Central Tendency

MEAN

Characteristics of the Mean

- The arithmetic mean is the most widely used measure of location.
- Major characteristics:
  - All values are used.
  - It is unique.
  - The sum of the deviations from the mean is 0.
  - It is calculated by summing the values and dividing by the number of values.

Population Mean

For ungrouped data, the population mean is the sum of all the population values divided by the total number of population values:

POPULATION MEAN $$\mu = \frac{\Sigma X}{N} \qquad [3–1]$$

where:

- μ represents the population mean. It is the Greek lowercase letter "mu."
- N is the number of values in the population.
- X represents any particular value.
- Σ is the Greek capital letter "sigma" and indicates the operation of adding.
- ΣX is the sum of the X values in the population.

EXAMPLE – Population Mean

There are 12 automobile manufacturing companies in the United States. Listed below is the number of patents granted by the United States government to each company in a recent year.

Company	Number of Patents Granted	Company	Number of Patents Granted
General Motors	511	Mazda	210
Nissan	385	Chrysler	97
DaimlerChrysler	275	Porsche	50
Toyota	257	Mitsubishi	36
Honda	249	Volvo	23
Ford	234	BMW	13

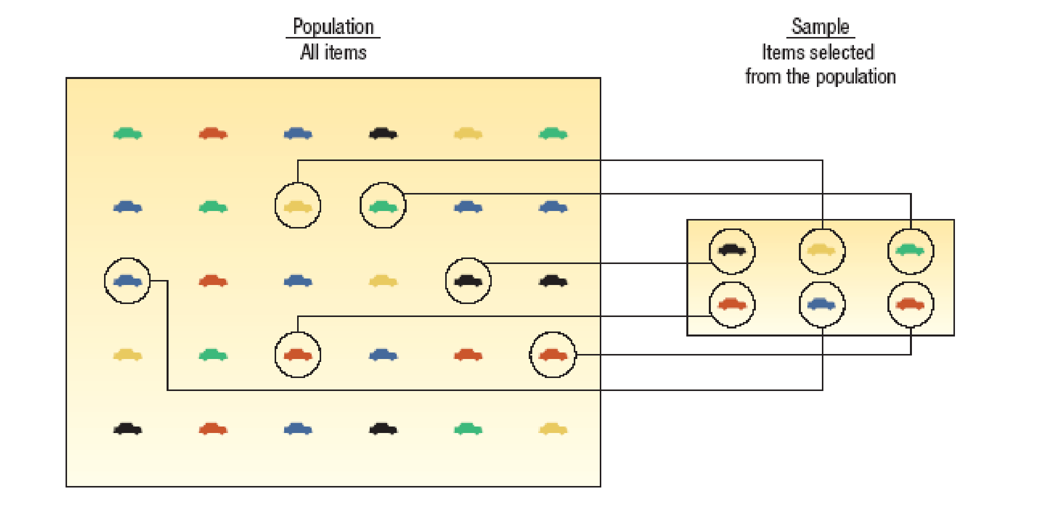
Is this information a sample or a population? What is the arithmetic mean number of patents granted?

$$\mu = \frac{\sum X}{N} = \frac{511+385+275+\ldots+36+23+13}{12} = \frac{2340}{12} = 195$$

Parameter Versus Statistics

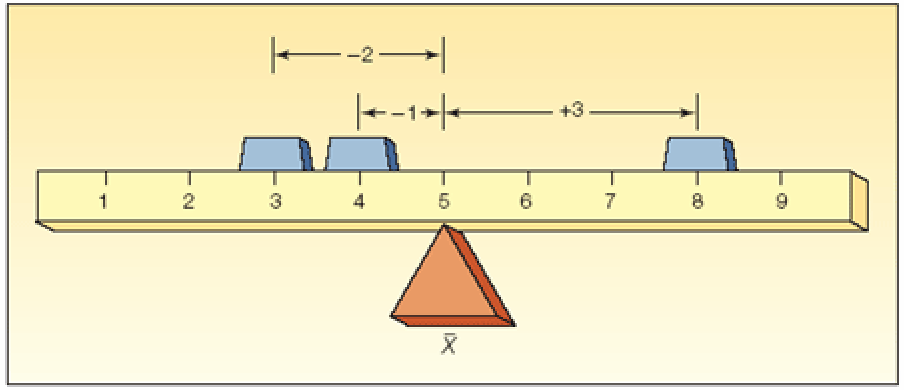
PARAMETER A measurable characteristic of a *population*.

STATISTIC A measurable characteristic of a *sample*.



Properties of the Arithmetic Mean

1. Every set of interval-level and ratio-level data has a mean.
2. All the values are included in computing the mean.
3. The mean is unique.
4. The sum of the deviations of each value from the mean is zero.



Sample Mean

- For ungrouped data, the sample mean is the sum of all the sample values divided by the number of sample values:

SAMPLE MEAN $$\bar{X} = \frac{\Sigma X}{n}$$ **[3–2]**

where:

$\bar{X}$ is the sample mean. It is read "X bar."

n is the number of values in the sample.

EXAMPLE – Sample Mean

SunCom is studying the number of minutes used monthly by clients in a particular cell phone rate plan. A random sample of 12 clients showed the following number of minutes used last month.

90	77	94	89	119	112
91	110	92	100	113	83

What is the arithmetic mean number of minutes used?

$$\text{Sample mean} = \frac{\text{Sum of all values in the sample}}{\text{Number of values in the sample}}$$

$$\bar{X} = \frac{\Sigma X}{n} = \frac{90 + 77 + \cdots + 83}{12} = \frac{1170}{12} = 97.5$$

Weighted Mean

- The weighted mean of a set of numbers $X_1, X_2, ..., X_n$, with corresponding weights $w_1, w_2, ..., w_n$, is computed from the following formula:

WEIGHTED MEAN

$$\bar{X}_w = \frac{w_1X_1 + w_2X_2 + w_3X_3 + \cdots + w_nX_n}{w_1 + w_2 + w_3 + \cdots + w_n} \quad [3\text{–}3]$$

EXAMPLE – Weighted Mean

The Carter Construction Company pays its hourly employees \$16.50, \$19.00, or \$25.00 per hour. There are 26 hourly employees, 14 of which are paid at the \$16.50 rate, 10 at the \$19.00 rate, and 2 at the \$25.00 rate. What is the mean hourly rate paid the 26 employees?

$$\bar{X}_w = \frac{14(\$16.50) + 10(\$19.00) + 2(\$25.00)}{14 + 10 + 2} = \frac{\$471.00}{26} = \$18.1154$$