

1. **Mean:** $\bar{x} = \frac{x_1 + x_2 + \dots + x_n}{n}$

2. **Median:** If the number of observations n is odd, then median is $\left(\frac{n+1}{2}\right)^{th}$ observation and if the number of observations n is even, then median is the mean of $\left(\frac{n}{2}\right)^{th}$ and $\left(\frac{n+1}{2}\right)^{th}$ observations.

3. **Measures of Dispersion, Range and Mean Deviation**

4. **Variance and Standard Deviation**

5. **Analysis of Frequency Distributions**

- **Measures of dispersion** Range, Quartile deviation, mean deviation, variance, standard deviation are measures of dispersion.

- Range = Maximum Value – Minimum Value

- **Mean deviation for ungrouped data**

$$M.D. (\bar{x}) = \frac{\sum |x_i - \bar{x}|}{n}$$

- **Mean Deviation from Median for ungrouped data**

$$M.D. (M) = \frac{\sum |x_i - M|}{n}$$

- **Mean deviation for grouped data**

$$M.D. (\bar{x}) = \frac{\sum f_i |x_i - \bar{x}|}{N}$$

- **Mean Deviation from Median for grouped data**

$$M.D. (M) = \frac{\sum f_i |x_i - M|}{N} \text{ where } N = \sum f_i$$

- **Variance and standard deviation for ungrouped data**

$$\text{Variance: } \sigma^2 = \frac{1}{n} \sum (x_i - \bar{x})^2$$

$$\text{Standard deviation: } \sigma = \sqrt{\frac{1}{n} \sum (x_i - \bar{x})^2}$$

- **Variance and standard deviation of a discrete frequency distribution**

$$\text{Variation: } \sigma^2 = \frac{1}{N} \sum (x_i - \bar{x})^2$$

Standard deviation: $\sigma^2 = \sqrt{\frac{1}{N} \sum f_i (x_i - \bar{x})^2}$

• **Variance and standard deviation of a continuous frequency distribution**

(i) If $\frac{x_i}{f_i}; i = 1, 2, 3, \dots, n$ is a continuous frequency distribution of a variate X,

then $\sigma^2 = \frac{1}{N} \sum f_i (x_i - \bar{x})^2$

(ii) If $x_1, x_2, \dots, x_n$ be the n given observations with respective frequencies

$f_1, f_2, \dots, f_n$, then $\sigma = \frac{1}{N} \sqrt{N \sum f_i x_i^2 - (\sum f_i x_i)^2}$, where $N = \sum f_i$

(iii) If $d_i = x_i - A$, where A is assumed mean, then $\sigma^2 = \frac{1}{N} \sum f_i d_i^2 - \left(\frac{\sum f_i d_i}{N} \right)^2$

(iv) If $u_i = \frac{x_i - A}{h}$, where h is the common difference of values of x , then

$\sigma^2 = \frac{1}{N} \left[\sum f_i u_i^2 - \left(\frac{\sum f_i u_i}{N} \right)^2 \right]$

- **Analysis of frequency distribution with equal means but different variances:** If the S.D. of group A < the S.D. of group B, then group A is considered more consistent or uniform.
- **Analysis of frequency distribution with unequal means:** In this case we compare the coefficient of variation [Coefficient of variation (C.V. = $\frac{100 \times \text{S.D.}}{\text{Mean}}$). The series having greater coefficient of variation is said to be more variable than the other.
- **Variance of the combined two series:** $\sigma^2 = \frac{1}{n_1 + n_2} [n_1 (\sigma_1^2 + d_1^2) + n_2 (\sigma_2^2 + d_2^2)]$
where n_1 and n_2 are the sizes of two groups, σ_1 and σ_2 are the S.D. of two groups,
 $d_1 = \bar{a} - \bar{x}$, $d_2 = \bar{b} - \bar{x}$ and $\bar{x} = \frac{n_1 \bar{a} + n_2 \bar{b}}{n_1 + n_2}$