Descriptive Statistics

Empirical Rule

What is **Descriptive Statistics**?

It is the term given to the analysis of data by using certain formulas or definition that ultimately helps describe, or summarize data in a meaningful way.

What are the types of **Descriptive Statistics**?

Descriptive Statistics It is commonly divided into

- **Central Tendency** and
- **Variability(Dispersion)**.

What are **Central Tendencies**?

Measures of central tendency include **mean**, **median** and **mode**.

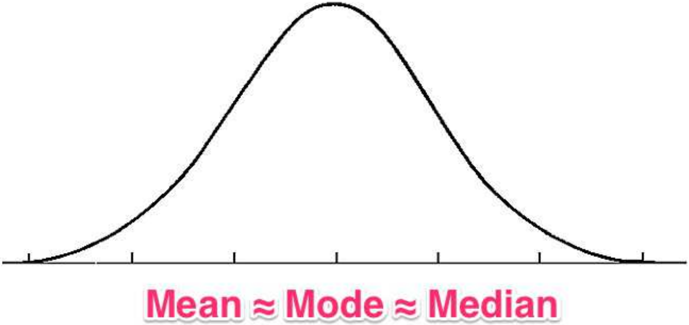
What are **Variability(Dispersion)**?

It measures how data elements vary or dispersed with respect to the sample mean $\bar{x}$.

These measures include **variance**, and **standard deviation**.

What is a **Bell-Shaped Distribution**?

A data has a approximately **Bell-Shaped** distribution when the **mean** , **mode** , and **median** are equal or approximately equal.

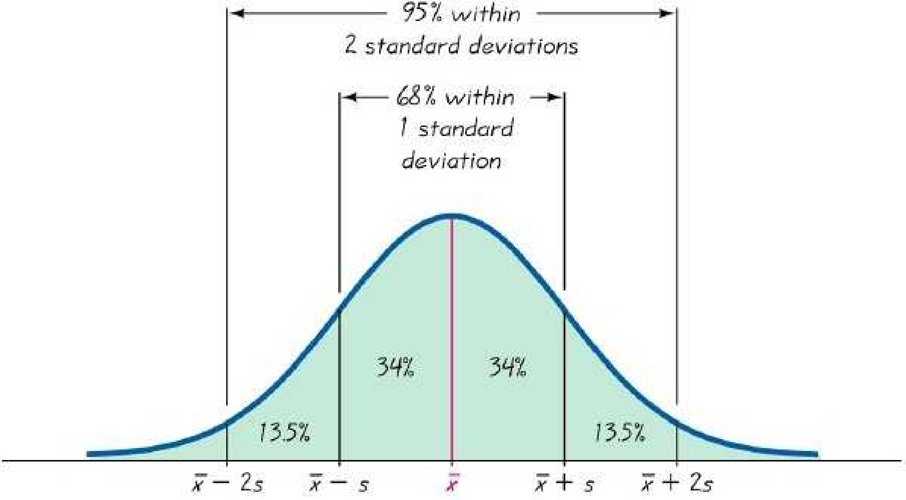


What is the **Empirical Rule**?

The **Empirical Rule** is used to provide the percentage of range of values that lie within a certain range of the data that has a **Bell-Shaped** distribution with given **Mean** and **Standard Deviation**.

What are the properties of the **Empirical Rule**?

- About 68% of all values fall within 1 standard deviation of the mean, that is $\boxed{\bar{x} \pm s}$.
- About 95% of all values fall within 2 standard deviations of the mean, that is $\boxed{\bar{x} \pm 2s}$.
- About 99.7% of all values fall within 3 standard deviations of the mean, that is $\boxed{\bar{x} \pm 3s}$.


95% within
2 standard deviations
68% within
1 standard
deviation
34%
34%
13.5%
13.5%
$\bar{x} - 2s$
$\bar{x} - s$
$\bar{x}$
$\bar{x} + s$
$\bar{x} + 2s$

What is the **Usual Range**?

The **Usual Range** is another name for the **95% Range** with the **Bell-Shaped** distribution data.

What are the **Usual** and **Unusual** values?

- Usual Values fall **within** the Usual Range.
- Unusual Values fall **outside** the Usual Range.

Example:

Find the 68% and 95% ranges of a bell-shaped distributed sample with the mean of 74 and standard deviation of 6.5.

Solution:

Since the data has a bell-shaped distribution, we can use the empirical rule to find the 68% and 95% ranges.

- For 68% range $\Rightarrow$ We compute $\bar{x} \pm s$.
  - $\bar{x} - s = 74 - 6.5 = 67.5$, and $\bar{x} + s = 74 + 6.5 = 80.5$.
  - So about 68% of the data falls within 67.5 and 80.5.
- For 95% range $\Rightarrow$ We compute $\bar{x} \pm 2s$.
  - $\bar{x} - 2s = 74 - 2(6.5) = 61$, and $\bar{x} + 2s = 74 + 2(6.5) = 87$.
  - So about 95% of the data falls within 61 and 87.

Example:

The salaries of 800 randomly selected nurses had a bell-shaped distributed with the mean of \$5800 and standard deviation of \$250.

- Find the usual range for the salaries of these nurses.
- What percentage of these nurses have a salary that is considered unusually high?
- How many of these nurses have a salary that is considered unusually high?

Solution:

Since the data has a bell-shaped distribution, we can use the empirical rule to answer these questions.

Solution Continued:

- For the usual range ⇒ We compute $\bar{x} \pm 2s$.
  - $\bar{x} - 2s = 5800 - 2(250) = 5300$,
    $\bar{x} + 2s = 5800 + 2(250) = 6300$.
  - So about 95% of salaries of these nurses falls within \$5300 and \$6300.
- For the unusual salaries, we know that 95% range implies usual salaries, so that leaves us with 5% for the unusual salaries with 2.5% of them have unusually high salaries.
- For the number of unusual high salaries, we need to compute 2.5% of the sample size of 800.
  - $2.5\% \cdot 800 = 0.025(800) = 20$
  - So about 20 of these nurses have unusually high salaries.