

# Methods for Distance Calculation

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Manhattan Distance

2

Euclidean Distance

3

Hamming Distance



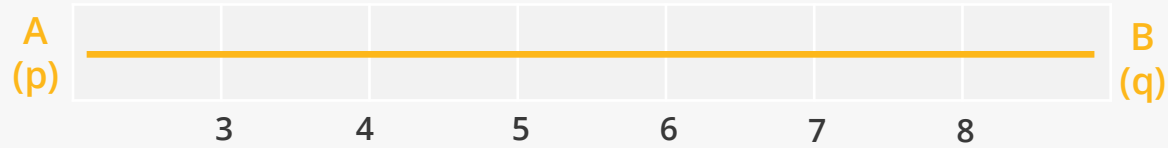
## Manhattan Distance

$$d = |p_1 - q_1| + |p_2 - q_2| + \dots + |p_n - q_n|$$

# Manhattan Distance



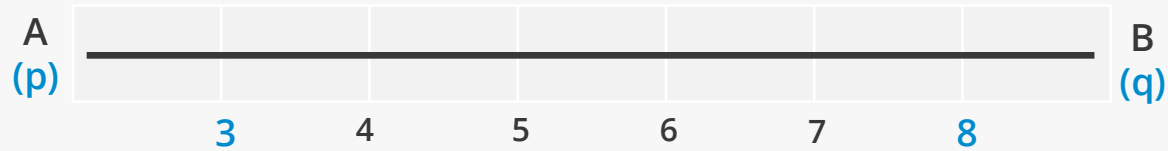
# Manhattan Distance



# Manhattan Distance

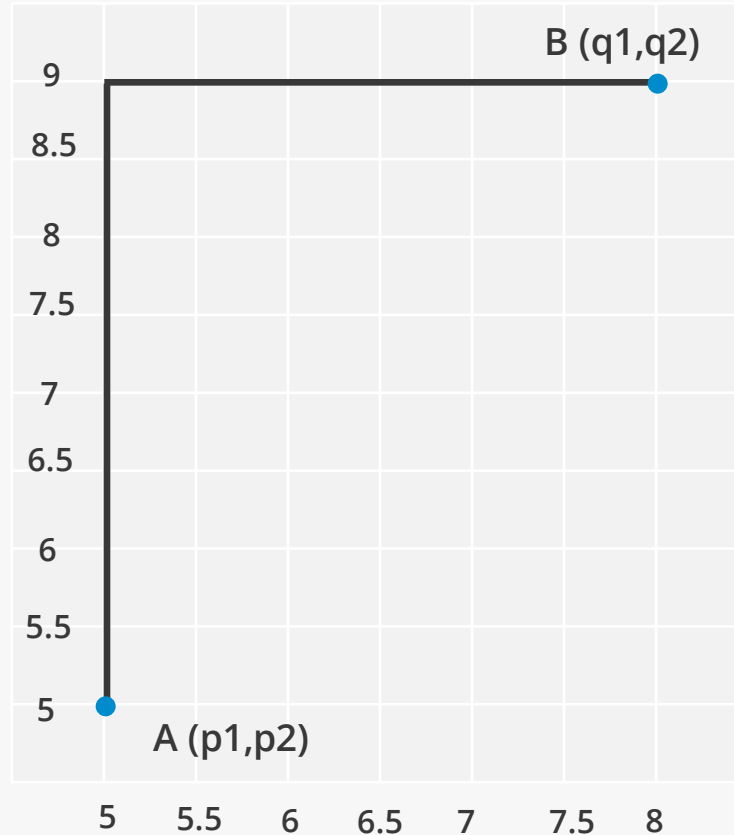


# Manhattan Distance

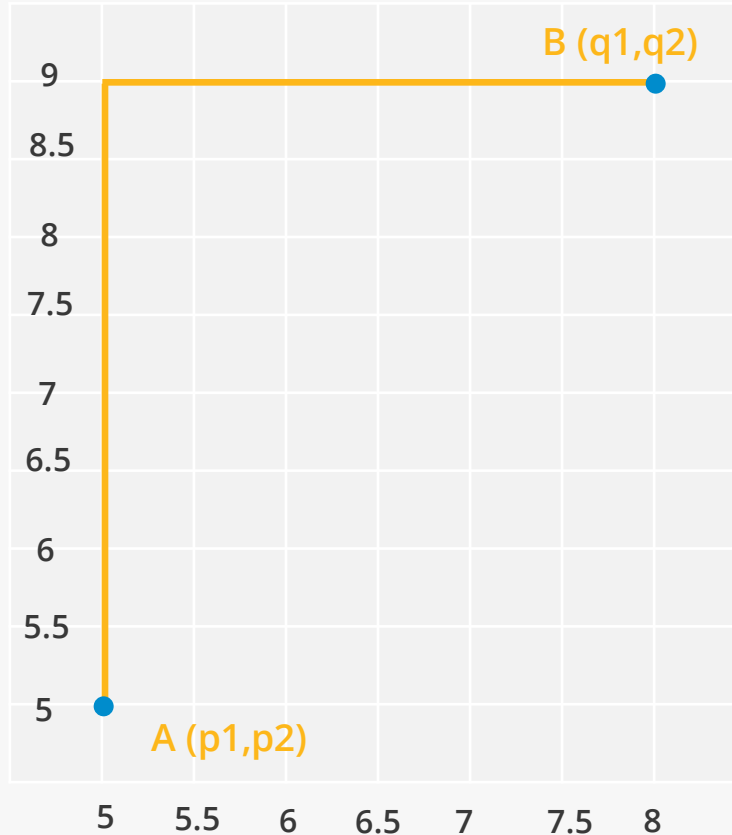


$$\begin{aligned}\text{Distance} &= |p - q| \\ &= |3 - 8| = 5 \text{ units}\end{aligned}$$

# Manhattan Distance

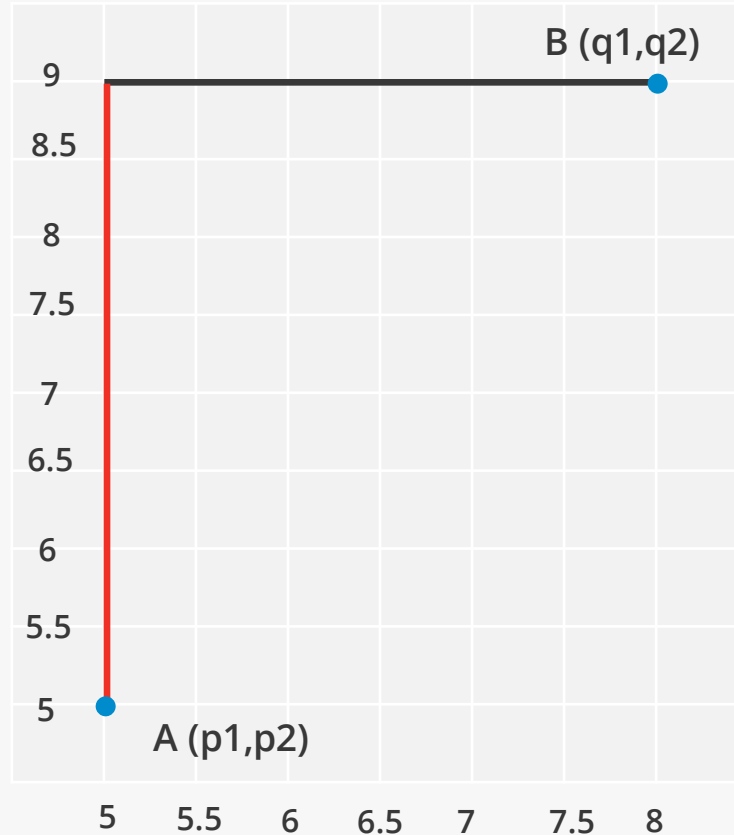


# Manhattan Distance

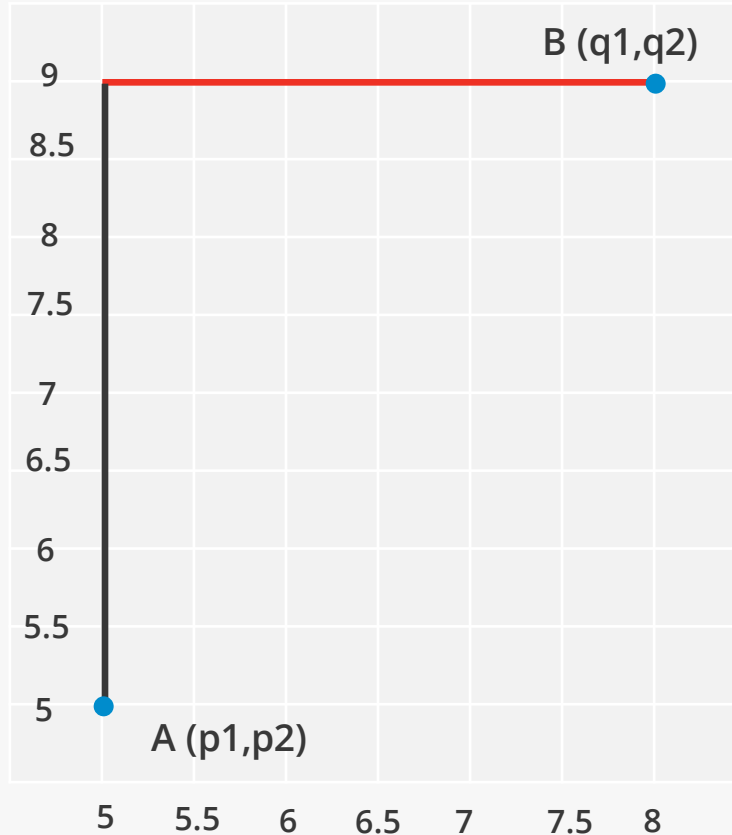




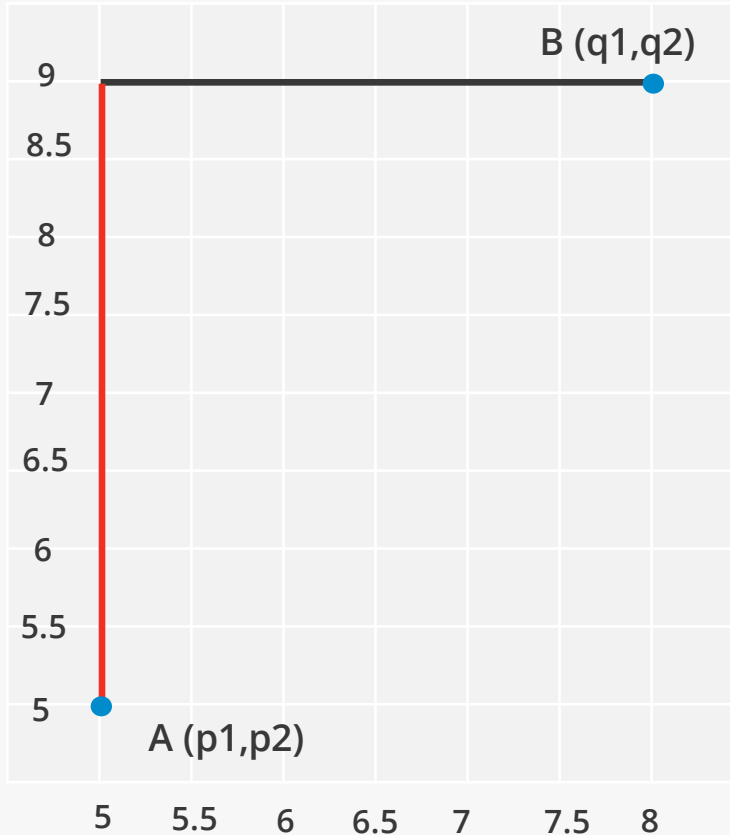
# Manhattan Distance



# Manhattan Distance

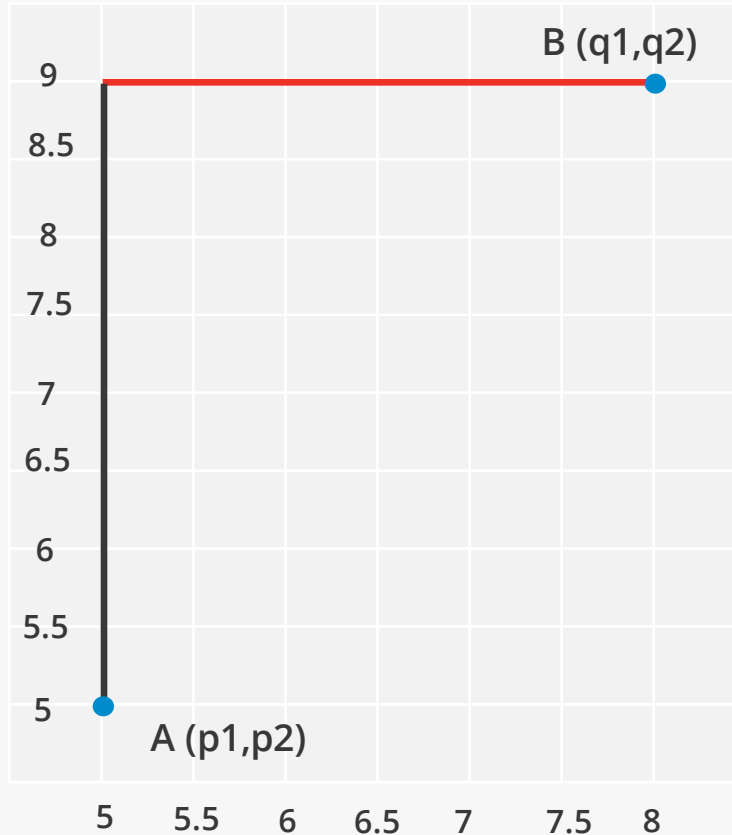


# Manhattan Distance



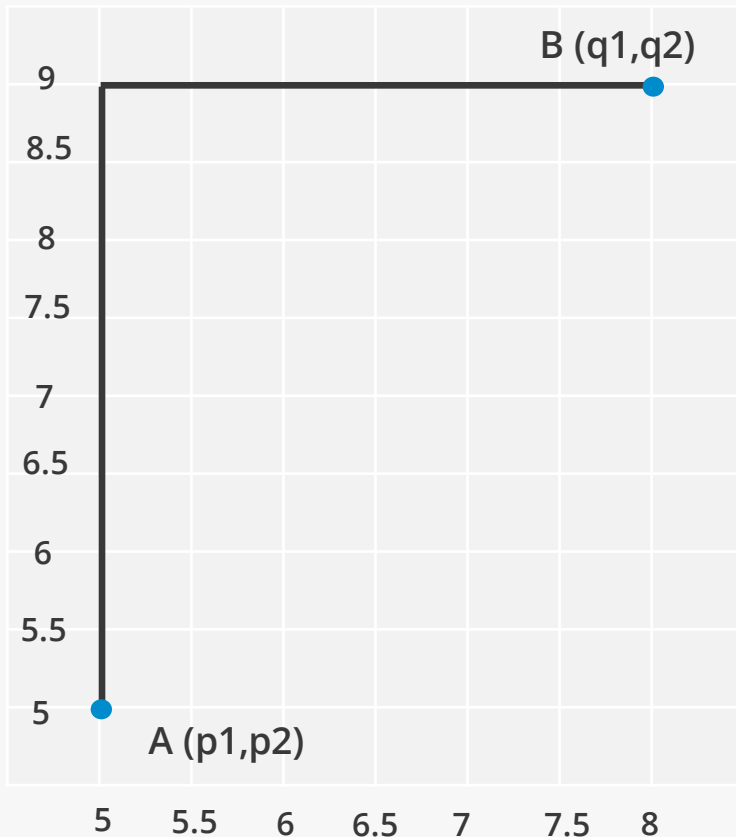
$$\text{Distance} = |p_1 - q_1| +$$

# Manhattan Distance



$$\text{Distance} = |p_1 - q_1| + |p_2 - q_2|$$
$$=$$

# Manhattan Distance



$$\begin{aligned}\text{Distance} &= |p_1 - q_1| + |p_2 - q_2| \\ &= |5 - 8| + |5 - 9| \\ &= 3 + 4 = \mathbf{7 \text{ Units}}\end{aligned}$$

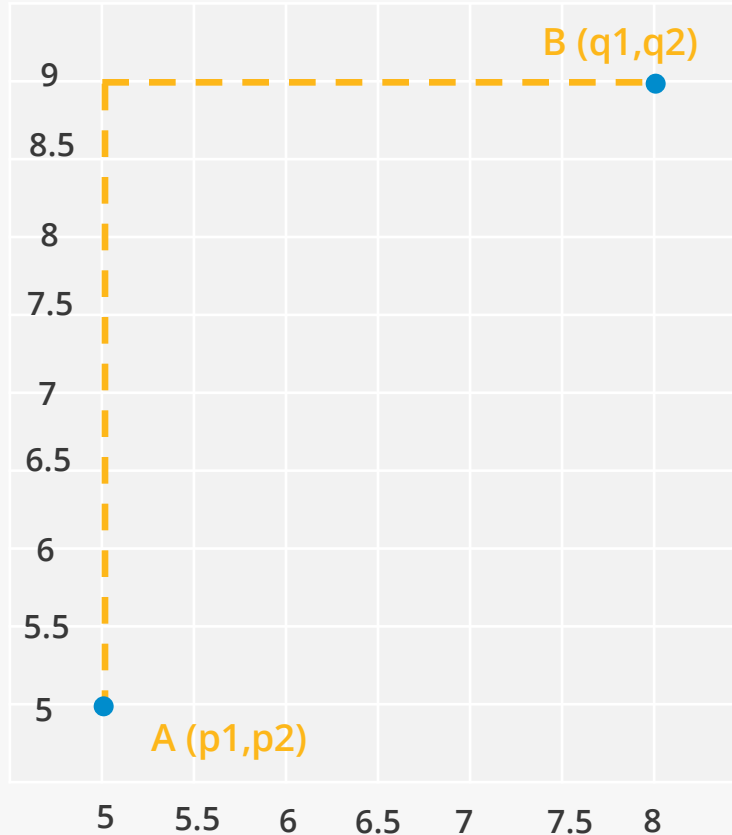
# Manhattan Distance

Distance for n dimensions:

$$d = |p_1 - q_1| + |p_2 - q_2| + \dots + |p_n - q_n|$$



# Manhattan Distance

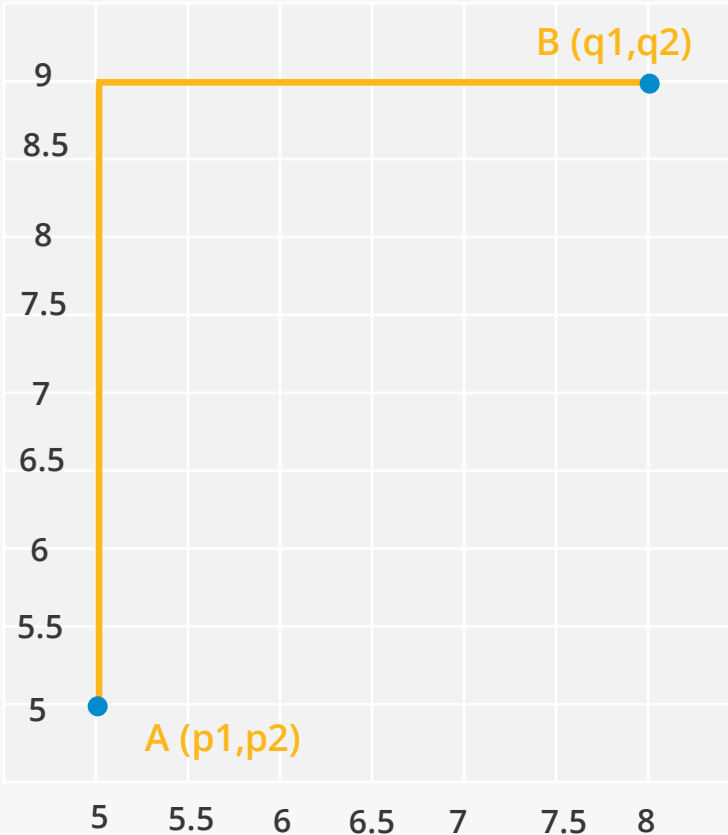




# Euclidean Distance

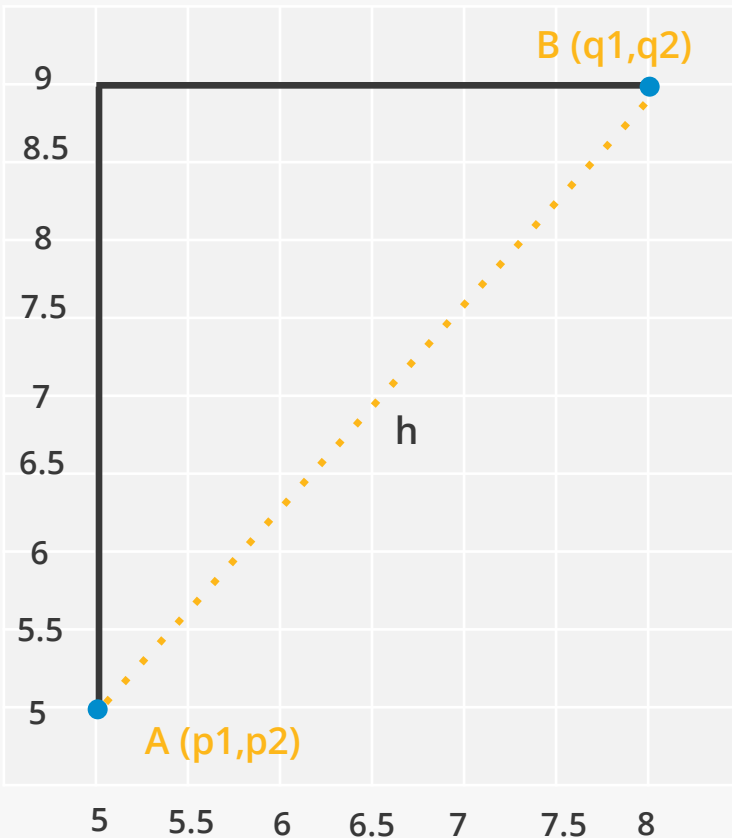


# Euclidean Distance



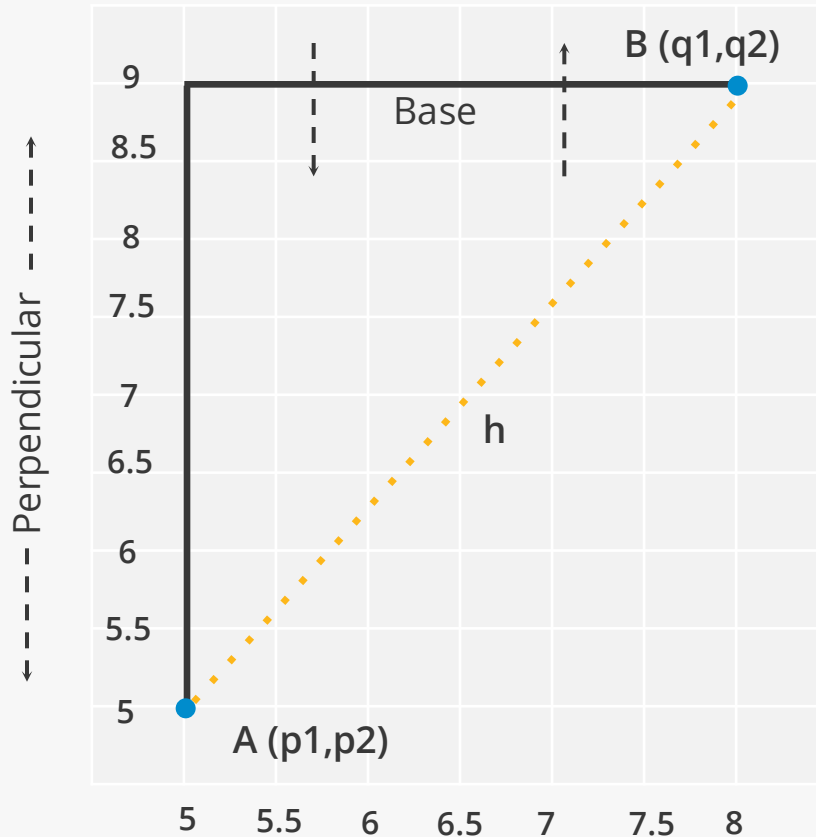
Distance between A and B  
= **7 Units**

# Euclidean Distance



Distance between A and B  
= **7 Units**

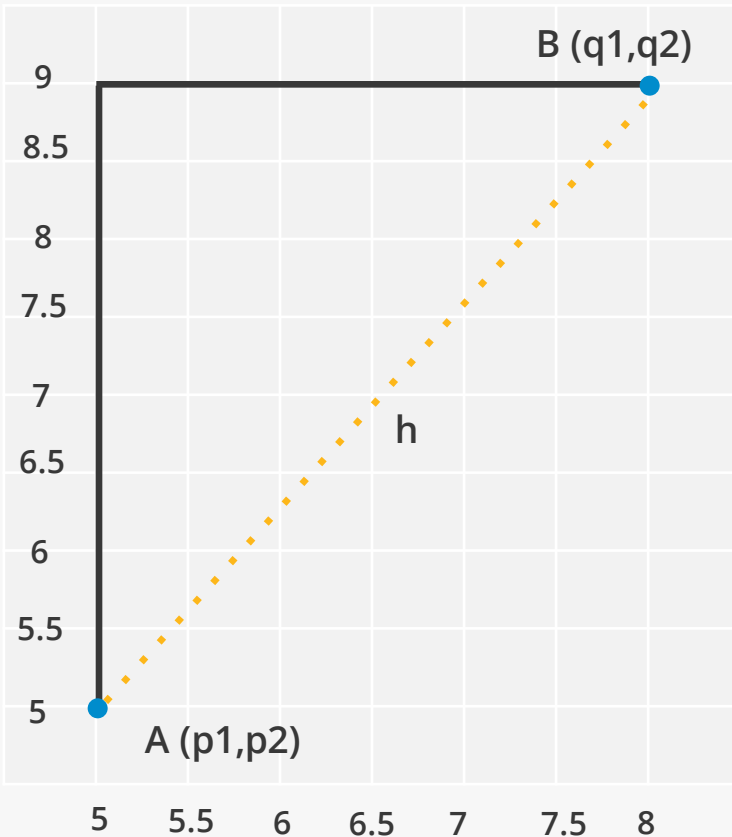
# Euclidean Distance



Pythagoras Theorem

$$\sqrt{\text{base}^2 + \text{perpendicular}^2} = c$$

# Euclidean Distance



$$\begin{aligned} & \sqrt{(p_1 - q_1)^2 + (p_2 - q_2)^2} \\ &= \sqrt{(5 - 9)^2 + (5 - 8)^2} \\ &= \sqrt{4^2 + 3^2} \\ &= \mathbf{5 \text{ Units}} \end{aligned}$$

# Euclidean Distance

Shortest distance between 2 points for n dimensions:

$$d = ( (p_1 - q_1)^2 + (p_2 - q_2)^2 + \dots + (p_n - q_n)^2 )^{1/2}$$



# Euclidean Distance

Shortest distance between 2 points for n dimensions:

$$\left[ \sum_{i=1}^n (p_i - q_i)^2 \right]^{1/2}$$





## Distance between 2 categorical variables



# Hamming Distance



# Hamming Distance

The Hamming Distance is the total number of differences between two strings of identical length. **Identical length** implies that the number of characters in both strings should be the same.




# Hamming Distance: Example

ID	Gender	Strings
A	Male	'0'
B	Female	'1'
C	Male	'0'


# Hamming Distance: Example

ID	Gender	Strings
A	Male	'0'
B	Female	'1'
C	Male	'0'



# Hamming Distance: Example


ID	Gender	Strings
A	Male	'0'
B	Female	'1'
C	Male	'0'



The diagram illustrates the Hamming distance between the strings '0' and '1'. A dashed blue bracket on the right side of the table groups the 'Strings' column for rows A and B. To the right of this bracket, the number '1' is written, indicating that there is one position (the first character) where the strings differ.

# Hamming Distance: Example

ID	Gender	Strings
A	Male	'0'
B	Female	'1'
C	Male	'0'



A diagram illustrating the Hamming distance between the strings '0' and '1'. It shows a dashed box containing the characters '1' and '0' aligned vertically. To the right of the '0' is a '0' character, and to the right of the '1' is a '1' character. This visualizes the difference between the two strings, which is 1.

# Hamming Distance: Example

ID	Gender	Marital Status	Employment Status
A	Male	Married	Self Employed
B	Female	Married	Salaried
C	Male	Unmarried	Unemployed

# Hamming Distance: Example

ID	Gender	Marital Status	Employment Status
A	'0'	'0'	'1'
B	'1'	'0'	'2'
C	'0'	'1'	'3'

# Hamming Distance: Example

ID	Gender	Marital Status	Employment Status	Strings
A	'0'	'0'	'1'	'001'
B	'1'	'0'	'2'	'102'
C	'0'	'1'	'3'	'013'



# Hamming Distance: Example

ID	Gender	Marital Status	Employment Status	Strings
A	'0'	'0'	'1'	'001'
B	'1'	'0'	'2'	'102'
C	'0'	'1'	'3'	'013'

# Hamming Distance: Example

ID	Gender	Marital Status	Employment Status	Strings
A	'0'	'0'	'1'	'001'
B	'1'	'0'	'2'	'102'
C	'0'	'1'	'3'	'013'

# Hamming Distance: Example

ID	Gender	Marital Status	Employment Status	Strings
A	'0'	'0'	'1'	'00 <b>1</b> '
B	'1'	'0'	'2'	'10 <b>2</b> '
C	'0'	'1'	'3'	'013'

# Hamming Distance: Example

ID	Gender	Marital Status	Employment Status	Strings
A	'0'	'0'	'1'	'001'
B	'1'	'0'	'2'	'102'
C	'0'	'1'	'3'	'013'

2

# Hamming Distance: Example

ID	Gender	Marital Status	Employment Status	Strings
A	'0'	'0'	'1'	'001'
B	'1'	'0'	'2'	'102'
C	'0'	'1'	'3'	'013'

2

# Hamming Distance: Example

ID	Gender	Marital Status	Employment Status	Strings
A	'0'	'0'	'1'	'001'
B	'1'	'0'	'2'	'102'
C	'0'	'1'	'3'	'013'

2

# Hamming Distance: Example

ID	Gender	Marital Status	Employment Status	Strings
A	'0'	'0'	'1'	'001'
B	'1'	'0'	'2'	'102'
C	'0'	'1'	'3'	'013'

A dashed box highlights the last two characters of the strings in the 'Strings' column, with a '2' indicating the Hamming distance between them.

