

Measures of Central Tendency.Q: What is Statistical Average?

Ans: Average is a single value, that is used to represent the set of data as a whole.

e.g. the average of 2, 4, 6, 8

$$is = \frac{2+4+6+8}{4} = \frac{20}{4} = 5 \text{ units.}$$

Q: What is Measure of Central tendency?

Ans: (As the averages tend to lie in the centre of the dist. so they are called measures of central tendency or measures of location.)

Q: What are the most common measures of central tendency (Types of Average)

Ans: The important types of Average are

- i The Arithmetic mean.
- ii The Geometric mean.
- iii The Harmonic mean.
- iv The median.
- v The Mode.

Q: Define Arithmetic Mean.

Ans: Let  $x_1, x_2, x_3, \dots, x_n$  are values. Then sum of all the values and dividing by their no., i.e. is called Arithmetic mean.

It is denoted by  $\bar{x}$

$$\checkmark \bar{x} = \frac{\sum x}{n} \text{ for ungrouped data.}$$

$$\checkmark \bar{x} = \frac{\sum fx}{\sum f} \text{ for grouped data.}$$

$\bar{x}$  = Sample mean

$\mu$  = Pop. mean

Note:  $\bar{X}$  = Sample Mean =  $\frac{\sum x}{n}$

$\mu$  = Population Mean =  $\frac{\sum x}{N}$

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Q: What is weighted Arithmetic Mean?

Ans: When the observations are not of equal importance, then we prefer weighted Arithmetic mean in place of Simple Arithmetic mean.

$$\bar{X}_w = \frac{\sum wx}{\sum w} \quad \frac{\sum fx}{\sum f} = \mu$$

Q: What is Combined Arithmetic Mean?

Ans: Let  $n_1, n_2, n_3, \dots, n_k$  are  $k$  subgroups of data having means  $\bar{x}_1, \bar{x}_2, \bar{x}_3, \dots, \bar{x}_k$  respectively.

Then their combined or pooled mean is given as:

$$\begin{aligned} \bar{X}_c = \bar{X} &= \frac{n_1 \bar{x}_1 + n_2 \bar{x}_2 + n_3 \bar{x}_3 + \dots + n_k \bar{x}_k}{n_1 + n_2 + n_3 + \dots + n_k} \\ &= \frac{\sum n \bar{x}}{\sum n} \end{aligned}$$

Q: Give some merits or Advantages of Arithmetic mean.

Ans: i) It is easy to calculate.

ii) It is easy to understand.

iii) It is based upon all the values.

iv) It is amenable to mathematical treatment.

Q: Give some demerits or Dis Advantages of Arithmetic mean.

i) It is not suitable for skewed dist.

ii) It is greatly affected by extreme values.

iii) It cannot be calculated for open end frequency dist.

Q: Define Geometric mean.

Ans: Let  $x_1, x_2, x_3, \dots, x_n$  are non zero +ve values. Then the  $n$ th product root of the values is called Geometric mean.

$$G = \sqrt[n]{(x_1 \times x_2 \times x_3 \times \dots \times x_n)}$$

$\checkmark = \text{Antilog} \left( \frac{\sum \log x}{n} \right)$  } ungrouped data.

$\checkmark G = \text{Antilog} \left( \frac{\sum f \log x}{\sum f} \right)$  for grouped data.

Q: Define Harmonic mean.

Ans: Let  $x_1, x_2, x_3, \dots, x_n$  are non zero values.

Then the reciprocal of Arithmetic mean but for reciprocal values is called Harmonic mean.

$\checkmark HM = \frac{n}{\sum (\frac{1}{x})}$  ungrouped data.

$\checkmark HM = \frac{\sum f}{\sum f (\frac{1}{x})}$  grouped data.

Q: Define median.

Ans: The value which divides an arrayed set of data into two equal parts is called median.

$\checkmark \tilde{x} = \frac{n+1}{2} \text{th value}$  for ungrouped.

$\checkmark \tilde{x} = l + \frac{h}{f} \left( \frac{n}{2} - c \right)$  for grouped data.

Q: What are Quartiles?

Ans: The values which divide an arrayed set of data into four equal parts are called Quartiles.

First 3 Quartiles are given as:

grouped data

For Continuous grouped data.

$$Q_1 = \left(\frac{n+1}{4}\right)^{\text{th}} \text{ value}$$

$$Q_1 = 1 + \frac{h}{f} \left( \frac{1n}{4} - c \right)$$

$$Q_2 = 2 \left(\frac{n+1}{4}\right)^{\text{th}} \text{ value} = \tilde{x}$$

$$Q_2 = 1 + \frac{h}{f} \left( \frac{2n}{4} - c \right) = \tilde{x}$$

$$Q_3 = 3 \left(\frac{n+1}{4}\right)^{\text{th}} \text{ value}$$

$$Q_3 = 1 + \frac{h}{f} \left( \frac{3n}{4} - c \right)$$

Note:  $Q_1$  = lower quartile

$Q_3$  = upper quartile

$$Q_2 = \tilde{x}$$

$$2, 4, 6$$

$$3 \sqrt{(2 \times 4 \times 6)}$$

$$\sqrt{2 \times 4}$$

$$4 \sqrt{\quad}$$

$$3 \sqrt{\quad}$$

$$2 \sqrt{\quad}$$

$$2 \sqrt{\quad}$$

Q: What are deciles?

Ans: The values which divide an arrayed set of data into ten equal parts are called deciles.

First 9 deciles are given as:

ungrouped data

For Continuous grouped data.

$$D_1 = \left(\frac{n+1}{10}\right)^{\text{th}} \text{ value}$$

$$D_1 = 1 + \frac{h}{f} \left( \frac{1n}{10} - c \right)$$

$$D_2 = 2 \left(\frac{n+1}{10}\right)^{\text{th}} \text{ value}$$

$$D_2 = 1 + \frac{h}{f} \left( \frac{2n}{10} - c \right)$$

$$D_9 = 9 \left(\frac{n+1}{10}\right)^{\text{th}} \text{ value}$$

$$D_9 = 1 + \frac{h}{f} \left( \frac{9n}{10} - c \right)$$

Q: What are Percentiles?

Ans: The values which divide an arrayed set of data into one hundred equal parts are called percentiles.

First 99 percentiles are given as:

ungrouped data

For Continuous grouped data.

$$P_1 = \left(\frac{n+1}{100}\right)^{\text{th}} \text{ value}$$

$$P_1 = 1 + \frac{h}{f} \left( \frac{1n}{100} - c \right)$$

$$P_2 = 2 \left(\frac{n+1}{100}\right)^{\text{th}} \text{ value}$$

$$P_2 = 1 + \frac{h}{f} \left( \frac{2n}{100} - c \right)$$

$$P_{99} = 99 \left(\frac{n+1}{100}\right)^{\text{th}} \text{ value}$$

$$P_{99} = 1 + \frac{h}{f} \left( \frac{99n}{100} - c \right)$$



Q: What are Quantiles or fractiles?

Ans: Quartiles, deciles and percentiles collectively are called Quantiles or fractiles.

Q: Define mode.

Ans: The value which occurs most frequently in the given set of data is called mode.

It is denoted by  $\hat{x}$ .

e.g. the mode of 2, 4, 4, 6, 8

$$\hat{x} = 4$$

Where for ~~continuous~~ grouped data:

$$\hat{x} = l + \frac{f_m - f_1}{(f_m - f_1) + (f_m - f_2)} \times h$$

$f_1$   $l = \text{lower}$   
 $f_2$   $h = \text{class width}$

Q: What is the empirical relation b/w mean, median and mode.

Ans: When the dist. is Symmetrical:

$$\text{mean} = \text{median} = \text{mode}$$

When the dist. is Skewed:

$$i) \text{ mean} - \text{mode} = 3(\text{mean} - \text{median})$$

$$ii) \text{ mode} = 3\text{median} - 2\text{mean}$$

Q: What is the relation b/w Am, Gm and Hm for two values:

Ans:  $G^2 = A \times H$

$$G = G.m$$

$$A = A.m$$

$$H = H.m$$

Q: What is the general

relation b/w Am, Gm and Hm

Ans:

$$A.m \geq G.m \geq H.m$$

Q: What are the Properties of Arithmetic mean?

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Ans:

i) The Arithmetic mean of Const. is Const.

$$\text{i.e. } \text{mean}(a) = a$$

ii) Sum of deviations from mean is zero

$$\text{i.e. } \sum (x - \bar{x}) = 0$$

iii) Sum of squares of deviations from mean is least

$$\text{i.e. } \sum (x - \bar{x})^2 < \sum (x - a)^2$$

iv) Combined Arithmetic is given as:

$$\bar{x} = \frac{n_1 \bar{x}_1 + n_2 \bar{x}_2 + \dots + n_k \bar{x}_k}{n_1 + n_2 + \dots + n_k}$$

$$\bar{x} = \frac{n_1 \bar{x}_1 + n_2 \bar{x}_2}{n_1 + n_2}$$

v) If  $y_i = ax_i + b$  then  $\bar{y} = a\bar{x} + b$  here  $a$  and  $b$  are constants  $x$  and  $y$  are variables

Q: Give some Properties of a good Average.

Ans i) It is well defined

ii) It is easy to calculate

iii) It is easy to understand

iv) It is based on all the values

v) It is capable of mathematical treatment

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