STATISTICS

1. Arithmetic Mean / or Mean

If $x_1, x_2, x_3, ...x_n$ are n values of variate x_i then their A.M. $\bar{x}$ is defined as

$$\bar{x} = \frac{x_1 + x_2 + x_3 + ... + x_n}{n} = \frac{\sum_{i=1}^{n} x_i}{n}$$

If $x_1, x_2, x_3, ... x_n$ are values of veriate with frequencies $f_1, f_2, f_3, ...f_n$ then their A.M. is given by

$$\bar{x} = \frac{f_1x_1 \times f_2x_2 + f_3x_3 + ...f_nf_n}{f_1 + f_2 + f_3 + ... + f_n} = \frac{\sum_{i=1}^{n} f_ix_i}{N}, \text{ where } N = \sum_{i=1}^{n} f_i$$

2. Properties of Arithmetic Mean :

(i) Sum of deviation of variate from their A.M. is always zero that is $\Sigma(x_i - \bar{x}) = 0$.

(ii) Sum of square of deviation of variate from their A.M. is minimum that is $\Sigma(x_i - \bar{x})^2$ is minimum

(iii) If $\bar{x}$ is mean of variate x_i then
A.M. of $(x_i + \lambda) = \bar{x} + \lambda$
A.M. of $\lambda_i . x_i = \lambda . \bar{x}$
A.M. of $(ax_i + b) = a\bar{x} + b$

3. Median

The median of a series is values of middle term of series when the values are written is ascending order or descending order. Therefore median, divide on arranged series in two equal parts

For ungrouped distribution :

If n be number of variates in a series then

$$\text{Median} = \begin{cases} \left(\frac{n+1}{2}\right)^{th} \text{term}, (\text{when n is odd}) \\ \text{Mean of} \left(\frac{n}{2}\right)^{th} \text{and} \left(\frac{n}{2}+2\right)^{th} \text{term} (\text{when n is even}) \end{cases}$$

4. Mode

If a frequency distribution the mode is the value of that variate which have the maximum frequency. Mode for

For ungrouped distribution :

The value of variate which has maximum frequency.

For ungrouped frequency distribution :

The value of that variate which have maximum frequency.
Relationship between mean, median and mode.

(i) In symmetric distribution, mean = mode = median

(ii) In skew (moderately asymmetrical) distribution, median divides mean and mode internally in 1 : 2 ratio.

$$\Rightarrow \quad \text{median} = \frac{2(\text{Mean}) + (\text{Mode})}{3}$$

5. Range

$$\frac{\text{difference of extreme values}}{\text{sum of extreme values}} = \frac{L - S}{L + S}$$

where L = largest value and S = smallest value

6. Mean deviation :

$$\text{Mean deviation} = \frac{\sum_{i=1}^{n} | x_i - A |}{n}$$

$$\text{Mean deviation} = \frac{\sum_{i=1}^{n} f_i | x_i - A |}{N} \quad \text{(for frequency distribution)}$$

7. Variance :

Standard deviation = $+\sqrt{\text{variance}}$

formula

$$\sigma_x^2 = \frac{\Sigma(x_i - \bar{x})^2}{n}$$

$$\sigma_x^2 = \frac{\sum_{i=1}^{n} x_i^2}{n} - \left(\frac{\sum_{i=1}^{n} x_i}{n} \right)^2 = \frac{\sum_{i=1}^{n} x_i^2}{n} - (\bar{x})^2$$

$\sigma_d^2 = \frac{\Sigma d_i^2}{n} - \left(\frac{\Sigma di}{n} \right)^2$, where $d_i = x_i - a$, where a = assumed mean

(ii) coefficient of S.D. = $\left(\frac{\sigma}{\bar{x}} \right)$

coefficient of variation = $\left(\frac{\sigma}{\bar{x}} \right) \times 100$ (in percentage)

Properties of variance :

(i) $var(x_i + \lambda) = var(x_i)$

(ii) $var(\lambda . x_i) = \lambda^2 (var\ x_i)$

(iii) $var(a\ x_i + b) = a^2 (var\ x_i)$

where λ, a, b are constant.