

# Central Tendency

Mean      Mode      Median

① Mean :-  
 $\bar{x} = \frac{\sum x}{N}$  (Discrete)  
 $\bar{x} = \frac{\sum Fx}{N}$  (F.D)  
 $\bar{x} = \frac{\sum Fxm}{N}$  (Grouped)  
 Assumed Mean :-  
 $\bar{x} = A + \frac{\sum fd}{N} \times C$

② Median :-  
 $Me = d_1 + \left( \frac{\frac{N}{2} - N_f}{N_u - N_f} \right) \times C$   
 $\sum |x - Me|$  is minimum  
 If  $n = \text{even}$  → Jan Middle  
 If  $n = \text{odd}$  → avg. of Middle.

③ Mode :-  
 $Mo = d_1 + \left( \frac{f_0 - f_{-1}}{2f_0 - f_{-1} - f_1} \right) \times C$

Relation b/w Mean, Median, Mode :-

Mean - Mode = 3 (Mean - Median)

Mean - Mode = 3 Mean - 3 Median

Mode = Mean - 3 Means + 3 Median

Mode = 3 Median - 2 Mean

Combined Mean :-  
 $\bar{x}_c = \frac{n_1 \bar{x}_1 + n_2 \bar{x}_2}{n_1 + n_2}$

Partition values :-

| Name       | No. of equal parts |
|------------|--------------------|
| Median     | 2                  |
| Quartile   | 4                  |
| Decile     | 10                 |
| Percentile | 100                |

⇒ Rank Calculation (n+1)<sup>th</sup> term :- Value of P depends on P.v.

|                 | Median | Quartile Median | Decile | Percentile |
|-----------------|--------|-----------------|--------|------------|
| 1 <sup>st</sup> | 1/2    | 1/4             | 1/10   | 1/100      |
| 2 <sup>nd</sup> |        | 2/4             | 2/10   | 2/100      |
| Last            |        | 3/4             | 9/10   | 99/100     |

Geometric Mean :-  
 → In Discrete  
 $G = (x_1 \times x_2 \times \dots \times x_n)^{1/n}$   
 → In Grouped :-  
 $G = (x_1^{f_1} \times x_2^{f_2} \times \dots \times x_n^{f_n})^{1/n}$

Harmonic Mean :-  
 Reciprocal of AM of observation.  
 In Discrete  
 $H = \frac{n}{\sum (1/x)}$   
 In grouped.  
 $H = \frac{n}{\sum (f/x)}$

Combined HM  
 $HM = \frac{n_1 + n_2}{\frac{n_1}{H_1} + \frac{n_2}{H_2}}$   
 Special Relation  
 $AM \times HM = (GM)^2$

Range :-  
 $L - S$   
Coefficient of Rank  
 $\frac{L - S}{L + S} \times 100$

Mean Deviation  
 In Discrete :-  
 $MD_A = \frac{\sum |x - A|}{n}$   
 In grouped :-  
 $MD_A = \frac{\sum F |x - A|}{n}$   
Coefficient of Mean Deviation  
 $CO_{MD} = \frac{MD \text{ about } A}{A (\text{Median})} \times 100$

Standard Deviation  
 In Discrete :-  
 $\sigma_x = SD_x = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$   
 $\sigma_x = SD_x = \sqrt{\frac{\sum x^2 - (\bar{x})^2}{n}}$   
 In grouped :-  
 $\sigma_x = SD_x = \sqrt{\frac{\sum F(x - \bar{x})^2}{n}}$   
 $= \sqrt{\frac{\sum Fx^2 - (\bar{x})^2}{n}}$

Quartile Deviations :-  
 $QD_x = \frac{Q_3 - Q_1}{2}$   
Coefficient of QD  
 $\frac{Q_3 - Q_1}{Q_3 + Q_1} \times 100$   
 Same as in Central tendency.

Relation b/w SD, MD, QD  
 $4SD = 5MD = 6QD$   
 OR  
 $SD : MD : QD = 15 : 12 : 10$

Coefficient of Variance :-  
 $\frac{SD}{\bar{x}} \times 100$   
 SD of any two no :-  
 Range  
 SD of 1<sup>st</sup> N<sup>2</sup> natural no. →  $S = \sqrt{\frac{n^2 - 1}{12}}$