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Session: 2023-2024

Design and Analysis of Algorithms Lab

V Semester

PRACTICAL NO. 8

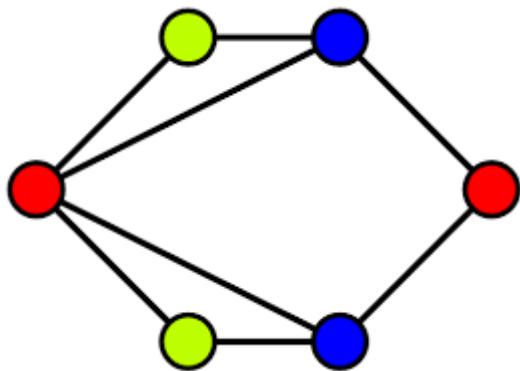
Aim: Implement Graph Colouring algorithm use Graph colouring concept.

Problem Statement:

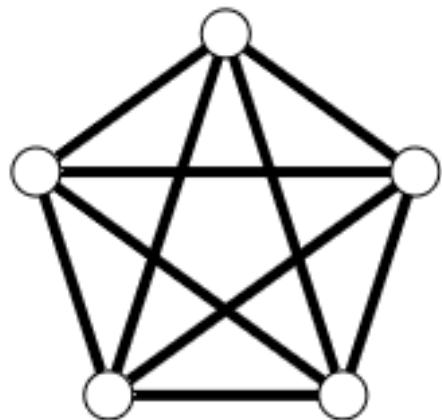
A GSM is a cellular network with its entire geographical range divided into hexadeciml cells. Each cell has a communication tower which connects with mobile phones within cell. Assume this GSM network operates in different frequency ranges. Allot frequencies to each cell such that no adjacent cells have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

int graph[MAX][MAX];
int color[MAX];
int v;
int m;

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

```
    return true;
}

bool graphColoringUtil(int v) {
    if (v == V)
        return true;

    for (int c = 1; c <= m; c++) {
        if (isSafe(v, c)) {
            color[v] = c;

            if (graphColoringUtil(v + 1))
                return true;

            color[v] = 0;
        }
    }

    return false;
}

bool graphColoring() {
    for (int i = 0; i < V; i++)
        color[i] = 0;

    if (!graphColoringUtil(0))
        return false;
}
```

```
    printf("\nSolution does Not Exist.\n");

    return false;
}

printf("\nColor Assigned to Each Vertex:\n");

for (int i = 0; i < V; i++)

    printf("Vertex %d ---> Colour %d\n", i + 1, color[i]);

return true;

}

int main() {

    printf("Enter the Number of Vertices: ");

    scanf("%d", &V);

    printf("Enter the 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]);
        }
    }

    printf("Enter the Number of Colors Available: ");

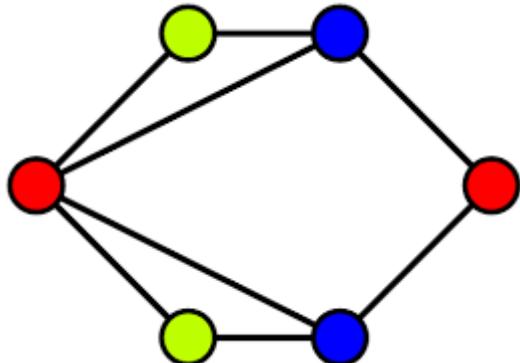
    scanf("%d", &m);

    graphColoring();
}
```

```
    return 0;  
}
```

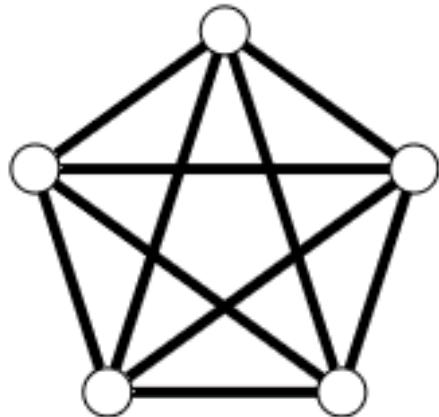
Output:

Graph 1:



```
Enter the Number of Vertices: 6  
Enter the Adjacency Matrix (6 x 6):  
0 1 1 0 1 1  
1 0 1 0 0 0  
1 1 0 1 0 0  
0 0 1 0 1 0  
1 0 0 1 0 1  
1 0 0 0 1 0  
Enter the Number of Colors Available: 3  
  
Color Assigned to Each Vertex:  
Vertex 1 ---> Colour 1  
Vertex 2 ---> Colour 2  
Vertex 3 ---> Colour 3  
Vertex 4 ---> Colour 1  
Vertex 5 ---> Colour 2  
Vertex 6 ---> Colour 3
```

Graph 2:



```
Enter the 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
Enter the Number of Colors Available: 5

Color Assigned to Each Vertex:
Vertex 1 ---> Colour 1
Vertex 2 ---> Colour 2
Vertex 3 ---> Colour 3
Vertex 4 ---> Colour 4
Vertex 5 ---> Colour 5
```

GFG Output:

The screenshot shows a solved problem on the GeeksforGeeks (GFG) platform. The problem involves graph coloring for a complete graph K5. The user has provided the adjacency matrix and the number of colors available. The output shows the color assigned to each vertex: Vertex 1 (Colour 1), Vertex 2 (Colour 2), Vertex 3 (Colour 3), Vertex 4 (Colour 4), and Vertex 5 (Colour 5). The code provided is a Python solution for the graph coloring problem using a backtracking approach.

```
1- class Solution:
2-     def graphColoring(self, V, edges, m):
3-         adj = [[0]*V for _ in range(V)]
4-         for u, v in edges:
5-             adj[u][v] = adj[v][u] = 1
6-
7-         color = [0]*V
8-
9-         def isSafe(node, c):
10-             for k in range(V):
11-                 if adj[node][k] == 1 and color[k] == c:
12-                     return False
13-             return True
14-
15-         def solve(node):
16-             if node == V:
17-                 return True
18-             for c in range(1, m+1):
19-                 if isSafe(node, c):
20-                     color[node] = c
21-                     if solve(node+1):
22-                         return True
23-                     color[node] = 0
24-
25-             return False
26-
27-         return solve(0)
```