

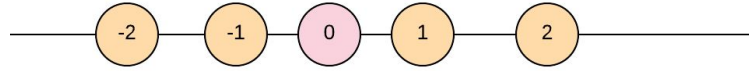
# Spread of Data

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- The measure of central tendency are not adequate to describe the data.

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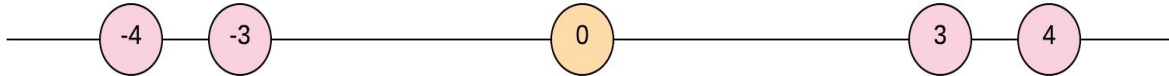
- The measure of central tendency are not adequate to describe the data.



Mean = 0

Median = 0

Vs

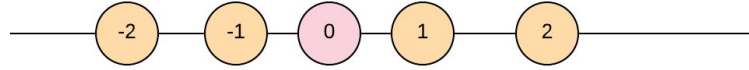


Mean = 0

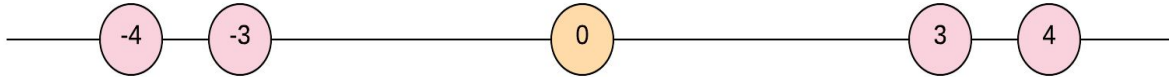
Median = 0

# Spread of Data

- The measure of central tendency are not adequate to describe the data.



Vs



Mean, Median = 0 for both

# Spread of Data

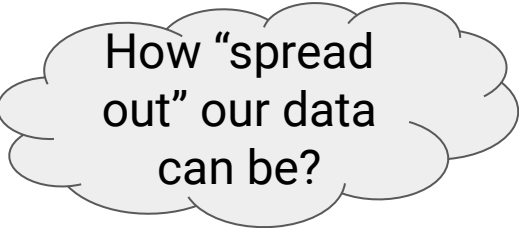
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- Measures of spread describe how similar or varied the set of data points are.

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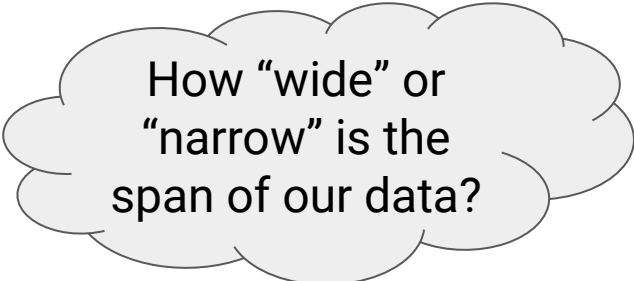
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- Spread, Variability, Dispersion.

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How “spread out” our data can be?



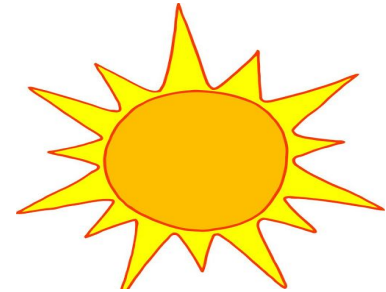
How “wide” or “narrow” is the span of our data?

# Spread of Data

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- Measures of spread describe how similar or varied the set of data points are.
- Spread, Variability, Dispersion.

How “spread out” our data can be?

How “wide” or “narrow” is the span of our data?



Temperature in Summer Month  
Vs  
Temperature throughout the year



# Variance and Standard Deviation

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The diagram illustrates the formula for standard deviation ( $\sigma$ ) with four numbered annotations:

- 1. the mean: Points to the  $\bar{x}$  term in the formula.
- 2. squared distances from mean: Points to the  $(x_i - \bar{x})^2$  term in the formula.
- 3. variance ( $\sigma^2$ ): Points to the entire fraction  $\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$ .
- 4. standard deviation ( $\sigma$ ): Points to the square root symbol  $\sqrt{\quad}$ .

The formula is shown as:

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}}$$

# Variance and Standard Deviation

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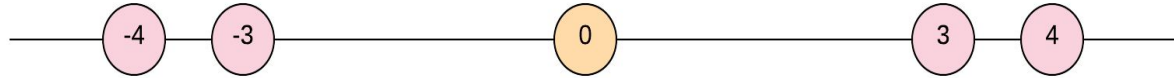
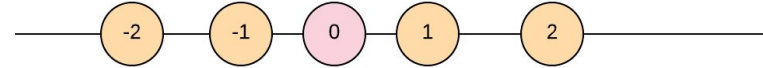
$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}}$$

4. standard deviation ( $\sigma$ )

1. the mean

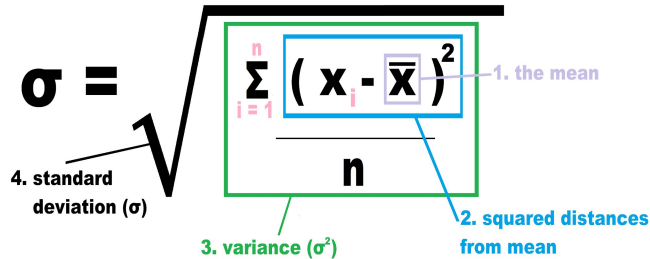
2. squared distances from mean

3. variance ( $\sigma^2$ )



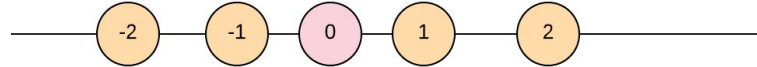
# Variance and Standard Deviation

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The diagram shows the formula for standard deviation:  $\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}}$ . Annotations include: 1. the mean (pointing to  $\bar{x}$ ), 2. squared distances from mean (pointing to  $(x_i - \bar{x})^2$ ), 3. variance ( $\sigma^2$ ) (pointing to the entire fraction inside the square root), and 4. standard deviation ( $\sigma$ ) (pointing to the square root symbol).

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}}$$



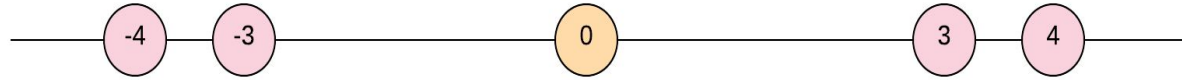
$$\sigma^2 = \frac{(-2-0)^2 + (-1-0)^2 + (0-0)^2 + (1-0)^2 + (2-0)^2}{5}$$

$$\sigma^2 = 2$$

$$\sigma = \sqrt{2} = 1.41$$

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$$\sigma^2 = \frac{(-4-0)^2 + (-3-0)^2 + (0-0)^2 + (3-0)^2 + (4-0)^2}{5}$$

$$\sigma^2 = 10$$

$$\sigma = \sqrt{10} = 3.162$$

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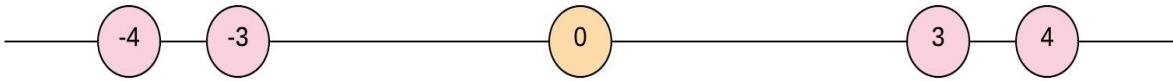
The diagram illustrates the formula for standard deviation ( $\sigma$ ) with four numbered annotations:

- 1. the mean: Points to  $\bar{x}$  in the formula.
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- 3. variance ( $\sigma^2$ ): Points to the entire fraction  $\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}$ .
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$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}}$$

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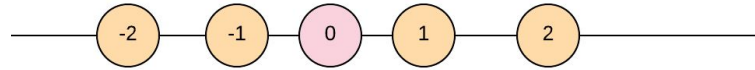
Average Difference  
(Not squared)

$$\frac{(-4-0) + (-3-0) + (0-0) + (3-0) + (4-0)}{5} = 0$$



# Variance and Standard Deviation

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Average Difference  
(Not squared)

$$\frac{(-2-0) + (-1-0) + (0-0) + (1-0) + (2-0)}{5} = 0$$

# Variance and Standard Deviation

- Variance is the average squared difference of the values from the mean.
- Standard Deviation is the square root of Variance.

The diagram illustrates the formula for standard deviation ( $\sigma$ ) with the following components and annotations:

- 4. standard deviation ( $\sigma$ )**: Points to the Greek letter sigma ( $\sigma$ ) on the left.
- =**: The equals sign.
- √**: The square root symbol.
- 3. variance ( $\sigma^2$ )**: Points to the entire fraction inside the square root.
- 1. the mean**: Points to the  $\bar{x}$  term in the numerator.
- 2. squared distances from mean**: Points to the squared term  $(x_i - \bar{x})^2$  in the numerator.

The formula is: 
$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - \bar{x})^2}{n}}$$

- If not squared positive deviation can cancel the negative deviation so taking Square of difference actually helps.

Thank You!