Mean

Arithmetic Mean

$$mean = \frac{(1 + 2 + 3 + \cdots + n)}{n}$$

Geometric Mean

$$(1 \times 2 \times 3 \times \ldots \times n)^{\frac{1}{n}} = mean$$

Harmonic Mean

$$\frac{\left(\frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n}\right)}{n} = \frac{1}{r = mean}$$

$$mean = \frac{n}{\frac{1}{1} + \frac{1}{2} + \frac{1}{3} + \cdots + \frac{1}{n}}$$

Quadratic Man

$$(1^2 + 2^2 + 3^2 + \cdots + n^2) = \ n \times (mean)^2$$

$$mean \ \ = \sqrt{\frac{(1^2 + 2^2 + 3^2 + \cdots + n^2)}{n}}$$

If all observations are equal, then all the means are equal.

Otherwise, these means has an inequality relation between them.
The relation is:

 # AM-GM-HM-QM inequality

$$\boldsymbol{HM \leq GM \leq AM \leq QM}$$

Central Tendency

There are 3 measure of central tendency.

1. Mean(M)
2. Median(Me)
3. Mode(Mo)

Measure Of Dispersion (**Scatteredness** of Dataset)

Dispersion measures the Scatteredness of observations of dataset from **Central Value**.

Measure of Dispersion: is an average deviation of observations from some central value.

1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Arithmetic Mean, M = 5.5

5.5-1 = 4.5

5.5-2 = 3.5

5.5-3 = 2.5

5.5-4 = 1.5

5.5-5 = 0.5

|5.5-6| = 0.5

|5.5-7| = 1.5

|5.5-8| = 2.5

|5.5-9| = 3.5

|5.5-10| = 4.5

Measure of Dispersion can be divided into 2 groups:

1. Absolute Measure of Dispersion
2. Relative Measure of Dispersion (unit free)

#Absolute measure of dispersion:

It is a measure which provides the information on average deviation, where measures depend on unit of the variable under study.

1. Range
2. Mean Deviation (M.D.)
3. Mean deviation from Mean [**M.D.(mean)**]
4. M.D.(median)
5. M.D.(mode)
6. Standard Deviation [S.D.] (second degree deviation)
7. Quartile Deviation [Q.D.]

$\#\, range = X_{max} - X_{min}$

Relative measure of range = $(X_{max} - X_{min})/(X_{\max} + X_{\min})$

#Mean Deviation:

$$\mathrm{M.D.(mean)} = \frac{1}{\mathrm{n}} \sum |x_i - \bar{x}|$$

$$\text{M. D. (mode)} = \frac{1}{\text{n}}\sum|x_i - Mo|$$

$$\text{M. D. (median)} = \frac{1}{\text{n}}\sum|x_i - Me|$$

R.M.D.(central value) = [M.D.(c.v.)] / c.v.

Here, c.v. = central value

#Standard Deviation:

$$Variance, V = \frac{1}{n}\sum(x_i - mean)^2$$

We get the squared value of average deviation from variance.

$$variance = deviation^2$$

$$deviation = \sqrt{variance}$$

$$\therefore S.D.(\sigma) = \sqrt{V} = \sqrt{\frac{1}{n}\sum(x_i - Mean)^2}$$

Mean Square Deviation (Second Order Deviation) can be measured from mean, median or mod.

But **M.S.D.** is minimum if deviation is measured from mean.

$$Variance, V = \frac{1}{n}\sum(x_i - \bar{x})^2$$

1-10 >> mean =5.5…… 8 = A (Arbitary Value)

$$\sum(x_i - \bar{x}) = 0$$

$$\frac{1}{n}\sum(x_i - A) = \bar{x} - A$$

$$\sum_{i,j=1}^{10} 5 \times i = 1 \times 1 + 2 \times 2 + \cdots + 10 \times 10$$

$$= 5 \times (1 + 2 + \cdots + 10)$$

$$= 5 \times \sum_{i=1}^{10} i$$

$$\sum_{i,j=1}^{10} j \times i \neq \sum_{i=1}^{10} i \times \sum_{j=1}^{10} j$$