RPS DAY 16-17 Assignments

Assignment 8

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Batch - CPPE

Day 16 and 17:

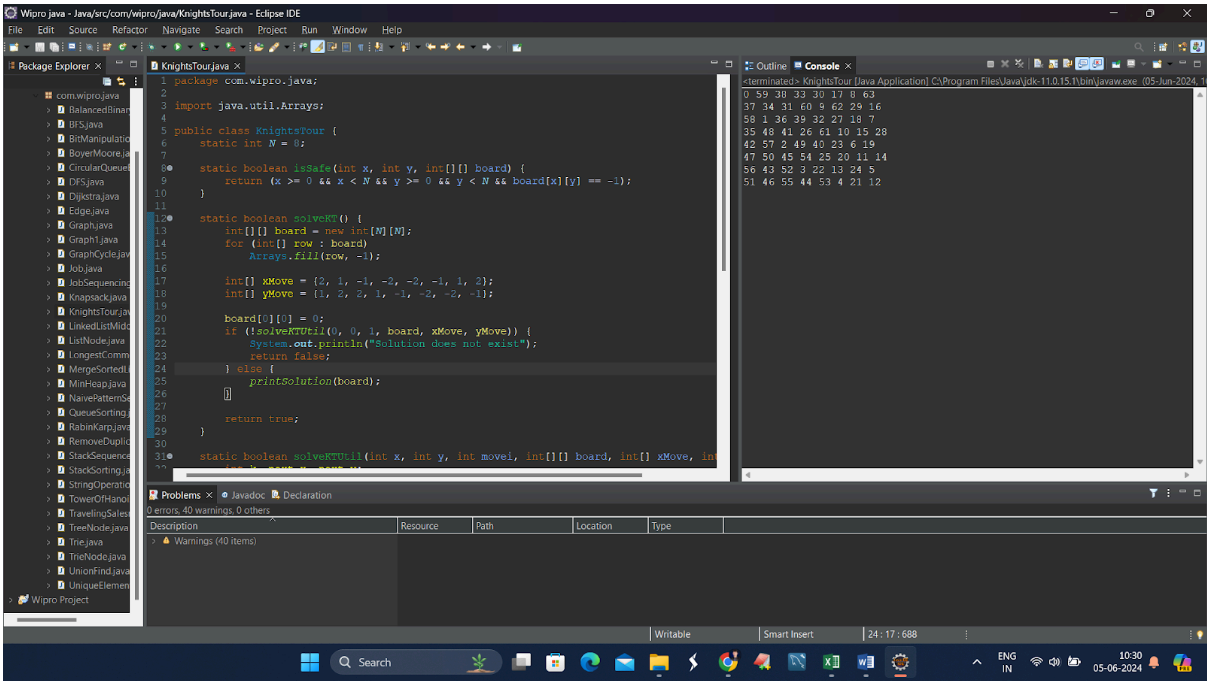
Task 1: The Knight's Tour Problem

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.

```
import  java.util.Arrays;

public class KnightsTour {

    static int N = 8;


    static boolean isSafe(int x, int y, int[][] board) {

        return (x >= 0 && x < N && y >= 0 && y < N && board[x][y] == -1);

    }


    static boolean solveKT() {

        int[][] board = new int[N][N];

        for (int[] row : board)

            Arrays.fill(row, -1);


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

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


        board[0][0] = 0;
    if (!solveKTUtil(0, 0, 1, board, xMove, yMove)) {
        System.out.println("Solution does not exist");
        return false;
    } else {
        printSolution(board);
    }

    return true;
}

static boolean solveKTUtil(int x, int y, int movei, int[][] board, int[] xMove, int[] yMove) {
    int k, next_x, next_y;
    if (movei == N * N)
        return true;

    for (k = 0; k < 8; k++) {
        next_x = x + xMove[k];
        next_y = y + yMove[k];
        if (isSafe(next_x, next_y, board)) {
            board[next_x][next_y] = movei;
            if (solveKTUtil(next_x, next_y, movei + 1, board, xMove, yMove))
                return true;
            else
                board[next_x][next_y] = -1;
        }
    }

    return false;
}
```

```
    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] + " ");
            System.out.println();
        }
    }

    public static void main(String[] args) {
        solveKT();
    }
}
```

OUTPUT:



Wipro java - Java/src/com/wipro/java/KnightsTour.java - Eclipse IDE
File Edit Source Refactor Navigate Search Project Run Window Help
Package Explorer
KnightsTour.java
Outline
Console

```
package com.wipro.java;

import java.util.Arrays;

public class KnightsTour {
    static int N = 8;

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

    static boolean solveKT() {
        int[][] board = new int[N][N];
        for (int[] row : board)
            Arrays.fill(row, -1);

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

        board[0][0] = 0;
        if (!solveKTUtil(0, 0, 1, board, xMove, yMove)) {
            System.out.println("Solution does not exist");
            return false;
        } else {
            printSolution(board);
        }

        return true;
    }

    static boolean solveKTUtil(int x, int y, int movei, int[][] board, int[] xMove, int
```

```
<terminated> KnightsTour [Java Application] C:\Program Files\Java\jdk-11.0.15.1\bin\javaw.exe  (05-Jun-2024, 1
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

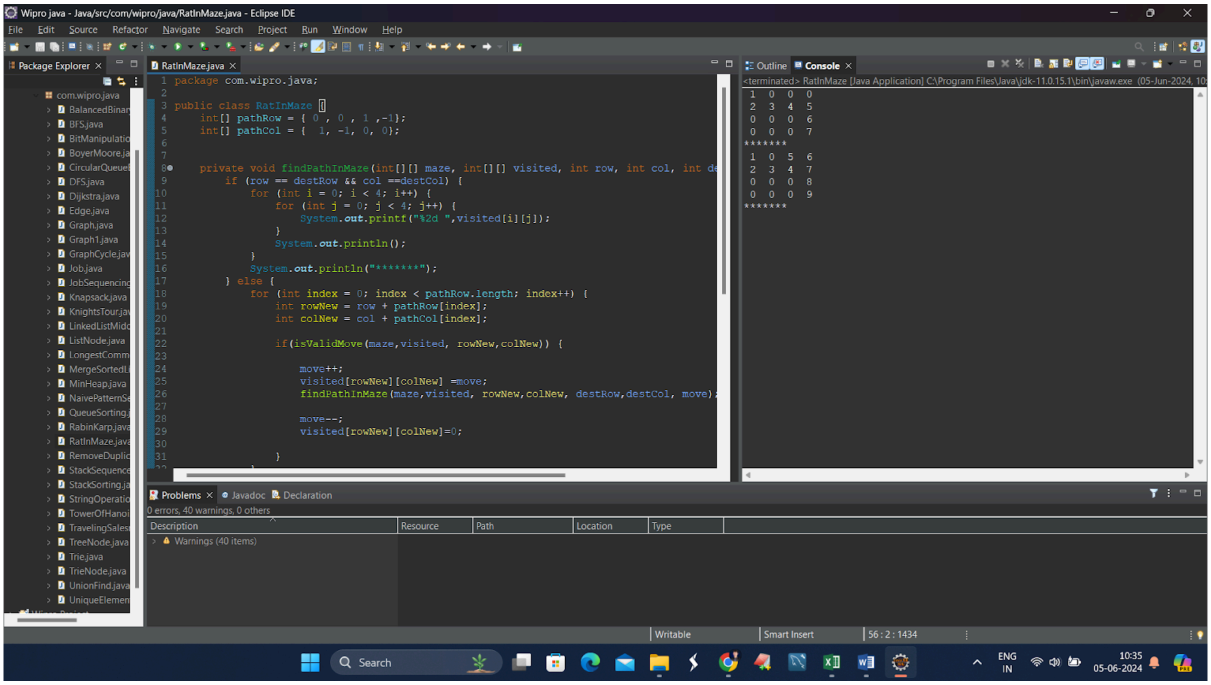
mplement a function bool SolveMaze(int[,] maze) that uses backtracking to find a path from the top left corner to the bottom right corner of a maze. The maze is represented by a 2D array where 1s are paths and 0s are walls. Find a rat's path through the maze. The maze size is 6x6.

```
public class RatInMaze {

    int[] pathRow = { 0 , 0 , 1 ,-1};

    int[] pathCol = {  1, -1, 0, 0};




    private void findPathInMaze(int[][] maze, int[][] visited, int row, int col, int destRow, int
destCol, int move) {

        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;

                }
            }
        }

    }

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

        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, 0 ,0 ,3,3, 1);

    }
```

}

OUTPUT:



Wipro java - Java/src/com/wipro/java/RatInMaze.java - Eclipse IDE

```
package com.wipro.java;

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


    private void findPathInMaze(int[][] maze, int[][] visited, int row, int col, int de
        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;

                }
```

```
<terminated> RatInMaze [Java Application] C:\Program Files\Java\jdk-11.0.15.1\bin\javaw.exe  (05-Jun-2024, 10:
 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
*******
```

Problems: 0 errors, 40 warnings, 0 others

Description	Resource	Path	Location	Type
Warnings (40 items)				

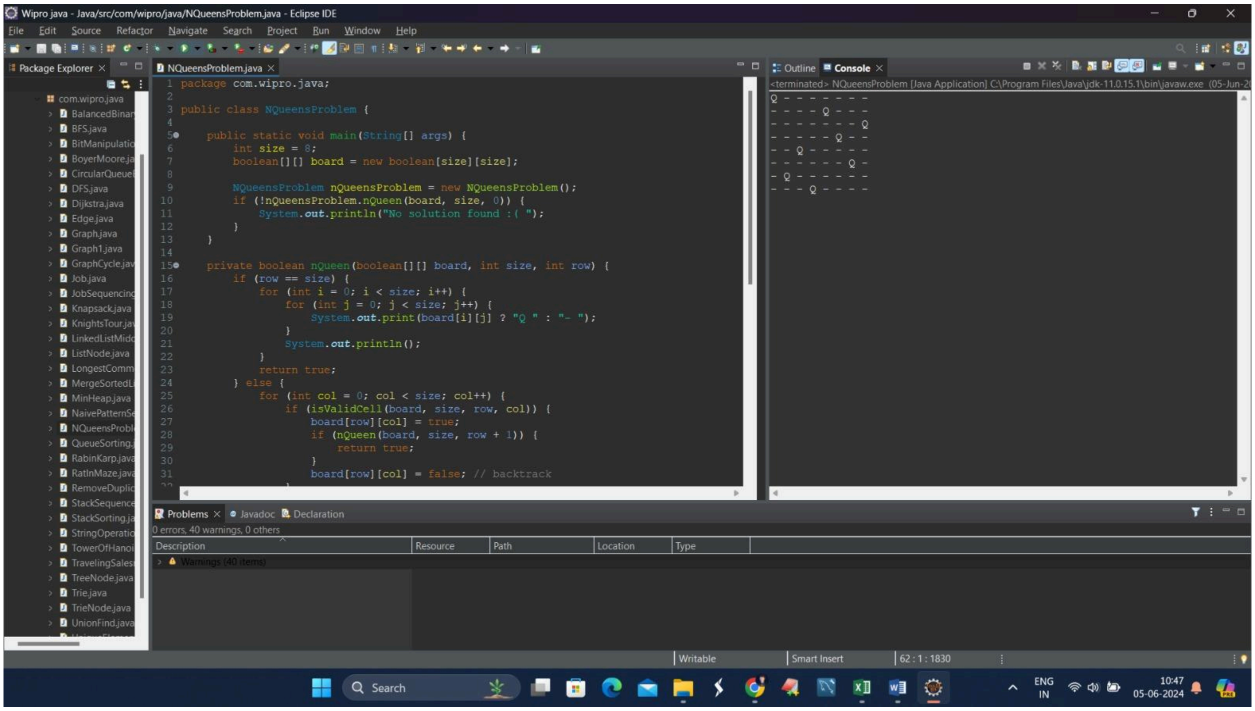
Task 3: N Queen Problem

Write a function bool SolveNQueen(int[,] board, int col) in C# 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.

```
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, 0)) {
            System.out.println("No solution found :( ");
        }
    }
```

```
private boolean nQueen(boolean[][] board, int size, int row) {
    if (row == size) {
        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 + 1)) {
                    return true;
                }
                board[row][col] = false; // backtrack
            }
        }
    }
    return false;
}

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

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

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

OUTPUT:



```java
package com.wipro.java;

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, 0)) {
            System.out.println("No solution found :( ");
        }
    }

    private boolean nQueen(boolean[][] board, int size, int row) {
        if (row == size) {
            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 + 1)) {
                        return true;
                    }
                    board[row][col] = false; // backtrack
```

```
<terminated> NQueensProblem [Java Application] C:\Program Files\Java\jdk-11.0.15.1\bin\javaw.exe (05-Jun-2
Q - - - - - - -
- - - - Q - - -
- - - - - - - Q
- - - - - Q - -
- - Q - - - - -
- - - - - - Q -
- Q - - - - - -
- - - Q - - - -
```

0 errors, 40 warnings, 0 others

Description	Resource	Path	Location	Type
Warnings (40 items)				