Standard Deviation

Measures of Variation: The Standard Deviation

- Shows variation about the mean
- Is the square root of the variance

  - **Sample standard deviation**:

$$S = \sqrt{\frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n - 1}}$$

Numerical Descriptive Measures For A Population: The Standard Deviation σ

- Standard Deviation variation about the mean
- Is the square root of the population variance

  - Population standard deviation:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N}(X_i - \mu)^2}{N}}$$

Example

10	12	14	15	17	18	18	24

- n=?
- Mean=?

$$S^2 = \frac{\sum_{i=1}^{n} (X_i - \overline{X})^2}{n - 1}$$

- Standard Dev = ? Yikes?!

Example

10	12	14	15	17	18	18	24

- n = **8**

$$\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$$

- Mean = 10+12+14+15+17+18+18+24 = 128

Mean = 128 / 8 = **16**

Measures of Variation: Sample Standard Deviation: Calculation Example

Sample Data (X_i) :

10	12	14	15	17	18	18	24

n = 8 Mean = $\overline{X}$ = 16

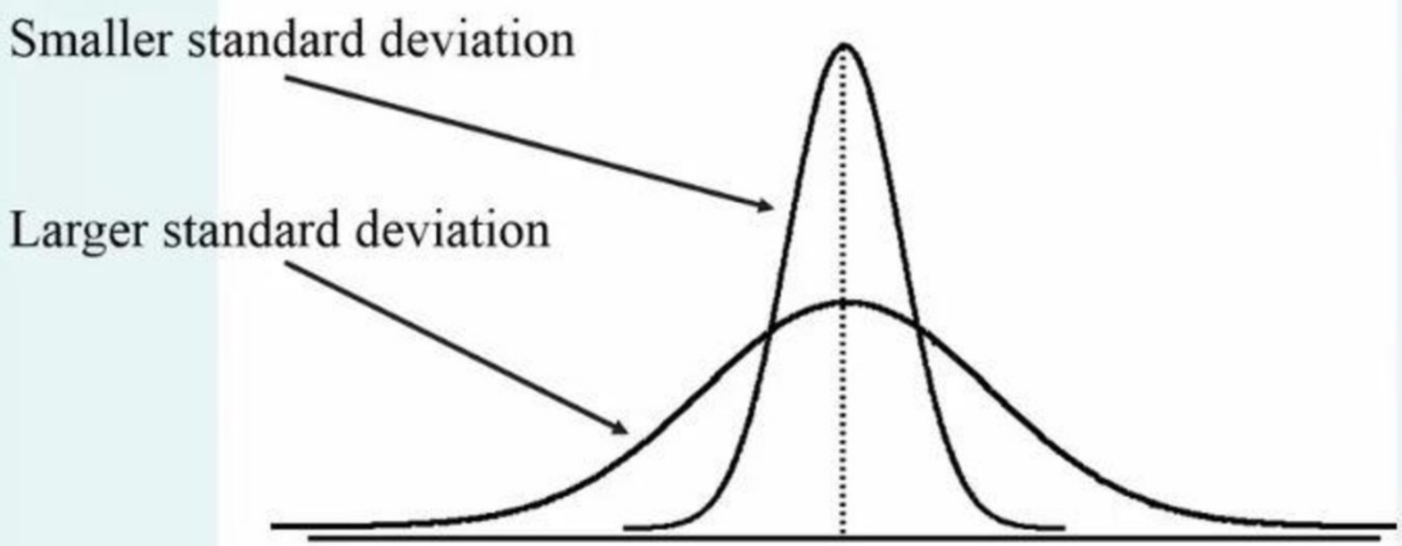
$$S = \sqrt{\frac{(10-\overline{X})^2 + (12-\overline{X})^2 + (14-\overline{X})^2 + \cdots + (24-\overline{X})^2}{n-1}}$$

$$= \sqrt{\frac{(10-16)^2 + (12-16)^2 + (14-16)^2 + \cdots + (24-16)^2}{8-1}}$$

$$= \sqrt{\frac{130}{7}} = \boxed{4.3095}$$

A measure of the "average" scatter around the mean

Measures of Variation: Comparing Standard Deviations



- The more the data are spread out, the greater the range, variance, and standard deviation.
- The more the data are concentrated, the smaller the range, variance, and standard deviation.