Statistics – Measures of Central Tendency

Mean, Median & Mode

What is the average / expected / most frequent value?

Measures of central Tendency – mean

The mean (average) is the sum of all observations divided by the number of observations.

$$\mu = \frac{\sum_{i=1}^{N} X_i}{N}$$

μ: mean
X_i: value of observation i
N: total number of observations

1, 2, 2, 2, 4, 4, 6

$$\text{mean} = \frac{1+2+2+2+4+4+6}{7} = \frac{21}{7} = 3$$

Measures of central Tendency – median

The median is the midpoint of a dataset when the data is arranged in ascending or descending order. Half of the observations lie above the median and half are below.

1, 2, 2, 2, 4, 4, 6

Measures of central Tendency – mode

The mode is the value that occurs most frequently in a data set. A data set may have one mode (unimodal), more than one mode or even no mode.

1, 2, 2, 2, 4, 4, 6

Measures of central Tendency – mean vs. median

The mean is sensitive to outliers. In some cases, the median is the better metric as the median is not affected by outliers.

1, 2, 2, 2,
4, 4, 6

mean: 3
median: 2

1, 2, 2, 2,
4, 4, 50

mean: 9.3
median: 2

Measures of central Tendency – geometric mean

The geometric mean is often used when calculating investment returns over multiple periods or when measuring compound interest / growth rates.

$$1 + R_G = \sqrt[n]{(1 + R_1) * (1 + R_2) * \cdots * (1 + R_n)}$$

R_t: Return in period t
n: total number of periods

10%, -5%, 12%

$$R_G = (1.1 * 0.95 * 1.12)^{\left(\frac{1}{3}\right)} - 1 = 5.38\%$$

arithmetic mean: 5.67%