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# DESIGN AND ANALYSIS OF ALGORITHMS

## LAB III SEMESTER

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Practical No. : 08

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Section : A4\_B3

Roll No : 43

**Aim:** Implement Graph Colouring algorithm using Graph colouring concept.

### **Problem Statement:**

A GSM is a cellular network with its entire geographical range divided into hexadecimal cells. Each cell has a communication tower which connects with mobile phones within the cell. Assume this GSM network operates in different frequency ranges. Allot frequencies to each cell such that no adjacent cells have the same frequency range.

**Code :**

```
#include <stdio.h>
```

```

#define MAX 10

int n;
int m;
int G[MAX][MAX];
int x[MAX];

void NextValue(int k)
{
    int j;

    while (1)
    {
        x[k] = (x[k] + 1) % (m + 1);

        if (x[k] == 0)
            return;

        for (j = 1; j <= n; j++)
        {
            if (G[k][j] != 0 && x[k] == x[j])
                break;
        }

        if (j == n + 1)
            return;
    }
}

void mColoring(int k)
{
    while (1)
    {
        NextValue(k);

        if (x[k] == 0)
            return;

        if (k == n)
        {
            printf("\nValid coloring: ");
            for (int i = 1; i <= n; i++)
                printf("%d ", x[i]);
        }
        else
    }
}

```

```

        {
            mColoring(k + 1);
        }
    }
}

int main()
{
    int i, j;
    char ch = 65;

    printf("Enter number of vertices: ");
    scanf("%d", &n);

    printf("Enter adjacency matrix (%d x %d):\n", n, n);
    for (i = 1; i <= n; i++)
    {
        for (j = i; j <= n; j++)
        {
            if (i != j)
            {
                printf("[%c][%c] = ", ch + i - 1, ch + j - 1);
                scanf("%d", &G[i][j]);
                G[j][i] = G[i][j];
            }
            else
            {
                G[i][j] = 0;
            }
        }
    }

    printf("Enter number of colors: ");
    scanf("%d", &m);

    for (i = 1; i <= n; i++)
        x[i] = 0;

    printf("\nAll possible valid colorings:\n");
    mColoring(1);

    return 0;
}

```

### Test Case 1:

```

Enter number of vertices: 6
Enter adjacency matrix (6 x 6):
[A][B] = 1
[A][C] = 1
[A][D] = 0
[A][E] = 1
[A][F] = 1
[B][C] = 1
[B][D] = 0
[B][E] = 0
[B][F] = 0
[C][D] = 1
[C][E] = 0
[C][F] = 1
[D][E] = 1
[D][F] = 0
[E][F] = 1
Enter number of colors: 3

All possible valid colorings:


Valid coloring: 1 --> 2 --> 3 --> 1 --> 3 --> 2
Valid coloring: 1 --> 2 --> 3 --> 2 --> 3 --> 2
Valid coloring: 1 --> 3 --> 2 --> 1 --> 2 --> 3
Valid coloring: 1 --> 3 --> 2 --> 3 --> 2 --> 3
Valid coloring: 2 --> 1 --> 3 --> 1 --> 3 --> 1
Valid coloring: 2 --> 1 --> 3 --> 2 --> 3 --> 1
Valid coloring: 2 --> 3 --> 1 --> 2 --> 1 --> 3
Valid coloring: 2 --> 3 --> 1 --> 3 --> 1 --> 3
Valid coloring: 3 --> 1 --> 2 --> 1 --> 2 --> 1
Valid coloring: 3 --> 1 --> 2 --> 3 --> 2 --> 1
Valid coloring: 3 --> 2 --> 1 --> 2 --> 1 --> 2
Valid coloring: 3 --> 2 --> 1 --> 3 --> 1 --> 2
PS D:\Sem_III\DAA_Laboratory>

```

## Test Case 2:

```
● Enter number of vertices: 5
Enter adjacency matrix (5 x 5):
[A][B] = 1
[A][C] = 1
[A][D] = 1
[A][E] = 1
[B][C] = 1
[B][D] = 1
[B][E] = 1
[C][D] = 1
[C][E] = 1
[D][E] = 1
Enter number of colors: 1

All possible valid colorings:
○ PS D:\Sem_III\DAA_Laboratory> █
```

</> ProblemEditorialSubmissionsComments

### M-Coloring Problem

Difficulty: MediumAccuracy: 34.42%Submissions: 176K+Points: 4Average Time: 45m

You are given an undirected graph consisting of **V** vertices and **E** edges represented by a list **edges[][]**, along with an integer **m**. Your task is to determine whether it is possible to **color the graph** using at most **m** different colors such that no two adjacent vertices share the **same color**. Return true if the graph can be colored with at most **m** colors, otherwise return false.

**Note:** The graph is indexed with 0-based indexing.

Python3 Start Timer

```
1 class Solution:
2     def graphColoring(self, v, edges, m):
3
4         adj = [[] for _ in range(v)]
5         for u, w in edges:
6             adj[u].append(w)
7             adj[w].append(u)
8
9
10        color = [0] * v
11
12
13        def isSafe(node, c):
14            for neighbor in adj[node]:
15                if color[neighbor] == c:
16                    return False
17            return True
18
19
20        def solve(node):
21
22            if node == v:
23                return True
24
25
26            for c in range(1, m + 1):
27                if isSafe(node, c):
28                    color[node] = c
29                    if solve(node + 1):
30                        return True
31                    color[node] = 0
32
33            return False
34
35
36        return solve(0)
37
```

Compilation Results Custom Input Y.O.G.I. (AI Bot)

Problem Solved Successfully

[Suggest Feedback](#)

Test Cases Passed <b>1114 / 1114</b>	Attempts : Correct / Total <b>1 / 1</b> Accuracy : 100%
Points Scored <b>4 / 4</b> Your Total Score: 16	Time Taken <b>0.04</b>

Link :

<https://www.geeksforgeeks.org/problems/m-coloring-problem-1587115620/1>