First: Measures of center(Mode, median, and mean)

- **Mode:** Refers to the data value that is most frequently observed

Example: what is the mode of **154**, 139, **154**,192,180,140,**154**,155,192

The mode is 154

- **Median:** Refers to the data value that is positioned in the middle of an ordered data set

$$\textbf{Median} = \frac{n+1}{2}$$

Example: what is the median of 139, 140,154,154,154,155,180,192,192

139 ↑

140

154

154

154

155 ↓

180

192

192

- **The mean:** is the average of the numbers

The mean is summation of all data values divided by total number of data vales

$$\text{Mean} = \frac{\Sigma x}{N}$$

- X= score
- Σ=sum
- N= how many numbers

Example: what is the mean of 2, 7, and 9

$$\text{Mean} = \frac{2+7+9}{3}$$

Second: Measures of spread (Range, Variance standard deviation, and standard error)

- **The range**= The range is the maximum minus minimum

Range= Max- Min

Example: what is the range of 2, 7, 9

Range= Max- Min

= 9 - 2

= 7

- **Variance**: It measures how far each number in the set is from the mean

Variance= $\frac{\Sigma(x-\bar{x})^2}{N-1}$

X= score

$\bar{x}$ = mean

Σ=sum

N= how many numbers

Example: What is the Variance of 10,12,16,19,20

x	$(x-\bar{x})$	$(x-\bar{x})^2$
10	10-15.4= **-5.4**	$(-5.4)^2$ = **29.16**
12	12-15.4= **-3.4**	$(-3.4)^2$ = **11.56**
16	16-15.4= **0.6**	$(0.6)^2$= **0.36**
19	19-15.4= **3.6**	$(3.6)^2$= **12.96**
20	20-15.4= **4.6**	$(4.6)^2$= **21.16**
$\bar{x}$= 15.4		**$\Sigma(x-\bar{x})^2$ = 75.2**

Variance = $\frac{75.2}{5-1}$

= 18.8

- **Standard deviation:** is a number used to tell you how values are spread out from the mean. A **low standard deviation** means that most of the numbers are very close to the average. A **high standard deviation** means that the numbers are spread out.

Standard deviation= $\sqrt{\frac{\Sigma(x-\bar{x})^2}{N-1}}$

$\underline{X}$= score
$\bar{x}$ = mean
Σ=sum
N= how many numbers

Example: What is the standard deviation of 10,12,16,19,20

x	$(x-\bar{x})$	$(x-\bar{x})^2$
10	10-15.4= **-5.4**	$(-5.4)^2$ = **29.16**
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$\bar{x}$= 15.4		**$\Sigma(x-\bar{x})^2$ = 75.2**

Standard deviation **=** $\sqrt{\frac{75.2}{5-1}}$ = 4.336

- **Standard error** :Standard error of the mean tells you how accurate your estimate of the mean is likely to be

S.E. = $\dfrac{\text{Standard deviation}}{\sqrt{N}}$

$= \dfrac{4.336}{\sqrt{5}}$