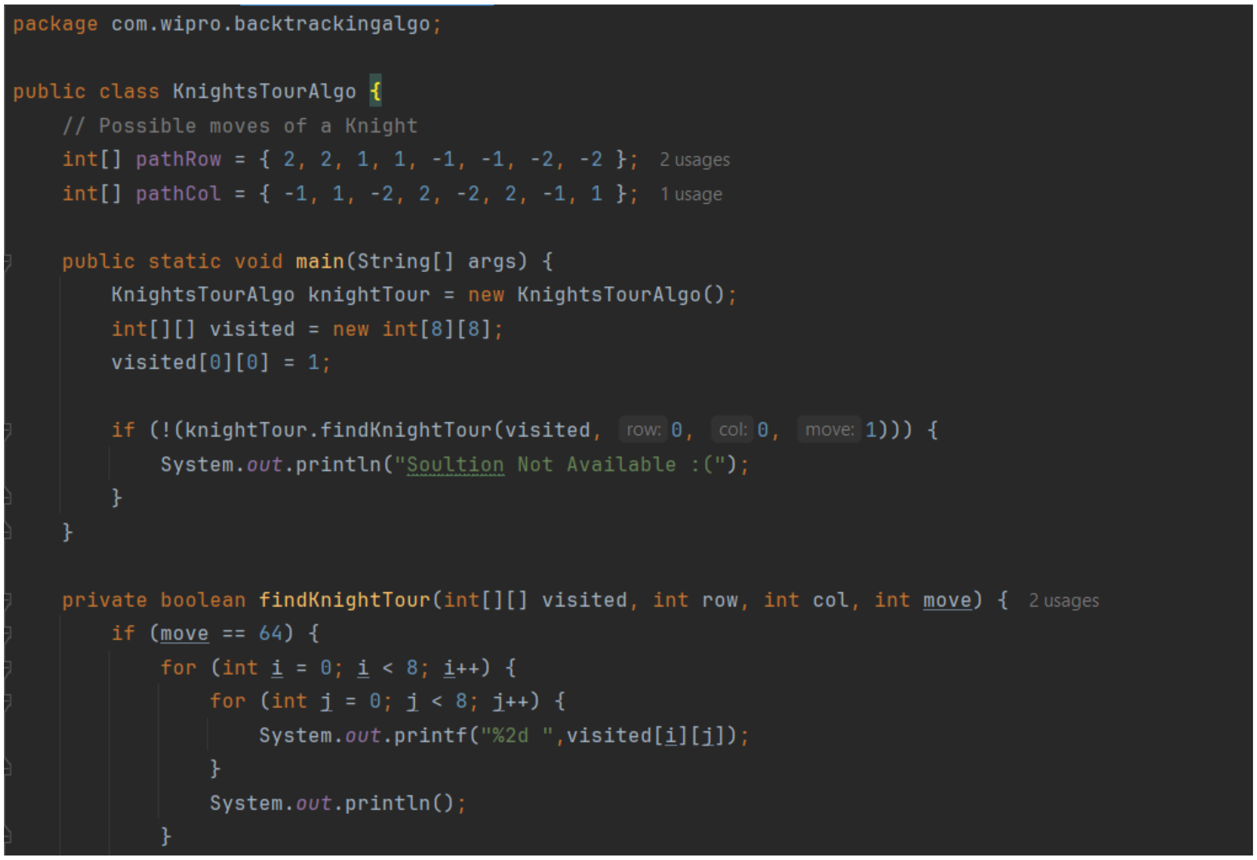
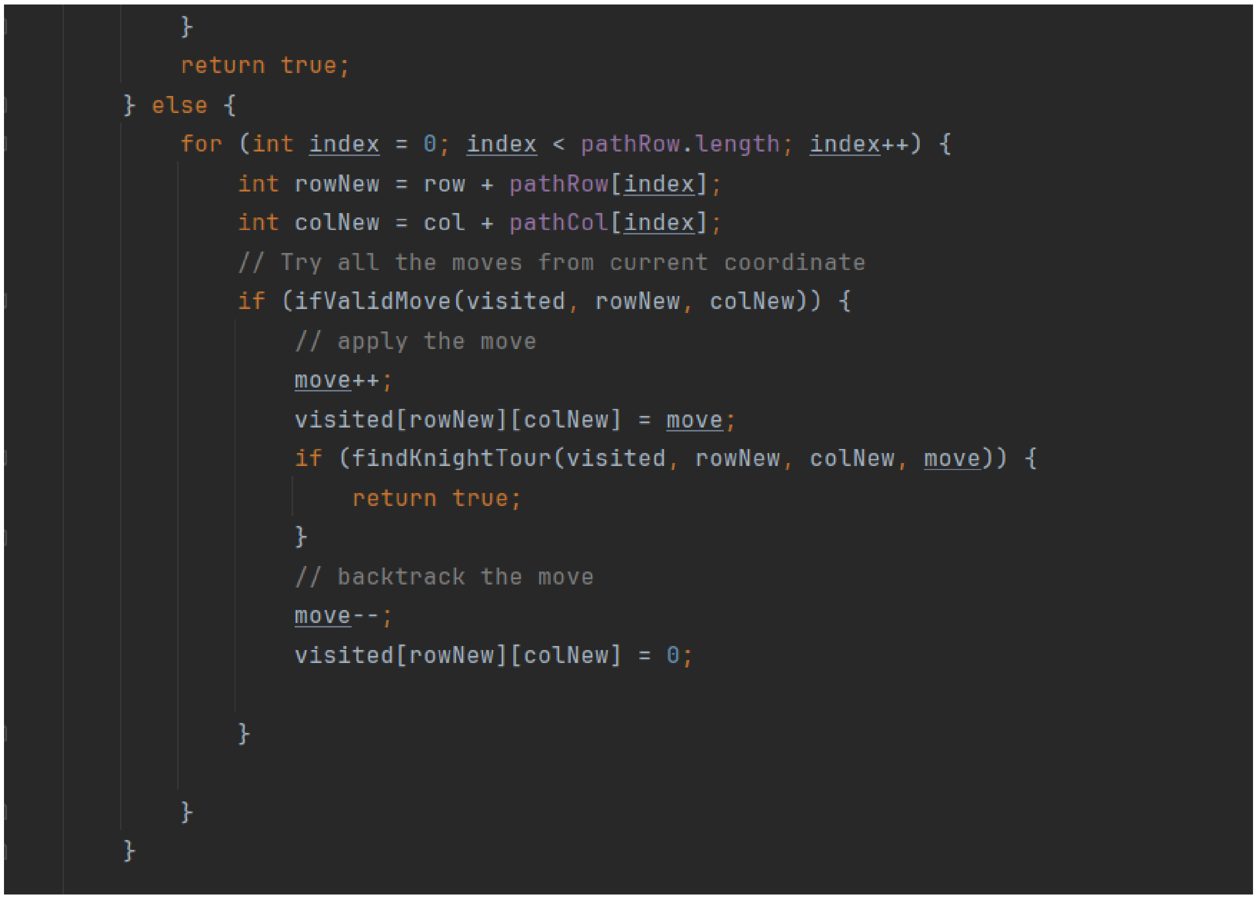
Day 16 and 17:

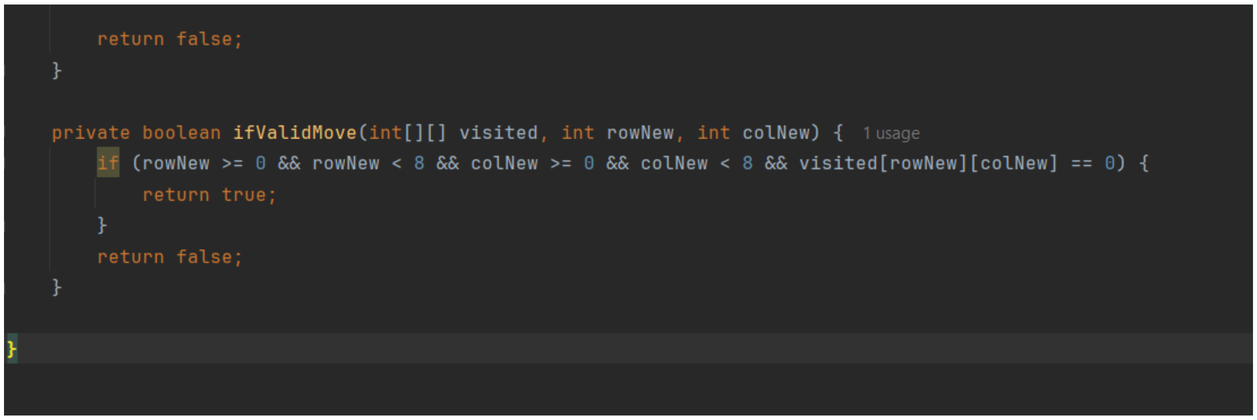
Task 1: The Knight's Tour Problem
Create a function bool SolveKnightsTour(int[,] board, int moveX, int moveY, int moveCount, int[] xMove, int[] yMove) that attempts to solve the Knight's Tour problem using backtracking. The function should return true if a solution exists and false otherwise. The board represents the chessboard, moveX and moveY are the current coordinates of the knight, moveCount is the current move count, and xMove[], yMove[] are the possible next moves for the knight. Fill the chessboard such that the knight visits every square exactly once. Keep the chessboard size to 8x8.



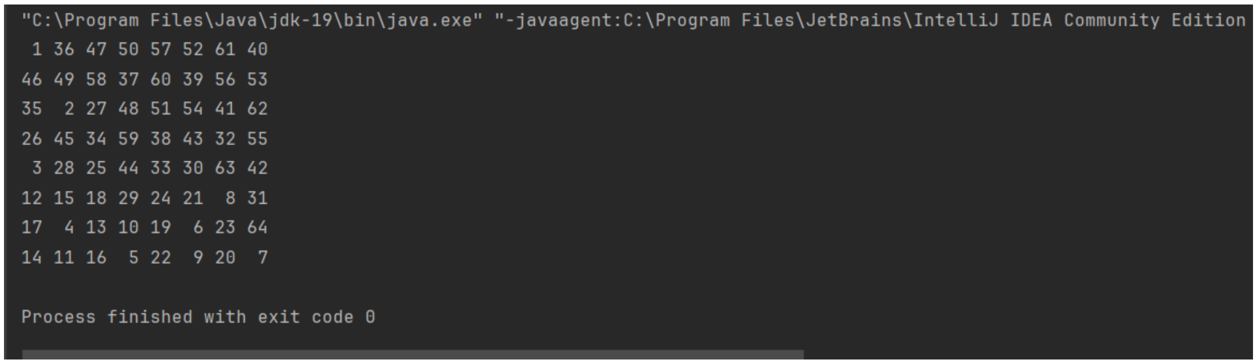
```
package com.wipro.backtrackingalgo;

public class KnightsTourAlgo {
    // Possible moves of a Knight
    int[] pathRow = { 2, 2, 1, 1, -1, -1, -2, -2 };  2 usages
    int[] pathCol = { -1, 1, -2, 2, -2, 2, -1, 1 };  1 usage

    public static void main(String[] args) {
        KnightsTourAlgo knightTour = new KnightsTourAlgo();
        int[][] visited = new int[8][8];
        visited[0][0] = 1;

        if (!(knightTour.findKnightTour(visited,  row: 0,  col: 0,  move: 1))) {
            System.out.println("Soultion Not Available :(");
        }
    }

    private boolean findKnightTour(int[][] visited, int row, int col, int move) {  2 usages
        if (move == 64) {
            for (int i = 0; i < 8; i++) {
                for (int j = 0; j < 8; j++) {
                    System.out.printf("%2d ",visited[i][j]);
                }
                System.out.println();
            }
```



```java
            }
            return true;
        } else {
            for (int index = 0; index < pathRow.length; index++) {
                int rowNew = row + pathRow[index];
                int colNew = col + pathCol[index];
                // Try all the moves from current coordinate
                if (ifValidMove(visited, rowNew, colNew)) {
                    // apply the move
                    move++;
                    visited[rowNew][colNew] = move;
                    if (findKnightTour(visited, rowNew, colNew, move)) {
                        return true;
                    }
                    // backtrack the move
                    move--;
                    visited[rowNew][colNew] = 0;

                }

            }
        }
```



```java
        return false;
    }

    private boolean ifValidMove(int[][] visited, int rowNew, int colNew) {  1 usage
        if (rowNew >= 0 && rowNew < 8 && colNew >= 0 && colNew < 8 && visited[rowNew][colNew] == 0) {
            return true;
        }
        return false;
    }

}
```



```
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 1 36 47 50 57 52 61 40
46 49 58 37 60 39 56 53
35  2 27 48 51 54 41 62
26 45 34 59 38 43 32 55
 3 28 25 44 33 30 63 42
12 15 18 29 24 21  8 31
17  4 13 10 19  6 23 64
14 11 16  5 22  9 20  7

Process finished with exit code 0
```
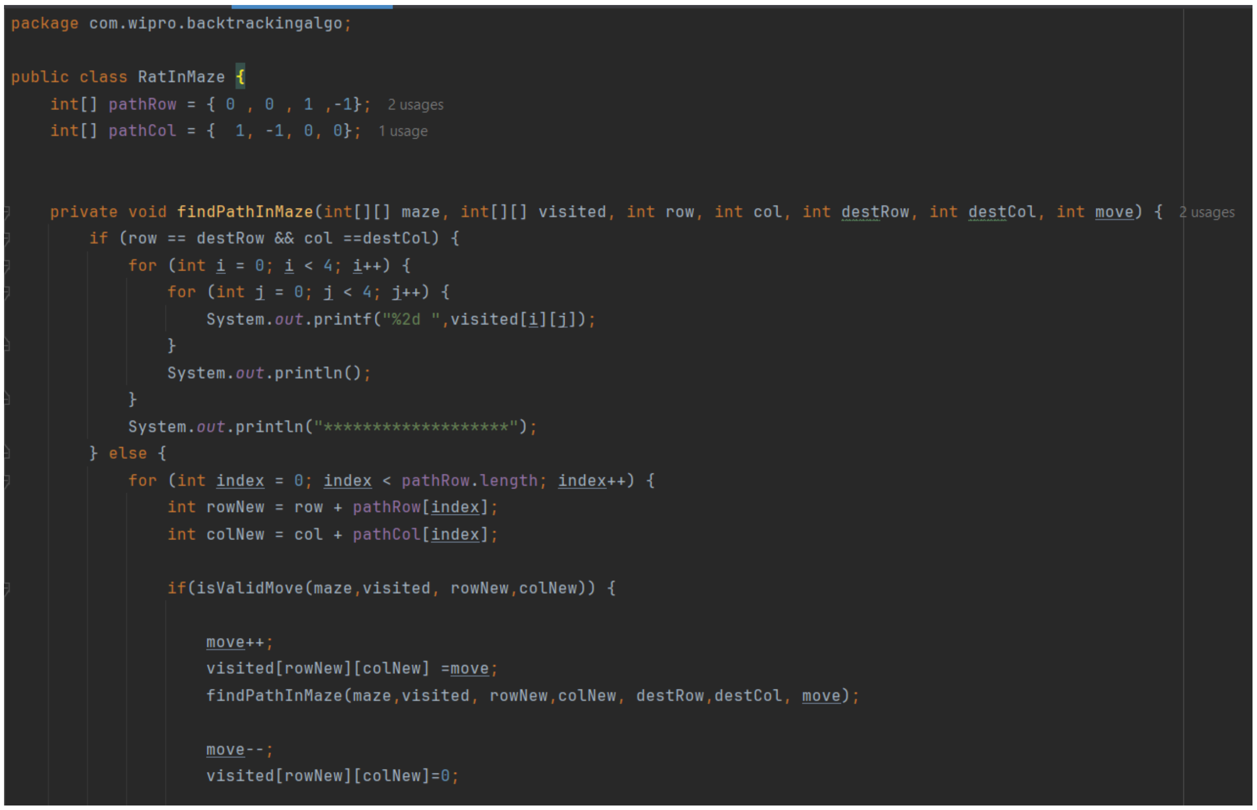
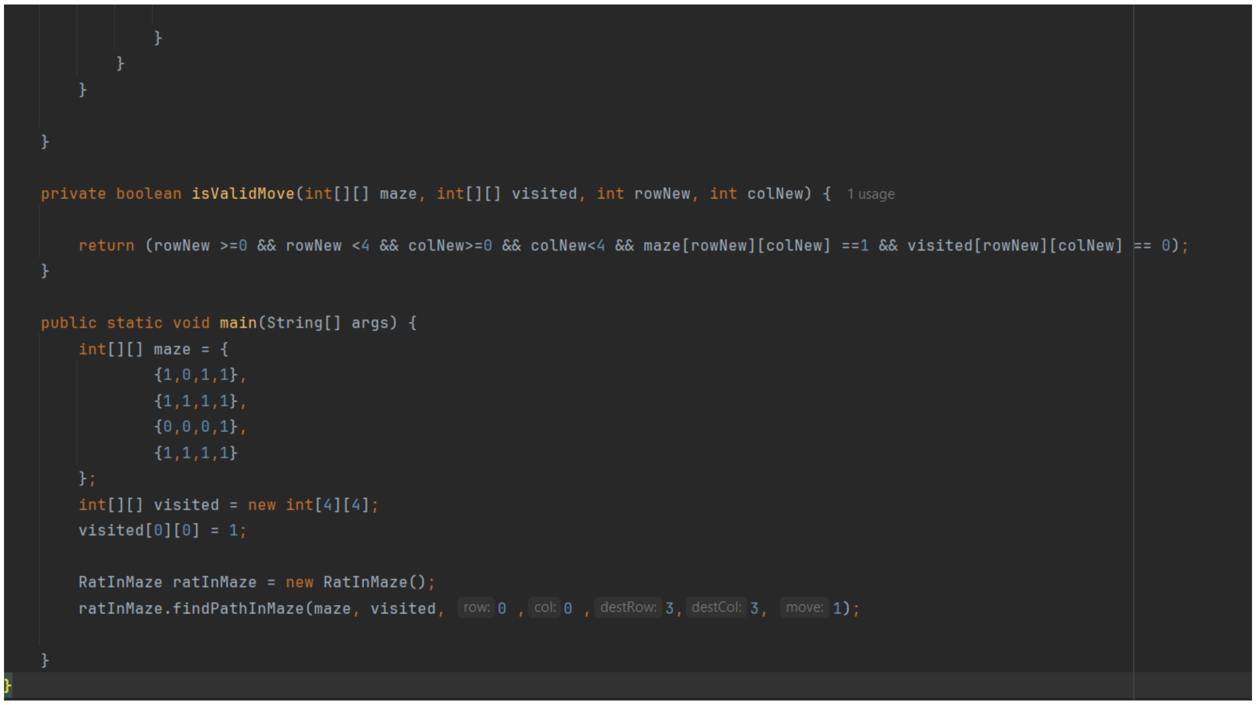

Task 2: Rat in a Maze
Implement a function bool SolveMaze(int[,] maze) that uses backtracking to find a path from the top left corner to the bottom right corner of a maze. The maze is represented by a 2D array where 1s are paths and 0s are walls. Find a rat's path through the maze. The maze size is 6x6.



```
package com.wipro.backtrackingalgo;

public class RatInMaze {
    int[] pathRow = { 0 , 0 , 1 ,-1};  2 usages
    int[] pathCol = {  1, -1, 0, 0};  1 usage


    private void findPathInMaze(int[][] maze, int[][] visited, int row, int col, int destRow, int destCol, int move) {  2 usages
        if (row == destRow && col ==destCol) {
            for (int i = 0; i < 4; i++) {
                for (int j = 0; j < 4; j++) {
                    System.out.printf("%2d ",visited[i][j]);
                }
                System.out.println();
            }
            System.out.println("*******************");
        } else {
            for (int index = 0; index < pathRow.length; index++) {
                int rowNew = row + pathRow[index];
                int colNew = col + pathCol[index];

                if(isValidMove(maze,visited, rowNew,colNew)) {

                    move++;
                    visited[rowNew][colNew] =move;
                    findPathInMaze(maze,visited, rowNew,colNew, destRow,destCol, move);

                    move--;
                    visited[rowNew][colNew]=0;
```



```java
                }
            }
        }

    }

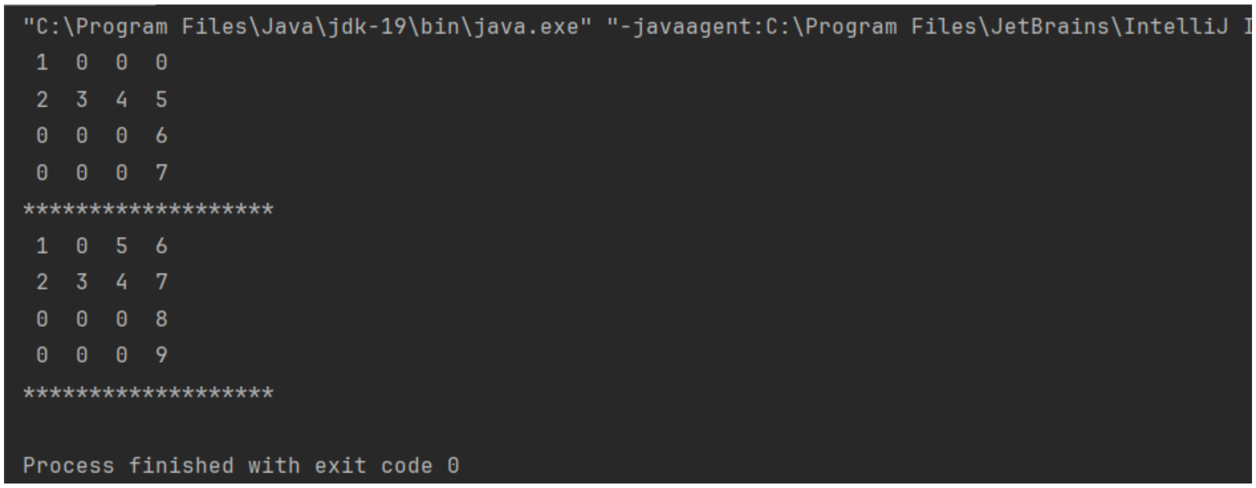
    private boolean isValidMove(int[][] maze, int[][] visited, int rowNew, int colNew) {  1 usage

        return (rowNew >=0 && rowNew <4 && colNew>=0 && colNew<4 && maze[rowNew][colNew] ==1 && visited[rowNew][colNew] == 0);
    }

    public static void main(String[] args) {
        int[][] maze = {
                {1,0,1,1},
                {1,1,1,1},
                {0,0,0,1},
                {1,1,1,1}
        };
        int[][] visited = new int[4][4];
        visited[0][0] = 1;

        RatInMaze ratInMaze = new RatInMaze();
        ratInMaze.findPathInMaze(maze, visited,  row: 0 ,  col: 0 ,  destRow: 3,  destCol: 3,  move: 1);

    }
}
```



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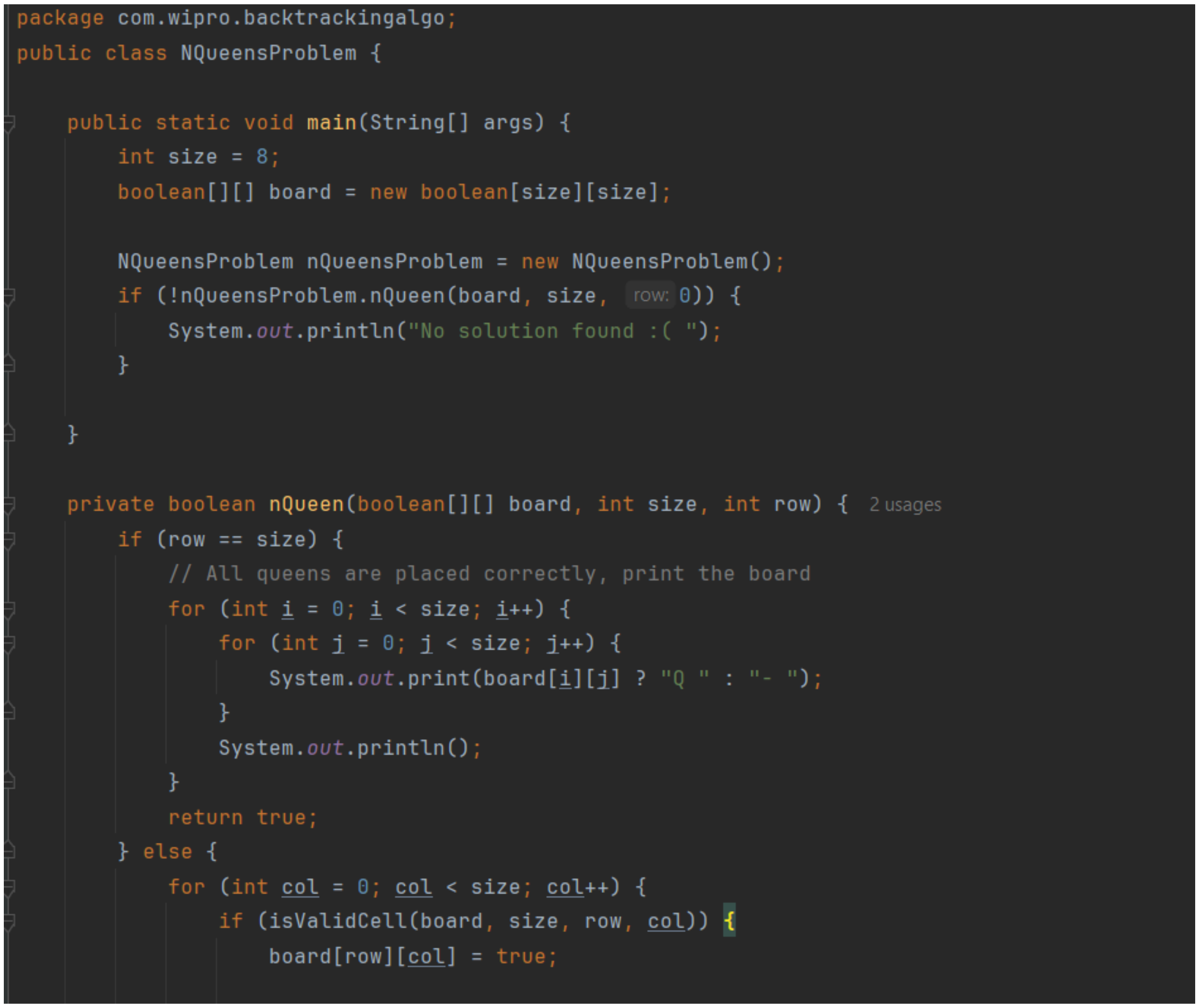
 1  0  0  0
 2  3  4  5
 0  0  0  6
 0  0  0  7
*******************
 1  0  5  6
 2  3  4  7
 0  0  0  8
 0  0  0  9
*******************

Process finished with exit code 0
```

Task 3: N Queen Problem
Write a function bool SolveNQueen(int[,] board, int col) in Java that places N queens on an N x N chessboard so that no two queens attack each other using backtracking. Place N queens on the board such that no two queens can attack each other. Use a standard 8x8 chessboard.



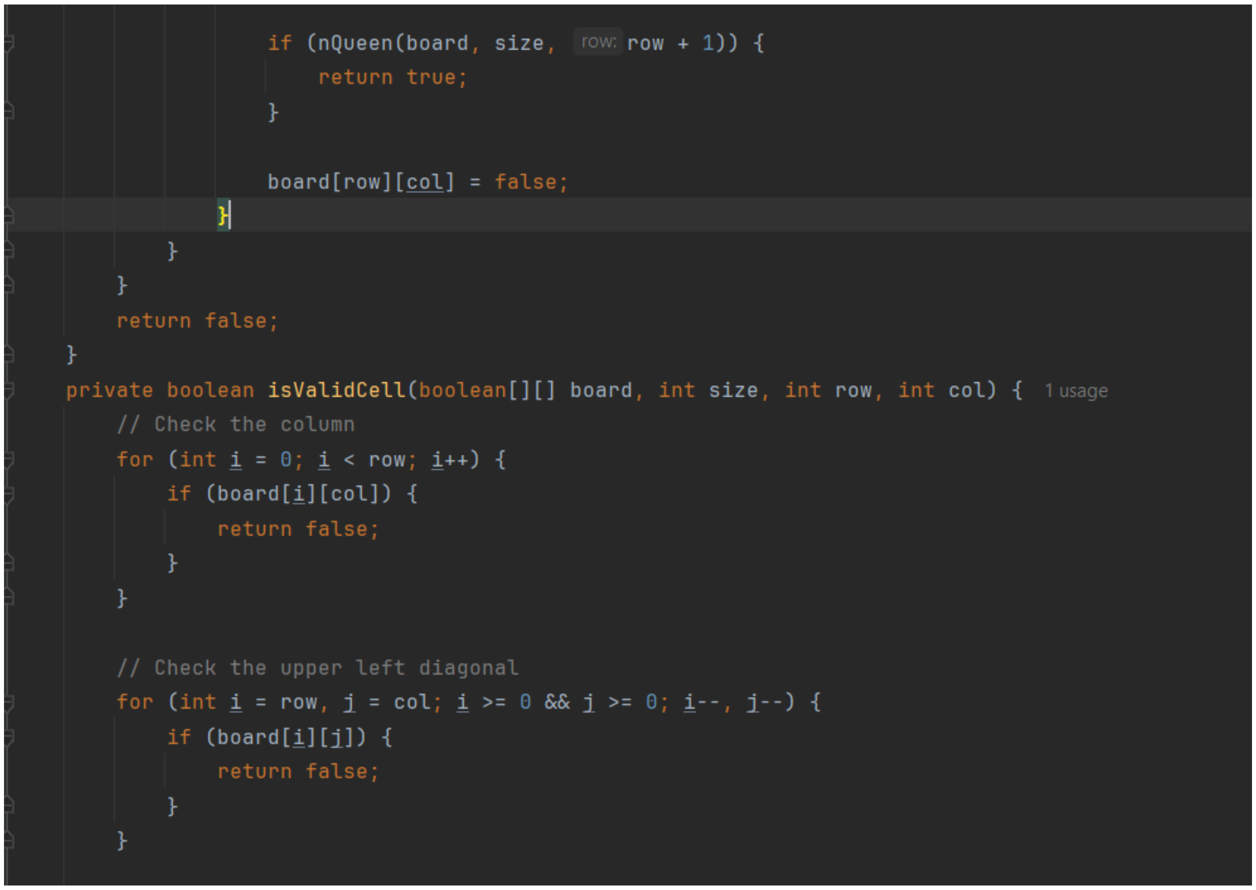
```
package com.wipro.backtrackingalgo;
public class NQueensProblem {

    public static void main(String[] args) {
        int size = 8;
        boolean[][] board = new boolean[size][size];

        NQueensProblem nQueensProblem = new NQueensProblem();
        if (!nQueensProblem.nQueen(board, size,  row: 0)) {
            System.out.println("No solution found :( ");
        }

    }

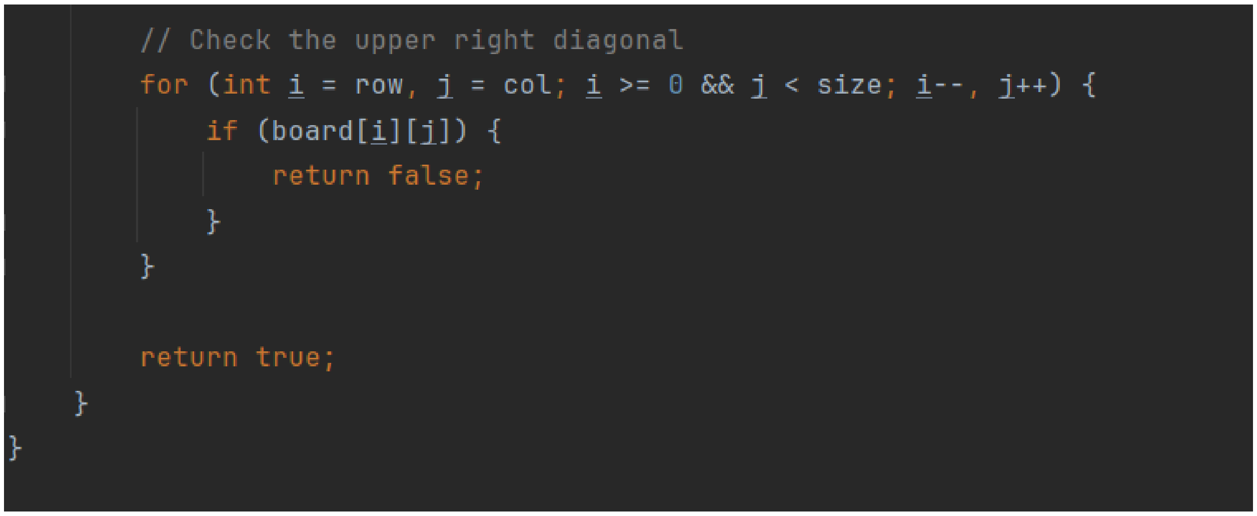
    private boolean nQueen(boolean[][] board, int size, int row) {  2 usages
        if (row == size) {
            // All queens are placed correctly, print the board
            for (int i = 0; i < size; i++) {
                for (int j = 0; j < size; j++) {
                    System.out.print(board[i][j] ? "Q " : "- ");
                }
                System.out.println();
            }
            return true;
        } else {
            for (int col = 0; col < size; col++) {
                if (isValidCell(board, size, row, col)) {
                    board[row][col] = true;
```



```
                if (nQueen(board, size, row: row + 1)) {
                    return true;
                }

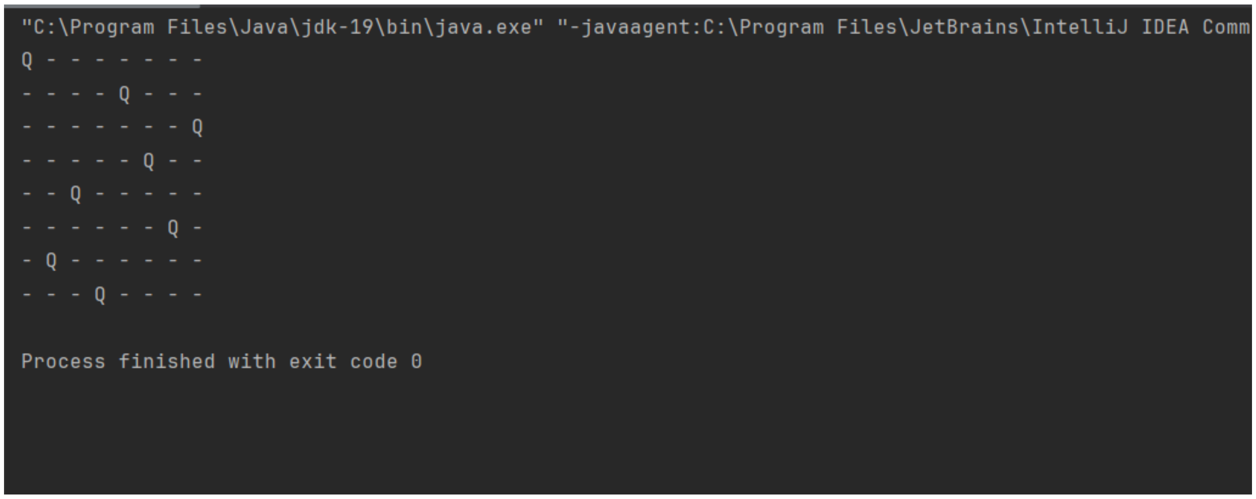
                board[row][col] = false;
            }
        }
    }
    return false;
}
private boolean isValidCell(boolean[][] board, int size, int row, int col) {  1 usage
    // Check the column
    for (int i = 0; i < row; i++) {
        if (board[i][col]) {
            return false;
        }
    }

    // Check the upper left diagonal
    for (int i = row, j = col; i >= 0 && j >= 0; i--, j--) {
        if (board[i][j]) {
            return false;
        }
    }
```



```
    // Check the upper right diagonal
    for (int i = row, j = col; i >= 0 && j < size; i--, j++) {
        if (board[i][j]) {
            return false;
        }
    }

    return true;
}
}
```



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