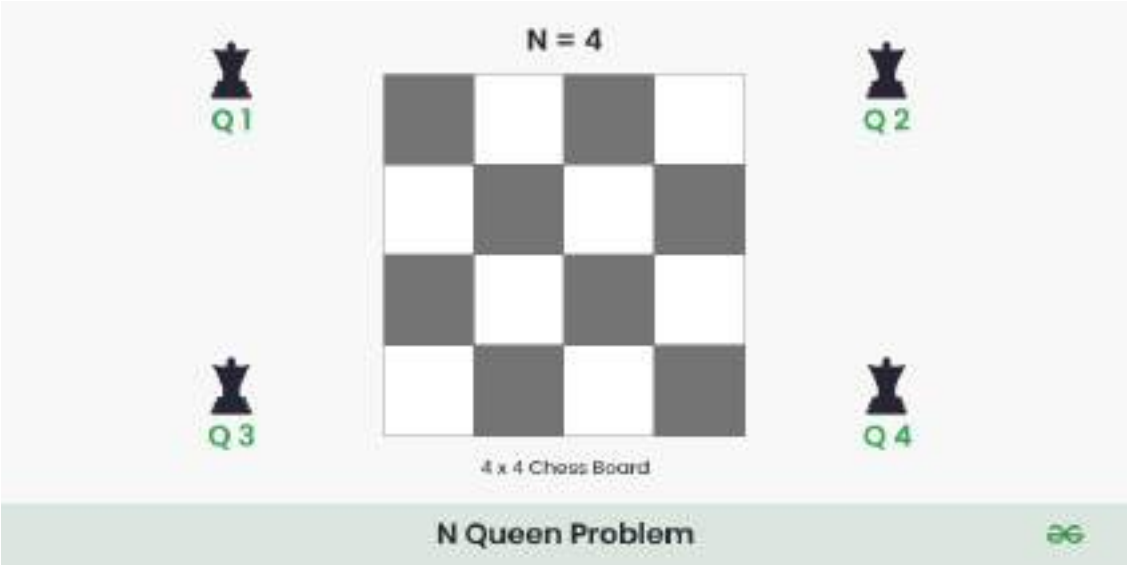
N Queen Problem

We have discussed **Knight's tour** and **Rat in a Maze** problem earlier as examples of Backtracking problems. Let us discuss N Queen as another example problem that can be solved using backtracking.

What is N-Queen problem?



The **N** Queen is the problem of placing **N** chess queens on an **N×N** chessboard so that no two queens attack each other.

For example, the following is a solution for the 4 Queen problem.

The expected output is in the form of a matrix that has '**Q**'s for the blocks where queens are placed and the empty spaces are represented by '**.**' . For example, the following is the output matrix for the above 4-Queen solution.

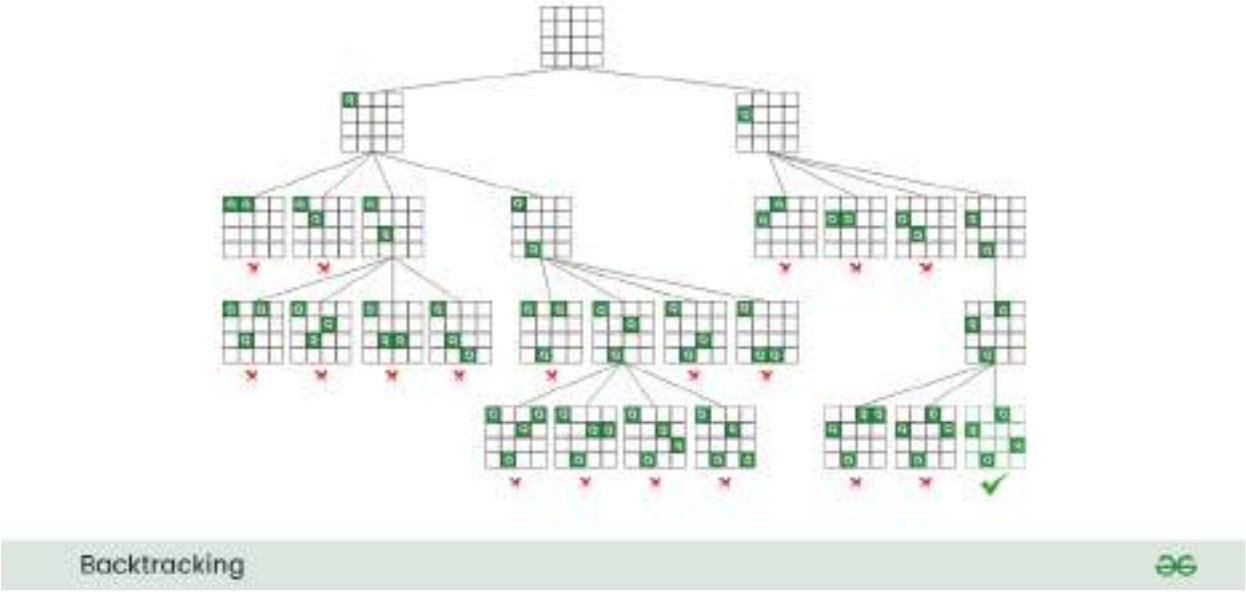
```
. Q . .
. . . Q
Q . . .
. . Q .
```

Recommended: Please solve it on "***PRACTICE***" first, before moving on to the solution.

N Queen Problem using Backtracking:

The idea is to place queens 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 queens. In the current column, if we find a row for which there is no clash, we mark this row and column as part of the solution. If we do not find such a row due to clashes, then we backtrack and return ***false****.*

Below is the recursive tree of the above approach:



Recursive tree for N Queen problem

Follow the steps mentioned below to implement the idea:

- Start in the leftmost column

- Then mark this **[row, column]** as part of the solution and recursively check if placing queen here leads to a solution.
- If placing the queen in **[row, column]** leads to a solution then return

- If placing queen doesn't lead to a solution then unmark this **[row, column]** then backtrack and try other rows.
- If all rows have been tried and valid solution is not found return **false** to trigger backtracking.

For better visualisation of this backtracking approach, please refer 4 Queen problem.

Note: We can also solve this problem by placing queens in rows as well.

Below is the implementation of the above approach:

C++

```
// C++ program to solve N Queen Problem using backtracking

#include <bits/stdc++.h>
#define N 4
using namespace std;

// A utility function to print solution
void printSolution(int board[N][N])
{
    for (int i = 0; i < N; i++) {
        for (int j = 0; j < N; j++)
           if(board[i][j])
            cout << "Q ";
           else cout<<". ";
        printf("\n");
    }
}

// A utility function to check if a queen can
// be placed on board[row][col]. Note that this
// function is called when "col" queens are
// already placed in columns from 0 to col -1.
// So we need to check only left side for
// attacking queens
bool isSafe(int board[N][N], int row, int col)
{
```

```
    // Check this row on left side
    for (i = 0; i < col; i++)
        if (board[row][i])
            return false;

    // Check upper diagonal on left side
    for (i = row, j = col; i >= 0 && j >= 0; i--, j--)
        if (board[i][j])
            return false;

    // Check lower diagonal on left side
    for (i = row, j = col; j >= 0 && i < N; i++, j--)
        if (board[i][j])
            return false;

    return true;
}

// A recursive utility function to solve N
// Queen problem
bool solveNQUtil(int board[N][N], int col)
{
    // base case: If all queens are placed
    // then return true
    if (col >= N)
        return true;

    // Consider this column and try placing
    // this queen in all rows one by one
    for (int i = 0; i < N; i++) {

        // Check if the queen can be placed on
        // board[i][col]
        if (isSafe(board, i, col)) {

            // Place this queen in board[i][col]
            board[i][col] = 1;

            // recur to place rest of the queens
            if (solveNQUtil(board, col + 1))
                return true;

            // If placing queen in board[i][col]
            // doesn't lead to a solution, then
            // remove queen from board[i][col]
            board[i][col] = 0; // BACKTRACK
        }
```

```
    // If the queen cannot be placed in any row in
    // this column col  then return false
    return false;
}

// This function solves the N Queen problem using
// Backtracking. It mainly uses solveNQUtil() to
// solve the problem. It returns false if queens
// cannot be placed, otherwise, return true and
// prints placement of queens in the form of 1s.
// Please note that there may be more than one
// solutions, this function prints one  of the
// feasible solutions.
bool solveNQ()
{
    int board[N][N] = { { 0, 0, 0, 0 },
                        { 0, 0, 0, 0 },
                        { 0, 0, 0, 0 },
                        { 0, 0, 0, 0 } };

    if (solveNQUtil(board, 0) == false) {
        cout << "Solution does not exist";
        return false;
    }

    printSolution(board);
    return true;
}

// Driver program to test above function
int main()
{
    solveNQ();
    return 0;
}

// This code is contributed by Aditya Kumar (adityakumar129)
```

C

```
// C program to solve N Queen Problem using backtracking

#define N 4
#include <stdbool.h>
#include <stdio.h>
```

```
{
    for (int i = 0; i < N; i++) {
        for (int j = 0; j < N; j++) {
            if(board[i][j])
                printf("Q ");
            else
                printf(". ");
        }
        printf("\n");
    }
}

// A utility function to check if a queen can
// be placed on board[row][col]. Note that this
// function is called when "col" queens are
// already placed in columns from 0 to col -1.
// So we need to check only left side for
// attacking queens
bool isSafe(int board[N][N], int row, int col)
{
    int i, j;

    // Check this row on left side
    for (i = 0; i < col; i++)
        if (board[row][i])
            return false;

    // Check upper diagonal on left side
    for (i = row, j = col; i >= 0 && j >= 0; i--, j--)
        if (board[i][j])
            return false;

    // Check lower diagonal on left side
    for (i = row, j = col; j >= 0 && i < N; i++, j--)
        if (board[i][j])
            return false;

    return true;
}

// A recursive utility function to solve N
// Queen problem
bool solveNQUtil(int board[N][N], int col)
{
    // Base case: If all queens are placed
    // then return true
    if (col >= N)
```

```
        // Consider this column and try placing
        // this queen in all rows one by one
        for (int i = 0; i < N; i++) {

            // Check if the queen can be placed on
            // board[i][col]
            if (isSafe(board, i, col)) {

                // Place this queen in board[i][col]
                board[i][col] = 1;

                // Recur to place rest of the queens
                if (solveNQUtil(board, col + 1))
                    return true;

                // If placing queen in board[i][col]
                // doesn't lead to a solution, then
                // remove queen from board[i][col]
                board[i][col] = 0; // BACKTRACK
            }
        }

        // If the queen cannot be placed in any row in
        // this column col  then return false
        return false;
    }

    // This function solves the N Queen problem using
    // Backtracking. It mainly uses solveNQUtil() to
    // solve the problem. It returns false if queens
    // cannot be placed, otherwise, return true and
    // prints placement of queens in the form of 1s.
    // Please note that there may be more than one
    // solutions, this function prints one  of the
    // feasible solutions.
    bool solveNQ()
    {
        int board[N][N] = { { 0, 0, 0, 0 },
                            { 0, 0, 0, 0 },
                            { 0, 0, 0, 0 },
                            { 0, 0, 0, 0 } };

        if (solveNQUtil(board, 0) == false) {
            printf("Solution does not exist");
            return false;
        }
```

```
}

// Driver program to test above function
int main()
{
    solveNQ();
    return 0;
}

// This code is contributed by Aditya Kumar (adityakumar129)
```

Java

```
// Java program to solve N Queen Problem using backtracking

public class NQueenProblem {
    final int N = 4;

    // A utility function to print solution
    void printSolution(int board[][])
    {
        for (int i = 0; i < N; i++) {
            for (int j = 0; j < N; j++) {
                if (board[i][j] == 1)
                    System.out.print("Q ");
                else
                    System.out.print(". ");
            }
            System.out.println();
        }
    }

    // A utility function to check if a queen can
    // be placed on board[row][col]. Note that this
    // function is called when "col" queens are already
    // placeed in columns from 0 to col -1. So we need
    // to check only left side for attacking queens
    boolean isSafe(int board[][], int row, int col)
    {
        int i, j;

        // Check this row on left side
        for (i = 0; i < col; i++)
            if (board[row][i] == 1)
                return false;
```

```
            if (board[i][j] == 1)
                return false;

        // Check lower diagonal on left side
        for (i = row, j = col; j >= 0 && i < N; i++, j--)
            if (board[i][j] == 1)
                return false;

        return true;
    }

    // A recursive utility function to solve N
    // Queen problem
    boolean solveNQUtil(int board[][], int col)
    {
        // Base case: If all queens are placed
        // then return true
        if (col >= N)
            return true;

        // Consider this column and try placing
        // this queen in all rows one by one
        for (int i = 0; i < N; i++) {

            // Check if the queen can be placed on
            // board[i][col]
            if (isSafe(board, i, col)) {

                // Place this queen in board[i][col]
                board[i][col] = 1;

                // Recur to place rest of the queens
                if (solveNQUtil(board, col + 1) == true)
                    return true;

                // If placing queen in board[i][col]
                // doesn't lead to a solution then
                // remove queen from board[i][col]
                board[i][col] = 0; // BACKTRACK
            }
        }

        // If the queen can not be placed in any row in
        // this column col, then return false
        return false;
    }
```

```
    // solve the problem. It returns false if queens
    // cannot be placed, otherwise, return true and
    // prints placement of queens in the form of 1s.
    // Please note that there may be more than one
    // solutions, this function prints one of the
    // feasible solutions.
    boolean solveNQ()
    {
        int board[][] = { { 0, 0, 0, 0 },
                          { 0, 0, 0, 0 },
                          { 0, 0, 0, 0 },
                          { 0, 0, 0, 0 } };

        if (solveNQUtil(board, 0) == false) {
            System.out.print("Solution does not exist");
            return false;
        }

        printSolution(board);
        return true;
    }

    // Driver program to test above function
    public static void main(String args[])
    {
        NQueenProblem Queen = new NQueenProblem();
        Queen.solveNQ();
    }
}
// This code is contributed by Abhishek Shankhadhar
```

Python3

```
# Python3 program to solve N Queen
# Problem using backtracking

global N
N = 4


def printSolution(board):
    for i in range(N):
        for j in range(N):
            if board[i][j] == 1:
                print("Q",end=" ")
```

```
# A utility function to check if a queen can
# be placed on board[row][col]. Note that this
# function is called when "col" queens are
# already placed in columns from 0 to col -1.
# So we need to check only left side for
# attacking queens
def isSafe(board, row, col):

    # Check this row on left side
    for i in range(col):
        if board[row][i] == 1:
            return False

    # Check upper diagonal on left side
    for i, j in zip(range(row, -1, -1),
                    range(col, -1, -1)):
        if board[i][j] == 1:
            return False

    # Check lower diagonal on left side
    for i, j in zip(range(row, N, 1),
                    range(col, -1, -1)):
        if board[i][j] == 1:
            return False

    return True


def solveNQUtil(board, col):

    # Base case: If all queens are placed
    # then return true
    if col >= N:
        return True

    # Consider this column and try placing
    # this queen in all rows one by one
    for i in range(N):

        if isSafe(board, i, col):

            # Place this queen in board[i][col]
            board[i][col] = 1

            # Recur to place rest of the queens
```

```
            # If placing queen in board[i][col
            # doesn't lead to a solution, then
            # queen from board[i][col]
            board[i][col] = 0

    # If the queen can not be placed in any row in
    # this column col then return false
    return False


# This function solves the N Queen problem using
# Backtracking. It mainly uses solveNQUtil() to
# solve the problem. It returns false if queens
# cannot be placed, otherwise return true and
# placement of queens in the form of 1s.
# note that there may be more than one
# solutions, this function prints one of the
# feasible solutions.
def solveNQ():
    board = [[0, 0, 0, 0],
             [0, 0, 0, 0],
             [0, 0, 0, 0],
             [0, 0, 0, 0]]

    if solveNQUtil(board, 0) == False:
        print("Solution does not exist")
        return False

    printSolution(board)
    return True


# Driver Code
if __name__ == '__main__':
    solveNQ()

# This code is contributed by Divyanshu Mehta
```

C#

```
// C# program to solve N Queen Problem
// using backtracking
using System;
```

```
// A utility function to print solution
void printSolution(int [,]board)
{
    for (int i = 0; i < N; i++)
    {
        for (int j = 0; j < N; j++)
        {
            if (board[i, j] == 1)
                Console.Write("Q ");
            else
                Console.Write(". ");
        }
        Console.WriteLine();
    }
}

// A utility function to check if a queen can
// be placed on board[row,col]. Note that this
// function is called when "col" queens are already
// placeed in columns from 0 to col -1. So we need
// to check only left side for attacking queens
bool isSafe(int [,]board, int row, int col)
{
    int i, j;

    // Check this row on left side
    for (i = 0; i < col; i++)
        if (board[row,i] == 1)
            return false;

    // Check upper diagonal on left side
    for (i = row, j = col; i >= 0 &&
         j >= 0; i--, j--)
        if (board[i,j] == 1)
            return false;

    // Check lower diagonal on left side
    for (i = row, j = col; j >= 0 &&
                  i < N; i++, j--)
        if (board[i, j] == 1)
            return false;

    return true;
}

// A recursive utility function to solve N
```

```
{
    // Base case: If all queens are placed
    // then return true
    if (col >= N)
        return true;

    // Consider this column and try placing
    // this queen in all rows one by one
    for (int i = 0; i < N; i++)
    {
        // Check if the queen can be placed on
        // board[i,col]
        if (isSafe(board, i, col))
        {
            // Place this queen in board[i,col]
            board[i, col] = 1;

            // Recur to place rest of the queens
            if (solveNQUtil(board, col + 1) == true)
                return true;

            // If placing queen in board[i,col]
            // doesn't lead to a solution then
            // remove queen from board[i,col]
            board[i, col] = 0; // BACKTRACK
        }
    }

    // If the queen can not be placed in any row in
    // this column col, then return false
    return false;
}

// This function solves the N Queen problem using
// Backtracking. It mainly uses solveNQUtil () to
// solve the problem. It returns false if queens
// cannot be placed, otherwise, return true and
// prints placement of queens in the form of 1s.
// Please note that there may be more than one
// solutions, this function prints one of the
// feasible solutions.
bool solveNQ()
{
    int [,]board = {{ 0, 0, 0, 0 },
                    { 0, 0, 0, 0 },
                    { 0, 0, 0, 0 },
                    { 0, 0, 0, 0 }};
```

```
        {
            Console.Write("Solution does not exist");
            return false;
        }

        printSolution(board);
        return true;
    }

    // Driver Code
    public static void Main(String []args)
    {
        GFG Queen = new GFG();
        Queen.solveNQ();
    }
}

// This code is contributed by Princi Singh
```

Javascript

```
// JavaScript program to solve N Queen
// Problem using backtracking
const N = 4

function printSolution(board)
{
    for(let i = 0; i < N; i++)
    {
        for(let j = 0; j < N; j++)
        {
            if(board[i][j] == 1)
                document.write("Q ")
            else
                document.write(". ")
        }
        document.write("</br>")
    }
}

// A utility function to check if a queen can
// be placed on board[row][col]. Note that this
// function is called when "col" queens are
// already placed in columns from 0 to col -1.
// So we need to check only left side for
```

```
        // Check this row on left side
        for(let i = 0; i < col; i++){
            if(board[row][i] == 1)
                return false
        }

        // Check upper diagonal on left side
        for (i = row, j = col; i >= 0 && j >= 0; i--, j--)
            if (board[i][j])
                return false

        // Check lower diagonal on left side
        for (i = row, j = col; j >= 0 && i < N; i++, j--)
            if (board[i][j])
                return false

        return true
    }

    function solveNQUtil(board, col){

        // base case: If all queens are placed
        // then return true
        if(col >= N)
            return true

        // Consider this column and try placing
        // this queen in all rows one by one
        for(let i=0;i<N;i++){

            if(isSafe(board, i, col)==true){

                // Place this queen in board[i][col]
                board[i][col] = 1

                // recur to place rest of the queens
                if(solveNQUtil(board, col + 1) == true)
                    return true

                // If placing queen in board[i][col
                // doesn't lead to a solution, then
                // queen from board[i][col]
                board[i][col] = 0
            }
        }
        // if the queen can not be placed in any row in
```

```
}

// This function solves the N Queen problem using
// Backtracking. It mainly uses solveNQUtil() to
// solve the problem. It returns false if queens
// cannot be placed, otherwise return true and
// placement of queens in the form of 1s.
// note that there may be more than one
// solutions, this function prints one of the
// feasible solutions.
function solveNQ(){
    let board = [ [0, 0, 0, 0],
                  [0, 0, 0, 0],
                  [0, 0, 0, 0],
                  [0, 0, 0, 0] ]

    if(solveNQUtil(board, 0) == false){
        document.write("Solution does not exist")
        return false
    }

    printSolution(board)
    return true
}

// Driver Code
solveNQ()

// This code is contributed by shinjanpatra
```


Output

```
. . Q .
Q . . .
. . . Q
. Q . .
```

Time Complexity: O(N!)
Auxiliary Space: O(N^2)

Further Optimization in is_safe() function:

The idea is not to check every element in the right and left diagonal, instead use the property of diagonals:

- *The sum of **i** and **j** is constant and unique for each right diagonal, where **i** is the row of elements and **j** is the column of elements.*
- *The difference between **i** and **j** is constant and unique for each left diagonal, where **i** and **j** are row and column of element respectively.*

Below is the implementation:

C++

```
// C++ program to solve N Queen Problem using backtracking

#include <bits/stdc++.h>
using namespace std;
#define N 4

// ld is an array where its indices indicate row-col+N-1
// (N-1) is for shifting the difference to store negative
// indices
int ld[30] = { 0 };

// rd is an array where its indices indicate row+col
// and used to check whether a queen can be placed on
// right diagonal or not
```

```
// Column array where its indices indicates column and
// used to check whether a queen can be placed in that
// row or not*/
int cl[30] = { 0 };

// A utility function to print solution
void printSolution(int board[N][N])
{
    for (int i = 0; i < N; i++) {
        for (int j = 0; j < N; j++)
            cout << " " << (board[i][j]==1?"Q":".") << " ";
        cout << endl;
    }
}

// A recursive utility function to solve N
// Queen problem
bool solveNQUtil(int board[N][N], int col)
{
    // Base case: If all queens are placed
    // then return true
    if (col >= N)
        return true;

    // Consider this column and try placing
    // this queen in all rows one by one
    for (int i = 0; i < N; i++) {

        // Check if the queen can be placed on
        // board[i][col]

        // To check if a queen can be placed on
        // board[row][col].We just need to check
        // ld[row-col+n-1] and rd[row+coln] where
        // ld and rd are for left and right
        // diagonal respectively
        if ((ld[i - col + N - 1] != 1 && rd[i + col] != 1)
            && cl[i] != 1) {

            // Place this queen in board[i][col]
            board[i][col] = 1;
            ld[i - col + N - 1] = rd[i + col] = cl[i] = 1;

            // Recur to place rest of the queens
            if (solveNQUtil(board, col + 1))
                return true;
```

```
            // remove queen from board[i][col]
            board[i][col] = 0; // BACKTRACK
            ld[i - col + N - 1] = rd[i + col] = cl[i] = 0;
        }
    }

    // If the queen cannot be placed in any row in
    // this column col  then return false
    return false;
}

// This function solves the N Queen problem using
// Backtracking. It mainly uses solveNQUtil() to
// solve the problem. It returns false if queens
// cannot be placed, otherwise, return true and
// prints placement of queens in the form of 1s.
// Please note that there may be more than one
// solutions, this function prints one  of the
// feasible solutions.
bool solveNQ()
{
    int board[N][N] = { { 0, 0, 0, 0 },
                        { 0, 0, 0, 0 },
                        { 0, 0, 0, 0 },
                        { 0, 0, 0, 0 } };

    if (solveNQUtil(board, 0) == false) {
        cout << "Solution does not exist";
        return false;
    }

    printSolution(board);
    return true;
}

// Driver program to test above function
int main()
{
    solveNQ();
    return 0;
}

// This code is contributed by Aditya Kumar (adityakumar129)
```

Java

```
import java.util.*;

class GFG {
    static int N = 4;

    // ld is an array where its indices indicate row-col+N-1
    // (N-1) is for shifting the difference to store
    // negative indices
    static int[] ld = new int[30];

    // rd is an array where its indices indicate row+col
    // and used to check whether a queen can be placed on
    // right diagonal or not
    static int[] rd = new int[30];

    // Column array where its indices indicates column and
    // used to check whether a queen can be placed in that
    // row or not
    static int[] cl = new int[30];

    // A utility function to print solution
    static void printSolution(int board[][])
    {
        for (int i = 0; i < N; i++) {
            for (int j = 0; j < N; j++)
                System.out.printf(" %d ", board[i][j]);
            System.out.printf("\n");
        }
    }

    // A recursive utility function to solve N
    // Queen problem
    static boolean solveNQUtil(int board[][], int col)
    {
        // Base case: If all queens are placed
        // then return true
        if (col >= N)
            return true;

        // Consider this column and try placing
        // this queen in all rows one by one
        for (int i = 0; i < N; i++) {
            // Check if the queen can be placed on
            // board[i][col]

            // To check if a queen can be placed on
            // board[row][col] We just need to check
```

```
            // diagonal respectively
            if ((ld[i - col + N - 1] != 1
                 && rd[i + col] != 1)
                && cl[i] != 1) {
                // Place this queen in board[i][col]
                board[i][col] = 1;
                ld[i - col + N - 1] = rd[i + col] = cl[i]
                    = 1;

                // Recur to place rest of the queens
                if (solveNQUtil(board, col + 1))
                    return true;

                // If placing queen in board[i][col]
                // doesn't lead to a solution, then
                // remove queen from board[i][col]
                board[i][col] = 0; // BACKTRACK
                ld[i - col + N - 1] = rd[i + col] = cl[i]
                    = 0;
            }
        }

        // If the queen cannot be placed in any row in
        // this column col then return false
        return false;
    }

    // This function solves the N Queen problem using
    // Backtracking. It mainly uses solveNQUtil() to
    // solve the problem. It returns false if queens
    // cannot be placed, otherwise, return true and
    // prints placement of queens in the form of 1s.
    // Please note that there may be more than one
    // solutions, this function prints one of the
    // feasible solutions.
    static boolean solveNQ()
    {
        int board[][] = { { 0, 0, 0, 0 },
                          { 0, 0, 0, 0 },
                          { 0, 0, 0, 0 },
                          { 0, 0, 0, 0 } };

        if (solveNQUtil(board, 0) == false) {
            System.out.printf("Solution does not exist");
            return false;
        }
```

```
    }

    // Driver Code
    public static void main(String[] args)
    {
        solveNQ();
    }
}

// This code is contributed by Princi Singh
```

Python3

```
# Python3 program to solve N Queen Problem using
# backtracking
N = 4

# ld is an array where its indices indicate row-col+N-1
# (N-1) is for shifting the difference to store negative
# indices
ld = [0] * 30

# rd is an array where its indices indicate row+col
# and used to check whether a queen can be placed on
# right diagonal or not
rd = [0] * 30

# Column array where its indices indicates column and
# used to check whether a queen can be placed in that
# row or not
cl = [0] * 30


# A utility function to print solution
def printSolution(board):
    for i in range(N):
        for j in range(N):
            print(board[i][j], end=" ")
        print()


# A recursive utility function to solve N
# Queen problem
def solveNQUtil(board, col):
```

```
            return True

        # Consider this column and try placing
        # this queen in all rows one by one
        for i in range(N):

            # Check if the queen can be placed on board[i][col]

            # To check if a queen can be placed on
            # board[row][col] We just need to check
            # ld[row-col+n-1] and rd[row+coln]
            # where ld and rd are for left and
            # right diagonal respectively
            if ((ld[i - col + N - 1] != 1 and
                 rd[i + col] != 1) and cl[i] != 1):

                # Place this queen in board[i][col]
                board[i][col] = 1
                ld[i - col + N - 1] = rd[i + col] = cl[i] = 1

                # Recur to place rest of the queens
                if (solveNQUtil(board, col + 1)):
                    return True

                # If placing queen in board[i][col]
                # doesn't lead to a solution,
                # then remove queen from board[i][col]
                board[i][col] = 0  # BACKTRACK
                ld[i - col + N - 1] = rd[i + col] = cl[i] = 0

                # If the queen cannot be placed in
                # any row in this column col then return False
        return False


# This function solves the N Queen problem using
# Backtracking. It mainly uses solveNQUtil() to
# solve the problem. It returns False if queens
# cannot be placed, otherwise, return True and
# prints placement of queens in the form of 1s.
# Please note that there may be more than one
# solutions, this function prints one of the
# feasible solutions.
def solveNQ():
    board = [[0, 0, 0, 0],
             [0, 0, 0, 0],
             [0, 0, 0, 0]
```

```
            printf("Solution does not exist")
            return False
        printSolution(board)
        return True


# Driver Code
if __name__ == '__main__':
    solveNQ()

# This code is contributed by SHUBHAMSINGH10
```

C#

```
// C# program to solve N Queen Problem using backtracking

using System;

class GFG {
    static int N = 4;

    // ld is an array where its indices indicate row-col+N-1
    // (N-1) is for shifting the difference to store
    // negative indices
    static int[] ld = new int[30];

    // rd is an array where its indices indicate row+col
    // and used to check whether a queen can be placed on
    // right diagonal or not
    static int[] rd = new int[30];

    // Column array where its indices indicates column and
    // used to check whether a queen can be placed in that
    // row or not
    static int[] cl = new int[30];

    // A utility function to print solution
    static void printSolution(int[, ] board)
    {
        for (int i = 0; i < N; i++) {
            for (int j = 0; j < N; j++)
                Console.Write(" {0} ", board[i, j]);
            Console.Write("\n");
        }
    }
```

```
static bool solveNQUtil(int[, ] board, int col)
{
    // Base case: If all queens are placed
    // then return true
    if (col >= N)
        return true;

    // Consider this column and try placing
    // this queen in all rows one by one
    for (int i = 0; i < N; i++) {
        // Check if the queen can be placed on
        // board[i,col]

        // To check if a queen can be placed on
        // board[row,col].We just need to check
        // ld[row-col+n-1] and rd[row+coln] where
        // ld and rd are for left and right
        // diagonal respectively
        if ((ld[i - col + N - 1] != 1
             && rd[i + col] != 1)
            && cl[i] != 1) {
            // Place this queen in board[i,col]
            board[i, col] = 1;
            ld[i - col + N - 1] = rd[i + col] = cl[i]
                = 1;

            // Recur to place rest of the queens
            if (solveNQUtil(board, col + 1))
                return true;

            // If placing queen in board[i,col]
            // doesn't lead to a solution, then
            // remove queen from board[i,col]
            board[i, col] = 0; // BACKTRACK
            ld[i - col + N - 1] = rd[i + col] = cl[i]
                = 0;
        }
    }

    // If the queen cannot be placed in any row in
    // this column col then return false
    return false;
}

// This function solves the N Queen problem using
// Backtracking. It mainly uses solveNQUtil() to
// solve the problem. It returns false if queens
```

```
    // Please note that there may be more than one
    // solutions, this function prints one of the
    // feasible solutions.
    static bool solveNQ()
    {
        int[, ] board = { { 0, 0, 0, 0 },
                          { 0, 0, 0, 0 },
                          { 0, 0, 0, 0 },
                          { 0, 0, 0, 0 } };

        if (solveNQUtil(board, 0) == false) {
            Console.Write("Solution does not exist");
            return false;
        }

        printSolution(board);
        return true;
    }

    // Driver Code
    public static void Main(String[] args)
    {
        solveNQ();
    }
}

// This code is contributed by Rajput-Ji
```

Javascript

```
    // JavaScript code to implement the approach

let N = 4;

// ld is an array where its indices indicate row-col+N-1
// (N-1) is for shifting the difference to store negative
// indices
let ld = new Array(30);

// rd is an array where its indices indicate row+col
// and used to check whether a queen can be placed on
// right diagonal or not
let rd = new Array(30);

// Column array where its indices indicates column and
```

```
// A utility function to print solution
function printSolution( board)
{
    for (let i = 0; i < N; i++)
    {
        for (let j = 0; j < N; j++)
            document.write(board[i][j] + " ");
        document.write("<br/>");
    }
}

// A recursive utility function to solve N
// Queen problem
function solveNQUtil(board, col)
{
    // Base case: If all queens are placed
    // then return true
    if (col >= N)
        return true;

    // Consider this column and try placing
    // this queen in all rows one by one
    for (let i = 0; i < N; i++)
    {

        // Check if the queen can be placed on
        // board[i][col]

        // To check if a queen can be placed on
        // board[row][col].We just need to check
        // ld[row-col+n-1] and rd[row+coln] where
        // ld and rd are for left and right
        // diagonal respectively
        if ((ld[i - col + N - 1] != 1 &&
             rd[i + col] != 1) && cl[i] != 1)
        {
            // Place this queen in board[i][col]
            board[i][col] = 1;
            ld[i - col + N - 1] =
            rd[i + col] = cl[i] = 1;

            // Recur to place rest of the queens
            if (solveNQUtil(board, col + 1))
                return true;

            // If placing queen in board[i][col]
```

```
                board[i][col] = 0; // BACKTRACK
                ld[i - col + N - 1] =
                rd[i + col] = cl[i] = 0;
            }
        }

        // If the queen cannot be placed in any row in
        // this column col then return false
        return false;
    }

    // This function solves the N Queen problem using
    // Backtracking. It mainly uses solveNQUtil() to
    // solve the problem. It returns false if queens
    // cannot be placed, otherwise, return true and
    // prints placement of queens in the form of 1s.
    // Please note that there may be more than one
    // solutions, this function prints one of the
    // feasible solutions.
    function solveNQ()
    {
        let board = [[ 0, 0, 0, 0 ],
                     [ 0, 0, 0, 0 ],
                     [ 0, 0, 0, 0 ],
                     [ 0, 0, 0, 0 ]];

        if (solveNQUtil(board, 0) == false)
        {
            document.write("Solution does not exist");
            return false;
        }

        printSolution(board);
        return true;
    }

    // Driver code
    solveNQ();

    // This code is contributed by sanjoy_62.
```


Output

```
. . Q .
```

. Q . .

Time Complexity: O(N!)
Auxiliary Space: O(N)

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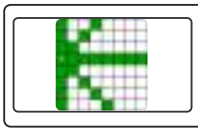
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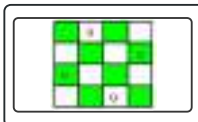
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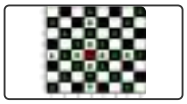
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