PROBLEM STATEMENT - 1

Find the closest pair of points

Generate a random pair of 100 values. Apply the closest pair algorithm to find the closest pair (distance).

The Brute force solution computes the distance between each pair and returns the smallest. It is O(n^2). By using divide and Conquer algorithm, we can calculate in O(nLogn).

Formula for distance between two points p(x1,y1) and q(x2,y2).

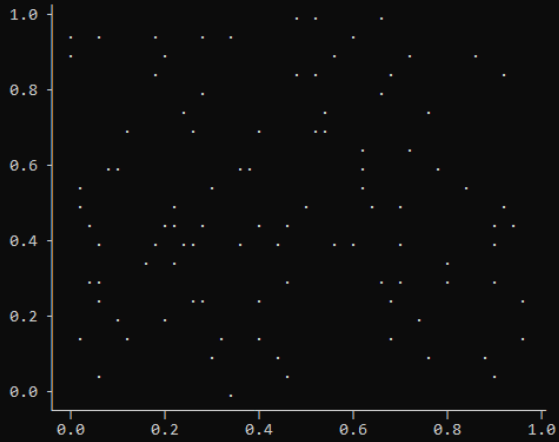$$d=\sqrt{((x2 - x1)^2 + (y2 - y1)^2)}$$

ALGORITHM

1. The 100 random points for the input array is generated using the rand() function between range 0 to 1.

2. The input array is sorted as per x coordinates.

3. Find P[n/2], the middle point in the array we sorted.

4. Divide the array of points P[ ] in 2 halves. The first sub array contains P[0] to P[n/2] and the second part contains points from P[n/2+1] to P[n-1].

5. Then find the shortest distance in both the sub arrays using recursion. Let dl & dr be the shortest distance in the left and right sub arrays respectively. And then make d the smallest of dl & dr.

6. From the above steps, we have found the shortest distance in the 2 parts of the array. Now think of the distance between the points in which one lies in the left part and another in the right sub array. Consider the vertical straight line y=n/2, and take all the points whose x coordinates are closer than d to y=n/2 and store such points in strip[ ].

7. Sort this strip[ ] array based on the y coordinates of the points.

8. Now find the shortest distance of points in strip[ ].

9. Finally, find the minimum of d and shortest distance in strip[ ].

10. Print a graph with all the random points plotted in it.

11. Display the closest distance and the closest pair of points.

OUTPUT


```
lect C:\Users\user\Documents\Curneu Assessment\Problem 2\closest pair.exe

  1.0 ┤
                                    . .        .
      │   . .      . .    . .      . .       .
      │     .                          .
      │              .          .  .       .
  0.8 ┤          .      .     . .       .          .
      │       .          .        .
      │        .               .         .
      │    . .           .          .
  0.6 ┤     . .               .        .
      │    .             .          .
      │    .      . .    . .    .   .    .
      │    .  . .    .   .    .   .    . .
  0.4 ┤    .      .    . .        .       . .
      │    .        .        .
      │     . .          .        .
      │    . .        .     .   .
  0.2 ┤     .     .          .
      │     . .     .           .
      │       .        .              .
      │          .          .       .
  0.0 ┤                .
      └───┬─────┬─────┬─────┬─────┬─────┬──
         0.0   0.2   0.4   0.6   0.8   1.0

Smallest Distance among the 100 random points is : 0.0141422
Closest Points are :
,0.46
,0.45

----------------------------
ess exited after 0.04461 seconds with return value 0
s any key to continue . . . █
```