Divide And Conquer

Main Focus: Closest Pair of Points

NOTE: See Video To Understand This Well!

$O(nlogn)$ **solution:** Divide the points into 2 equal halves based on median of x- coordinates.

Algorithm:

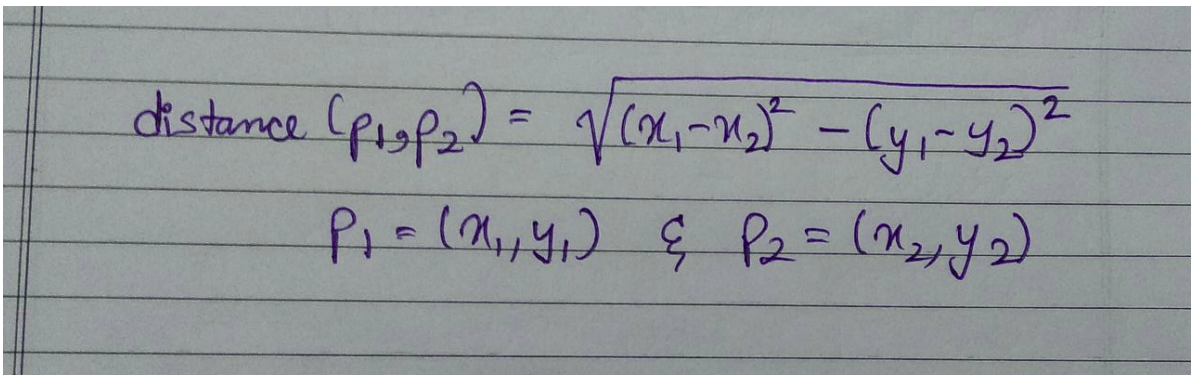
1. Sort the given points in S (given set of points) based on their x-coordinates. Partition S into two subsets S_1 and S_2, about the line l through median os S. ← Divide Part of DnC.
2. Find the closest-pairs in S_1 and S_2 and call them L and R recursively.
3. Now, steps 4 to 8 form the Combining component of the DnC technique.
4. Let us assume that δ = $min(L, R)$.
5. Eliminate points that are farther than δ apart from l.
6. Consider the remaining points and sort based on their y-coordinates.
7. Scan the remaining points in the y order and compute the distances of each point to all its neighbours that are distanced no more than $2 \times \delta$ (that's the reason for sorting according to y)-
8. If any of these distances is less than δ then update δ.

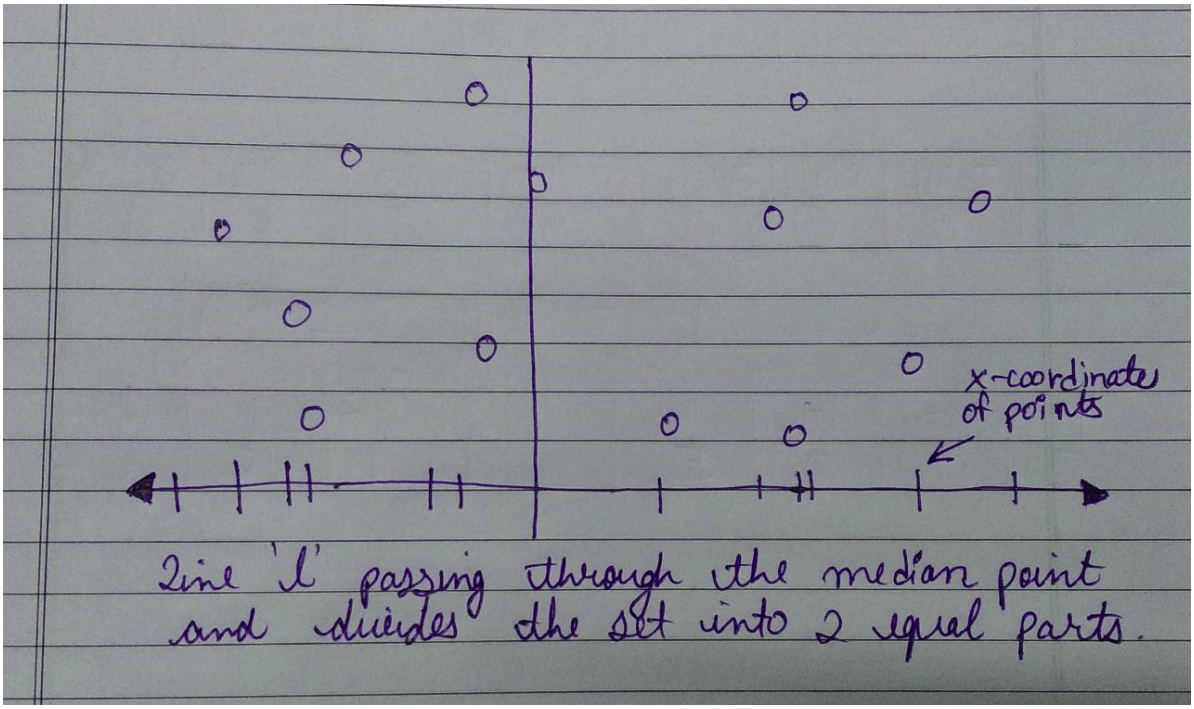
Analysis:

1. Step 1 and 2 take $O(nlogn) for sorting and recursively finding the minimum.$
2. Step 4 takes $O(1)$.
3. Step 5 takes $O(n)$ for scanning and elimination.
4. Step 6 takes $O(nlogn)$ for sorting.
5. Step 7 takes $O(n)$ for scanning.

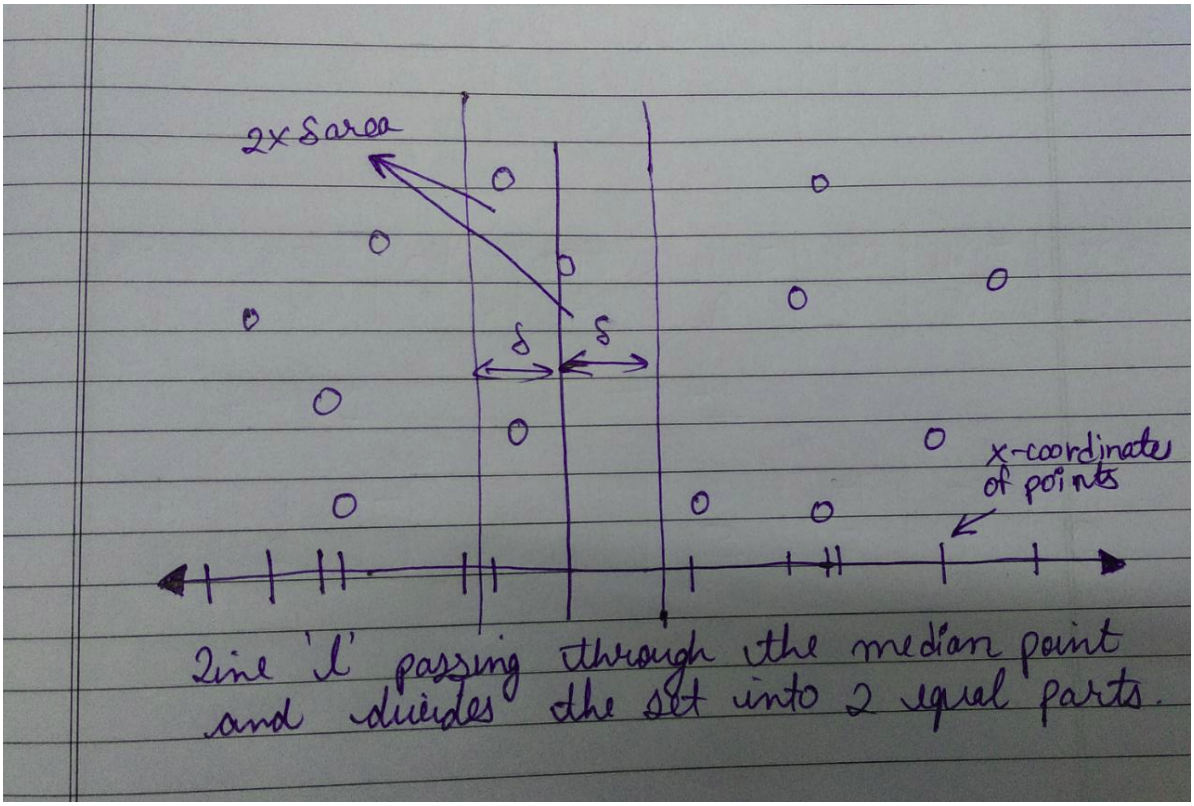
Therefore, Total Compexity: $O(nlogn) + O(1) + O(n) + O(n) + O(n) \approx O(nlogn)$

Images Used In The Video:





Line 'l' passing through the median point and divides the set into 2 equal parts.



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