Part 6

In this part, we learn about the geometric mean and the harmonic mean and how to use them in analyzing data with examples. analysis

Data analysis

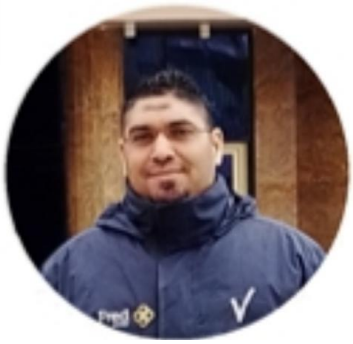
View statistical data

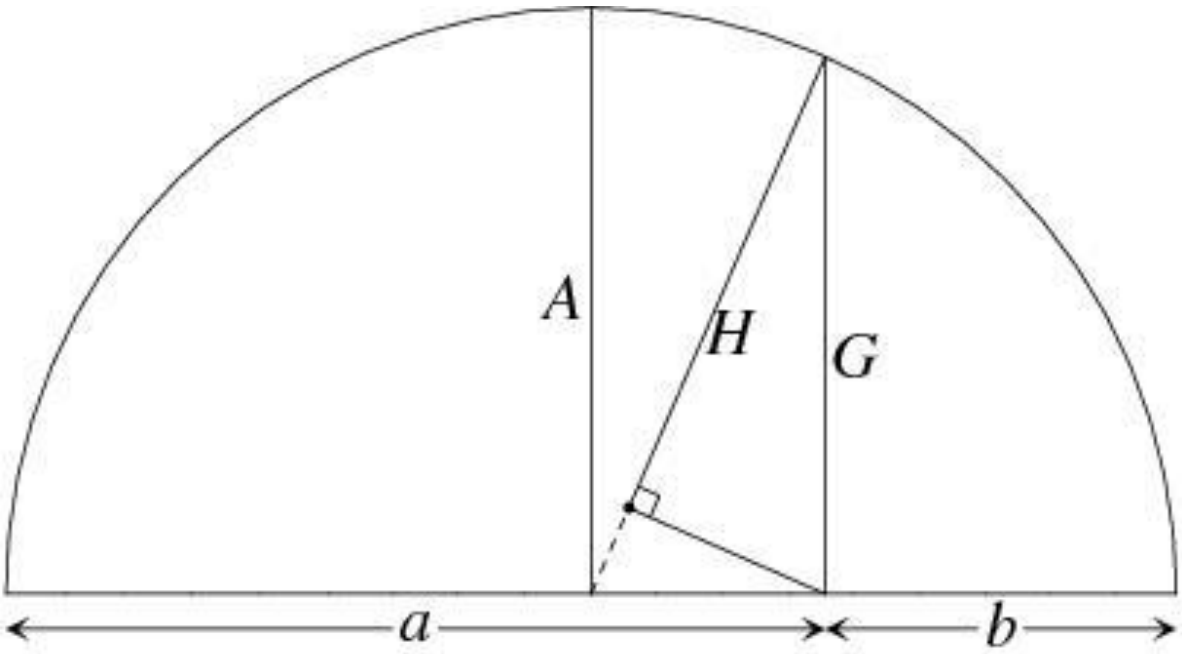
Measures of central tendency

geometric mean

&

the harmonic mean





Measures of central tendency

The geometric mean

definition of the geometric mean: This average is used to describe a phenomenon according to the rate of its change, especially when the behavior of the phenomenon follows the pattern of the geometric sequence, so the geometric mean is the nth root of the product of the values x or C

- **Methods for calculating the geometric mean**: **We distinguish in Calculating the geometric mean between discrete and continuous data.**
- **Discrete data: We distinguish here between repeated and non-repeated data.**
- **Discrete non-recurring data**: **The geometric mean in this case is calculated as follows:**

$$G = \sqrt[n]{x_1 \times x_2 \times x_3 \times \ldots \times x_n}$$

Or

$$logG = \frac{\sum \log x_i}{n} \Rightarrow G = 10^{logG}$$

Example

Let us have the following data: 2, 3, 5, 8, 10, the geometric mean of these values is:

$$G = \sqrt[5]{2 \times 3 \times 5 \times 8 \times 10} = \mathbf{4,74}$$

Or

$$logG = \frac{log2 + log3 + log5 + log8 + log10}{5} = \frac{0{,}30 + 0{,}48 + 0{,}70 + 0{,}90 + 1}{5}$$
$$= 0{,}676 \Rightarrow G = 10^{logG} = 10^{0{,}676} = \mathbf{4,74}$$

Connected data:

The geometric mean in this case is calculated as follows:

$$G = \sqrt[\sum f_i]{c_1^{f_1} \times c_2^{f_2} \times c_3^{f_3} \times \ldots \times c_n^{f_n}}$$

Or

$$logG = \frac{\sum f_i \log c_i}{\sum f_i} = \sum fr_i \log c_i \Rightarrow G = 10^{logG}$$

Harmonic mean

Definition of harmonic mean

It is the reciprocal of the arithmetic mean of the reciprocal of the values x or C. The harmonic mean is used in the case if the studied mean is the product of dividing two other variables such as velocity, density.

- **Methods of calculating the harmonic average:**
  We distinguish between the harmonic average between separate and continuous data.
- **Discrete data:**
  Here we distinguish between redundant and non-recurring data.
- **Non-repeating discrete data:**
  The harmonic mean in this case is calculated as follows:

$$H = \frac{n}{\sum \frac{1}{x_i}}$$

- **Non-repeating discrete data:**
  The harmonic mean in this case is calculated as follows

$$H = \frac{\sum f_i}{\sum \frac{f_i}{x_i}}$$

Example

A car travels 200 km at 50 km/h and 100 km travels at

100 km/h

Required: **What is the average speed of the car over its course?**

$$H = \frac{\sum f_i}{\sum \frac{f_i}{x_i}} = \frac{300}{\frac{200}{50} + \frac{100}{100}} = \frac{300}{5} = 60\ km/h$$

Related data: **expressed by law in the following relationship:**

$$H = \frac{\sum f_i}{\sum \frac{f_i}{c_i}}$$

Square Mean (MQ)

- **Definition of the Square Mean:**
  It is the square root of the arithmetic average of the squares of values x or C
- **Methods for calculating the squared mean:**
  We distinguish between the harmonic mean between discrete and continuous data.
- **Discrete data:**
  We distinguish here between repeated and non-repeated data.
- **Discrete non-recurring data:**
  The harmonic mean in this case is calculated as follows:

$$MQ = \sqrt{\frac{\sum x_i^2}{n}}$$

- **Discrete non-recurring data:** **The harmonic mean in this case is calculated as follows:**

$$MQ = \sqrt{\frac{\sum f_i x_i^2}{\sum f_i}} = \sqrt{\sum fr_i x_i^2}$$

- **Related data:**
  The law is expressed by the following relationship:

$$MQ = \sqrt{\frac{\sum f_i c_i^2}{\sum f_i}} = \sqrt{\sum fr_i c_i^2}$$

Example

Let's have the following frequency table:

Classes	2 - 4	4 – 6	6 - 8	8 - 10	10 – 12
f_i	4	3	2	3	4

Required:

Determine the value of the quatrains

$$MQ = \sqrt{\frac{\sum f_i c_i^2}{\sum f_i}} = \sqrt{\frac{4 \times 3^2 + 3 \times 5^2 + 2 \times 7^2 + 3 \times 9^2 + 4 \times 11^2}{16}} = \sqrt{\frac{936}{16}}$$
$$= \sqrt{58{,}5} = \mathbf{7,65}$$

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If you like the scientific material, share it with others so that the benefit spreads, and if you have questions, I am happy to communicate with you. Mohamed Abu Libdah, a statistician and data analyst at the National Cancer Institute, Cairo University, Egypt