Lab Assignment - 6

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Problem Statement -1:

Write a menu driven C++ program to implement a graph using adjacency list (linked list) without using STL. Perform following operations on the graph.

1. BFS traversal
2. DFS traversal
3. Cycle finding in the graph
4. Calculate diameter of the graph

DATA STRUCTURES USED:

- Queues
- Stacks
- Linked List
- Union-Find data structures
- Arrays

ALGORITHMS USED:

- BFS algorithms
- DFS algorithms
- Union-find algorithms to check for cycle in the graph
- Floyd-Warshall's algorithm to calculate diameter of the graph

```
thefox@thebunker:~/Desktop/CSN261_Assign/csn261_assign6
$ ./q1
Usage ./q1 fileName
thefox@thebunker:~/Desktop/CSN261_Assign/csn261_assign6
$ ./q1 L6_Q1_sample_input.txt

Select an option
        1.BFS traversal
        2.DFS traversal
        3.Cycle finding in graph
        4.Diameater of the graph
        5.Exit
1
A B C F I D U

Select an option
        1.BFS traversal
        2.DFS traversal
        3.Cycle finding in graph
        4.Diameater of the graph
        5.Exit
2
A B F D C U I
```

```
3
Yes

Select an option
        1.BFS traversal
        2.DFS traversal
        3.Cycle finding in graph
        4.Diameater of the graph
        5.Exit
4
3

Select an option
        1.BFS traversal
        2.DFS traversal
        3.Cycle finding in graph
        4.Diameater of the graph
        5.Exit
```

Problem Statement -2:

Write a C++ program to implement a binomial heap using heap data structures (without using STL). Print the order of each binomial heap and use Graphviz to show the forest of binomial heap.

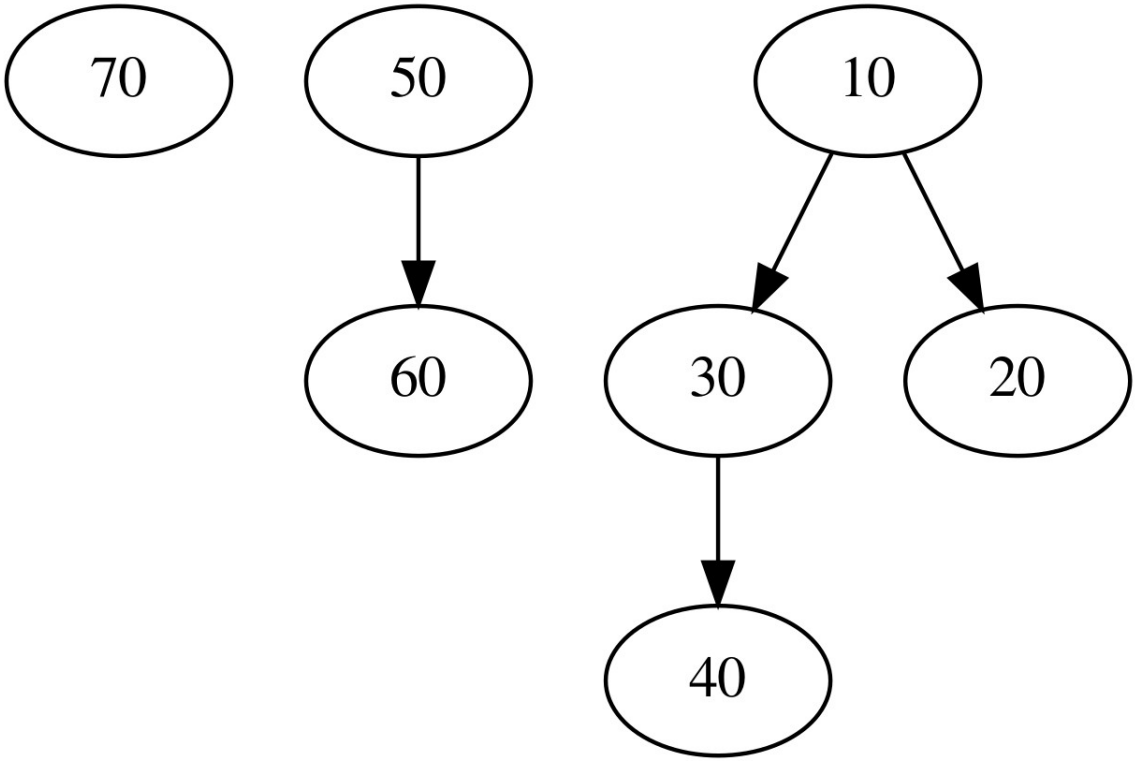
DATA STRUCTURES USED:

- Trees
- Heap

ALGORITHMS USED:

- Binomial heap algorithms
- Recursive algorithms to print the heap and also to write the dot file

```
thefox@thebunker:~/Desktop/CSN261_Assign/csn261_assign6
$ ./q2
Enter the number of elements
7
Enter the elements
10 20 30 40 50 60 70
0 : 70
1 : 50 60
2 : 10 30 40 20
thefox@thebunker:~/Desktop/CSN261_Assign/csn261_assign6
$ ls q2.dot
q2.dot
thefox@thebunker:~/Desktop/CSN261_Assign/csn261_assign6
$ dot -Tpdf q2.dot -o q2.pdf
thefox@thebunker:~/Desktop/CSN261_Assign/csn261_assign6
$ eog q2.pdf
thefox@thebunker:~/Desktop/CSN261_Assign/csn261_assign6
$ evince q2.pdf
```


70
50
10
60
30
20
40

Problem Statement -3:

Write a C++ program to implement Bentley-Ottmann Algorithm to find and print all the intersection points of n given lines. Use of STL is allowed. The specific type of data structure that must be used include Priority Queue and BST. Using least square method find the linear fit of the M found intersection points and print the line in the form ax+b. The student should demonstrate this on a GUI using QT library. The input should be given in following format:

1. Input number of line segments, N
2. N lines where 2N points are provided, i.e., 2 points in each line

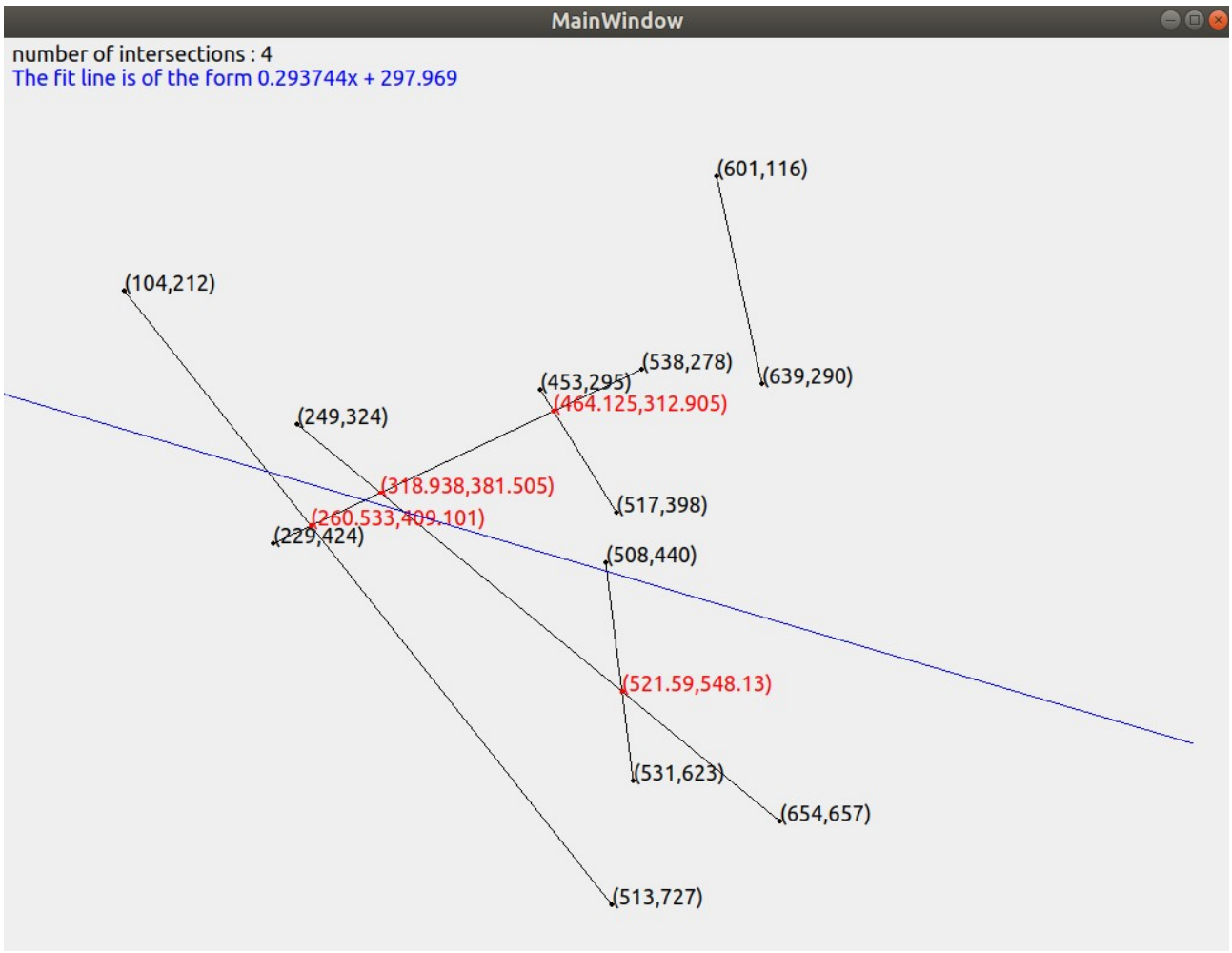
DATA STRUCTURES USED:

- Priority Queue
- Trees
- Sets
- Vectors
- Arrays

ALGORITHMS USED:

- Bentley-Ottman Algorithm
- Linear Regression Formula to get linear fit lines

```
thefox@thebunker:~/Desktop/CSN261_Assign/csn261_assign6
$ ./q3_gui
Enter the number of lines : 6
Enter the coordinates space separated
104 212 513 727
229 424 538 278
249 324 654 657
508 440 531 623
453 295 517 398
639 290 601 116
No. of intersection points: 4
(260.533,409.101)
(318.938,381.505)
(464.125,312.905)
(521.59,548.13)
```


MainWindow
number of intersections : 4
The fit line is of the form 0.293744x + 297.969
(601,116)
(104,212)
(538,278)
(639,290)
(453,295)
(464.125,312.905)
(249,324)
(318.938,381.505)
(517,398)
(260.533,409.101)
(229,424)
(508,440)
(521.59,548.13)
(531,623)
(654,657)
(513,727)