**VISHWAKARMA INSTITUTE OF TECHNOLOGY**

COMPUTER ENGINEERING

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**Subject: Artificial Intelligence (AI)**

**LAB ASSIGNMENT NO – 4**

Implementation of **N-Queens Problem** as a Constraint Satisfaction Problem.

*The N-Queens problem is a classic Constraint Satisfaction Problem (CSP) where you need to place N queens on an N×N chessboard in such a way that no two queens threaten each other. This means no two queens can be in the same row, column, or diagonal.*

**Approach - Backtracking:**

1. Begin with the first column, which represents a variable.
2. For each row in the current column's domain:
3. Check if placing a queen in this row violates any of the established constraints. If it does, proceed to the next row.
4. When a valid row is found, assign it to the current column and move on to the next column.
5. If you reach a column where it's impossible to place a queen without breaking the constraints, backtrack to the previous column and explore the next row.
6. Keep following this process until you've successfully placed N queens on the chessboard, achieving a solution, or determine that no solution exists.

**Code:**

*#include*<bits/stdc++.h>

using namespace std;

bool isSafe(int col, int row, int n, vector<vector<int>>& v){

*for*(int i = row-1; i >= 0; i--){

*if*(v[i][col] == 1) *return* false;

    }

*for*(int i = row-1, j = col-1; i >= 0 && j >= 0; i--, j--){

*if*(v[i][j] == 1) *return* false;

    }

*for*(int i = row-1, j = col+1; i >= 0 && j < n; i--, j++){

*if*(v[i][j] == 1) *return* false;

    }

*return* true;

}

void placeNQueens(int n, int row, vector<vector<int>>& v){

*if*(row == n){

*for*(int i = 0; i < n; i++){

*for*(int j = 0; j < n; j++){

                cout << v[i][j] << " ";

            }

            cout << endl;

        }

        cout << endl;

*return*;

    }

*for*(int j = 0; j < n; j++){

*if*(isSafe(j, row, n, v)){

            v[row][j] = 1;

            placeNQueens(n, row+1, v);

            v[row][j] = 0;

        }

    }

}

int main(){

    int n;

    cin >> n;

    vector<vector<int>> v(n, vector<int>(n, 0));

*if*(n < 4){

        cout << "Solution does not exist for this input!" << endl;

*return* 0;

    }

    placeNQueens(n, 0, v);

*return* 0;

}

**Output:**

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