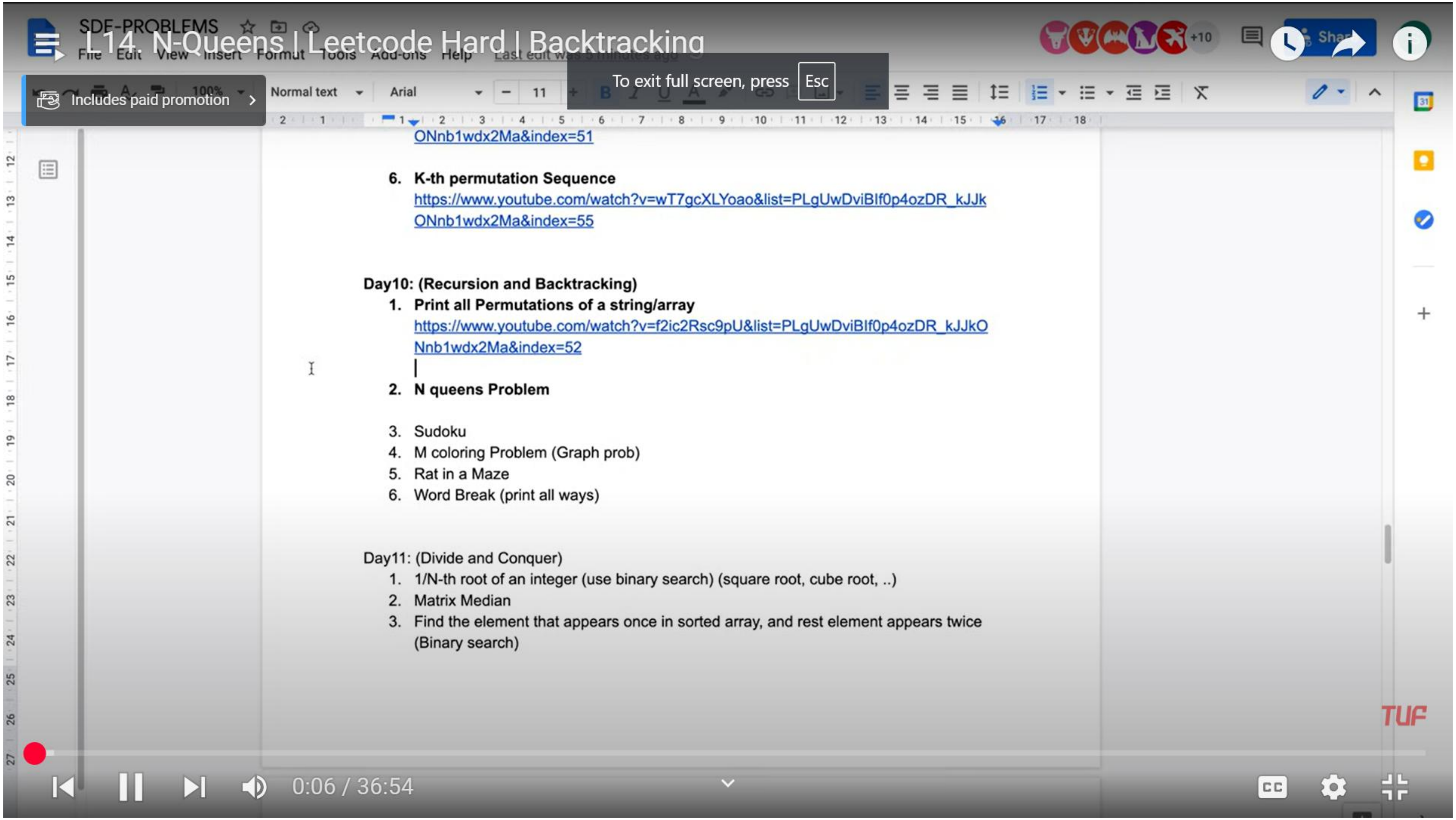
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L14. N-Queens | Leetcode Hard | Backtracking
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0:06 / 36:54
TUF

ONnb1wdx2Ma&index=51

6. **K-th permutation Sequence**
   https://www.youtube.com/watch?v=wT7gcXLYoao&list=PLgUwDviBIf0p4ozDR_kJJkONnb1wdx2Ma&index=55

Day10: (Recursion and Backtracking)

1. **Print all Permutations of a string/array**
   https://www.youtube.com/watch?v=f2ic2Rsc9pU&list=PLgUwDviBIf0p4ozDR_kJJkONnb1wdx2Ma&index=52
2. **N queens Problem**
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4. M coloring Problem (Graph prob)
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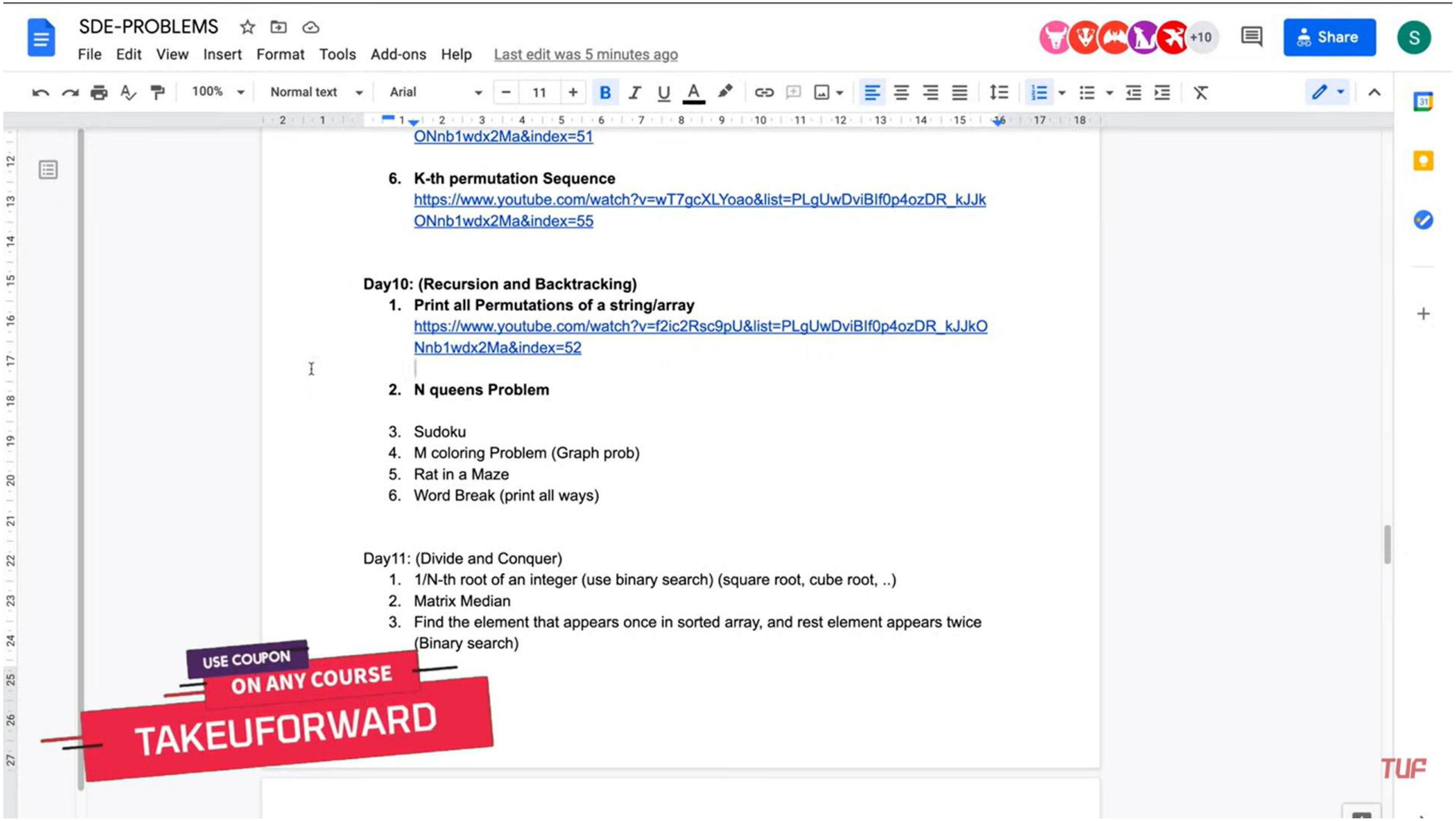
6. Word Break (print all ways)

Day11: (Divide and Conquer)

1. 1/N-th root of an integer (use binary search) (square root, cube root, ..)
2. Matrix Median
3. Find the element that appears once in sorted array, and rest element appears twice (Binary search)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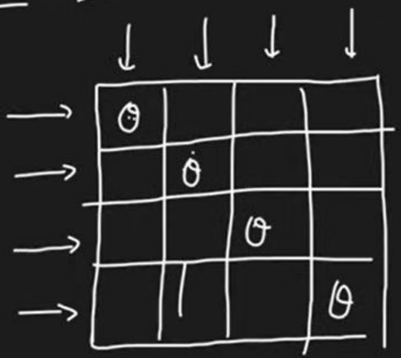
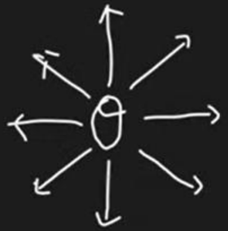
N = 4 Queens



→ Every row → 1 Q

→ Every col → 1 Q

→ None of the Q attack each other



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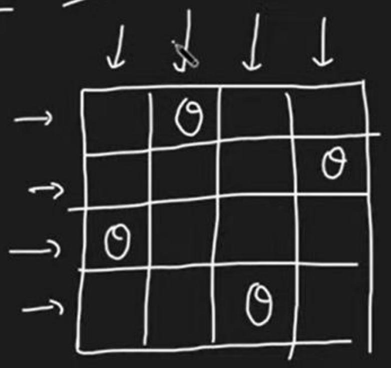

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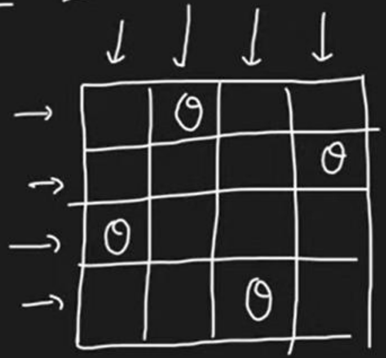

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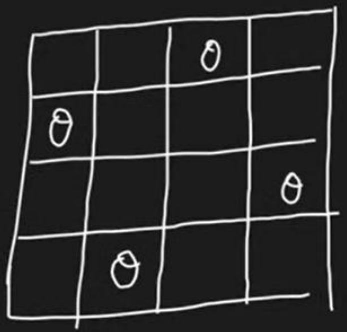

N.

N × N.

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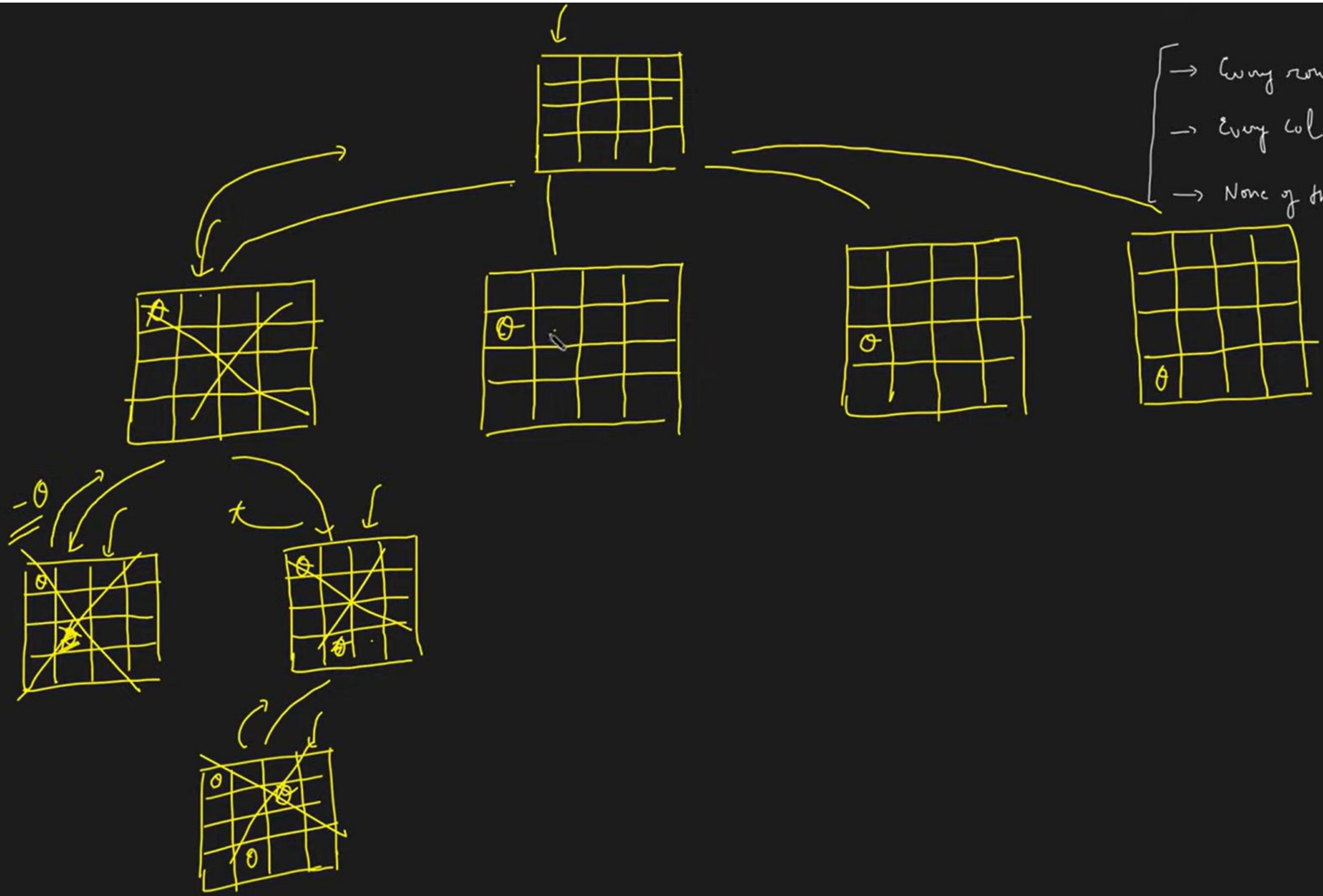

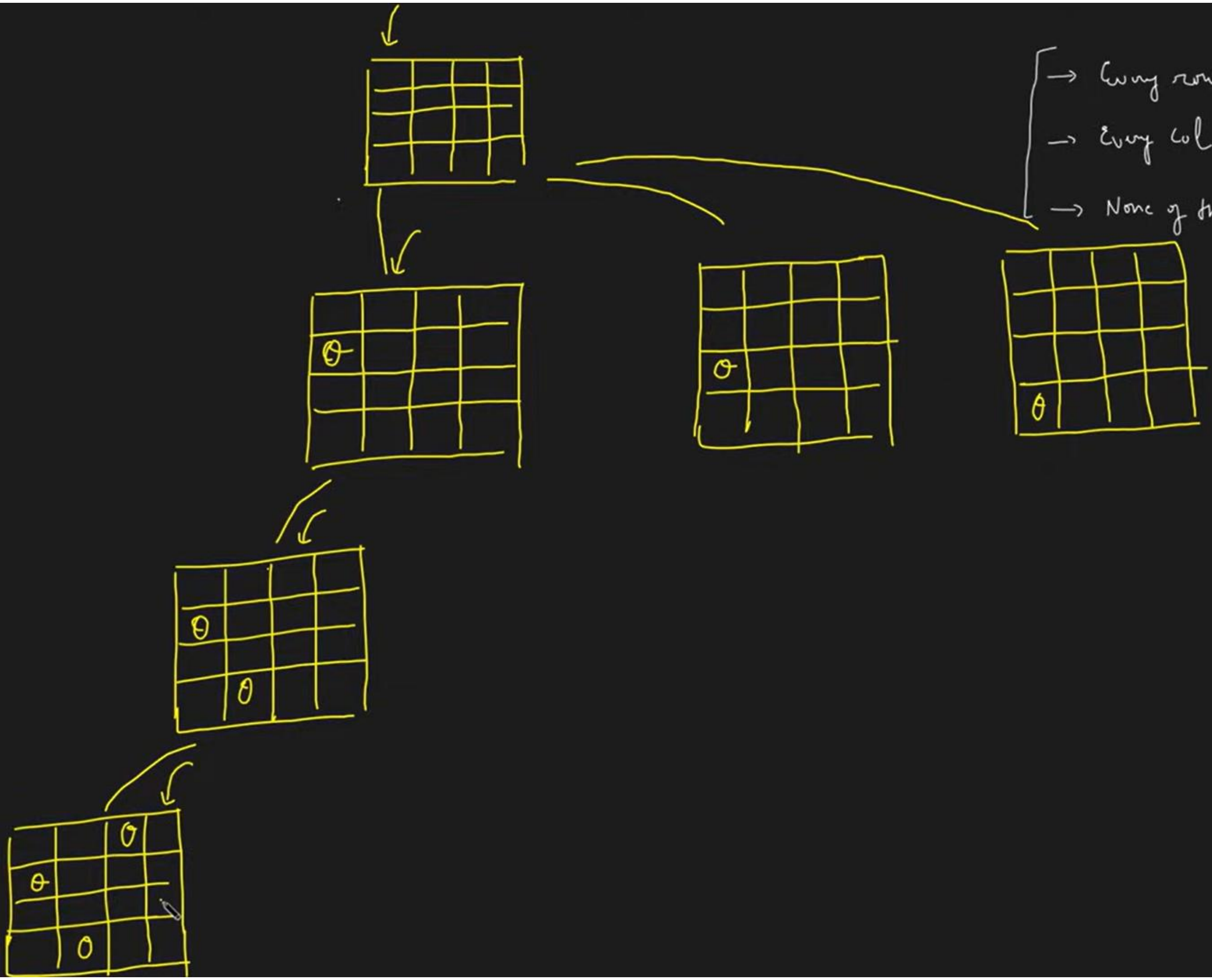
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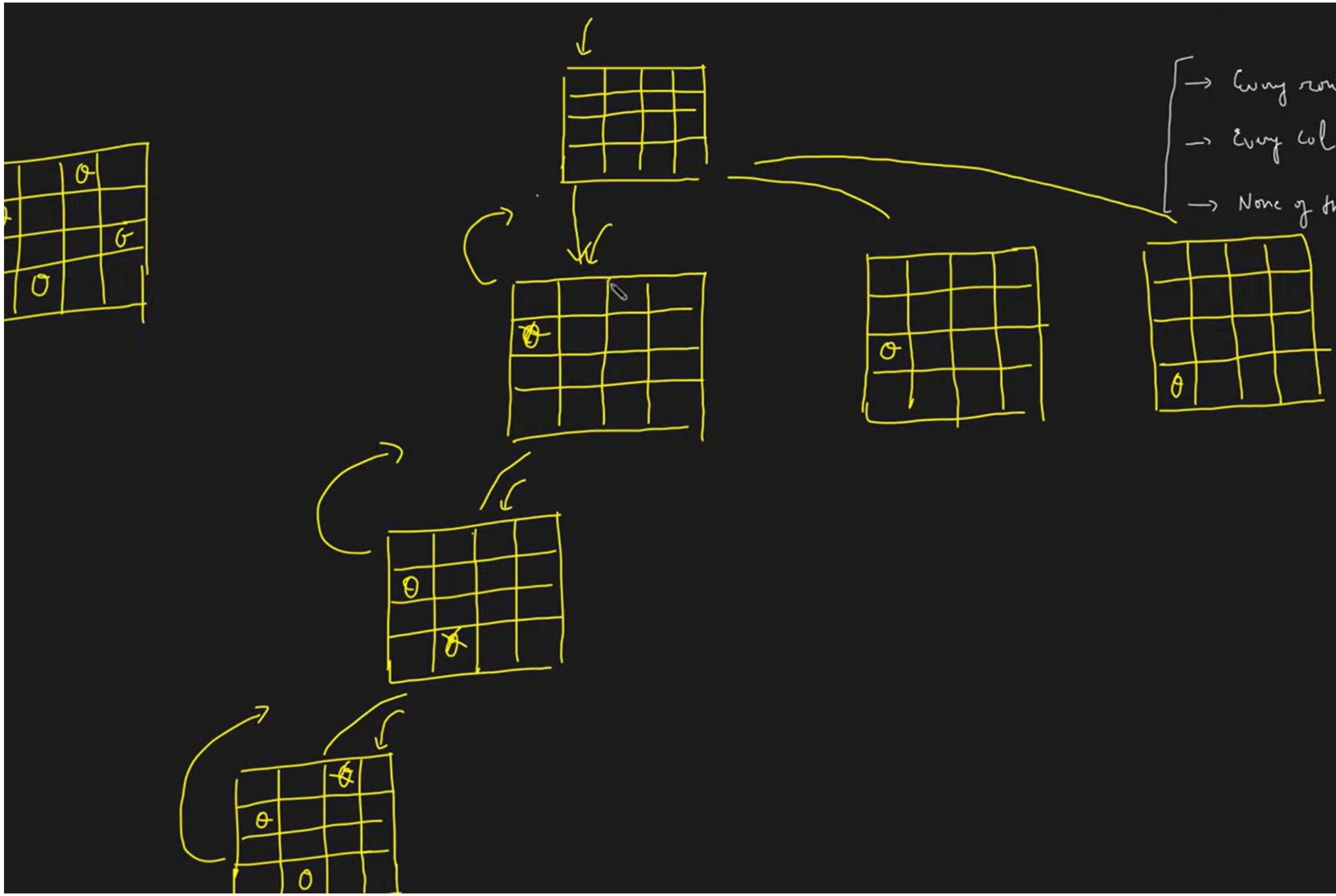
Q
Q
Q
Q
Q
Q
Q
Q



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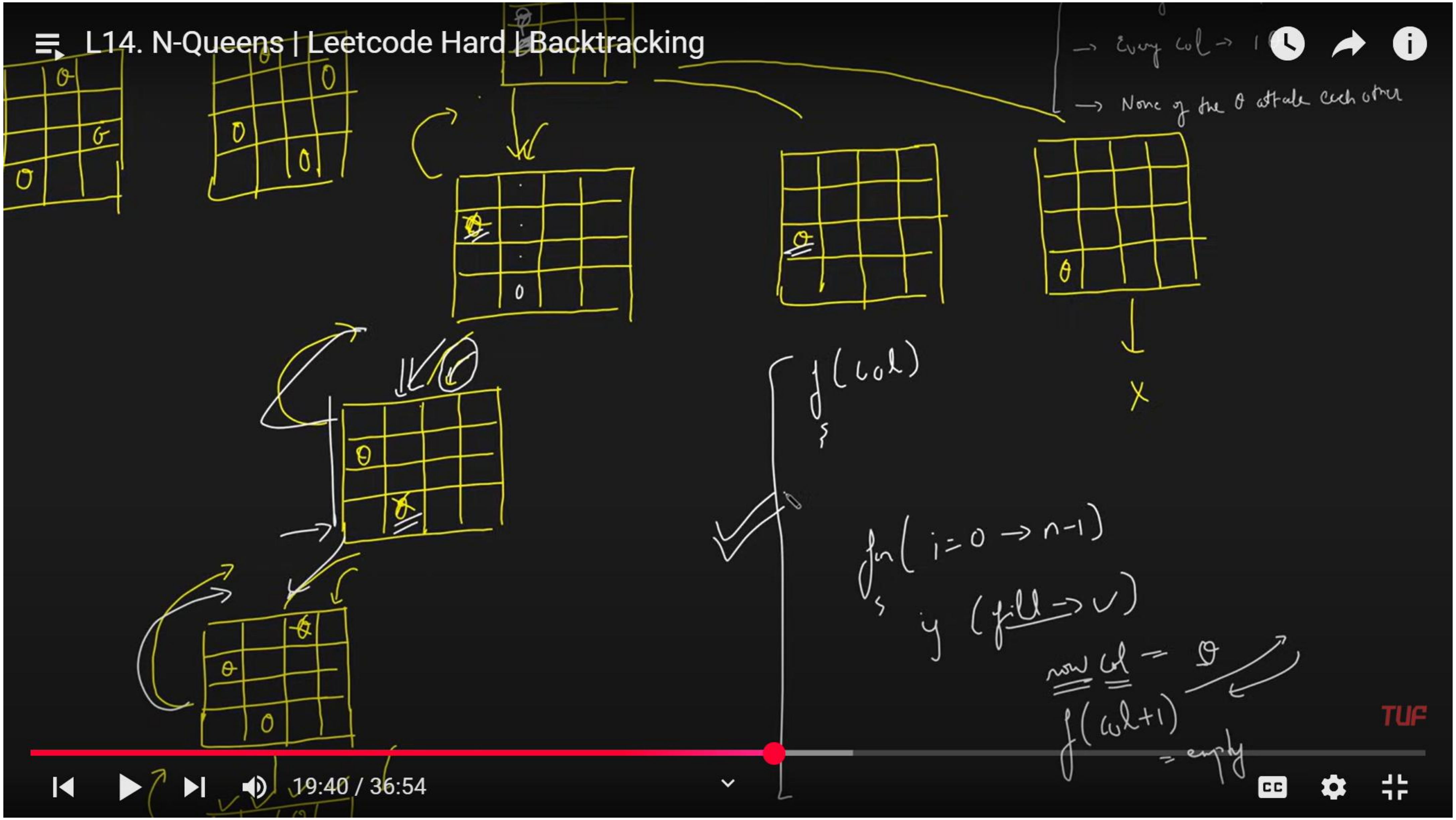


L14. N-Queens | Leetcode Hard | Backtracking

→ Every col → 1

→ None of the Q attack each other

f(col)
{

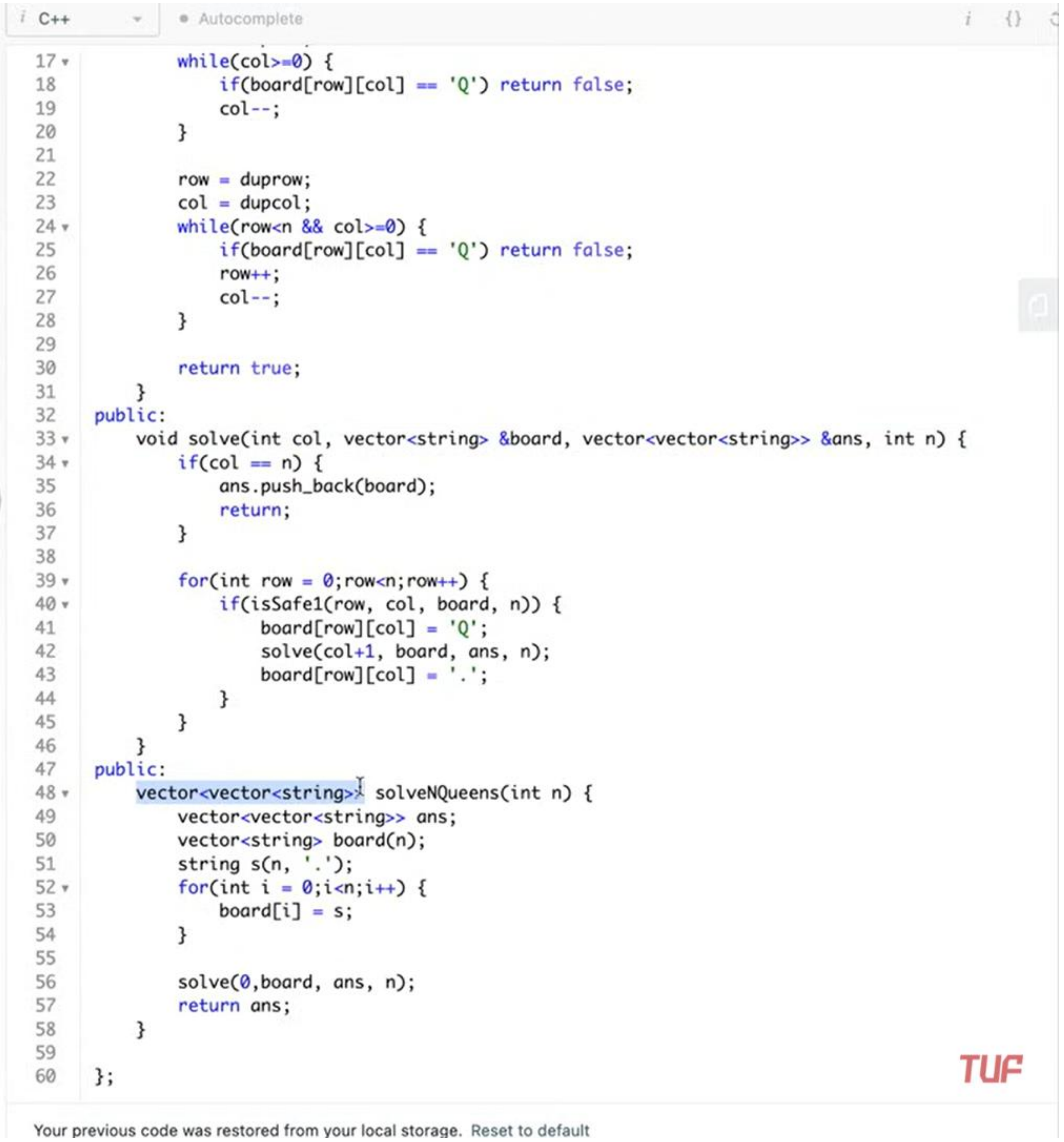
for(i=0 → n-1)
{
 if (fill → v)

 row col = Q

 f(col+1)

 = empty

19:40 / 36:54



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        while(col>=0) {
            if(board[row][col] == 'Q') return false;
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        }

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        while(row<n && col>=0) {
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public:
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        if(col == n) {
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        for(int i = 0;i<n;i++) {
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        solve(0,board, ans, n);
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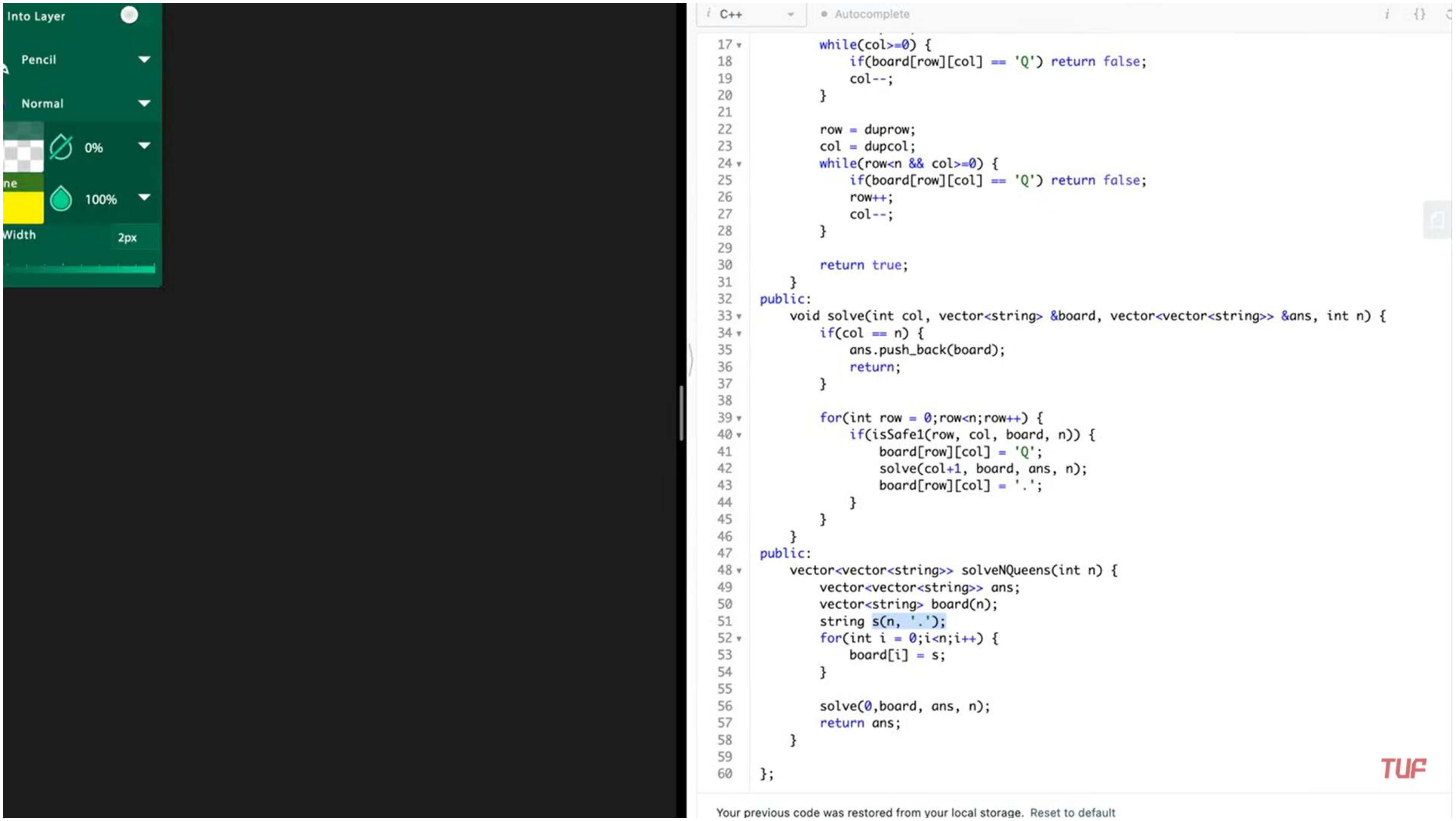
Your previous code was restored from your local storage. Reset to default



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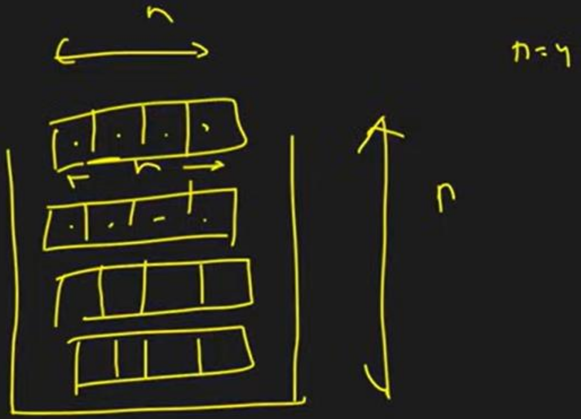

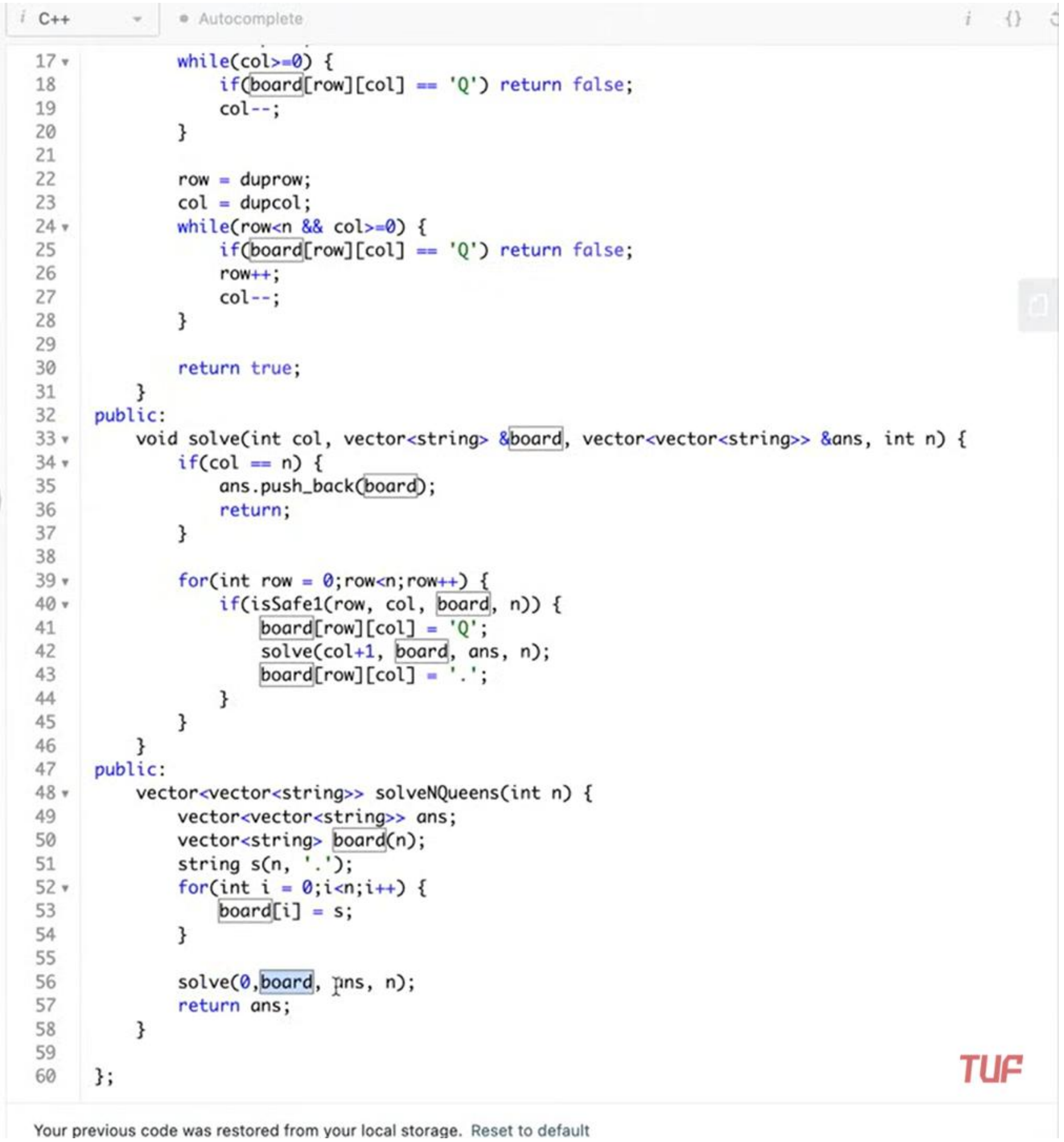

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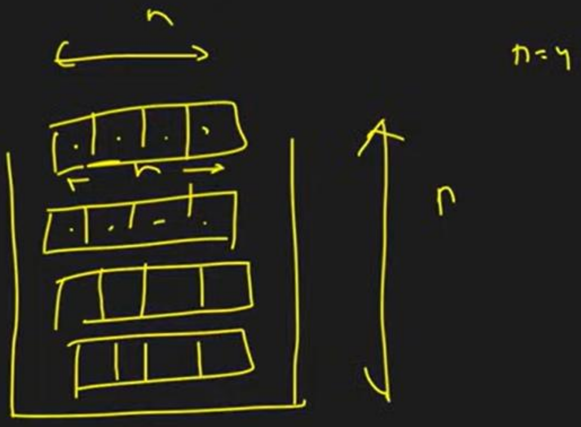

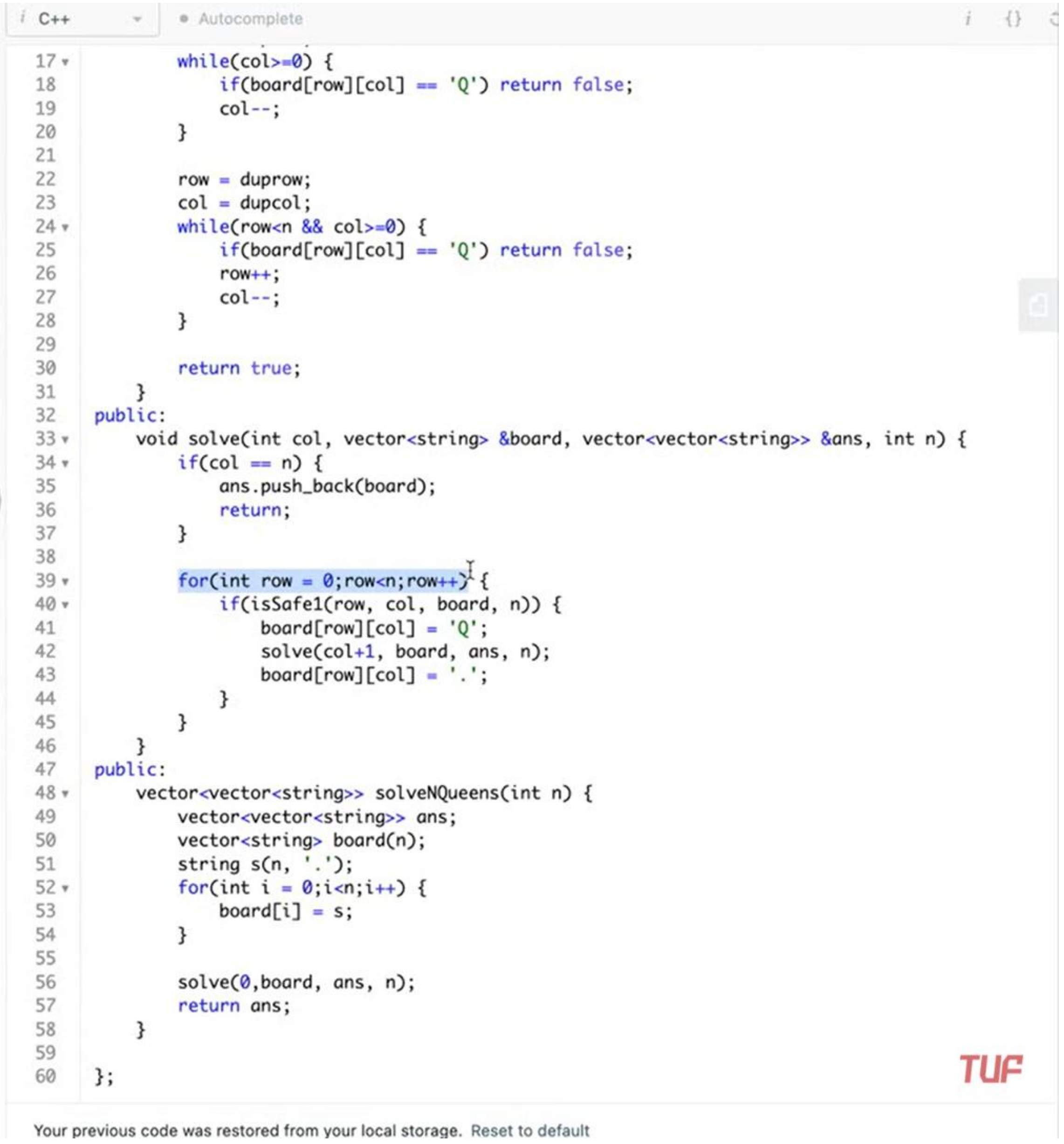

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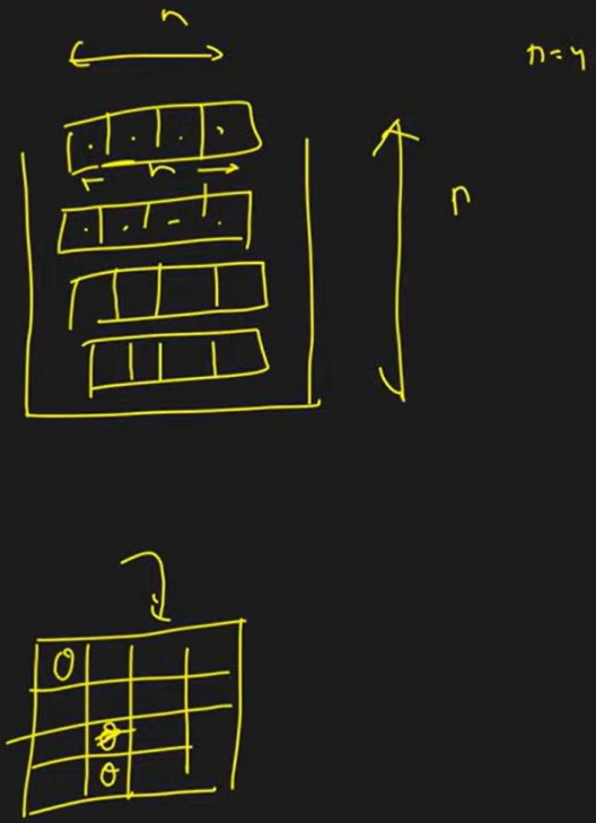

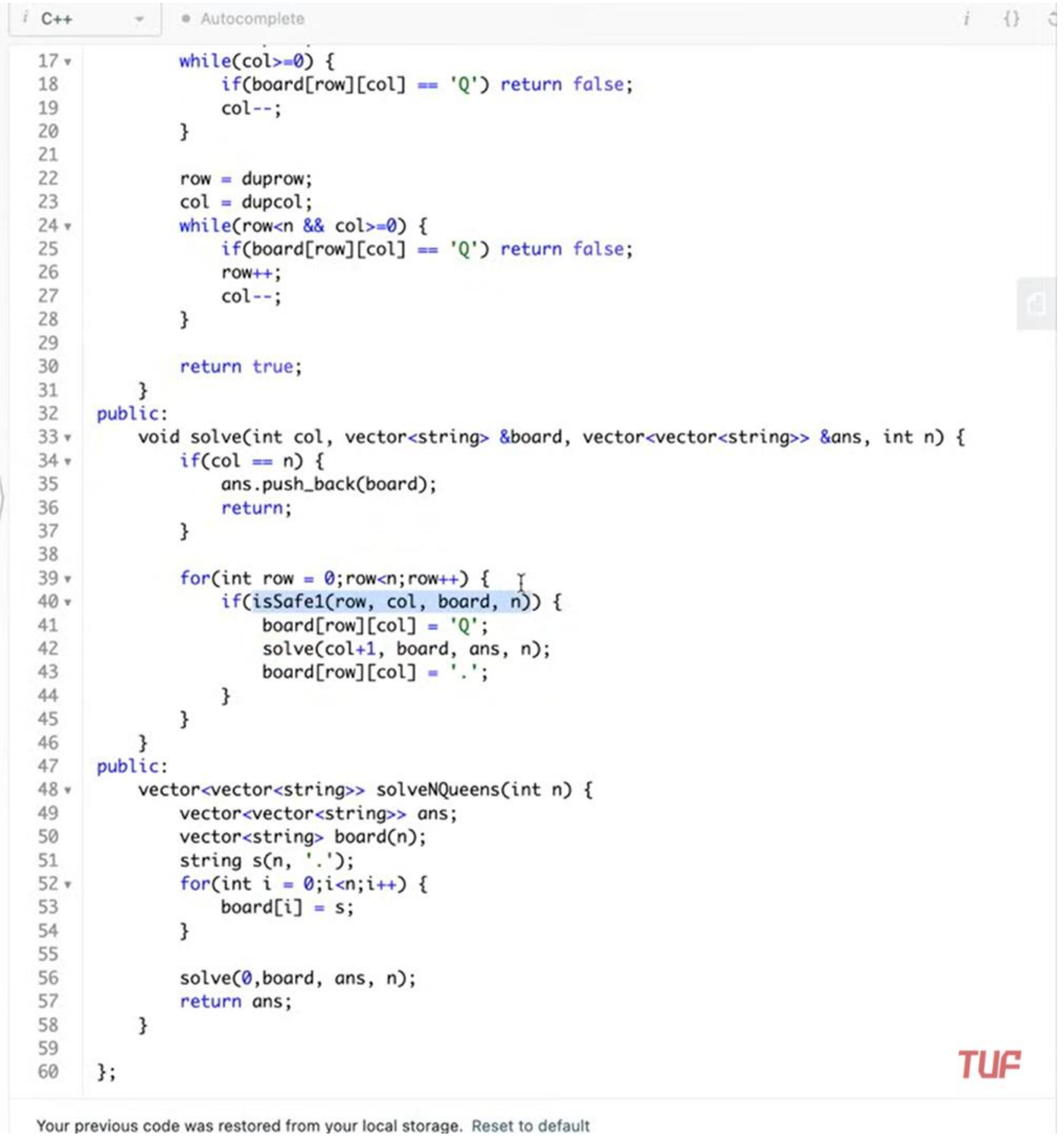

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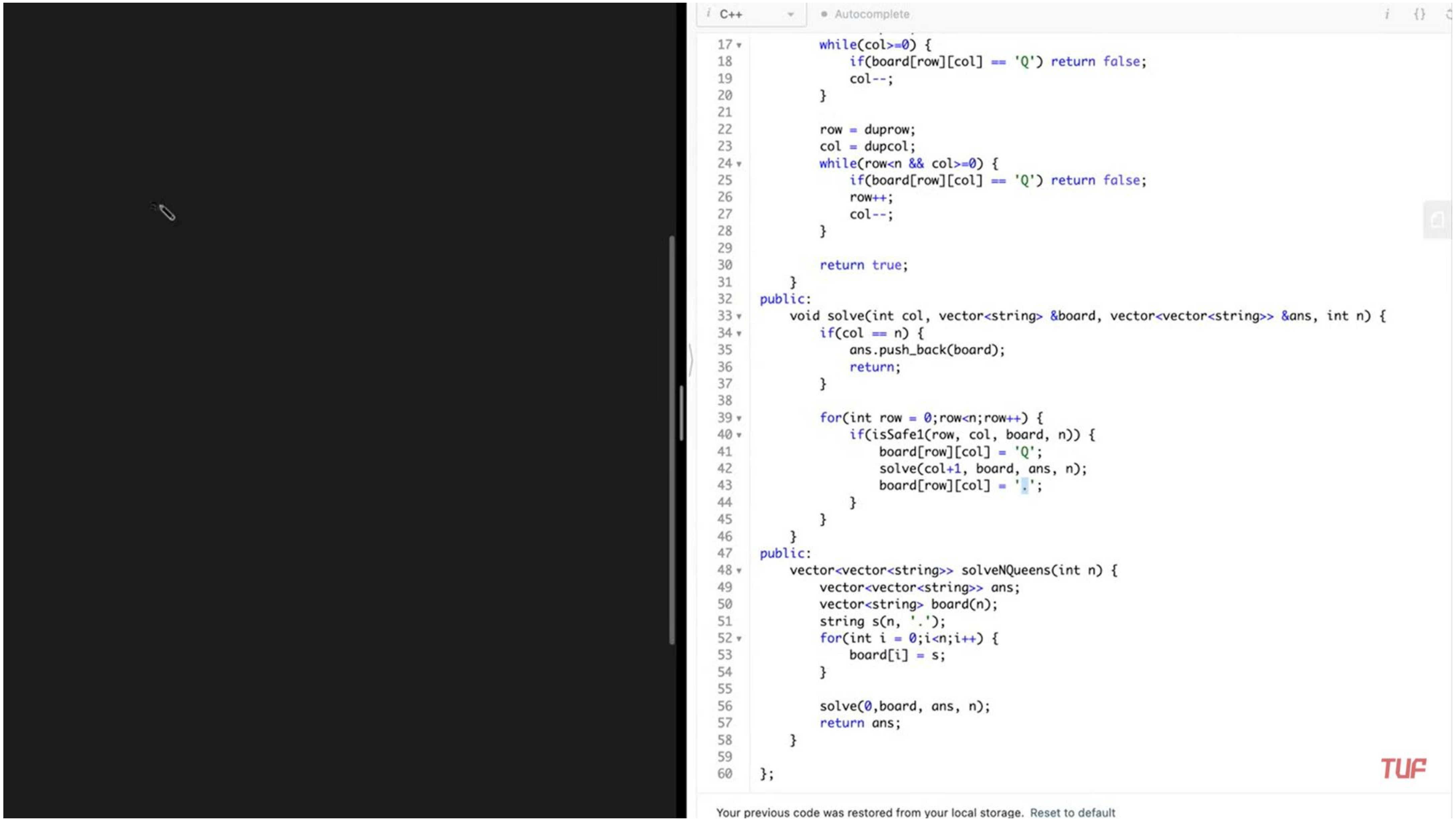
C++ Autocomplete

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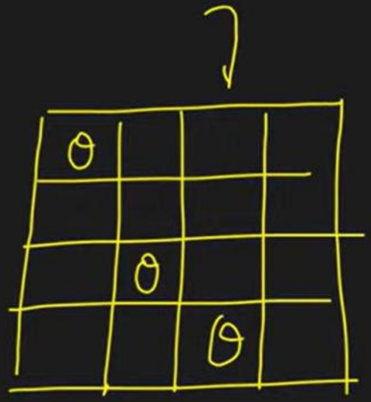

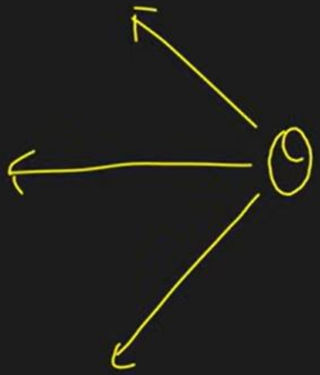

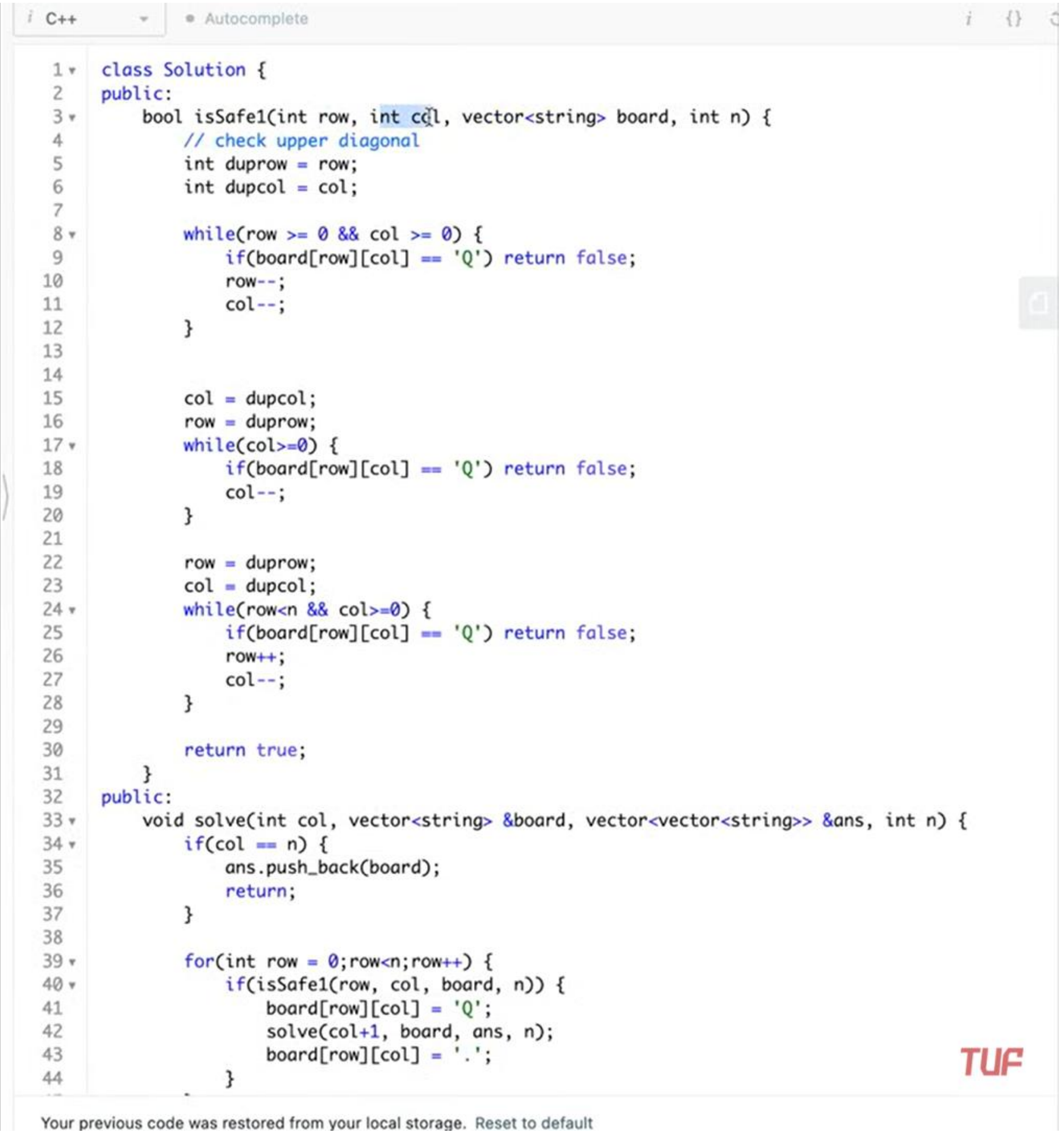

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public:
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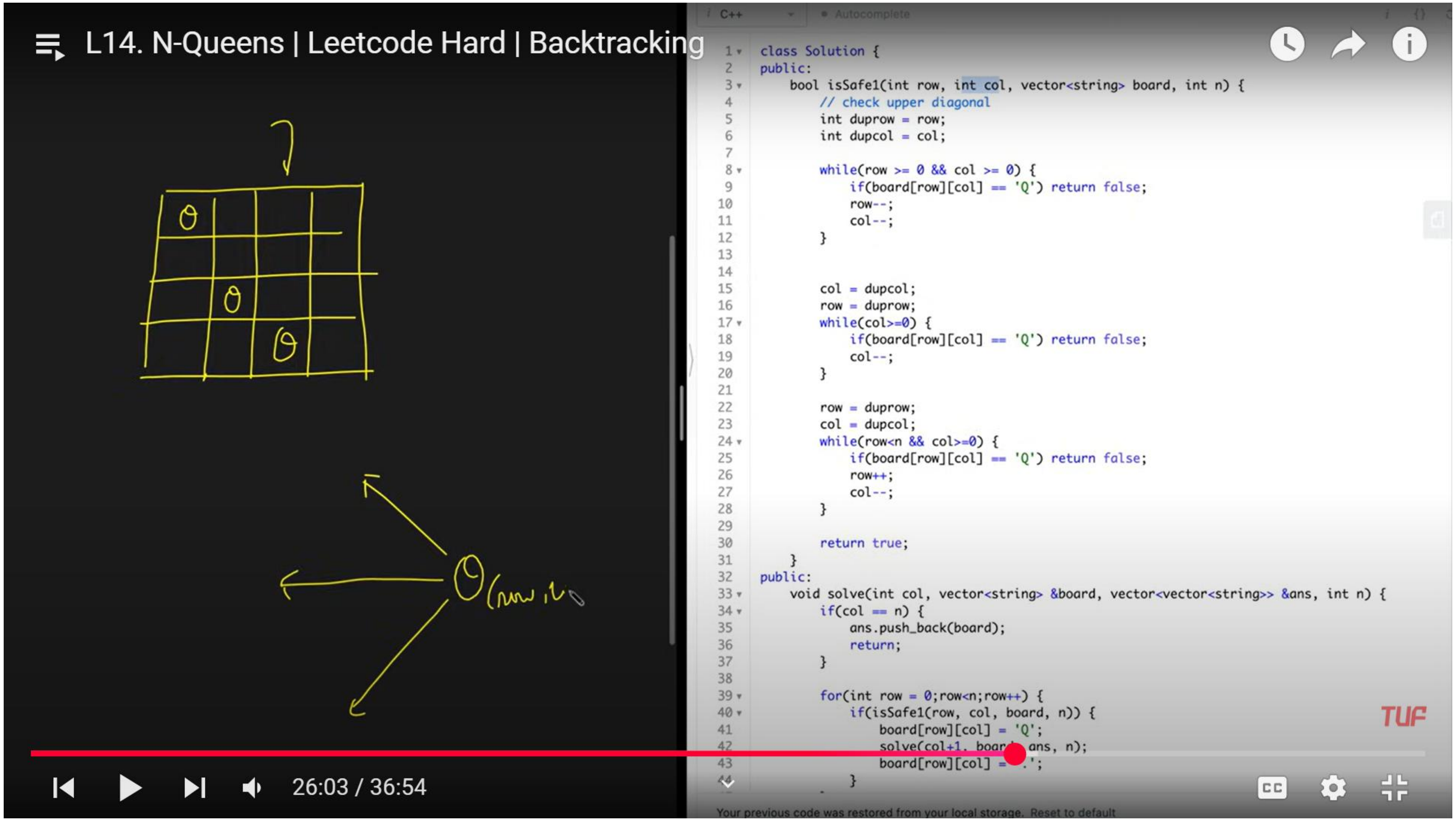

L14. N-Queens | Leetcode Hard | Backtracking

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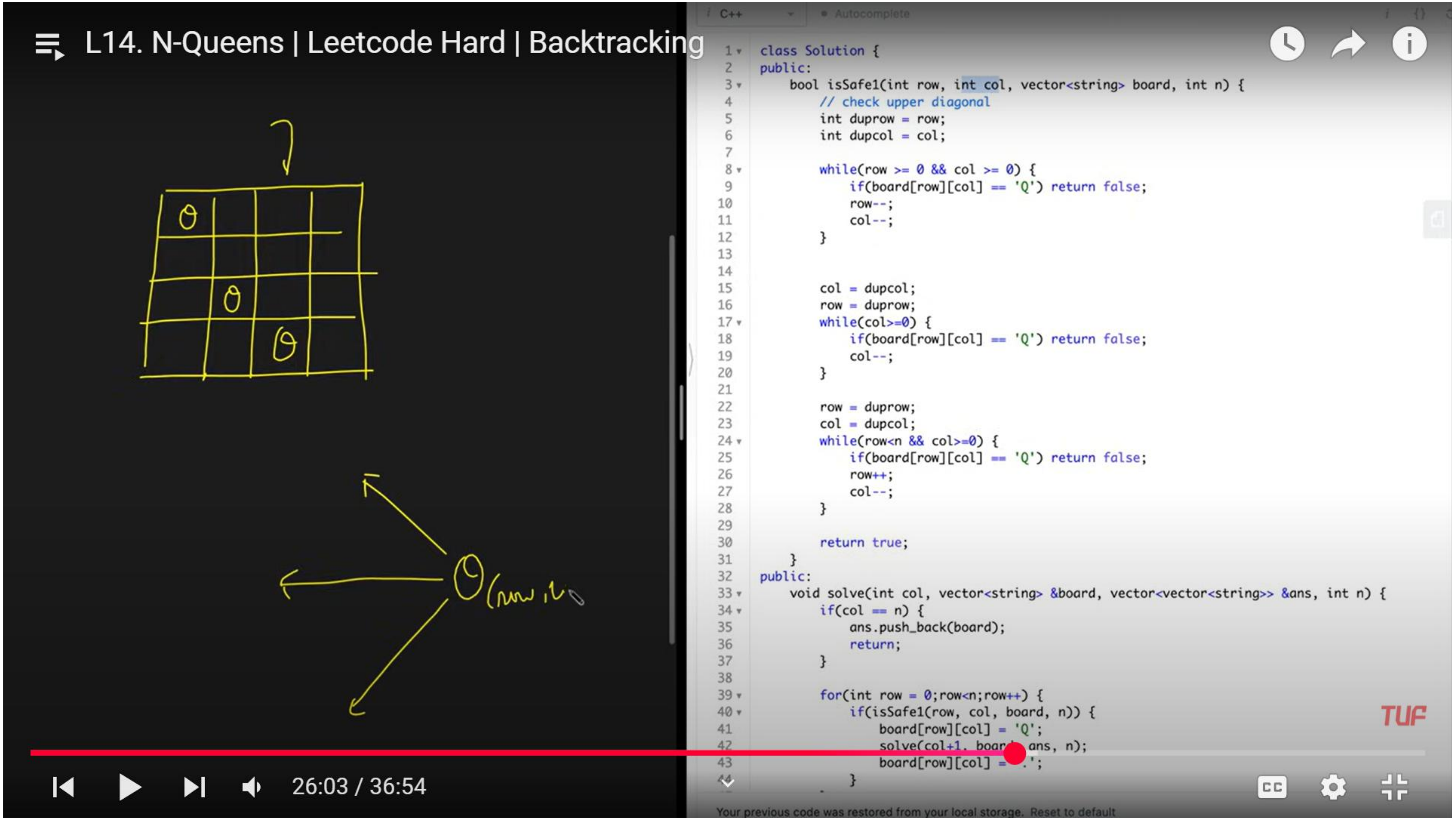

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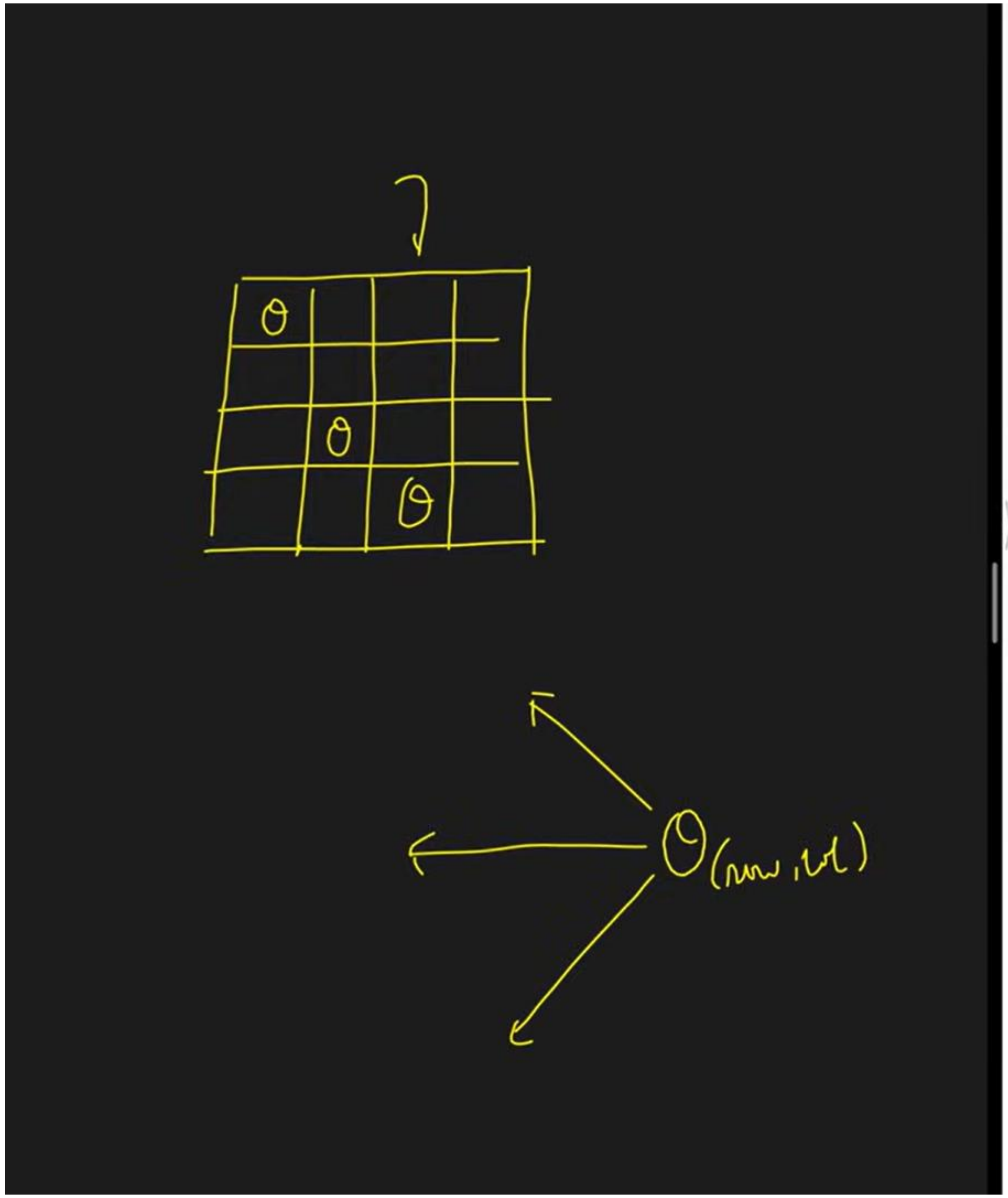

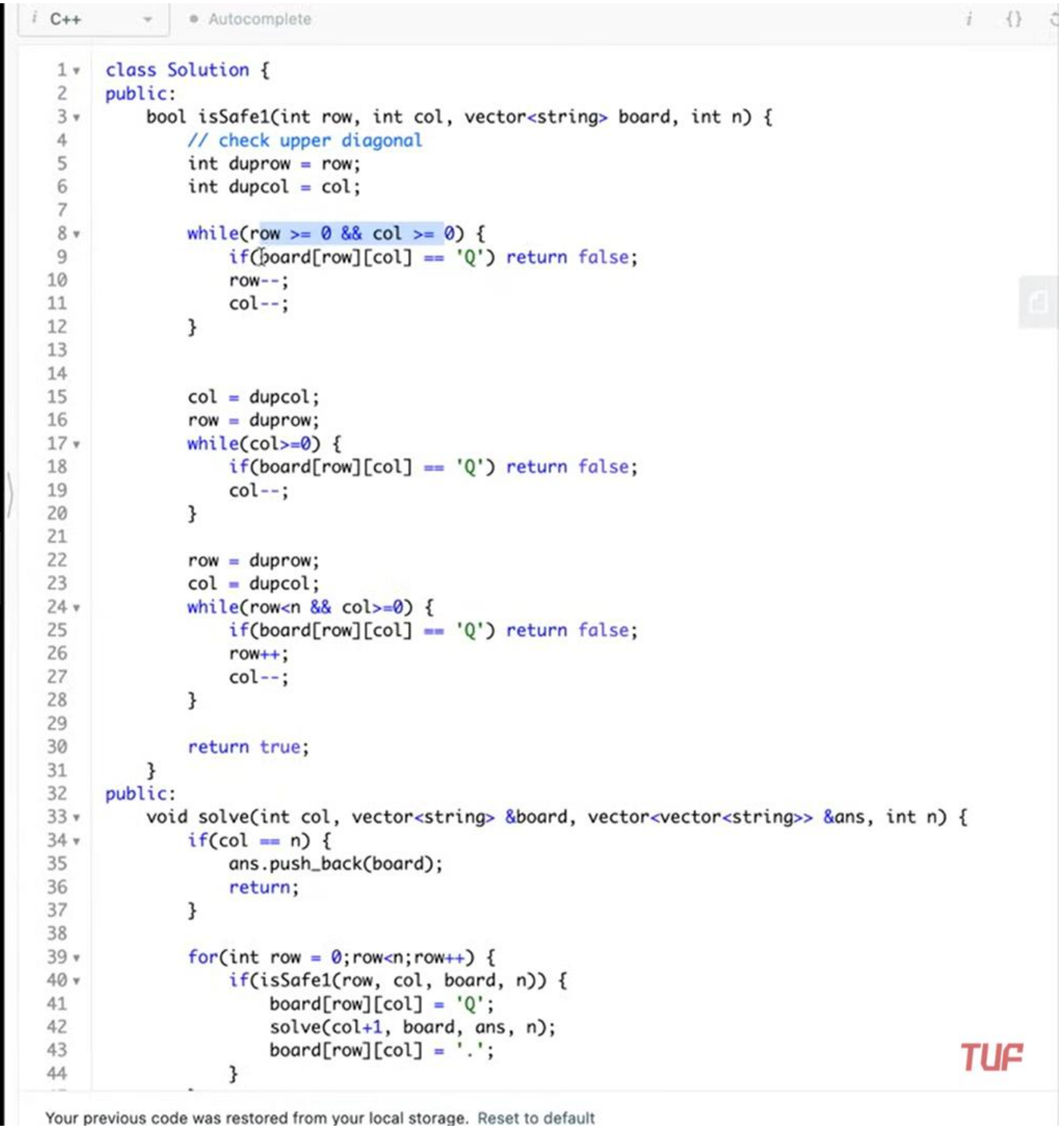

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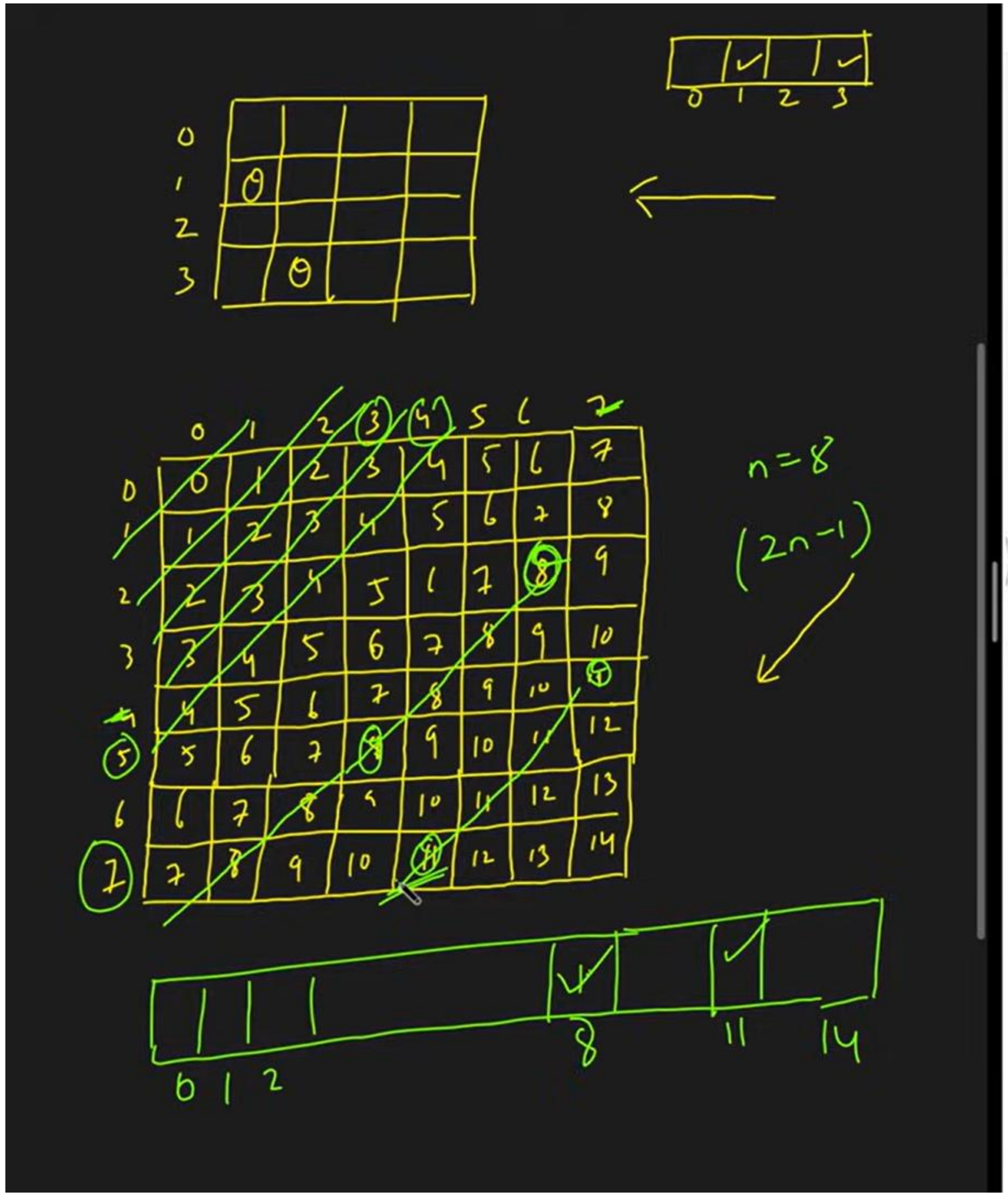

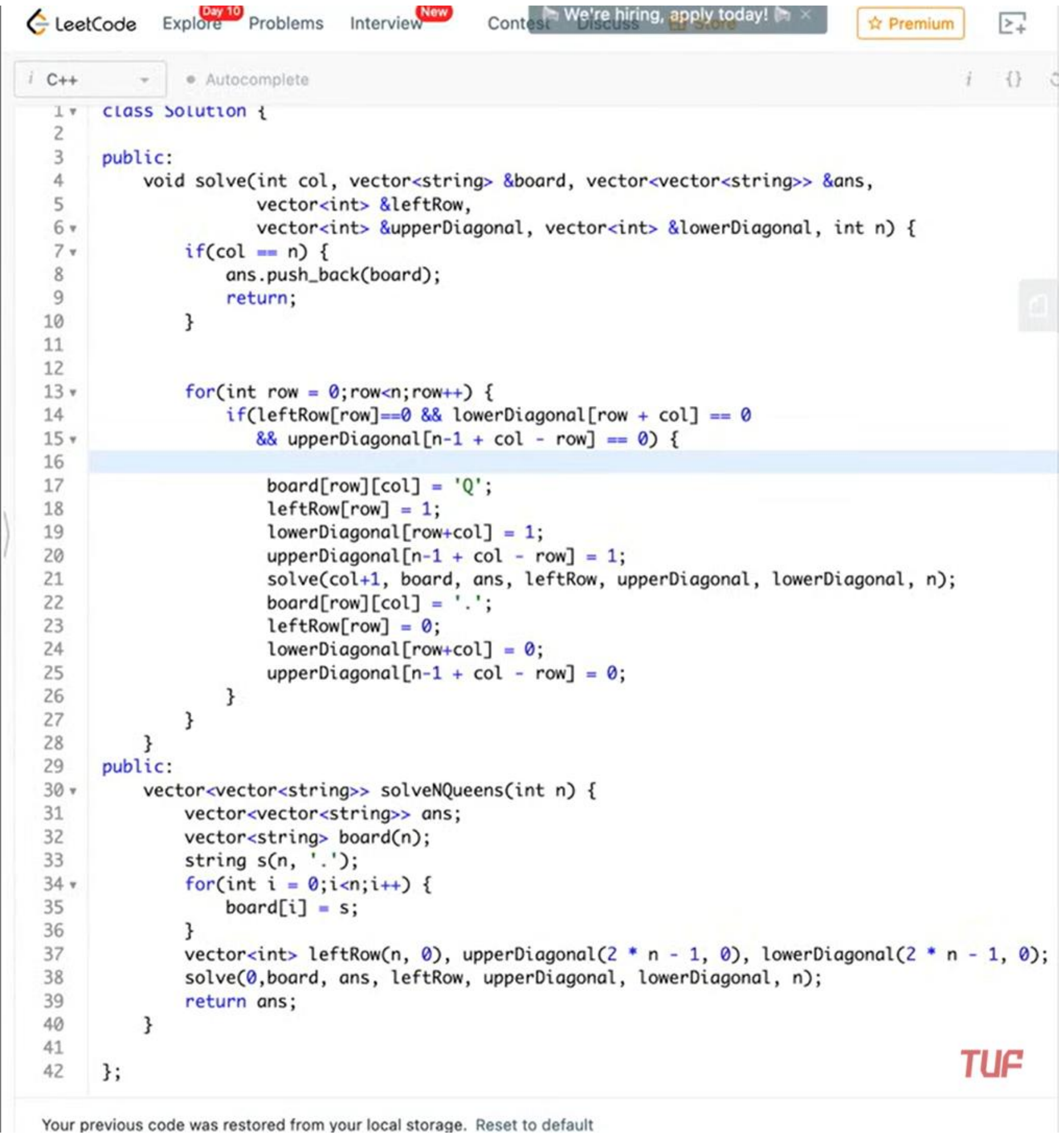

```cpp
class Solution {

public:
    void solve(int col, vector<string> &board, vector<vector<string>> &ans,
               vector<int> &leftRow,
               vector<int> &upperDiagonal, vector<int> &lowerDiagonal, int n) {
        if(col == n) {
            ans.push_back(board);
            return;
        }


        for(int row = 0;row<n;row++) {
            if(leftRow[row]==0 && lowerDiagonal[row + col] == 0
               && upperDiagonal[n-1 + col - row] == 0) {

                board[row][col] = 'Q';
                leftRow[row] = 1;
                lowerDiagonal[row+col] = 1;
                upperDiagonal[n-1 + col - row] = 1;
                solve(col+1, board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
                board[row][col] = '.';
                leftRow[row] = 0;
                lowerDiagonal[row+col] = 0;
                upperDiagonal[n-1 + col - row] = 0;
            }
        }
    }
public:
    vector<vector<string>> solveNQueens(int n) {
        vector<vector<string>> ans;
        vector<string> board(n);
        string s(n, '.');
        for(int i = 0;i<n;i++) {
            board[i] = s;
        }
        vector<int> leftRow(n, 0), upperDiagonal(2 * n - 1, 0), lowerDiagonal(2 * n - 1, 0);
        solve(0,board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
        return ans;
    }

};
```

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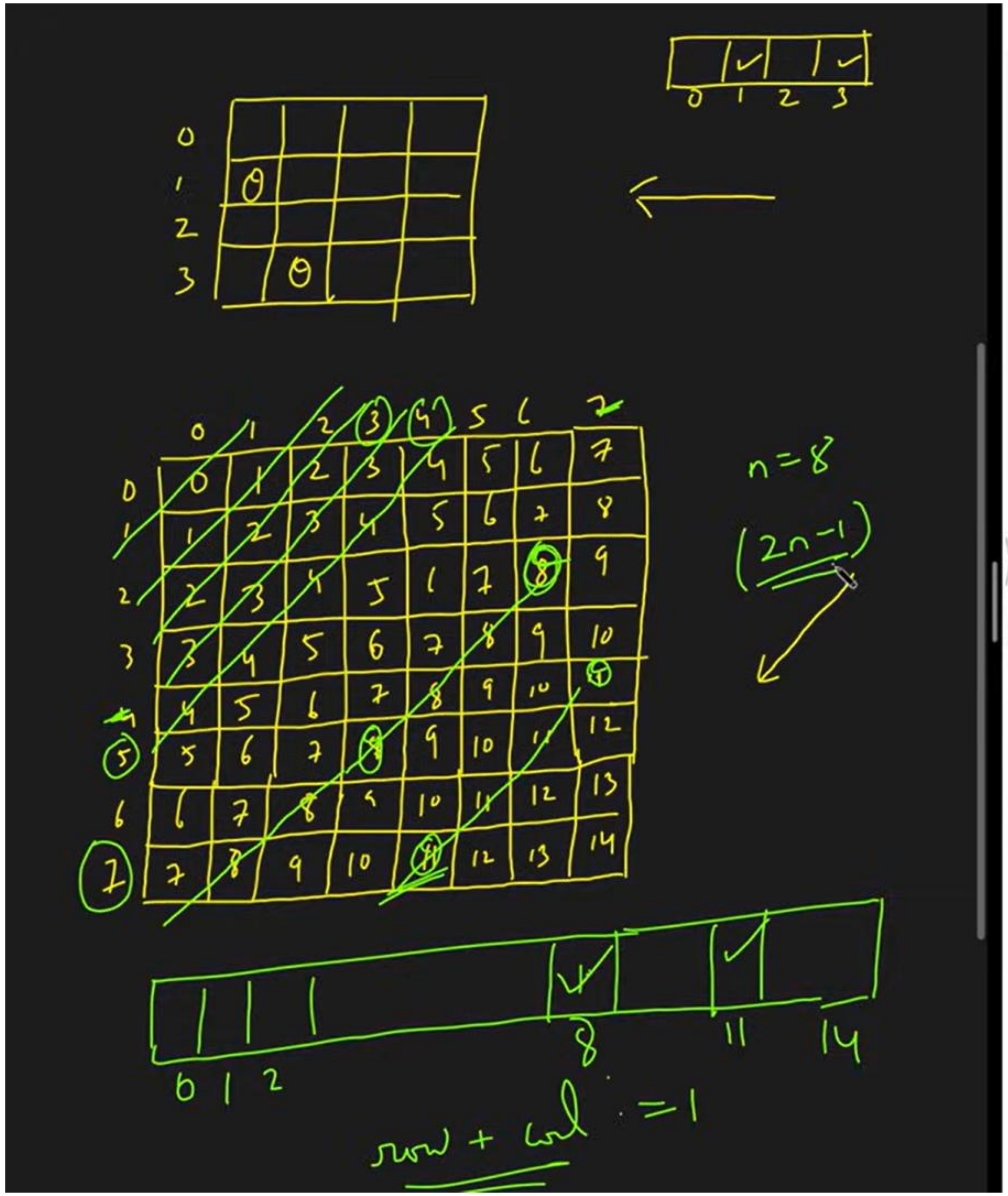

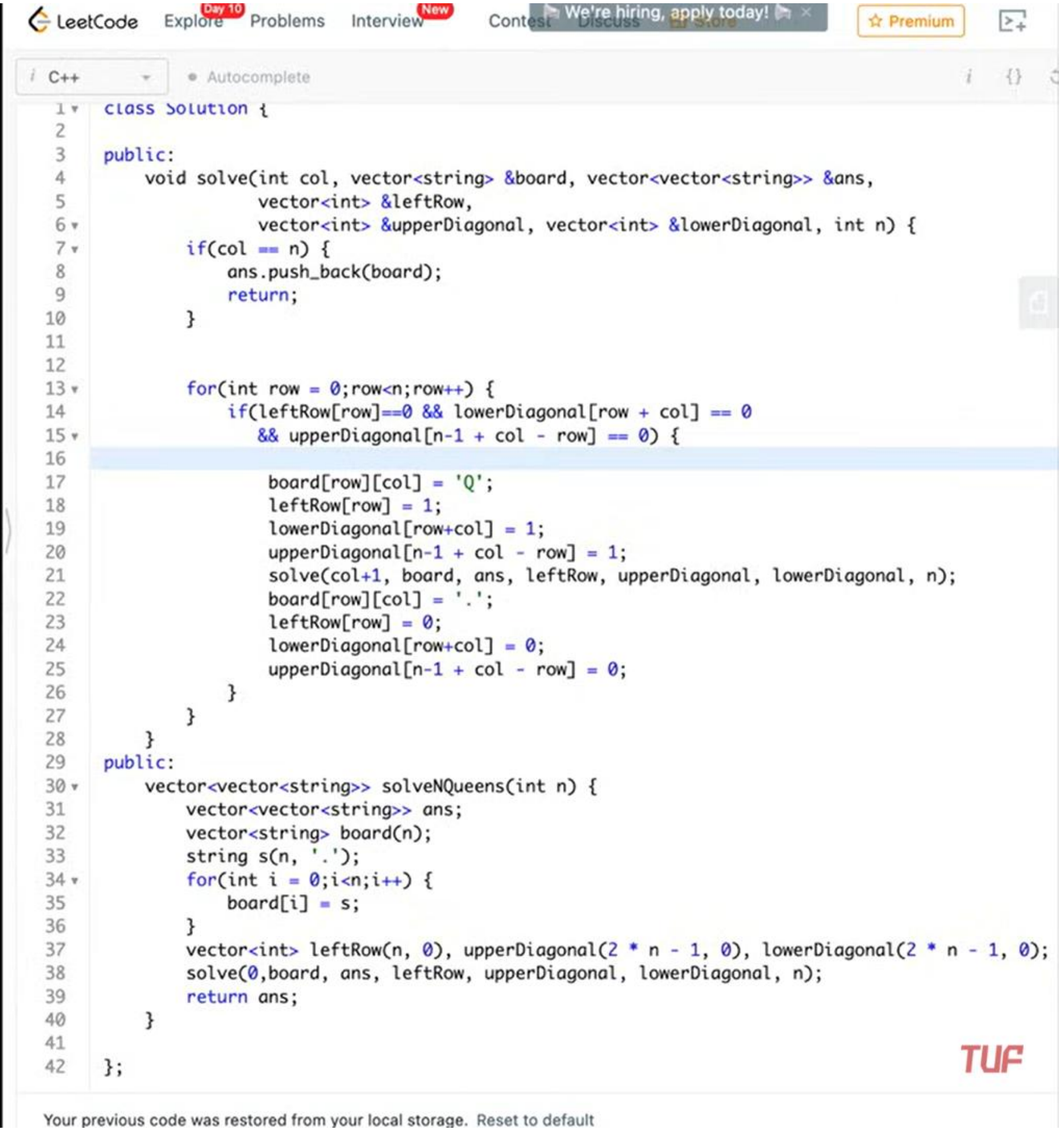

```cpp
class Solution {

public:
    void solve(int col, vector<string> &board, vector<vector<string>> &ans,
               vector<int> &leftRow,
               vector<int> &upperDiagonal, vector<int> &lowerDiagonal, int n) {
        if(col == n) {
            ans.push_back(board);
            return;
        }


        for(int row = 0;row<n;row++) {
            if(leftRow[row]==0 && lowerDiagonal[row + col] == 0
               && upperDiagonal[n-1 + col - row] == 0) {

                board[row][col] = 'Q';
                leftRow[row] = 1;
                lowerDiagonal[row+col] = 1;
                upperDiagonal[n-1 + col - row] = 1;
                solve(col+1, board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
                board[row][col] = '.';
                leftRow[row] = 0;
                lowerDiagonal[row+col] = 0;
                upperDiagonal[n-1 + col - row] = 0;
            }
        }
    }
public:
    vector<vector<string>> solveNQueens(int n) {
        vector<vector<string>> ans;
        vector<string> board(n);
        string s(n, '.');
        for(int i = 0;i<n;i++) {
            board[i] = s;
        }
        vector<int> leftRow(n, 0), upperDiagonal(2 * n - 1, 0), lowerDiagonal(2 * n - 1, 0);
        solve(0,board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
        return ans;
    }

};
```

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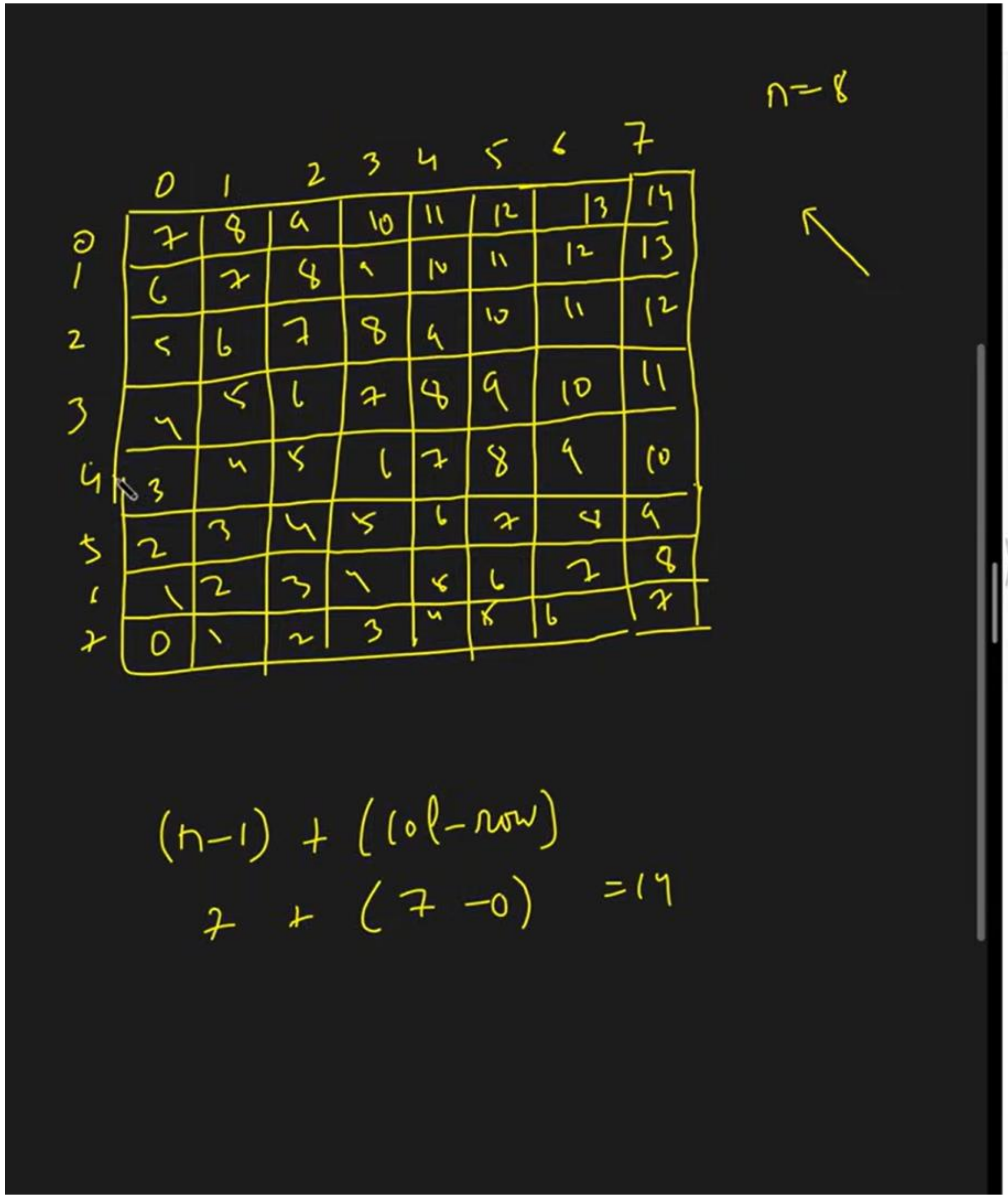
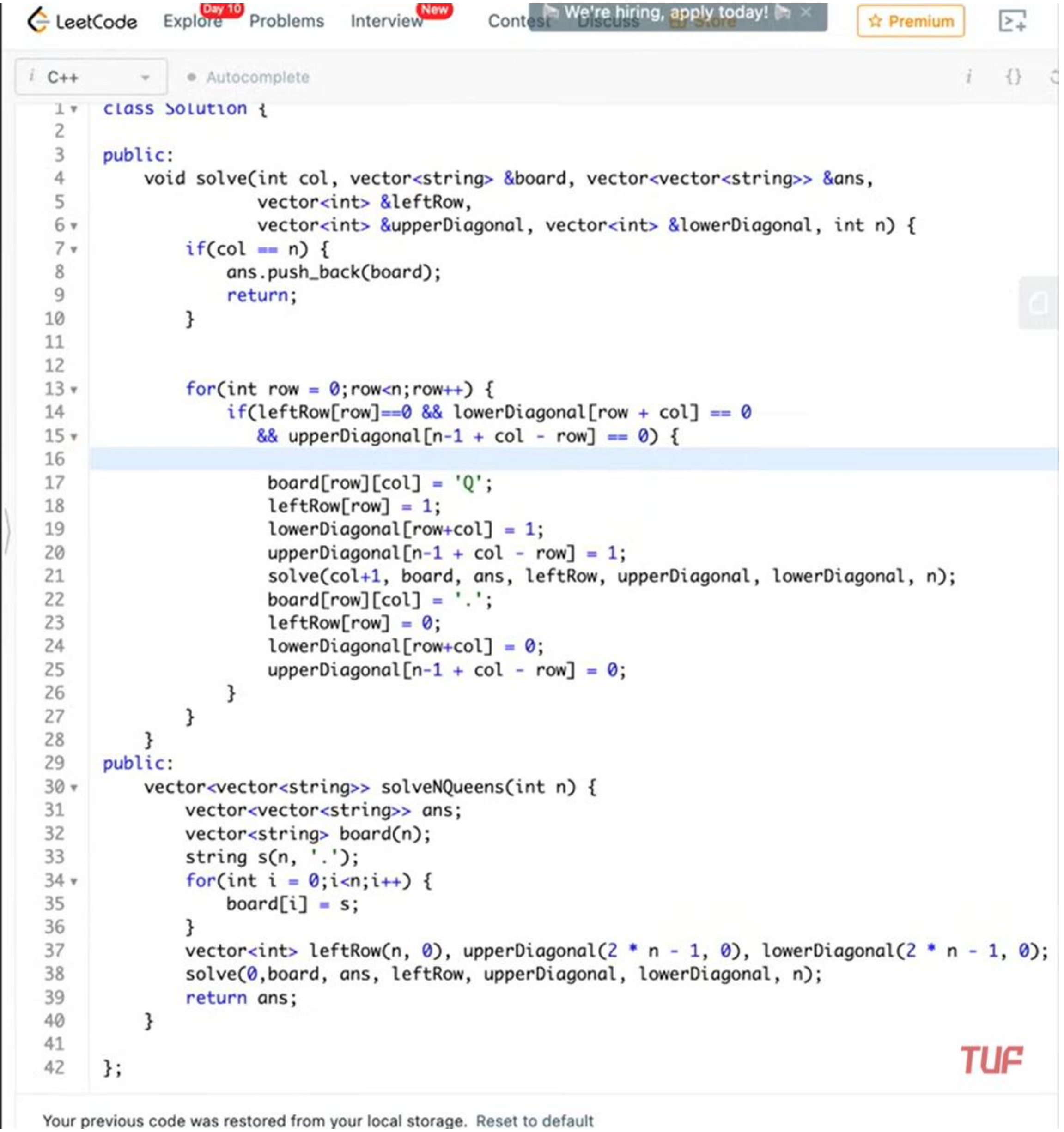


$n=8$

	0	1	2	3	4	5	6	7
0	7	8	9	10	11	12	13	14
1	6	7	8	9	10	11	12	13
2	5	6	7	8	9	10	11	12
3	4	5	6	7	8	9	10	11
4	3	4	5	6	7	8	9	10
5	2	3	4	5	6	7	8	9
6	1	2	3	4	5	6	7	8
7	0	1	2	3	4	5	6	7

$$(n-1) + (col - row)$$
$$7 + (7 - 0) = 14$$



```cpp
class Solution {

public:
    void solve(int col, vector<string> &board, vector<vector<string>> &ans,
               vector<int> &leftRow,
               vector<int> &upperDiagonal, vector<int> &lowerDiagonal, int n) {
        if(col == n) {
            ans.push_back(board);
            return;
        }


        for(int row = 0;row<n;row++) {
            if(leftRow[row]==0 && lowerDiagonal[row + col] == 0
               && upperDiagonal[n-1 + col - row] == 0) {

                board[row][col] = 'Q';
                leftRow[row] = 1;
                lowerDiagonal[row+col] = 1;
                upperDiagonal[n-1 + col - row] = 1;
                solve(col+1, board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
                board[row][col] = '.';
                leftRow[row] = 0;
                lowerDiagonal[row+col] = 0;
                upperDiagonal[n-1 + col - row] = 0;
            }
        }
    }
public:
    vector<vector<string>> solveNQueens(int n) {
        vector<vector<string>> ans;
        vector<string> board(n);
        string s(n, '.');
        for(int i = 0;i<n;i++) {
            board[i] = s;
        }
        vector<int> leftRow(n, 0), upperDiagonal(2 * n - 1, 0), lowerDiagonal(2 * n - 1, 0);
        solve(0,board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
        return ans;
    }

};
```

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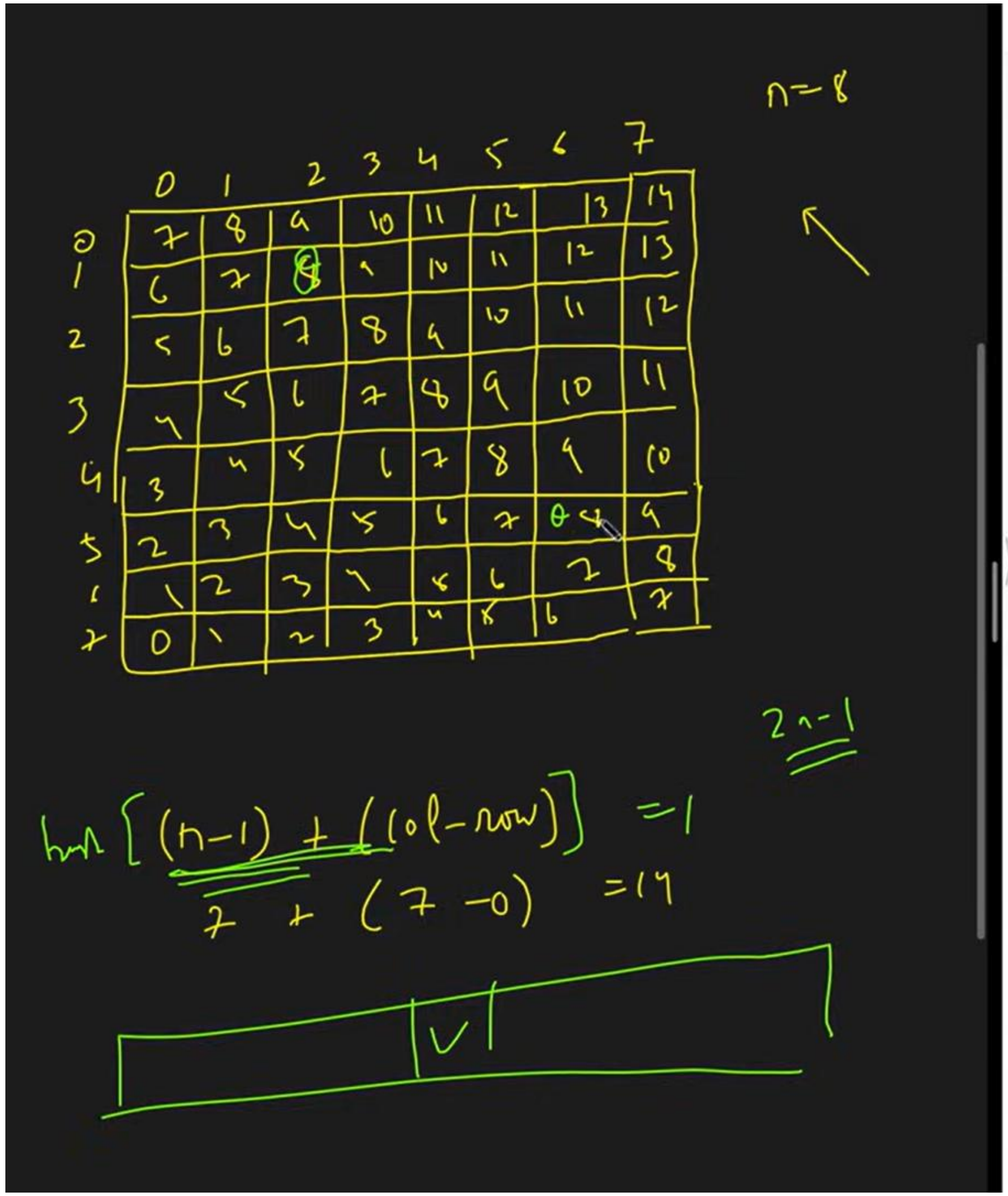

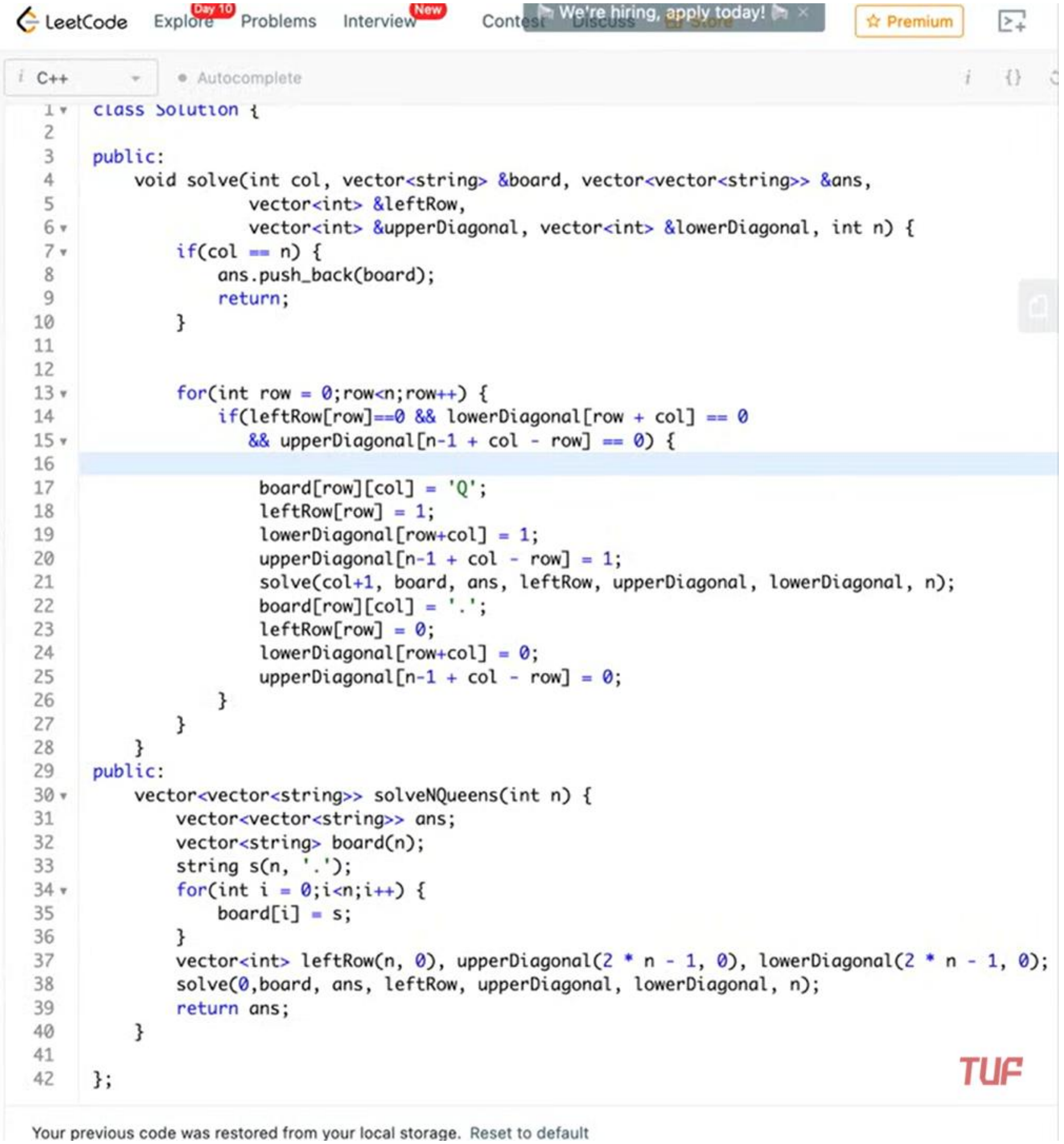

```cpp
class Solution {

public:
    void solve(int col, vector<string> &board, vector<vector<string>> &ans,
               vector<int> &leftRow,
               vector<int> &upperDiagonal, vector<int> &lowerDiagonal, int n) {
        if(col == n) {
            ans.push_back(board);
            return;
        }


        for(int row = 0;row<n;row++) {
            if(leftRow[row]==0 && lowerDiagonal[row + col] == 0
               && upperDiagonal[n-1 + col - row] == 0) {

                board[row][col] = 'Q';
                leftRow[row] = 1;
                lowerDiagonal[row+col] = 1;
                upperDiagonal[n-1 + col - row] = 1;
                solve(col+1, board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
                board[row][col] = '.';
                leftRow[row] = 0;
                lowerDiagonal[row+col] = 0;
                upperDiagonal[n-1 + col - row] = 0;
            }
        }
    }
public:
    vector<vector<string>> solveNQueens(int n) {
        vector<vector<string>> ans;
        vector<string> board(n);
        string s(n, '.');
        for(int i = 0;i<n;i++) {
            board[i] = s;
        }
        vector<int> leftRow(n, 0), upperDiagonal(2 * n - 1, 0), lowerDiagonal(2 * n - 1, 0);
        solve(0,board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
        return ans;
    }

};
```

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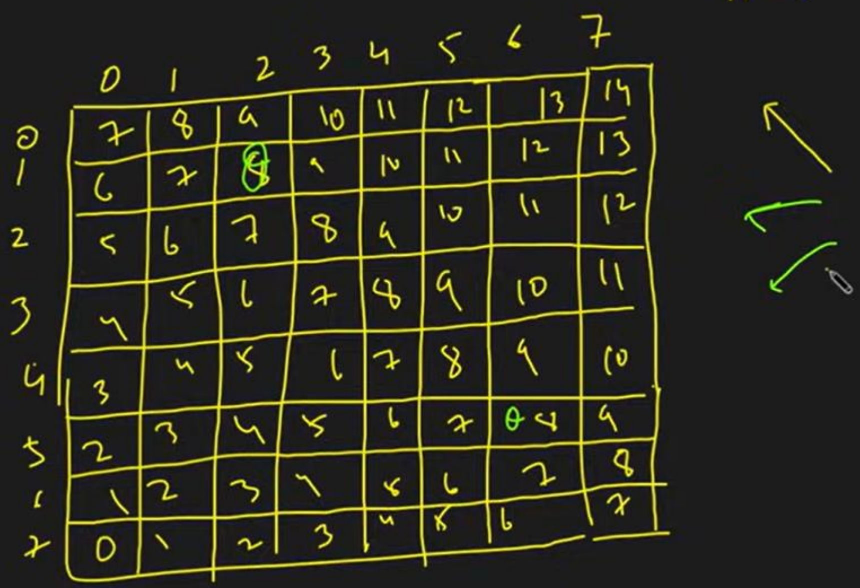
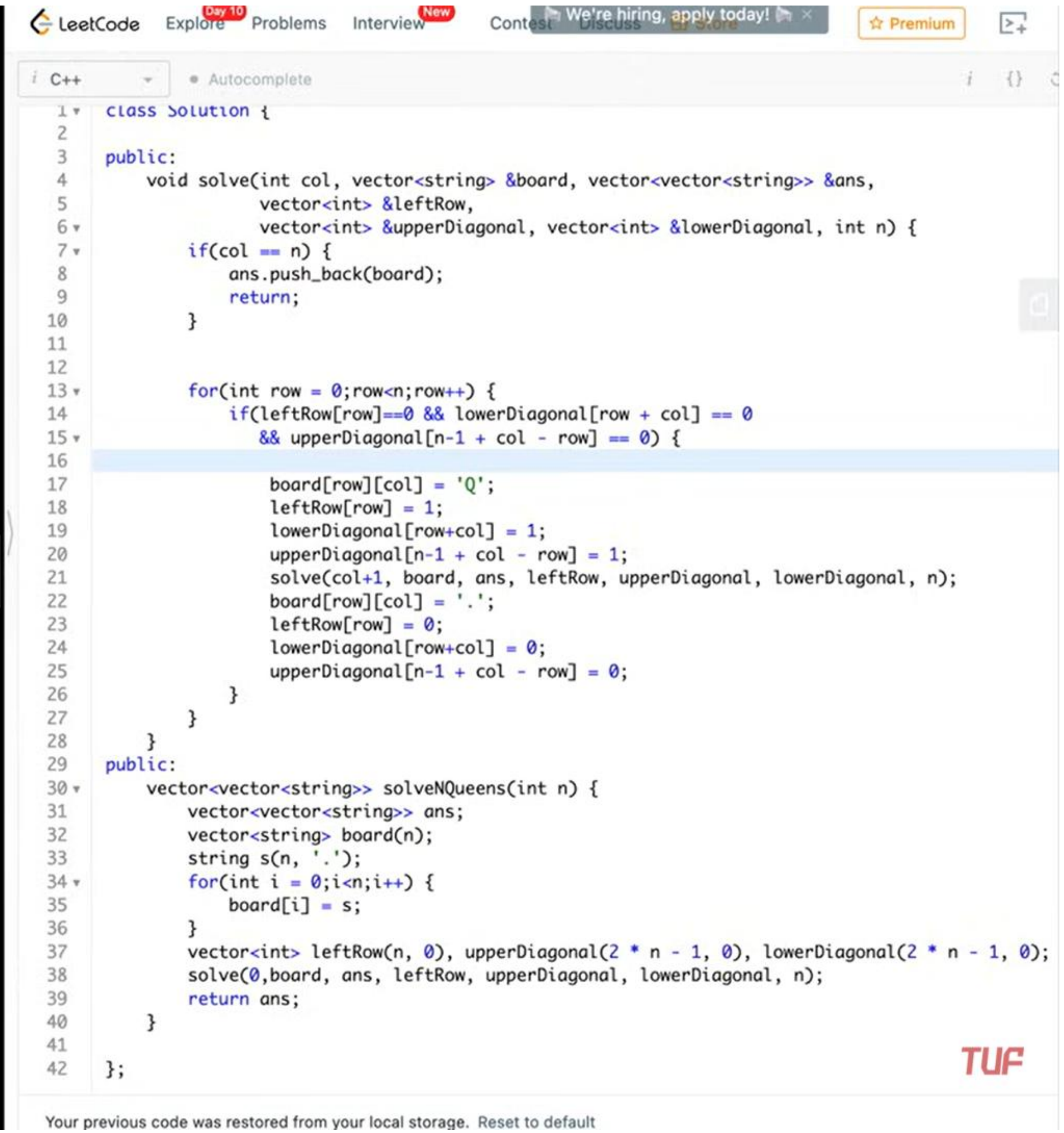
$n=8$



$$\text{hmh}\left[\underline{(n-1)}+(col-row)\right]=1$$

$$7+(7-0)=14$$

$$\underline{\underline{2n-1}}$$



```cpp
class Solution {

public:
    void solve(int col, vector<string> &board, vector<vector<string>> &ans,
               vector<int> &leftRow,
               vector<int> &upperDiagonal, vector<int> &lowerDiagonal, int n) {
        if(col == n) {
            ans.push_back(board);
            return;
        }


        for(int row = 0;row<n;row++) {
            if(leftRow[row]==0 && lowerDiagonal[row + col] == 0
               && upperDiagonal[n-1 + col - row] == 0) {

                board[row][col] = 'Q';
                leftRow[row] = 1;
                lowerDiagonal[row+col] = 1;
                upperDiagonal[n-1 + col - row] = 1;
                solve(col+1, board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
                board[row][col] = '.';
                leftRow[row] = 0;
                lowerDiagonal[row+col] = 0;
                upperDiagonal[n-1 + col - row] = 0;
            }
        }
    }
public:
    vector<vector<string>> solveNQueens(int n) {
        vector<vector<string>> ans;
        vector<string> board(n);
        string s(n, '.');
        for(int i = 0;i<n;i++) {
            board[i] = s;
        }
        vector<int> leftRow(n, 0), upperDiagonal(2 * n - 1, 0), lowerDiagonal(2 * n - 1, 0);
        solve(0,board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
        return ans;
    }

};
```

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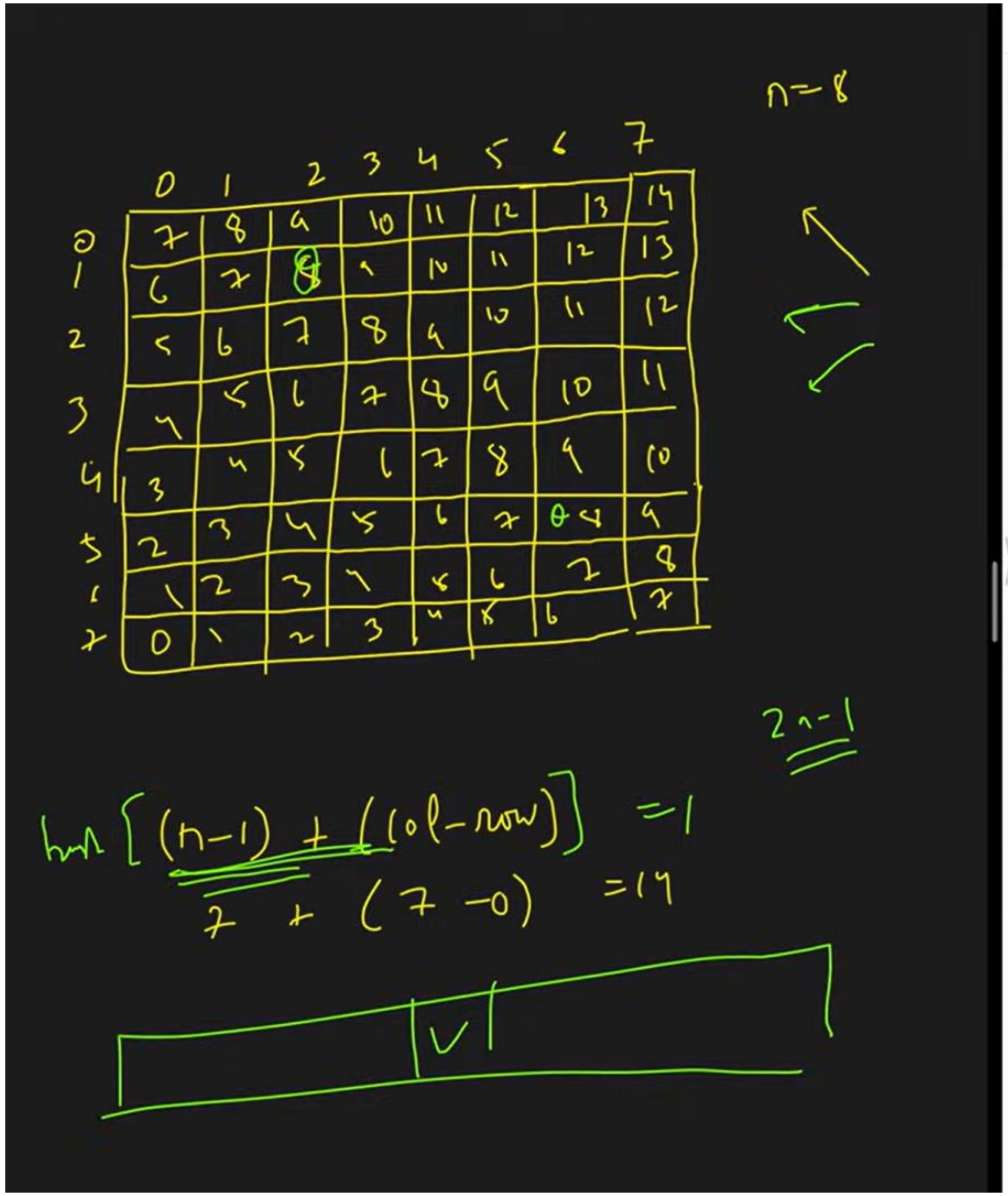

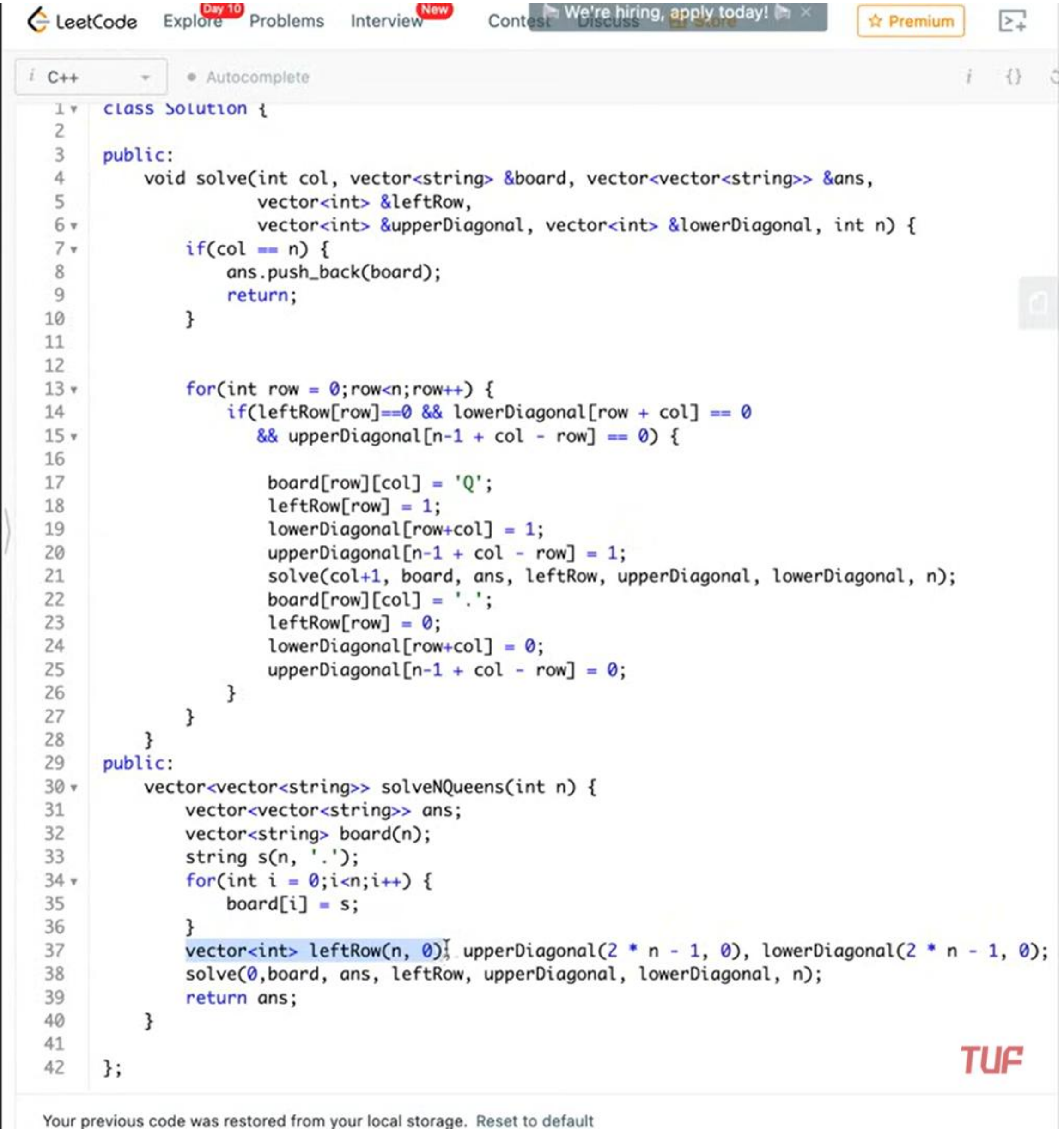

```cpp
class Solution {

public:
    void solve(int col, vector<string> &board, vector<vector<string>> &ans,
               vector<int> &leftRow,
               vector<int> &upperDiagonal, vector<int> &lowerDiagonal, int n) {
        if(col == n) {
            ans.push_back(board);
            return;
        }


        for(int row = 0;row<n;row++) {
            if(leftRow[row]==0 && lowerDiagonal[row + col] == 0
               && upperDiagonal[n-1 + col - row] == 0) {

                board[row][col] = 'Q';
                leftRow[row] = 1;
                lowerDiagonal[row+col] = 1;
                upperDiagonal[n-1 + col - row] = 1;
                solve(col+1, board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
                board[row][col] = '.';
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        }
    }
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    vector<vector<string>> solveNQueens(int n) {
        vector<vector<string>> ans;
        vector<string> board(n);
        string s(n, '.');
        for(int i = 0;i<n;i++) {
            board[i] = s;
        }
        vector<int> leftRow(n, 0), upperDiagonal(2 * n - 1, 0), lowerDiagonal(2 * n - 1, 0);
        solve(0,board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
        return ans;
    }

};
```

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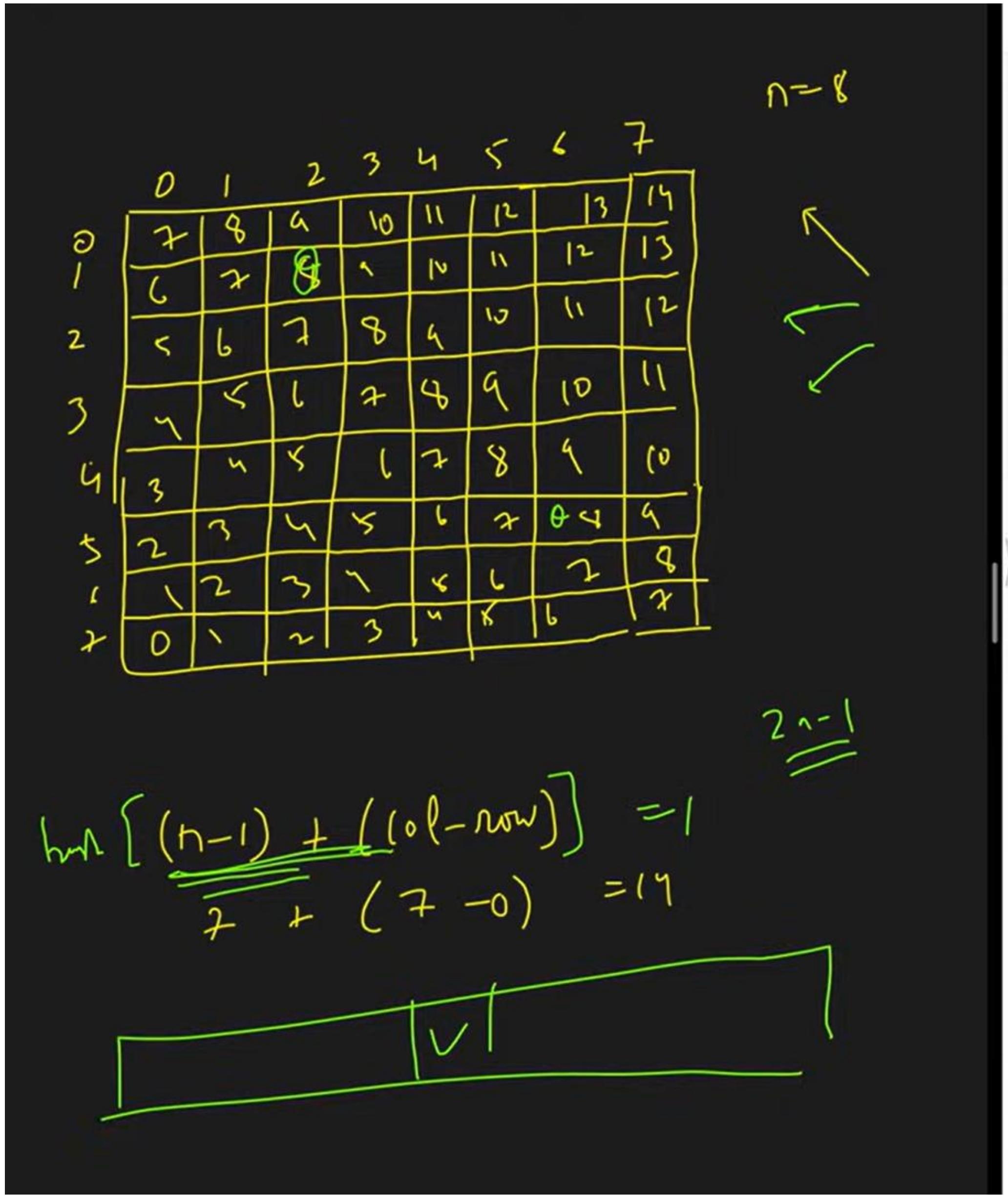

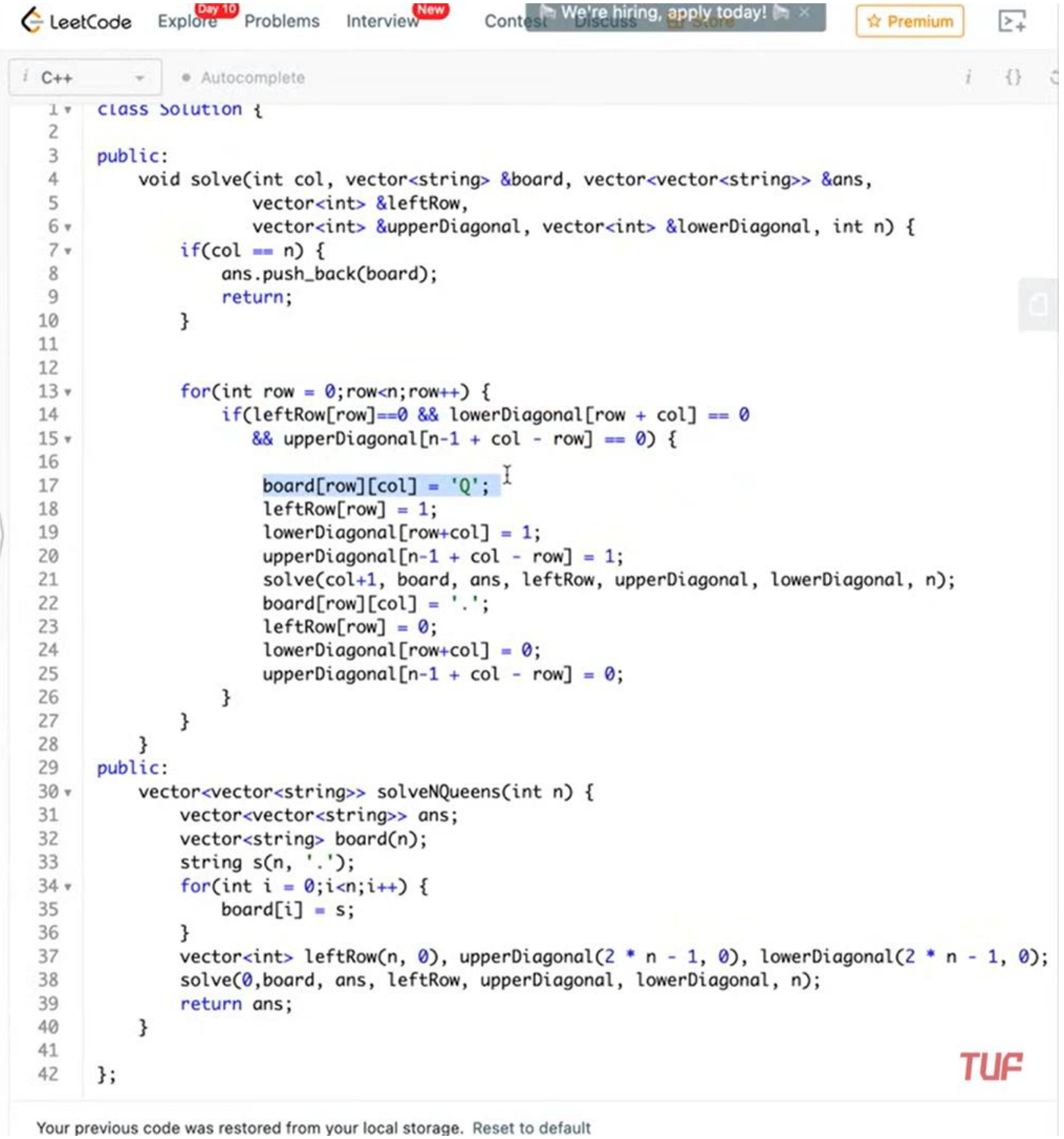

```cpp
class Solution {

public:
    void solve(int col, vector<string> &board, vector<vector<string>> &ans,
               vector<int> &leftRow,
               vector<int> &upperDiagonal, vector<int> &lowerDiagonal, int n) {
        if(col == n) {
            ans.push_back(board);
            return;
        }


        for(int row = 0;row<n;row++) {
            if(leftRow[row]==0 && lowerDiagonal[row + col] == 0
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                board[row][col] = 'Q';
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                upperDiagonal[n-1 + col - row] = 1;
                solve(col+1, board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
                board[row][col] = '.';
                leftRow[row] = 0;
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            }
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    }
public:
    vector<vector<string>> solveNQueens(int n) {
        vector<vector<string>> ans;
        vector<string> board(n);
        string s(n, '.');
        for(int i = 0;i<n;i++) {
            board[i] = s;
        }
        vector<int> leftRow(n, 0), upperDiagonal(2 * n - 1, 0), lowerDiagonal(2 * n - 1, 0);
        solve(0,board, ans, leftRow, upperDiagonal, lowerDiagonal, n);
        return ans;
    }

};
```

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