

TASK:6

Solve a Map Coloring problem using constraint satisfaction approach by applying following constraints

AIM

To implement a graph coloring algorithm that assigns colors to university departments in such a way that no two neighboring nodes share the same color, using Python

ALGORITHM

- 1: Start the program.
- 2: Represent the departments/districts as a **graph**, where nodes represent departments and edges represent adjacency (neighbors).
- 3: Define the set of available **colors** (e.g., Red, Green, Blue).
- 4: Initialize an empty **assignment** to keep track of the color chosen for each department.
- 5: Create a function `is_safe(dept, color)` that checks whether assigning a particular color to a department is valid (i.e., no neighbor has the same color).
- 6: Create a recursive function `assign_colors(departments, index)` that tries to assign colors to each department.
- 7: If all departments are assigned a valid color (`index == total departments`), return success.
- 8: For the current department, try each available color:
 - If safe, assign it temporarily and move to the next department.
 - If not safe, try the next color.
- 9: If no color can be assigned, backtrack by removing the assignment and return failure.
- 10: After recursion finishes, print the assigned colors if successful, else print that no valid coloring is possible.

PROGRAM

University Departments Decoration

Departments adjacency (Graph as dictionary)

```
graph = {  
    "A": ["B", "C", "D"],  
    "B": ["A", "C"],  
    "C": ["A", "B", "D"],  
    "D": ["A", "C"]  
}
```

Available theme colors

```
colors = ["Red", "Green", "Blue"]
```

Store final assignment

```
assignment = {}
```

Check if assigning a color is safe

```
def is_safe(dept, color):  
    for neighbor in graph[dept]:  
        if neighbor in assignment and assignment[neighbor] == color:  
            return False  
    return True
```

Backtracking function

```
def assign_colors(departments, index=0):  
    if index == len(departments):  
        return True  
  
    dept = departments[index]  
  
    for color in colors:  
        if is_safe(dept, color):  
            assignment[dept] = color  
            if assign_colors(departments, index + 1):
```

```
        return True
    assignment.pop(dept) # backtrack
```

```
return False
```

```
# Main
```

```
departments = list(graph.keys())
```

```
if assign_colors(departments):
```

```
    print("✅ Valid theme coloring found:")
```

```
    for dept, color in assignment.items():
```

```
        print(f"Department {dept} → {color}")
```

```
else:
```

```
    print("❌ No valid coloring possible.")
```

OUTPUT:

```
===== RESTART: C:/Users/manikanta/OneDrive/Desktop/vtu26123/Task_6.py ===  
[✓] Valid theme coloring found:  
Department A → Red  
Department B → Green  
Department C → Blue  
Department D → Green  
|
```

RESULT

Thus, the implementation a graph coloring algorithm that assigns colors to university departments in such a way that no two neighboring nodes share the same color, using Python was successfully executed and output was verified.