INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

CSN-261 : Data Structures Laboratory

Assignment-5

Name : **HEMANT**

Enr. No. : **18114030**

E-mail : **hemant@cs.iitr.ac.in**

Problem 1 :

Given: n 2D points and two orthogonal polygons. Problem: Find the set of points lie inside the overlapping region (rectangular) of the two given orthogonal polygons. Write a program in Java to solve the above problem applying k-d tree data structure.

Algorithm Used :

A K-D Tree(also called as K-Dimensional Tree) is a binary search tree where data in each node is a K-Dimensional point in space.In short, it is a space partitioning(details below) data structure for organizing points in a K-Dimensional space. A non-leaf node in K-D tree divides the space into two parts, called as half- spaces.

Points to the left of this space are represented by the left subtree of that node and points to the right of the space are represented by the right subtree. We will soon be explaining the concept on how the space is divided and tree is formed. In a 2D tree the root would have an x-aligned plane, the root's children would both have y-aligned planes, the root's grandchildren would all have x- aligned planes, and the root's great-grandchildren would all have y-aligned planes and so on.

Data Structure Used :

1.KD Tree

2.Arrays

3.Objects

Snapshots :

```
(base) hemant@hemant-hp:~/Desktop/DS_Prac_L7$ java q1
Enter the coordinates of Rectangle (Bottom Left, Top Right) : 3.5 5.1 6.5 8.4
Enter the coordinates of Second Polygon :
4.1 2.2 6.7 2.2 6.7 4.3 5.4 4.3 5.4 8.7 4.1 8.7
Enter the number of points to be checked :
10
4.3 4.1 5 5.8 5.2 34.3 8 6 6.7 7.7 2.2 6.8 4.4 8.1 3.6 7.3 8 7.5 6.6
(5.0,5.8)        (4.4,8.1)        (3.6,7.3)  ▮
```

Problem 2 :

Given n values in an array and two index values, find the result of the following queries

1. minimum value

2. maximum value

3. sum

4. update by adding 4 with each element, within the given index

range using Segment tree. Also implement the brute-force method and compare the execution time of both the methods.

A segment tree is a data structure used for storing information about intervals, range or segments. It facilitates efficient range querying in O(log n), where n is the size of the given problem.

Algorithms Used :

Segment Tree is a basically a binary tree used for storing the intervals or segments. Each node in the Segment Tree represents an

interval. Consider an array of size and a corresponding Segment Tree : The root of will represent the whole array A [0 : N − 1].

Data Structure Used :

1.Segment Tree

2.Objects

3.Arrays

Snapshots :

```
(base) hemant@hemant-hp:~/Desktop/DS_Prac_L7$ java Que2
Enter the Array size : 6
Enter the Array elements : 4 7 1 3 2 6
Enter the operation index :
1. Get Minimum Value :
2. Get Maximum Value :
3. Get Sum :
4. Add 4 to each element :
5. Exit
Index : 1
Also enter the index range : 1 5
Minimum value from 1 to 5 is 1
1. Get Minimum Value :
2. Get Maximum Value :
3. Get Sum :
4. Add 4 to each element :
5. Exit
Index : 2
Also enter the index range : 3 5
Maximum value  from 3 to 5 is 6
```

```
1. Get Minimum Value :
2. Get Maximum Value :
3. Get Sum :
4. Add 4 to each element :
5. Exit
Index : 3
Also enter the index range : 2 4
Sum is 6
1. Get Minimum Value :
2. Get Maximum Value :
3. Get Sum :
4. Add 4 to each element :
5. Exit
Index : 4
Also enter the index range : 2 5
1. Get Minimum Value :
2. Get Maximum Value :
3. Get Sum :
4. Add 4 to each element :
5. Exit
Index : 5

Execution Time is :44.540005794 seconds
```