

MEASURES OF CENTRAL TENDENCY

Comprehensive Revision Master - Note

1 Arithmetic Mean (AM)

INDIVIDUAL SERIES (DATA: $X_1, X_2, \dots$)

Direct Method	$\bar{x} = \sum x / n$
Assumed Mean (A)	$\bar{x} = A + (\sum d / n)$ [$d = x - A$]

DISCRETE SERIES (DATA: X WITH FREQUENCY: F)

Direct Method	$\bar{x} = \sum fx / N$ [$N = \sum f$]
Short-cut Method	$\bar{x} = A + (\sum fd / N)$

CONTINUOUS SERIES (CLASS INTERVALS)

Direct Method	$\bar{x} = \sum fm / N$ [$m = \text{Mid-value}$]
Step Deviation	$\bar{x} = A + [(\sum fd' / N) \times h]$ [$d' = (m - A) / h$]

PROPERTIES 1. $\sum (x - \bar{x})$ is always 0. | 2. $\sum (x - \bar{x})^2$ is **Minimum** | 3. If a constant 'k' is added to all values, new Mean = $\bar{x} + k$.

2. Median (M) & Partition Values

Note: Always arrange data in Ascending Order first.

Type	Rank / Position	Continuous Series Formula
Median (M)	(N/2) th item	$\text{Value} = L + \left[\frac{(\text{Rank} - cf)}{f} \right] \times h$
Quartiles (Q _i)	(iN/4) th item	
Deciles (D _i)	(iN/10) th item	
Percentiles (P _i)	(iN/100) th item	

IDENTITIES Median = Q₂ = D₅ = P₅₀. | **CAUTION:** In Individual/Discrete use (N+1) instead of N for Rank.

3. Mode (Z)

Inspection Method	Value with highest frequency
Continuous Series	$Z = L + \left[\frac{(f_1 - f_0)}{(2f_1 - f_0 - f_2)} \right] \times h$
Empirical Formula	Mode = 3 Median - 2 Mean

WHEN TO USE EMPIRICAL? When distribution is skewed or multi-modal (more than one mode).

4. Geometric (GM) & Harmonic Mean (HM)

Geometric Mean	$GM = \text{Antilog} \left[\frac{\sum (f \cdot \log x)}{N} \right]$
Harmonic Mean	$HM = N / \sum (f / x)$
Speed / Rates	$\text{Avg Speed} = \frac{2xy}{(x + y)}$ [If distance is same]

RELATIONS 1. $GM^2 = AM \times HM$ | 2. $AM \geq GM \geq HM$ | 3. Use GM for Ratios/Percentages

5. Quick-Reference Toolbox

N: Total Frequency ($\sum f$)

m Mid-value ($(L_1 + L_2) / 2$)

h: Class Width ($L_2 - L_1$)

f_1 : Modal Class Freq.

f_0 : Pre-Modal Freq.

f_2 : Post-Modal Freq.

cf: Cumulative Freq. (preceding)

A: Assumed Mean

xw : $\sum wx / \sum w$ (Weighted)

CORRECTION & COMBINED FORMULAS

- Corrected $\sum x = (\text{Incorrect } \sum x) - (\text{Wrong Item}) + (\text{Correct Item})$
- Combined Mean $(x_{12}) = (n_1 x_1 + n_2 x_2) / (n_1 + n_2)$