

VIJAY M

22IT125

DAY -6

CODING PROBLEM AND PRACTICES

1. Minimum Path Sum

Time Complexity : $O(n*n)$

Solution:

```
import java.util.ArrayList;
import java.util.List;

class GfG {
    static int
    minSumPathRec(ArrayList<ArrayList<Integer> > triangle,
                  int i, int j) {

        if (i == triangle.size())
            return 0;

        return triangle.get(i).get(j)
            + Math.min(
                minSumPathRec(triangle, i + 1, j),
                minSumPathRec(triangle, i + 1, j + 1));
    }

    static int
    minSumPath(ArrayList<ArrayList<Integer> > triangle) {
        return minSumPathRec(triangle, 0, 0);
    }

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

```

ArrayList<ArrayList<Integer> > triangle
    = new ArrayList<>();
triangle.add(new ArrayList<>(List.of(2)));
triangle.add(new ArrayList<>(List.of(3, 9)));
triangle.add(new ArrayList<>(List.of(1, 6, 7)));

System.out.println(minSumPath(triangle));
}
}

```

Output:

```

1
2 import java.util.ArrayList;
3 import java.util.List;
4
5 class GFG {
6     static int minSumPathRec(ArrayList<ArrayList<Integer> > triangle,
7                             int i, int j) {
8
9         if (i == triangle.size())
10            return 0;
11
12        return triangle.get(i).get(j)
13            + Math.min(
14                minSumPathRec(triangle, i + 1, j),
15                minSumPathRec(triangle, i + 1, j + 1));
16    }
17 }
18
19
20

```

Run GFG

C:\Users\sanja\.jdk\openjdk-23.0.1\bin\java.exe "-javaagent:C:\Users\sanja\AppData\Local\JetBrains\IntelliJ IDEA 2024.2.4\lib\idea_rt.jar=64524:C:\Users\sanja\AppData\Local\Je
6

Process finished with exit code 0

2. Validate Binary Search Tree

Time Complexity : $O(n^2)$

Solution :

```

class Node {
    int data;
    Node left, right;
}

```

```

Node(int value) {
    data = value;
    left = right = null;
}
}

class GfG {

    static int maxVal(Node node) {
        if (node == null) return Integer.MIN_VALUE;
        return
            Math.max(node.data,
                Math.max(maxVal(node.left), maxVal(node.right)));
    }

    static int minVal(Node node) {
        if (node == null) return Integer.MAX_VALUE;
        return
            Math.min(node.data,
                Math.min(minVal(node.left), minVal(node.right)));
    }

    static boolean isBST(Node node) {
        if (node == null) return true;

        if (node.left != null && maxVal(node.left) >= node.data)
            return false;

        if (node.right != null && minVal(node.right) <= node.data)
            return false;

        return isBST(node.left) && isBST(node.right);
    }
}

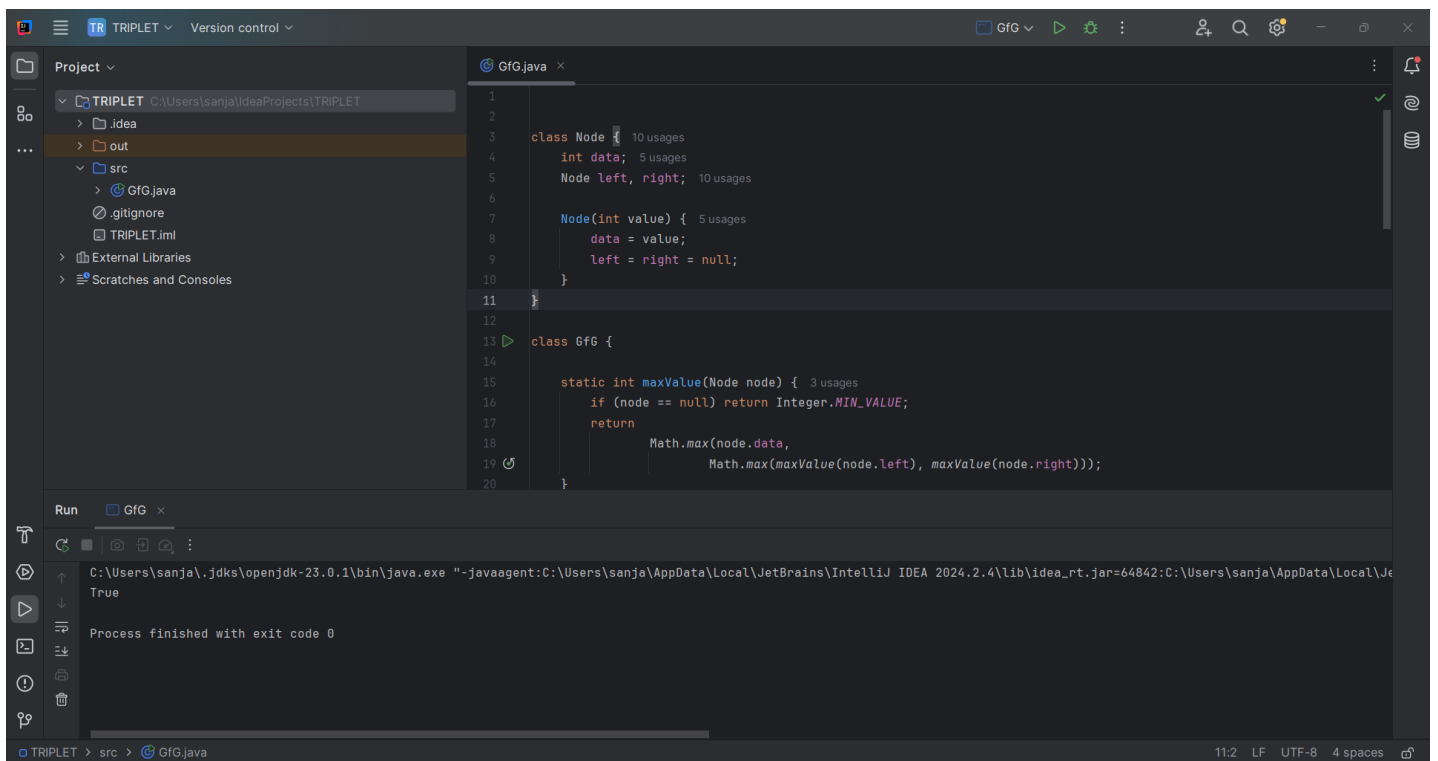
```

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

```
    Node root = new Node(4);  
    root.left = new Node(2);  
    root.right = new Node(5);  
    root.left.left = new Node(1);  
    root.left.right = new Node(3);
```

```
    if (isBST(root)) {  
        System.out.println("True");  
    }  
    else {  
        System.out.println("False");  
    }  
}
```

Output:



The screenshot shows an IDE window with a project named 'TRIPILET'. The 'src' folder contains 'GfG.java'. The code in 'GfG.java' defines a 'Node' class with 'data', 'left', and 'right' attributes, and a 'GfG' class with a static method 'maxValue' that recursively finds the maximum value in a BST. The 'main' method creates a BST with root 4, left child 2, right child 5, and further children 1 and 3. It then calls 'isBST' and prints the result. The 'Run' tab shows the command executed: 'C:\Users\sanja\.jdk\openjdk-23.0.1\bin\java.exe "-javaagent:C:\Users\sanja\AppData\Local\JetBrains\IntelliJ IDEA 2024.2.4\lib\idea_rt.jar=64842:C:\Users\sanja\AppData\Local\J...' and the output 'True'. The process finished with exit code 0.

```
1  
2  
3 class Node { 10 usages  
4     int data; 5 usages  
5     Node left, right; 10 usages  
6  
7     Node(int value) { 5 usages  
8         data = value;  
9         left = right = null;  
10    }  
11  
12  
13 class GfG {  
14  
15     static int maxValue(Node node) { 3 usages  
16         if (node == null) return Integer.MIN_VALUE;  
17         return  
18             Math.max(node.data,  
19                 Math.max(maxValue(node.left), maxValue(node.right)));  
20    }  
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```

3. Word Ladder

Time Complexity : $O(N * M)$

Solution:

```
import java.util.*;

class GFG
{
    static int shortestChainLen(String start,
                                String target,
                                Set<String> D)
    {
        if(start == target)
            return 0;

        if (!D.contains(target))
            return 0;

        int level = 0, wordlength = start.length();

        Queue<String> Q = new LinkedList<>();
        Q.add(start);

        while (!Q.isEmpty())
        {
            ++level;

            int sizeofQ = Q.size();

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

```

{

char []word = Q.peek().toCharArray();
Q.remove();

for (int pos = 0; pos < wordlength; ++pos)
{

    char orig_char = word[pos];

    for (char c = 'a'; c <= 'z'; ++c)
    {
        word[pos] = c;

        if (String.valueOf(word).equals(target))
            return level + 1;

        if (!D.contains(String.valueOf(word)))
            continue;
        D.remove(String.valueOf(word));

        Q.add(String.valueOf(word));
    }

    word[pos] = orig_char;
}
}

return 0;
}

public static void main(String[] args)
{

    Set<String> D = new HashSet<String>();

```

```

    D.add("poon");
    D.add("plee");
    D.add("same");
    D.add("poie");
    D.add("plie");
    D.add("poin");
    D.add("plea");
    String start = "toon";
    String target = "plea";
    System.out.print("Length of shortest chain is: "
        + shortestChainLen(start, target, D));
}
}

```

Output:

The screenshot shows an IDE with a project named 'TRIPLET'. The file 'GfG.java' is open, displaying the following code:

```

1  import java.util.*;
2
3
4  class GfG
5  {
6
7
8      static int shortestChainLen(String start, 1 usage
9                                  String target,
10                                 Set<String> D)
11  {
12
13      if(start == target)
14          return 0;
15
16      if (!D.contains(target))
17          return 0;
18
19      int level = 0, wordlength = start.length();
20

```

The 'Run' tab at the bottom shows the execution output:

```

C:\Users\sanja\.jdk\openjdk-23.0.1\bin\java.exe "-javaagent:C:\Users\sanja\AppData\Local\JetBrains\IntelliJ IDEA 2024.2.4\lib\idea_rt.jar=65100:C:\Users\sanja\AppData\Local\Je
Length of shortest chain is: 7
Process finished with exit code 0

```

The status bar at the bottom indicates the file is 'GfG.java' in the 'src' directory, with a line length of 15:1, LF line endings, UTF-8 encoding, and 4 spaces for indentation.

4. Word Ladder 2

Time Complexity : $O(N^2)$

Solution:

```
import java.util.*;

public class GFG
{
    public static class node
    {
        String word;
        int len;
        public node(String word, int len)
        {
            this.word = word;
            this.len = len;
        }
    }

    public static boolean isAdj(String a, String b)
    {
        int count = 0;
        for (int i = 0; i < a.length(); i++)
        {
            if (a.charAt(i) != b.charAt(i))
                count++;
        }
        if (count == 1)
            return true;
        return false;
    }

    public static int ladderLength(String beginWord, String endWord,
                                   ArrayList<String> wordList)
    {

```



```
Queue<node> q1 = new LinkedList<>();
Queue<node> q2 = new LinkedList<>();
HashMap<String, Integer> vis1 = new HashMap<>();
HashMap<String, Integer> vis2 = new HashMap<>();
```

```
node start = new node(beginWord, 1);
node end = new node(endWord, 1);
```

```
vis1.put(beginWord, 1);
q1.add(start);
vis2.put(endWord, 1);
q2.add(end);
```

```
while (q1.size() > 0 && q2.size() > 0)
{
```

```
    node curr1 = q1.remove();
    node curr2 = q2.remove();
    for (int i = 0; i < wordList.size(); i++)
    {
```

```
        if (isAdj(curr1.word, wordList.get(i)) &&
            vis1.containsKey(wordList.get(i)) == false)
        {
```

```
            node temp = new node(wordList.get(i),
                                   curr1.len + 1);
            q1.add(temp);
            vis1.put(wordList.get(i), curr1.len + 1);
```

```
            if (temp.word.equals(endWord))
            {
```

```

        return temp.len;
    }

    if (vis2.containsKey(temp.word))
    {
        return temp.len + vis2.get(temp.word) - 1;
    }
}

for (int i = 0; i < wordList.size(); i++)
{

    if (isAdj(curr2.word,wordList.get(i)) &&
        vis2.containsKey(wordList.get(i)) == false)
    {

        node temp = new node(wordList.get(i),
            curr2.len + 1 );
        q2.add(temp);
        vis2.put(wordList.get(i), curr2.len + 1);

        if (temp.word.equals(beginWord))
        {
            return temp.len;
        }

        if (vis1.containsKey(temp.word))
        {
            return temp.len + vis1.get(temp.word) - 1;
        }
    }
}

return 0;

```

```

}
public static void main(String args[])
{
    ArrayList<String> wordList = new ArrayList<>();
    wordList.add("poon");
    wordList.add("plee");
    wordList.add("same");
    wordList.add("poie");
    wordList.add("plie");
    wordList.add("poin");
    wordList.add("plea");
    String start = "toon";
    String target = "plea";
    System.out.println(ladderLength(start, target, wordList));
}
}
}

```

Output:

```

1  import java.util.*;
2  public class GFG
3  {
4      public static class node 12 usages
5      {
6          String word; 9 usages
7          int len; 9 usages
8          public node(String word, int len) 4 usages
9          {
10             this.word = word;
11             this.len = len;
12         }
13     }
14
15     public static boolean isAdj(String a, String b) 2 usages
16     {
17         int count = 0;
18         for (int i = 0; i < a.length(); i++)
19         {
20             if (a.charAt(i) != b.charAt(i))

```

Run GFG

C:\Users\sanja\jdk\openjdk-23.0.1\bin\java.exe "-javaagent:C:\Users\sanja\AppData\Local\JetBrains\IntelliJ IDEA 2024.2.4\lib\idea_rt.jar=65375:C:\Users\sanja\AppData\Local\Je
7

Process finished with exit code 0

TRIPLET > src > GFG > node > node

5.Course Schedule

Time Complexity : $O(n)$

Solution:

```
import java.util.ArrayList;
import java.util.Scanner;

class Course {
    String courseName;
    String courseCode;
    String instructor;
    String timeSlot;

    public Course(String courseName, String courseCode, String instructor, String
timeSlot) {
        this.courseName = courseName;
        this.courseCode = courseCode;
        this.instructor = instructor;
        this.timeSlot = timeSlot;
    }

    public void displayCourseInfo() {
        System.out.println("Course Name: " + courseName);
        System.out.println("Course Code: " + courseCode);
        System.out.println("Instructor: " + instructor);
        System.out.println("Time Slot: " + timeSlot);
        System.out.println("-----");
    }
}

public class CourseSchedule {
    private ArrayList<Course> courses;

    public CourseSchedule() {
```

```

    courses = new ArrayList<>();
}

public void addCourse(String courseName, String courseCode, String instructor,
String timeSlot) {
    Course course = new Course(courseName, courseCode, instructor, timeSlot);
    courses.add(course);
}

public void displayAllCourses() {
    if (courses.isEmpty()) {
        System.out.println("No courses scheduled.");
    } else {
        for (Course course : courses) {
            course.displayCourseInfo();
        }
    }
}

public void searchCourseByCode(String courseCode) {
    boolean found = false;
    for (Course course : courses) {
        if (course.courseCode.equalsIgnoreCase(courseCode)) {
            course.displayCourseInfo();
            found = true;
            break;
        }
    }
    if (!found) {
        System.out.println("Course with code " + courseCode + " not found.");
    }
}

public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);

```

```
CourseSchedule schedule = new CourseSchedule();
```

```
while (true) {  
    System.out.println("Course Schedule Program");  
    System.out.println("1. Add a Course");  
    System.out.println("2. Display All Courses");  
    System.out.println("3. Search Course by Code");  
    System.out.println("4. Exit");  
    System.out.print("Choose an option: ");  
    int choice = scanner.nextInt();  
    scanner.nextLine();  
    switch (choice) {  
        case 1:  
            // Add a course  
            System.out.print("Enter course name: ");  
            String name = scanner.nextLine();  
            System.out.print("Enter course code: ");  
            String code = scanner.nextLine();  
            System.out.print("Enter instructor name: ");  
            String instructor = scanner.nextLine();  
            System.out.print("Enter time slot: ");  
            String timeSlot = scanner.nextLine();  
            schedule.addCourse(name, code, instructor, timeSlot);  
            System.out.println("Course added successfully.");  
            break;  
  
        case 2:  
            schedule.displayAllCourses();  
            break;  
  
        case 3:  
            System.out.print("Enter course code to search: ");  
            String searchCode = scanner.nextLine();  
            schedule.searchCourseByCode(searchCode);  
            break;  
    }  
}
```

case 4:

```
System.out.println("Exiting...");  
scanner.close();  
return;
```

default:

```
System.out.println("Invalid choice. Please try again.");
```

```
}
```

```
}
```

```
}
```

```
}
```

Output:

The screenshot shows the IntelliJ IDEA IDE with the 'CourseSchedule.java' file open. The code defines a 'Course' class with attributes 'courseName', 'courseCode', 'instructor', and 'timeSlot'. It includes a constructor and a 'displayCourseInfo()' method. The IDE's 'Run' window at the bottom shows the execution of the 'CourseSchedule' program, displaying a menu with options: '1. Add a Course', '2. Display All Courses', '3. Search Course by Code', '4. Exit', and 'Choose an option:'.

```
1 import java.util.ArrayList;  
2 import java.util.Scanner;  
3  
4 class Course { 5 usages  
5     String courseName; 2 usages  
6     String courseCode; 3 usages  
7     String instructor; 2 usages  
8     String timeSlot; 2 usages  
9  
10    public Course(String courseName, String courseCode, String instructor, String timeSlot) { 1 usage  
11        this.courseName = courseName;  
12        this.courseCode = courseCode;  
13        this.instructor = instructor;  
14        this.timeSlot = timeSlot;  
15    }  
16  
17    public void displayCourseInfo() { 2 usages  
18        System.out.println("Course Name: " + courseName);  
19        System.out.println("Course Code: " + courseCode);  
20        System.out.println("Instructor: " + instructor);  
21    }  
22 }
```

Run CourseSchedule x

C:\Users\sanja\jdk\openjdk-23.0.1\bin\java.exe "-javaagent:C:\Users\sanja\AppData\Local\JetBrains\IntelliJ IDEA 2024.2.4\lib\idea_rt.jar=49204:C:\Users\sanja\AppData\Local\Je
Course Schedule Program
1. Add a Course
2. Display All Courses
3. Search Course by Code
4. Exit
Choose an option:

TRIPLET > src > CourseSchedule.java > Course 4:15 LF UTF-8 4 spaces

6.Design Tic Tae Toe

Time Complexity :

Solution:

```
import java.util.Scanner;

public class TicTacToe {
    private char[][] board;
    private int
        currentPlayer;
    public TicTacToe()
    {
        board = new char[3][3];
        for (int i = 0; i < 3; ++i) {
            for (int j = 0; j < 3; ++j) {
                board[i][j] = ' ';
            }
        }
        currentPlayer = 1;
    }
    public void printBoard()
    {
        for (int i = 0; i < 3; ++i) {
            for (int j = 0; j < 3; ++j) {
                System.out.print(board[i][j]);
                if (j < 2) {
                    System.out.print(" | ");
                }
            }
            System.out.println();
            if (i < 2) {
                System.out.println("-----");
            }
        }
    }
}
```



```

}
public boolean isBoardFull()
{
    for (int i = 0; i < 3; ++i) {
        for (int j = 0; j < 3; ++j) {
            if (board[i][j] == ' ') {
                return false;
            }
        }
    }
    return true;
}

public boolean makeMove(int row, int column)
{
    if (row < 0 || row >= 3 || column < 0 || column >= 3
        || board[row][column] != ' ') {
        return false; // Invalid move
    }
    board[row][column]
        = (currentPlayer == 1) ? 'X' : 'O';
    currentPlayer
        = 3 - currentPlayer; // Switch player (1 to 2 or

    return true;
}

public boolean checkWinner()
{
    for (int i = 0; i < 3; ++i) {
        if (board[i][0] != ' '
            && board[i][0] == board[i][1]
            && board[i][1] == board[i][2]) {
            return true;
        }
        if (board[0][i] != ' '

```

```

        && board[0][i] == board[1][i]
        && board[1][i] == board[2][i]) {
    return true;
}
}
if (board[0][0] != ' ' && board[0][0] == board[1][1]
    && board[1][1] == board[2][2]) {
    return true;
}
if (board[0][2] != ' ' && board[0][2] == board[1][1]
    && board[1][1] == board[2][0]) {
    return true;
}
return false;
}
public static void main(String[] args)
{
    TicTacToe game = new TicTacToe();
    Scanner scanner = new Scanner(System.in);
    int row, column;
    while (!game.isBoardFull() && !game.checkWinner()) {
        game.printBoard();
        System.out.print(
            "Player " + game.currentPlayer
            + ", enter your move (row and column): ");
        row = scanner.nextInt();
        column = scanner.nextInt();

        if (game.makeMove(row, column)) {
            System.out.println("Move successful!");
        }
        else {
            System.out.println(
                "Invalid move. Try again.");
        }
    }
}

```

```

    }
    game.printBoard();
    if (game.checkWinner()) {
        System.out.println("Player "
            + (3 - game.currentPlayer)
            + " wins!");
    }
    else {
        System.out.println("It's a draw!");
    }
    scanner.close();
}
}
}

```

Output:

The screenshot shows an IDE window with the following components:

- Project View:** Shows the project structure with folders like .idea, out, and src. The src folder contains the TicTacToe class.
- Code Editor:** Displays the TicTacToe.java file. The code includes:


```

1  import java.util.Scanner;
2
3  public class TicTacToe {
4      private char[][] board; 26 usages
5      private int 6 usages
6          currentPlayer;
7      public TicTacToe() 1 usage
8      {
9          board = new char[3][3];
10         for (int i = 0; i < 3; ++i) {
11             for (int j = 0; j < 3; ++j) {
12                 board[i][j] = ' ';
13             }
14         }
15         currentPlayer = 1;
16     }
17
18     public void printBoard() 2 usages
19     {
20         for (int i = 0; i < 3; ++i) {

```
- Run Console:** Shows the command used to run the program:


```

C:\Users\sanja\.jdk\openjdk-23.0.1\bin\java.exe "-javaagent:C:\Users\sanja\AppData\Local\JetBrains\IntelliJ IDEA 2024.2.4\lib\idea_rt.jar=49825:C:\Users\sanja\AppData\Local\J

```

 The output of the program is displayed below the command:


```

| |
-----
| |
-----
| |
Player 1, enter your move (row and column):

```