(G)$. Total coloring is a type of coloring of both the vertices and edges of a graph. Total coloring is a type of coloring of both the vertices and edges of a graph. Total coloring is always assumed to be proper in the sense that no adjacent vertices, no adjacent edges and no edge and its end vertices are assigned the same color. The total chromatic number of a graph G is the fewest colors needed in any total coloring of G and is denoted by $\chi''(G)$. David S. Johnson et al presented the simulated annealing schemes for graph coloring . Daniel Brelaz presented the new methods to color the vertices of a graph . One of the algorithms uses the machine based learning for graph coloring problem and used 78 identified features for that problem . Amit Mittal et al described a method for graph coloring with minimum number of colors and it takes less time as compared to other techniques.

II. BASIC DEFINITION

Graph coloring is one of the well known parameter in graph theory and many researchers introduced different types of coloring of which vertex coloring is one among them. Although a graph is the pictorial representation of a real – world problem.

2.1 Graph

A graph is determined as a mathematical structure that represents a particular function by connecting a set of points. It is used to create a pairwise relationship between objects. The graph is made up of vertices (nodes) that are connected by the edges (lines).

2.2 Proper Edge Coloring

A proper edge coloring of a graph is an edge coloring such that no two adjacent edges are assigned the same color.

2.3 Edge Coloring

An edge coloring of a graph G is a function $f : E(G) \rightarrow C$, where C is a set of distinct colors. For any positive integer k, a k-edge coloring is an edge coloring that uses exactly k different colors.

2.4 Chromatic Number

In a graph, no two adjacent vertices, adjacent edges, or adjacent regions are colored with minimum number of colors. This number is called the chromatic number and the graph is called a properly colored graph.

2.5 Parse tree

A parse tree or parsing tree or derivation tree or concrete syntax tree is an ordered, rooted tree that represents the syntactic structure of a string according to some context-free grammar.

2.6 Context-free grammar

A context-free grammar is a set of recursive rules used to generate patterns of strings. A context-free grammar can describe all regular languages and more, but they cannot describe all possible languages. Context-free grammars are studied in fields of theoretical computer science, compiler design, and linguistics.

III. USING EDGE COLOR BY PARSE TREE

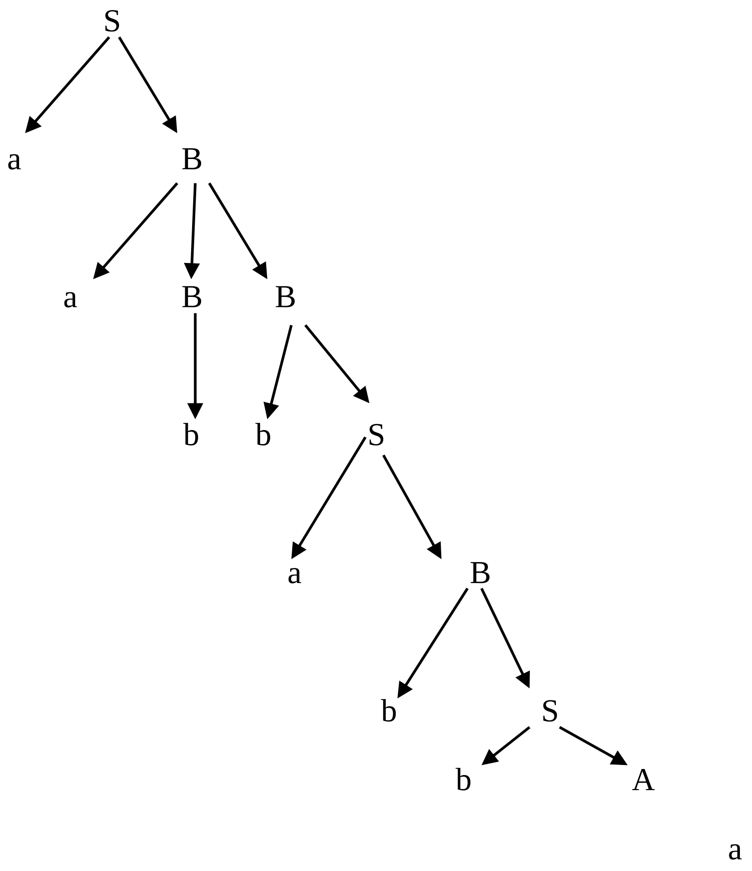
The string " aabbabba " using parse tree for following context free grammer

$$S \rightarrow aB \mid bA$$

$$A \rightarrow a \mid aS \mid bAA$$

$$B \rightarrow b \mid bS \mid aBB$$

PARSE TREE :



Take the parse tree (S, A, B, a, b) to be the vertices

$$V = \{ v_1, v_2, v_3, v_4, v_5 \}$$

Then edges of the parse tree is $E = \{ e_1, e_2, e_3, e_4, e_5, e_6, e_7 \}$

vertices	Parse tree
v_1	S
v_2	A
v_3	B
v_4	a
v_5	b

Edges	Connected vertices
e_1	$V_1 \rightarrow V_3$
e_2	$V_4 \rightarrow V_3$
e_3	$V_4 \rightarrow V_5$
e_4	$V_1 \rightarrow V_4$
e_5	$V_1 \rightarrow V_5$
e_6	$V_1 \rightarrow V_2$
e_7	$V_2 \rightarrow V_3$

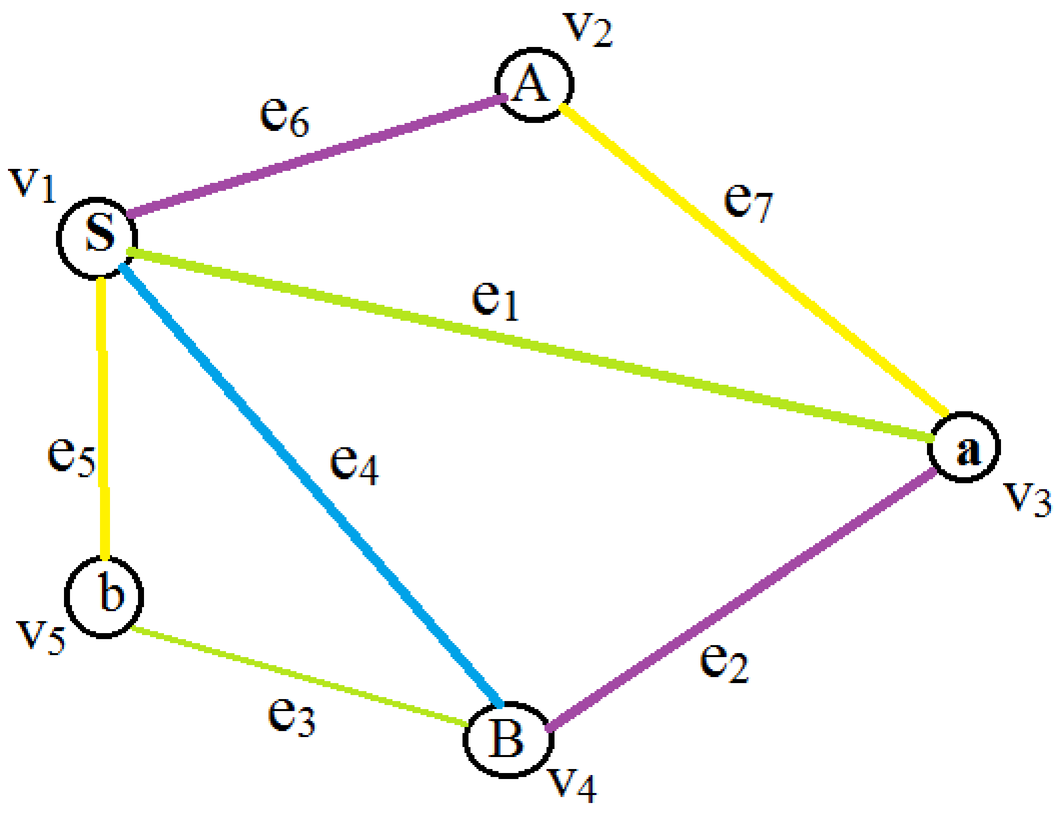
Slot:1 Green Color- e_1 and e_3

Slot:2 Violet Color- e_2 and e_6

Slot:3 Yellow Color- e_5 and e_7

Slot:4 Blue Color- e_4

Graph for parse tree:



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Explanation :

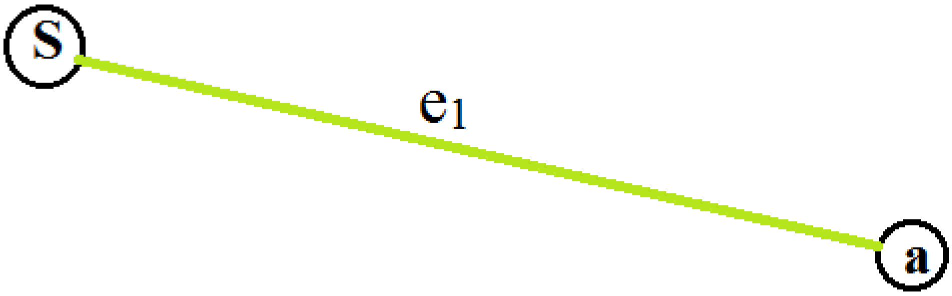
Take the parse tree (S, A, B, a, b) to be the vertices

$$V = \{ v_1, v_2, v_3, v_4, v_5 \}$$

Then edges of the parse tree is $E = \{ e_1, e_2, e_3, e_4, e_5, e_6, e_7 \}$

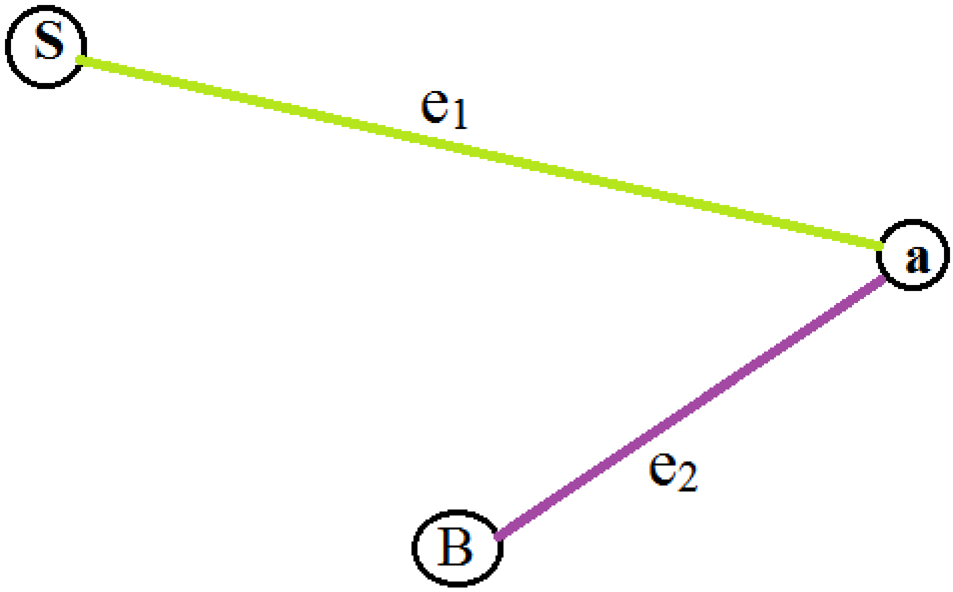
Start giving coloring on the Edges,

(i) Plotting Green color for the Edge e_1 which between V_1 and V_3



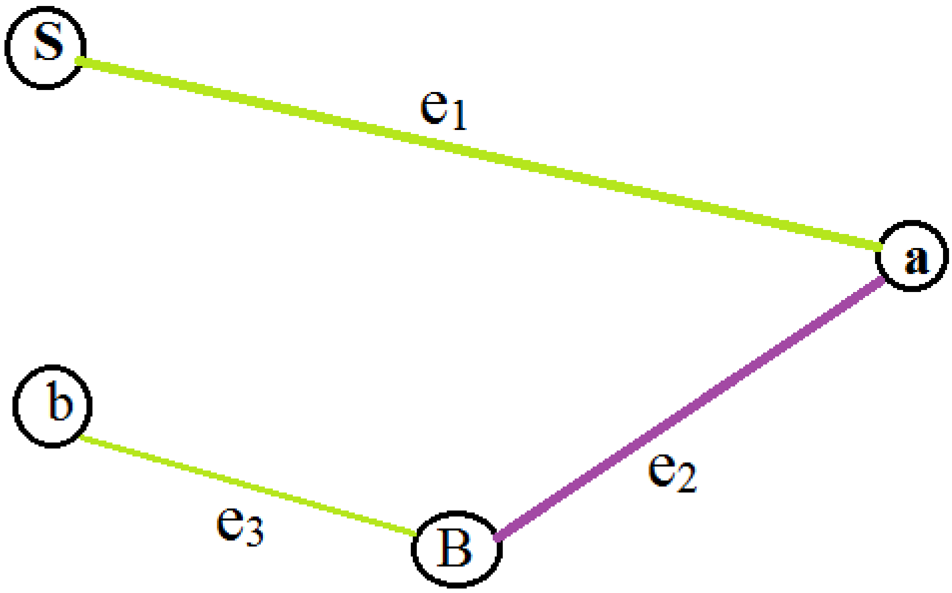
Here V_1 represents S and V_2 represents A.

(ii) Now, move on e_2, e_2 is connect by V_4 and V_3 which is shows the figure given below



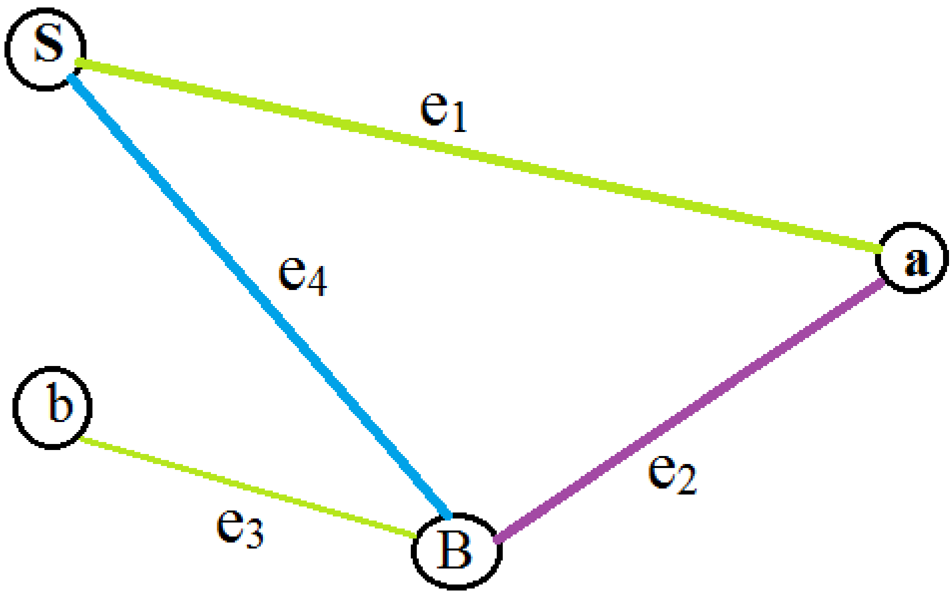
Here V_4 and V_3 represents B and s. The graph of parse tree B is tends to a.

(iii) From extend the figure to move onto e_3 ,



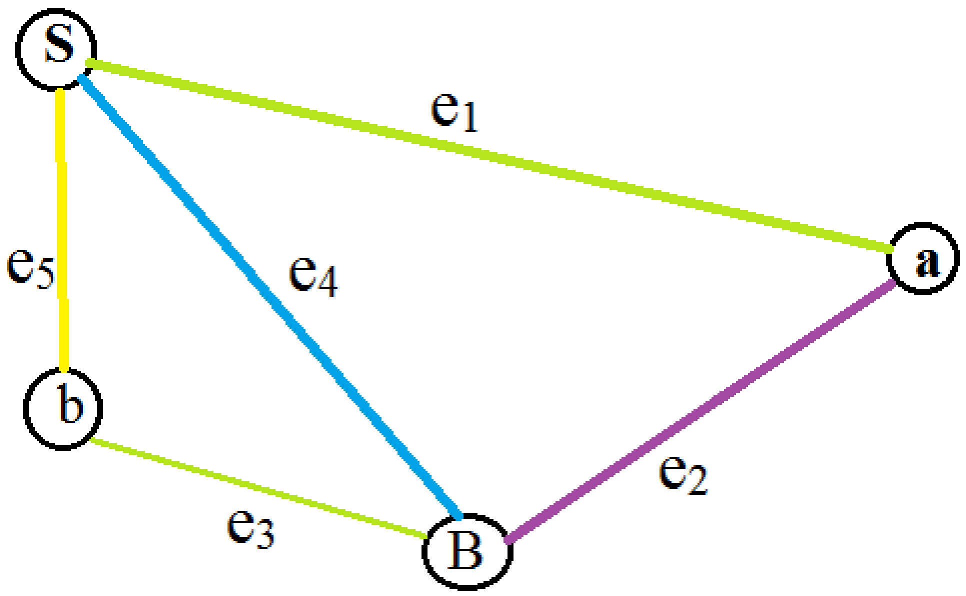
v_4 and v_5 connecting by edge which is e_3. The Above figure shows that the parse tree of a graph is the edge between B $\rightarrow$ b.

(iv) Then forward to e_4,



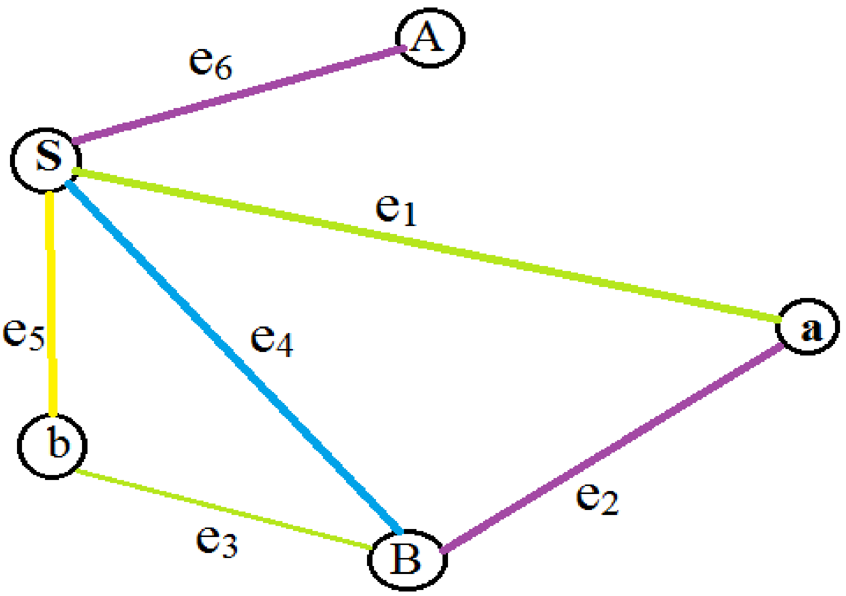
The graph is mentioned the path between S and B.

(v) Here the graph of e_5 is connecting by S and b



Edge e_5 is the path of the parse tree of a graph.

(vi) Now, move on e_6, e_6 is connect by V_1 and V_2 which is shows the figure given below



Here V_1 and V_2 represents the path between S and A. The graph of parse tree S is tends to A.

(vii) From extend the graph to e_7 ,

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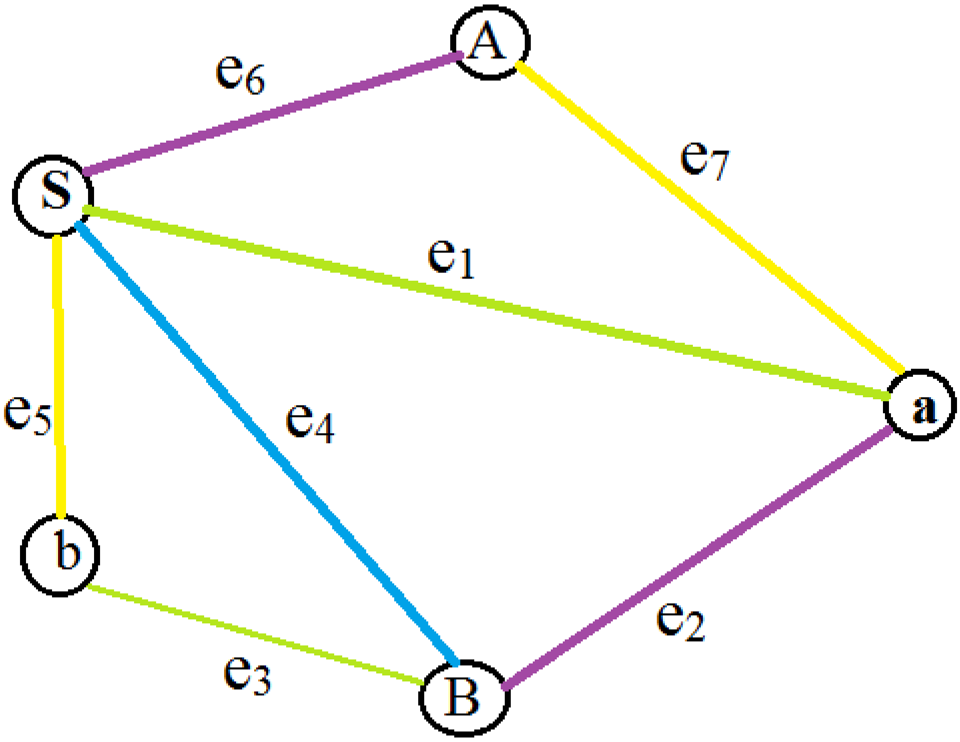
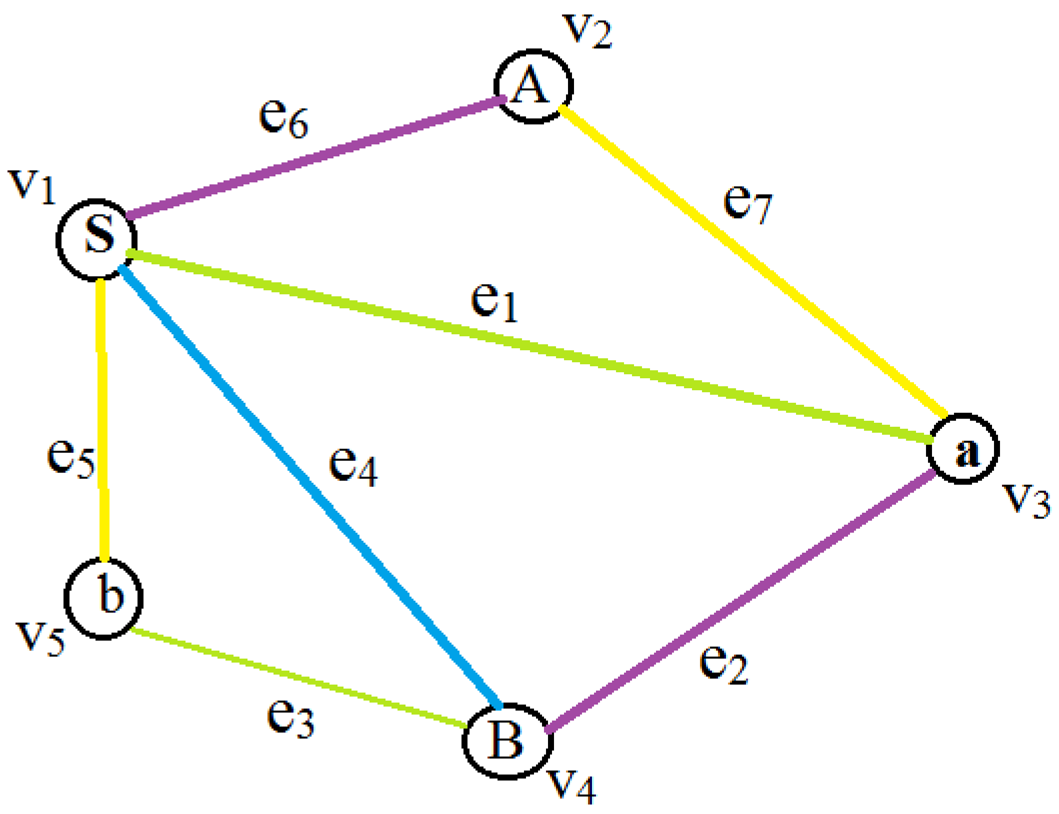


V_2 and v_3 connecting by edge which is e_7. The Above figure shows that the parse tree of a graph is the edge between A → a.

Giving the name for vertices



(viii) Therefore, hence the chromatic number **χ (G) =5.**

IV. CONCLUSIONS

Here I conclude this paper discussion with the topic of Application of graph color (Edge color) by parse tree and how to applying parse tree in graph with explanation.

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BIOGRAPHIES (Optional not mandatory)

I am M.Kanya and I am studying M.Sc.Mathematics. I love Mathematics. I realize without maths there is nothing because maths is all. Upcoming days I want to publish many papers which is there in maths.