# Four Colouring Problem Applying in Tamilnadu (District) 

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#### Abstract

Graph coloring problem is one of the most popular areas in the field of Graph theory and gas a long and illustrious history and by using four color problem. In graph coloring, each vertex of the graph is colored in such a manner that no two adjacent vertices have the same color. So far there are several techniques are presented for vertex coloring. In this paper, we propose an algorithm based on the four color problem, to colored all the vertices o the given graph with the minimum number of four colors used and the provide the numerical examples for four color apply to Tamilnadu districts proposed algorithm this algorithm helps us to determine the chromatic number of any graph.


Key Words: vertex coloring, chromatic number of the graph.

## 1. INTRODUCTION:

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 if friends notice that in such diagrams are is mainly interested in whether (or) not two given points are points are joint by a line. The manner in which they are joint is immaterial. A mathematical abstraction of situation of this type gives rise to the concept of graph [1]. A graph is a set of vertices and edges, the vertices being denoted by set V and edges by set E [2]. Graph coloring has been studied as an algorithm problem since the early 1970's. The first result about graph coloring deals almost exclusively with planner graphs in the forms 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, net working, register allocation and many more. There are many types total coloring such as four coloring, vertex coloring, edge coloring, total coloring, fractional coloring etc.

Four coloring problem can be defined as to assign the color to every vertex of the graph by keeping the constraints that no two adjacent vertices receives the same color such that the number of colors assigned to the vertices should be minimum. The minimum number of colors that will be used to colour the vertices of the given graph G is called the chromatic number of the graph and it is denoted by $\chi(\mathrm{G})$ [3].

On the greedy algorithms which mostly uses the techniques of deciding the color of vertices sequentially in the four coloring process [2]. Greedy algorithm gives the minimum number of colors for vertex coloring but it need not to be a chromatic number [That only used for four colors]. Tabu search techniques provide the optimal coloring of a graph [4]. David S. Johnson et al presented the simulated annealing schemes for graph coloring [5]. Daniel Brelaz presented the new methods to color the vertices of a graph [6] one of the algorithm uses the machine based learning for graph coloring problem and used 78 identified features for that problem [7]. Amit mittal et al described a method for graph coloring with minimum number of four colors and it takes less time as compared to other techniques [8]. K A Santosa et al, presented the vertex coloring using adjacency matrix [10]. In this paper we propose an algorithm to find the proper coloring of graph using Tamilnadu district which is different from the algorithm proposed by [10], also to suit all types of graph.

## 2. DEFINITION:

Painting all the vertices of a graph with colours such that no two adjacent vertices have the same colour is called the proper coloring or simply coloring of a graph. A graph in which every vertex has been assigned a color according to a proper coloring is called a proper colored graph. A graph G that requires k different colors for its proper coloring, and no less, is called a k - chromatic graph, and the number k is called the chromatic number of G .

## 3. Four Colouring Problem Applying in Tamilnadu (District) - Algorithm :

Step: 1
Use graph coloring to determine the least number of colors that can be used to color the map of Tamilnadu so that district with common boundaries have different colors.
Step: 2

- Assign a label to each district. These will be your vertices.
- Label degrees.
- Start coloring with middle degree vertex

Step: 3 PROBLEM SOLVING STRATEGY

- Assign to each district. These will be your vertices.
- Use edges to connect the vertices of districts that share borders.
- Use the procedure for coloring a graph.

Step: 4
The color of each region is the color of the corresponding vertex.
Step: 5
The result is a 4-color graph. In turns out that four colors are necessary for this map although other configurations are possible.
Step: 6
Hence we applied with minimum four color. But not applicable to three colors.
Step: 7
Since satisfies that four colour problem and chromatic number.

$$
\chi(\mathrm{G})=4
$$

## 4. Explain Four Color Problems Applying in Tamil Nadu Districts:

Consider TN district map.


Let us denote Nilagiri district as red colour.


- No two adjacent vertices have same color, so we choose Erode as blue and Coimbatore as green colour.
- Tripur is not adjacent to Nilagiri, so we denote the same red colour.
- By using the above algorithm we denote yellow colour for Dindigul.
- As karur is surrounded by adjacent colours red, blue and yellow, so we use green colour for karur.
- With this algorithm we fill up the whole TN districts


1. Here, we applied for minimum four colours (red, green, blue, yellow). Hence, it can't be apply for three colours.

2. Since it satisfies four colour theorem and chromatic number.
3. $\chi(\mathrm{G})=4$.

## 5. CONCLUSION:

In this paper we discussed with how to apply for four colours using by Tamilnadu districts with no adjacency and proof of explanation.

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