Assignment 3

NQueen & Graph Colouring Problem

⇒ Problem Statement: Solve NQueen and graph coloring problems using both back tracking and branch & bound techniques.

⇒ Theory:

1) N Queen Problem: The N-queen puzzle is the problem of placing n queens on an nxn chessboard such that no two queens attack each other.

Solution: The idea is to place queen one by one in different columns starting from the leftmost column. when we place a queen in a column, we check for clashes with already placed queen. In the current column, if we find a row for which there is no clash, we mark this row and column as a part of the solution. If we do not find such a row due to clashes then we backtrack and return false.

- Algorithm:

1) Start with the leftmost column
2) If all queens are placed, return true.
3) Try all rows in the current column
   Do following for every tried row:
   a. If the queen can be placed safely in this row, then mark this [row, column] as part of the solution and recursively check if placing queen there leads to a solution.
   b. If placing the queen in a raw leads to solution - then return true.
   c. If placing queen doesn't lead to a solution then unmark this [row, column] and go a step a & try other row.
4) If all rows have been tried and nothing worked, return false to trigger backtracking.

2) Graph Coloring Problem: It involves assigning colors to certain elements of a graph subject to certain restrictions and constraints. In other words, the process of assigning colors to the vertex such that no two adjacents have same color is called graph coloring problem.

Approach: In this, the idea is to color a vertex and while coloring any adjacent vertex, choose a different color similarly color every possible vertex following the restriction till any further vertex is left for coloring.

In any case, if all adjacent vertices for a given vertex are colored, then backtrack and change color.

If after coloring, if we return back to same vertex that we started with and all colors are used, then more colors are needed. Hence return false.

- Algorithm:

1) Consider a color and check if it is valid i.e. from the given vertex check whether its adjacent vertices have been colored with the same color.
2) If true, pick a different color
3) Else, continue coloring the vertices
4) If no other color is left unused, then backtrack.

⇒ Conclusion : N-Queen and Graph Coloring problem was solved using backtracking and branch and bound techniques.