DAA Practical 8

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Section- A6 / B3

Rollno- 49

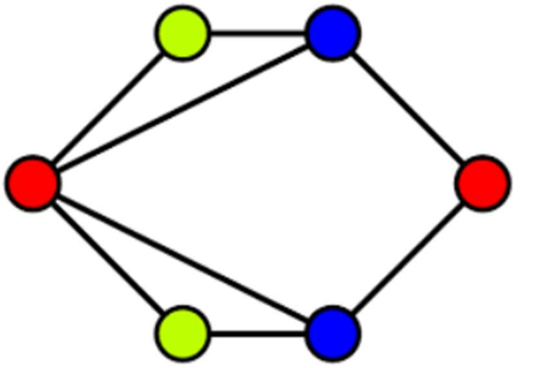
Aim: Implement Graph Colouring algorithm use Graph colouring concept.

Problem Statement:

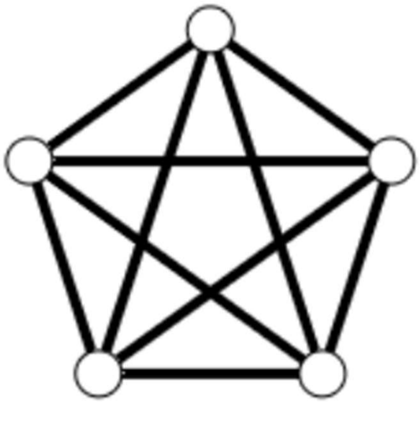
A GSM is a cellular network with its entire geographical range divided into hexadecimal cells. Each cell has a communication tower which connects with mobile phones within cell. Assume this GSM network operates in different frequency ranges. Allot frequencies to each cell such that no adjacent cells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

Consider an undirected graph G = (V, E) shown in fig. Find the colour assigned to each node using Backtracking method. Input is the adjacency matrix of a graph G(V, E), where V is the number of Vertices and E is the number of edges.

Graph 1:



Graph 2:



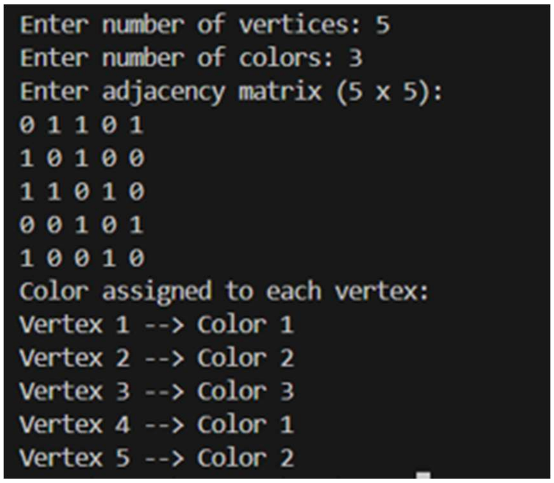
CODE-

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

#define MAX 20

bool isSafe(int v, int graph[MAX][MAX], int color[], int c, int V) {
    for (int i = 0; i < V; i++) {
    if (graph[v][i] && color[i] == c)
    return false;
    }
    return true;
}

bool graphColoringUtil(int graph[MAX][MAX], int m, int color[], int v, int V) {
    if (v == V)
    return true;

    for (int c = 1; c <= m; c++) {
    if (isSafe(v, graph, color, c, V)) {
    color[v] = c;
    if (graphColoringUtil(graph, m, color, v + 1, V))
        return true;
    color[v] = 0;
    }
    }
    return false;
}

void graphColoring(int graph[MAX][MAX], int m, int V) {
    int color[MAX];
    for (int i = 0; i < V; i++)
    color[i] = 0;

    if (!graphColoringUtil(graph, m, color, 0, V)) {
   printf("No solution exists using %d colors.\n", m);
    return;
    }

    printf("Color assigned to each vertex:\n");
    for (int i = 0; i < V; i++)
   printf("Vertex %d --> Color %d\n", i + 1, color[i]);
}
```

```
int main() {
        int V, m;
        int graph[MAX][MAX];

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

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

        printf("Enter adjacency matrix (%d x %d):\n", V, V);
        for (int i = 0; i < V; i++) {
        for (int j = 0; j < V; j++) {
        scanf("%d", &graph[i][j]);
        }
        }

   graphColoring(graph, m, V);
        return 0;
}
```

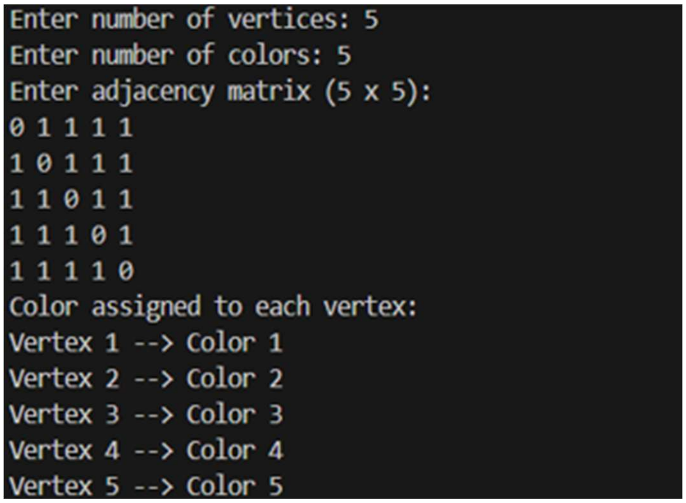
OUTPUT-

For graph 1-



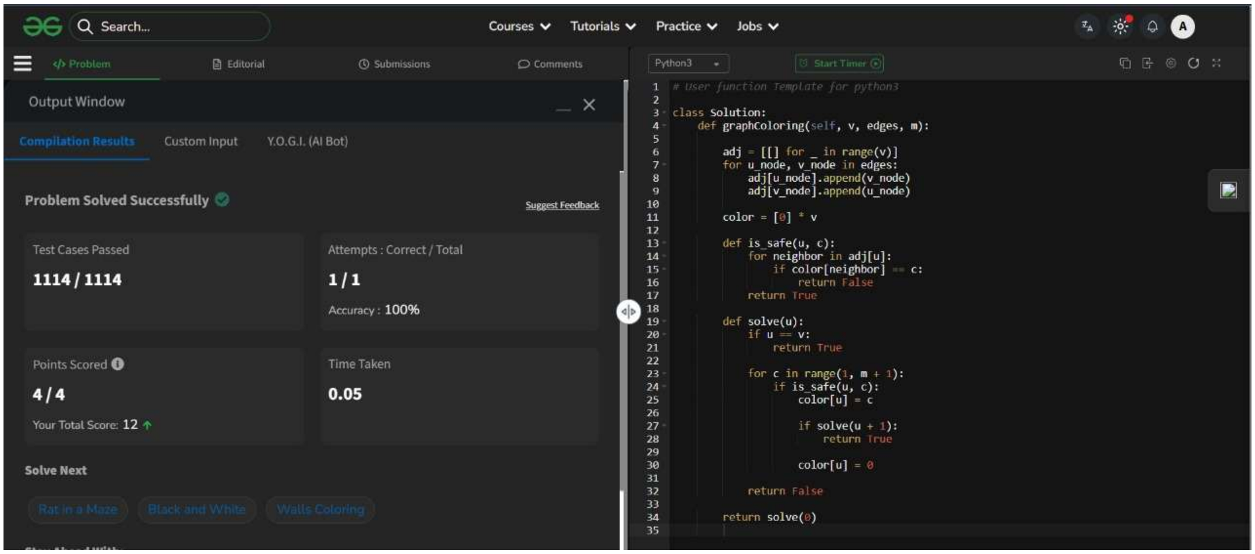
```
Enter number of vertices: 5
Enter number of colors: 3
Enter adjacency matrix (5 x 5):
0 1 1 0 1
1 0 1 0 0
1 1 0 1 0
0 0 1 0 1
1 0 0 1 0
Color assigned to each vertex:
Vertex 1 --> Color 1
Vertex 2 --> Color 2
Vertex 3 --> Color 3
Vertex 4 --> Color 1
Vertex 5 --> Color 2
```

For graph 2-



```
Enter number of vertices: 5
Enter number of colors: 5
Enter adjacency matrix (5 x 5):
0 1 1 1 1
1 0 1 1 1
1 1 0 1 1
1 1 1 0 1
1 1 1 1 0
Color assigned to each vertex:
Vertex 1 --> Color 1
Vertex 2 --> Color 2
Vertex 3 --> Color 3
Vertex 4 --> Color 4
Vertex 5 --> Color 5
```

GFG :



Problem Solved Successfully

Test Cases Passed
1114 / 1114

Attempts : Correct / Total
1 / 1
Accuracy : 100%

Points Scored
4 / 4
Your Total Score: 12

Time Taken
0.05

```python
# User function Template for python3

class Solution:
    def graphColoring(self, v, edges, m):

        adj = [[] for _ in range(v)]
        for u_node, v_node in edges:
            adj[u_node].append(v_node)
            adj[v_node].append(u_node)

        color = [0] * v

        def is_safe(u, c):
            for neighbor in adj[u]:
                if color[neighbor] == c:
                    return False
            return True

        def solve(u):
            if u == v:
                return True

            for c in range(1, m + 1):
                if is_safe(u, c):
                    color[u] = c

                    if solve(u + 1):
                        return True

                    color[u] = 0

            return False

        return solve(0)

```