Central Tendency

[Say K also Mean is K]

I^{st} Order Measurement

लवारिस Property

- Δ of origin ✓
- Δ of scale ✓
- Δ of sign ✓

Is affected due to change in origin and scale

- AM ≥ GM ≥ HM
- GM = $\sqrt{AM \times HM}$

Relationship :
Mode : 3md − 2X̄
Mo − X̄ = 3(md − X̄)

Quantitative Average

Positional Average

$Q_2 = D_5 = P_{50}$

AM

Individual

- Average formula = $\frac{\text{sum}}{\text{no}}$

$\frac{\sum x}{n}, \frac{\sum fx}{\sum f}, \frac{\sum fm}{\sum f}$

- Properties

1. A.M. is the most popular measure of CT.
2. Sum of deviations from A.M. is always 0.
$\sum X - \bar{X} = 0$
3. Combined A.M. can be calculated.
$\bar{X}_{12} = \frac{\bar{X}_1 n_1 + \bar{X}_2 n_2}{n_1 + n_2}$
4. Mean can be calculated using assumed mean formula
$\bar{X} = A + \frac{\sum d}{n}$
5. A.M. can not be represented graphically.
6. $\sum (x-\bar{x})^2$ = minimum

- Depends all observation
- Much affected due to sampling flactuations.

GM

- GM is best measure of CT for ratios & percentages.
- Formula Individual
$(axbac \ldots)^{\frac{1}{n}}$
Discrete
$\left(X^{f1} x X^{\frac{f2}{2}} \ldots X^{\frac{fn}{n}}\right)^{\frac{1}{\Sigma n}}$
Continuos
$(M_1^{f1} x M_2^{f2} \ldots)^{\frac{1}{\Sigma f}}$

Difficult to compute and comprehent

Profit and losses given G.M. cannot be calculated

finding Average rate of Return

HM

- Used for variables having reciprocal relationship
- Formula

Individual
$HM = \frac{n}{\frac{1}{X1} + \frac{1}{X2} \cdots \frac{1}{Xn}}$

Discrete
$HM = \frac{\Sigma f}{\frac{f1}{X1} + \frac{f2}{X2} \cdots \frac{fn}{Xn}}$

$HM = \frac{\Sigma f}{\frac{f1}{m1} + \frac{f2}{m2} \cdots \frac{fn}{m_n}}$

- आवन जावन Q is imp
- HM is the reciprocal of AM
- Combined HM
$= \frac{n1 + n2}{\frac{n1}{HM1} + \frac{n2}{HM2}}$

Average Speed = $\frac{2ab}{a+b}$

Total distance OR / Total Time

MEDIAN

2nd Quartile / Positional Average

- Individual
इधर से काटो, उधर से काटो, बीच में जो बचा वो median
- Discrete
S.01 $\frac{N}{2}$
S.01 $\frac{N}{2}$ को Locate करो in C.F.
S.03 आगे वाला is median
- Continuos
S.01 follow discrete
S.02 $M = l_1 + \left\{\frac{\frac{N}{2} - C}{F}\right\} \times H$ (i)
- Md is not affected by extremities of the observations
- Sum of absolute deviation from median is minimum.
$\sum |x - xmd|$ = minimum
- Calculated through Ogive.
- Partition Values all
Value = $\left[\text{order} X \left\{\frac{n+1}{4/10/100}\right\}\right]$ term
Quartiles Deciles Percentiles
$k\left(\frac{N+1}{4}\right)^{th}$ item /10/100
- Best for open' end classification

Middle Most Value

MODE

- Individual
Most repeated no.
- Discrete
No. with highest frequency
- Continuos
Find out model class & use.
Formula :
$MO = l_1 + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right) \times h$ (i)
- It is not uniquely defined.
- Calculated using Histogram.
- Mode: Unimodel, Bimodel, Multimodel
- least affected due to extreme observation.

$Mode = l_1 + \frac{\Delta 1}{\Delta 1 + \Delta 2} \times i$

They all depends only on sclale · they are independent of origin

Measures of Dispersion

[Measures of Dispersion] "Second order of averages"

लवारिस Property -
- Δ of origin ×
- Δ of scale ✓
- Δ of sign ×

Combined S.D

$\sqrt{\dfrac{n_1 s_1^2 + n_2 s_2^2 + n_1 d_1^2 + n_2 d_2^2}{n_1 + n_2}}$

s_1 & s_2 – S.D. of first and second

$d_1 = \bar{x}_1 - \bar{x}$, $d_2 = \bar{x}_2 - \bar{x}$

Relationship Between MD, QD & S.D.

4 S.D. = 5 MD = 6QD {4,5,6 करके समुन्दर में कूदो}

Absolute MOD

All are always positive

Mean Deviation

(Sum of absolute deviation)

$M.D. = \dfrac{\sum |X - \bar{X}|}{n}$

for frequency $\boxed{\dfrac{\sum f|x-\bar{x}|}{\sum f}}$

Or

$\dfrac{\sum |X - X_{md}|}{n}$

Or

$\dfrac{\sum |X - X_{mo}|}{n}$

- If frequencies of all observations are same, count them only once,
- M.D. from Median is minimum.

Depends upon all observation

Range

Max Value – Min Value = Range

*easiest & quickest to calculate dispersion.

Largest - Small

$R_y = |b| \cdot R_x$

b = Coefficient of x

Co. of y

Quartile Deviation

$Q.D. = \dfrac{Q_3 - Q_1}{2}$

* It is best suited for open end classification as it is based on middle 50% values

* Also called as semi inter quartile range.

Inter Quartile Range

$\Rightarrow Q_3 - Q_1$

$QD_y = |b| \cdot QD_x$

Standard Deviation

Mathematical Properties

$S.D. = \sqrt{\dfrac{\sum (X - \bar{X})^2}{n}}$

$S.D. = \sqrt{\dfrac{\sum X^2}{n} - (\bar{X})^2}$

S.D. = (sigma)

$S.D^2$ = variance

$\sqrt{\text{variance}}$ = S.D.

- For first n natural no.'s

$S.D. = \sqrt{\dfrac{n^2 - 1}{12}}$

If frequencies of all observations are same, count them once only.

S.D. between 2 no.'s

$= \dfrac{|a - b|}{2}$

- Combined S.D.

$= \sqrt{\dfrac{n_1(\sigma_1^2 + d_1^2) + n_2(\sigma_2^2 + d_2^2)}{n_1 + n_2}}$

$d_1 = \bar{X}_{12} - \bar{X}_1$

$d_2 = \bar{X}_{12} - \bar{X}_2$

Relative MOD

M.D.

Coeff. Of M.D.

$= \dfrac{M.D.}{\bar{x} | x_{md} | x_{mo}} \times 100$

Range

Coeff of Range

$= \dfrac{\text{Max} - \text{Min}}{\text{Max} + \text{Min}} \times 100$

$\dfrac{L - S}{L + S} \times 100$

Q.D.

Coeff of Q.D.

$= \dfrac{Q_3 - Q_1}{Q_3 + Q_1} \times 100$

Coeff of Q.D.

$= \dfrac{Q.D.}{M_d} \times 100$

Variation

Coeff of variation

$= \dfrac{S.D.}{\bar{x}} \times 100$

* It is used to measure consistency

Decision rule : Lower the better.

C.V	Consistency	Variability
Less	More	Less
More	less	More

... A.M., G.M. & H.M.

1. If All observation is equal
$AM = GM = HM$
2. All observation is Unequal
$A.M > G.M > H.M.$
3. Only Relation
$A.M. \geq G.M. \geq H.M$

$\boxed{A.M \times H.M = (G.M)^2}$

$$Z = 3M - 2\bar{X}$$
OR
$$\bar{X} - Z = 3(\bar{X} - M)$$

For two No.

1. $A.M. = \frac{a+b}{2}$
2. $G.M = \sqrt{ab}$
3. $H.M = \frac{2ab}{a+b}$

for symmetrical Distribution
$\bar{X} = M = Z$

for Negatively skwed distribution
$\bar{x} < M < Z$

for positive skwed distribution
$\bar{X} > M > Z$

	$\bar{X}$	M	Z
Mathematical Properties	✓	X	X
open end classification	X	✓	X