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.

```java
package com.assignment.day16_17;

public class KnightsTourAlgo {
    static int N = 8;


    static int[] xMove = { 2, 1, -1, -2, -2, -1, 1, 2 };
    static int[] yMove = { 1, 2, 2, 1, -1, -2, -2, -1 };


    static void initializeBoard(int[][] board) {
        for (int x = 0; x < N; x++)
            for (int y = 0; y < N; y++)
                board[x][y] = -1;
    }

    static void printSolution(int[][] board) {
        for (int x = 0; x < N; x++) {
            for (int y = 0; y < N; y++)
                System.out.print(board[x][y] + "\t");
            System.out.println();
        }
    }


    static boolean isSafe(int x, int y, int[][] board) {
        return (x >= 0 && x < N && y >= 0 && y < N &&
board[x][y] == -1);
    }
```

```
    public static boolean solveKnightsTour(int[][] board,
int moveX, int moveY, int moveCount, int[] xMove, int[]
yMove) {
        if (moveCount == N * N)
            return true;

        for (int k = 0; k < 8; k++) {
            int nextX = moveX + xMove[k];
            int nextY = moveY + yMove[k];

            if (isSafe(nextX, nextY, board)) {
                board[nextX][nextY] = moveCount;

                if (solveKnightsTour(board, nextX, nextY,
moveCount + 1, xMove, yMove))
                    return true;
                else
                    board[nextX][nextY] = -1; //
Backtracking
            }
        }

        return false;
    }

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

        initializeBoard(board);

        board[0][0] = 0;

        if (solveKnightsTour(board, 0, 0, 1, xMove,
yMove))
            printSolution(board);
        else
            System.out.println("Solution does not
exist");
    }
}
```

Output:

```
Problems  @ Javadoc  Declaration  Coverage  Console ×
<terminated> KnightsTourAlgo (1) [Java Application] C:\Program Files\Java\jdk-17\bin\javaw.exe  (05-Jun-2024, 8:52:44 pm – 8:52:4
0       59      38      33      30      17      8       63
37      34      31      60      9       62      29      16
58      1       36      39      32      27      18      7
35      48      41      26      61      10      15      28
42      57      2       49      40      23      6       19
47      50      45      54      25      20      11      14
56      43      52      3       22      13      24      5
51      46      55      44      53      4       21      12
```

Task 2: Rat in a Maze

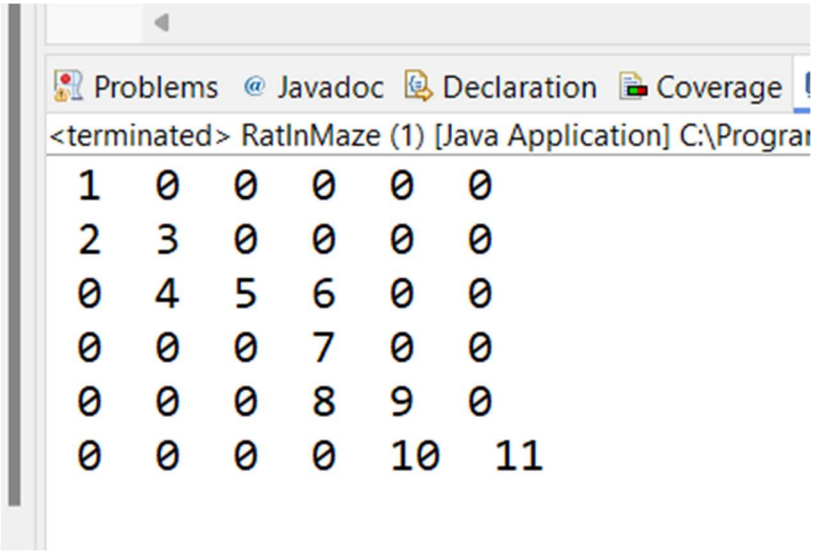
Implement a function bool SolveMaze(int[,] maze) that uses backtracking to find a path from the top left corner to the bottom right corner of a maze. The maze is represented by a 2D array where 1s are paths and 0s are walls. Find a rat's path through the maze. The maze size is 6x6.

```java
package com.assignment.day16_17;

public class RatInMaze {
    final int N = 6;
    int path=1;

    void printSolution(int sol[][]) {
        for (int i = 0; i < N; i++) {
            for (int j = 0; j < N; j++)
                System.out.print(" " + sol[i][j] + " ");
            System.out.println();
        }
    }

    boolean isSafe(int maze[][], int x, int y) {
        return (x >= 0 && x < N && y >= 0 && y < N &&
maze[x][y] == 1);
    }
```

```
    boolean solveMaze(int maze[][]) {
        int sol[][] = new int[N][N];

        if (!solveMazeUtil(maze, 0, 0, sol)) {
            System.out.println("Solution doesn't exist");
            return false;
        }

        printSolution(sol);
        return true;
    }

    boolean solveMazeUtil(int maze[][], int x, int y, int
sol[][]) {
        if (x == N - 1 && y == N - 1 && maze[x][y] == 1)
{
            sol[x][y] = path++;
            return true;
        }

        if (isSafe(maze, x, y)) {
            sol[x][y] = path++;

            if (solveMazeUtil(maze, x + 1, y, sol))
                return true;

            if (solveMazeUtil(maze, x, y + 1, sol))
                return true;

            sol[x][y] = 0;
            path--;
            return false;
        }

        return false;
    }

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

```
                        {0, 0, 0, 1, 0, 0},
                        {0, 0, 0, 1, 1, 1},
                        {0, 0, 0, 0, 1, 1}};
        rat.solveMaze(maze);
    }
}
```

Output:



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.assignment.day16_17;

public class NQueensProblem {
    final int N = 8;

    void printSolution(int board[][]) {
        for (int i = 0; i < N; i++) {
            for (int j = 0; j < N; j++)
                System.out.print(board[i][j]==1 ?"Q ":"-
");
            System.out.println();
        }
```

```
    }

    boolean isSafe(int board[][], int row, int col) {
        int i, j;

        for (i = 0; i < col; i++)
            if (board[row][i] == 1)
                return false;

        for (i = row, j = col; i >= 0 && j >= 0; i--, j--
)
            if (board[i][j] == 1)
                return false;

        for (i = row, j = col; j >= 0 && i < N; i++, j--)
            if (board[i][j] == 1)
                return false;

        return true;
    }

    boolean solveNQUtil(int board[][], int col) {
        if (col >= N)
            return true;

        for (int i = 0; i < N; i++) {
            if (isSafe(board, i, col)) {
                board[i][col] = 1;

                if (solveNQUtil(board, col + 1))
                    return true;

                board[i][col] = 0; // BACKTRACK
            }
        }

        return false;
    }

    boolean solveNQ() {
        int board[][] = new int[N][N];

        if (!solveNQUtil(board, 0)) {
```

```
            System.out.print("Solution does not exist");
            return false;
        }

        printSolution(board);
        return true;
    }

    public static void main(String args[]) {
        NQueensProblem Queen = new NQueensProblem();
        Queen.solveNQ();
    }
}
```

Output:

```
<terminated> NQueensProblem (1) [Java Appl
Q - - - - - - -
- - - - - - Q -
- - - - Q - - -
- - - - - - - Q
- Q - - - - - -
- - - Q - - - -
- - - - - Q - -
- - Q - - - - -
```