

hwe

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## 1

For this Exercise, I first set the size of points X to be 100. The closest distance turned out to be 90.53. and the run-time is :

Time for Brute-Force: 0.37549519538879395

Time for Algo: 0.0015120506286621094

And the closest distance of size of 200 is 35.97 while the run-time is:

Time for Algo: 2.826683759689331

Time for Brute-Force: 0.002405881881713867

And the closest distance of size of 300 is 29.08 while the run-time is:

Time for Algo: 9.330415964126587

Time for Brute-Force: 0.0052337646484375

The result quite meets my expectation because the run-time of Brute-Force method is  $O(n^2)$ . But for the algorithm we designed is  $T(n) = 2T(n/2) + O(n \log n)$ , which is  $O(n * (\log n)^2)$ . And the algorithm we designed is way faster  $O(n^2)$  Brute-Force.

## 2

From our observation above, we can see for size of 100, we can see the time to 0.0015, for size of 200, the time is 0.002405 and for size of 300, the time is 0.005233. As the size multiplies, the time is roughly multiplied in same factors. Therefore, the run-time of my algorithm to be roughly  $O(n)$ .