

CSCE 310H - Fall 2021

Computer Science III - honors

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$$d = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$$

A hand-drawn diagram illustrating the Euclidean distance formula. Two points are plotted on a grid. Point 1 is at coordinates (x_1, y_1) and Point 2 is at (x_2, y_2) . A vertical line segment connects the two points, and a horizontal line segment connects them. The length of this hypotenuse is labeled d , representing the distance between the two points.

Pairs = Combinations of size 2

given a set of n distinct elements,
how many combinations (order does
not matter)
of k elements are there?

n "choose" k

$${n \choose k} = C(n, k) = {n \choose k} = {}_n C_k$$

$$\binom{n}{k} = \frac{n!}{(n-k)! k!}$$

ex:

$$\binom{n}{2} = \text{number of pairs}$$

$$= \frac{n!}{(n-2)! 2!}$$

$$= \frac{n(n-1)}{2}$$

$$\in O(n^2)$$

$$= \frac{n^2}{2} - \frac{n}{2}$$

Input: A set of points $A = \{(x_1, y_1), \dots, (x_n, y_n)\}$

Output: 2 closest points in A

1 $\text{MinDist} \leftarrow \infty$

2 for each pair of points $(x_a, y_a), (x_b, y_b)$ in A

3 $d \leftarrow \sqrt{(x_a - x_b)^2 + (y_a - y_b)^2}$

4 if $d < \text{MinDist}$

5 $\text{MinDist} \leftarrow d$

6 $(P_a, P_b) \leftarrow (P_1, P_2)$

7 Output (P_a, P_b)

1) Input: A

2) Input size: n

3) Element Op:

comp, \sim in C

4) $\binom{n}{2}$ 5) $O(n^2)$

~~for x in A :~~

O loose

~~for y in A :~~

$n \in \Theta(n)$

$n \in O(n^2)$

$n \in O(2^n)$

for $i = 0 \dots n-1$

 for $j = i+1 \dots n$

\dots

i

$$\sum_{i=0}^{n-1} \sum_{j=i+1}^{n-1} 1 = \sum_{i=0}^{n-1} (n-i)$$

$$\sum_{i=1}^n i = \frac{n(n+1)}{2}$$

Gauss's Formula