# CSCE 310H - Fall 2021

## Computer Science III - honors

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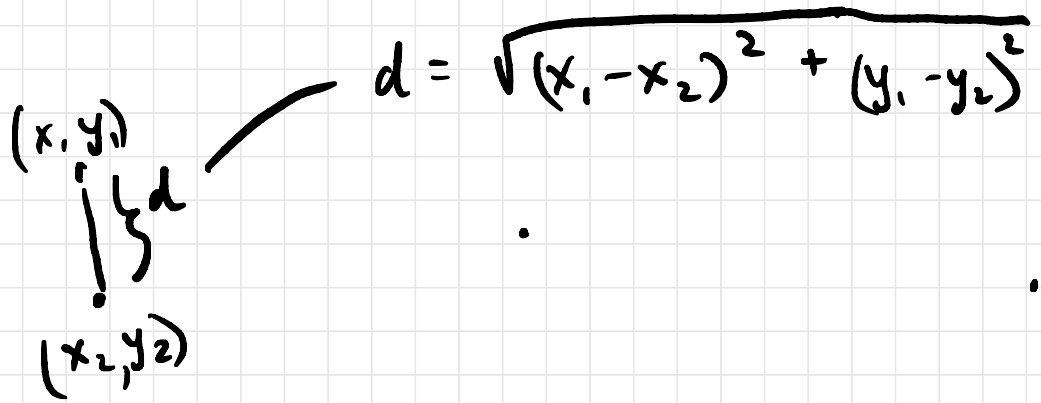



Pairs = Combinations of size 2

given a set of $n$ distinct elements,

how many combinations (order does not matter) of $k$ elements are there?

$n$ "choose" $k$

$$\binom{n}{k} = C(n,k) = C_k^n = {}_nC_k$$

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

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

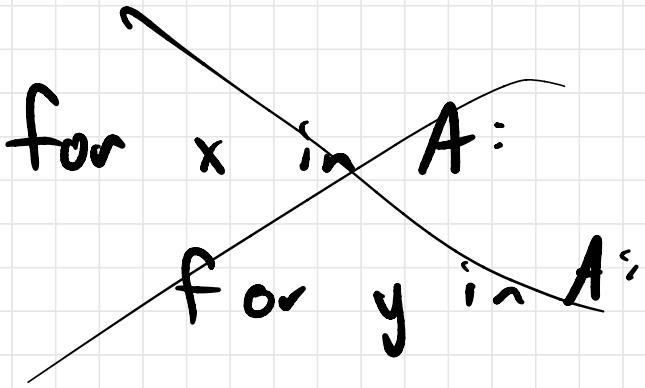
```
1  MinDist ← ∞
2  for each pair of points (x_a, y_a), (x_b, y_b) in A
3      d ← sqrt((x_a - x_b)^2 + (y_a - y_b)^2)
4      if d < MinDist
5          MinDist ← d
6          (p_a p_b) ← (p_1 p_2)
7  output (p_a p_b)
```

1) Input: A

2) Input size: n

3) Element Op: comp, line 4

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




0 loose

$n \in \Theta(n)$

$n \in O(n^2)$

$n \in O(2^n)$

for $i = 0 \dots n-1$

for $j = i+1 \dots n$

$\dots$

$1$

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

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

Gauss's Formula