Measure of **central tendency** is a value that represents a typical, or central, entry of a data set. The most common measures of central tendency are:

- **Mean (Average):** The sum of all the data entries divided by the number of entries.

  Population Mean: $\mu = \frac{\Sigma x}{N}$ Sample Mean: $\bar{x} = \frac{\Sigma x}{n}$

- **Median:** The value that lies in the **middle** of the data when the data set is **ordered.** If the data set has an odd number of entries, then the median is the middle data entry. If the data has an even number of entries, then the median is obtained by adding the two numbers in the middle and dividing result by two.
- **Mode**: The data entry that occurs with the **greatest frequency**. A data set may have one mode, more than one mode, or no mode. If no entry is repeated the data set has no mode.
- **Outliers** are not just greatest and least values, but values that are very different from the pattern established by the rest of the data. Outliers affect the mean. When outliers are present it is best to use the median as the measure of central tendency.

Measures of Variation:

- **Range:** The difference between the maximum and minimum data entries in the set. Range = (Max. data entry) – (Min. data entry)

- The **standard deviation** measure **variability** and **consistency** of the sample or population. In most real-world applications, consistency is a great advantage. In statistical data analysis, less variation is often better.

  Population Standard Deviation $= \sigma = \sqrt{\frac{\Sigma(x-\mu)^2}{N}}$ Sample Standard Deviation $= s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}}$

- Example: Find Population Mean and Sample Standard Deviation for the following data set: 5, 10, 15, 20

$$\bar{x} = \frac{\Sigma x}{n} = \frac{5+10+15+20}{4} = \frac{50}{4} = 12.5$$

Data	$\boldsymbol{x-\bar{x}}$	$\boldsymbol{(x-\bar{x})^2}$
5	**5 – (12.5) = –7.5**	$\mathbf{(-7.5)^2 = 56.25}$
10	**10 – (12.5) = –2.5**	$\mathbf{(-2.5)^2 = 6.25}$
15	**15 – (12.5) = 2.5**	$\mathbf{(2.5)^2 = 6.25}$
20	**20 – (12.5) = 7.5**	$\mathbf{(7.5)^2 = 56.25}$
		$\mathbf{\Sigma(x-\bar{x})^2 = 125.01}$

$$s = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n-1}} = \sqrt{\frac{125.01}{4-1}} \approx 6.455$$