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AI - Lab 1

Aim: n Queen's Problem

Initial state

0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

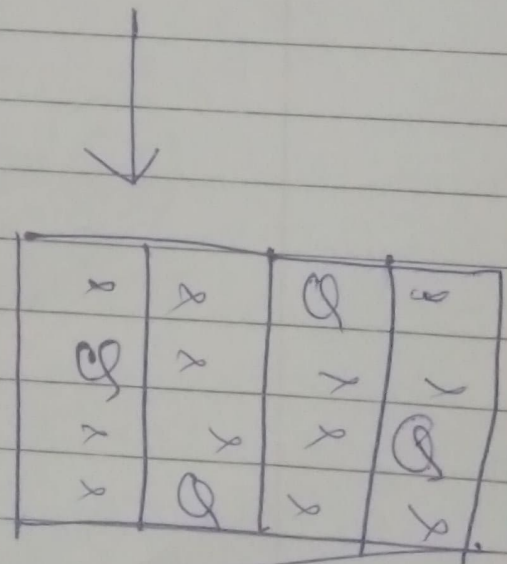
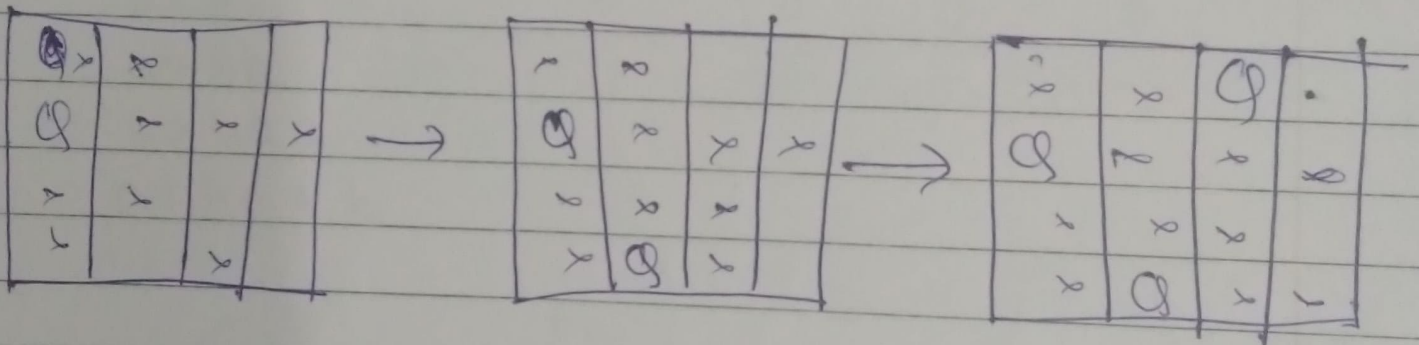
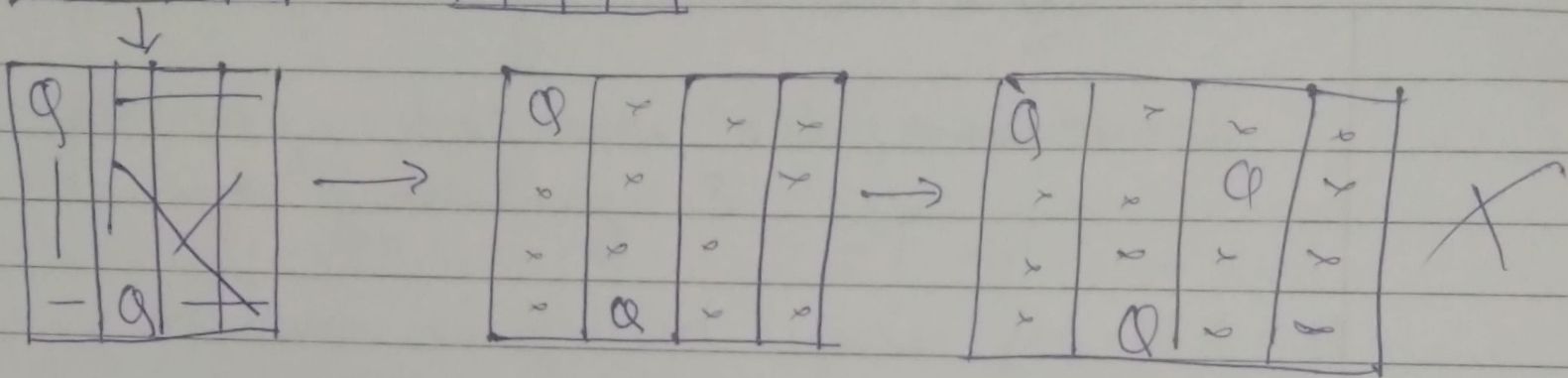
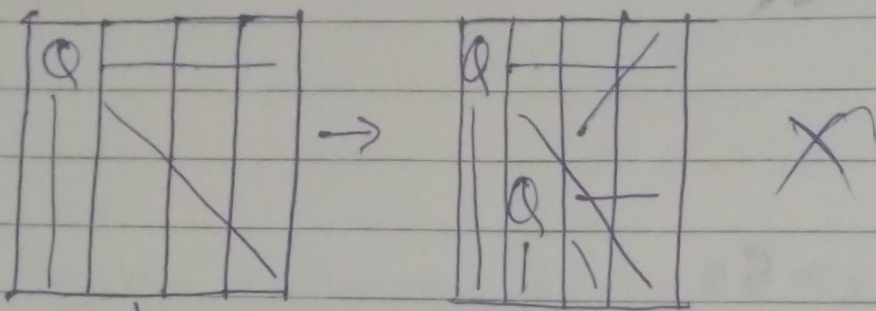
Final state

0	0	1	0
1	0	0	1
0	0	0	0
0	1	0	0

Problem Formulation: To arrange n-queens on a $n \times n$ chessboard in such a way that they do not fight each other by being in the same row, column, or diagonal.

Problem Solving:

Date



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n-queen Problem

ALGORITHM:

If there is a queen at the left of current col, then return false

If there is a queen at the left upper diagonal, then return false

If there is a queen at the left lower diagonal, then return false;

Return true //otherwise it is valid place

If all columns are filled, then return true

For each row of the board, do

If isValid(board, i, col), then

Set queen at place (i, col) in the board

If solveNQueen(board, col+1) = true, then return true

Otherwise remove queen from place (i, col) from board. Done, return false

CODE:

```
#include<iostream>
```

```
using namespace std;
```

```
#define N 4
```

```
void printBoard(int board[N][N]) {
```

```
    for (int i = 0; i < N; i++) {
```

```
        for (int j = 0; j < N; j++)
```

```
            cout << board[i][j] << " ";
```

```
            cout << endl;
```

```
    }
```

```
}
```

```
bool isValid(int board[N][N], int row, int col) {
```

```
    for (int i = 0; i < col; i++)
```

```
        if (board[row][i])
```

```

        return false;
    for (int i=row, j=col; i>=0 && j>=0; i--, j--)
        if (board[i][j])
            return false;
    for (int i=row, j=col; j>=0 && i<N; i++, j--)
        if (board[i][j])
            return false;
    return true;
}

bool solveNQueen(int board[N][N], int col) {
    if (col >= N)
        return true;
    for (int i = 0; i < N; i++) {
        if (isValid(board, i, col) ) {
            board[i][col] = 1;
            if ( solveNQueen(board, col + 1))
                return true;
            board[i][col] = 0;
        }
    }
    return false;
}

bool checkSolution() {
    int board[N][N];
    for(int i = 0; i<N; i++)
        for(int j = 0; j<N; j++)
            board[i][j] = 0;
    if ( solveNQueen(board, 0) == false ) {
        cout << "Solution does not exist";
    }
}

```

```

        return false;
    }

    printBoard(board);

    return true;
}

int main() {

    checkSolution();

}

```

The screenshot shows a C++ IDE with the following code in `main.cpp`:

```

1  #include<iostream>
2  using namespace std;
3  #define N 4
4  void printBoard(int board[N][N]) {
5      for (int i = 0; i < N; i++) {
6          for (int j = 0; j < N; j++)
7              cout << board[i][j] << " ";
8              cout << endl;
9      }
10 }
11 bool isValid(int board[N][N], int row, int col) {
12     for (int i = 0; i < col; i++)
13         if (board[row][i])
14             return false;
15     for (int i=row, j=col; i>=0 && j>=0; i--, j--)
16         if (board[i][j])
17             return false;
18     for (int i=row, j=col; j>=0 && i<N; i++, j--)
19         if (board[i][j])
20             return false;
21     return true;
22 }
23 bool solveNQueen(int board[N][N], int col) {
24     if (col >= N)
25         return true;
26     for (int i = 0; i < N; i++) {
27         if (isValid(board, i, col) ) {
28             board[i][col] = 1;

```

The console output shows the input board and the program's completion:

```

input
0 0 1 0
1 0 0 0
0 0 0 1
0 1 0 0

...Program finished with exit code 0
Press ENTER to exit console.

```

