8. MEASURES OF DISPERSION

(1 x 2) + (1 x 7) = 9 Marks

IMP FORMULAS, KEY CONCEPTS

In the lower classes, we learnt that Mean, Median, Mode, G.M and H.M are called Measures of central tendency. These measures give a rough idea about where the given data points are centred.

I) Mean($\bar{x}$) and Median (M)

Data type	Mean($\bar{x}$)	Median(M)
a) Ungrouped data	$\bar{x} = \frac{\text{Sum of items}}{\text{No. of items}}$	$M = \left(\frac{n+1}{2}\right)^{th}$ item , for **odd n** M= Average of $\frac{n}{2}, \frac{n+2}{2}$ items, for **even n**
b) Grouped data (Discrete)	$\bar{x} = \frac{\Sigma f_i x_i}{N}$ $N=\Sigma f_i$	M = The x_i whose c.f is equal or just greater than $\frac{N}{2}$; $N=\Sigma f_i$
c) Grouped data (Continuous)	$\bar{x} = \frac{\Sigma f_i x_i}{N}$ $N=\Sigma f_i$ x_i = Midpoints of class intervals	$M = l + \frac{C}{f}\left(\frac{N}{2} - m\right)$ Median class = class of $\frac{N}{2}^{th}$ item l = lower limit of median class C = width of class interval f = frequency of median class. m = cumulative frequency of the class just preceeding the median class

II) Mean from Step deviation Method (Shortcut Method):

$$\bar{x} = A + C\left(\frac{\Sigma f_i d_i}{N}\right)$$

(or) $\bar{x} = A + C\bar{d}$

where, A = Assumed mean

C = width of class interval

$$d_i = \frac{x_i - A}{C}$$

$$\bar{d} = \frac{\Sigma f_i d_i}{N}$$

Mean Deviation, Variation, Standard Deviation and Coefficient of Variation are called Measures of Dispersion. These measures describe the spread of the individual values around the central value.

III) Mean Deviation(M.D):

Data type	About Mean	About Median
a) Ungrouped data	$M.D = \frac{\Sigma \lvert x_i - \bar{x} \rvert}{n}$	$M.D = \frac{\Sigma \lvert x_i - M \rvert}{n}$
b) Grouped data (Discrete)	$M.D = \frac{\Sigma f_i \lvert x_i - \bar{x} \rvert}{N}$ $N = \Sigma f_i ; \bar{x} = \frac{\Sigma f_i x_i}{N}$	$M.D = \frac{\Sigma f_i \lvert x_i - M \rvert}{N}$ M = The x_i whose c.f is equal or just greater than $\frac{N}{2}$; $N=\Sigma f_i$
c) Grouped data (Continuous)	$M.D = \frac{\Sigma f_i \lvert x_i - \bar{x} \rvert}{N}$ Here $\bar{x}$ is calculated using step deviation method	$M.D = \frac{\Sigma f_i \lvert x_i - M \rvert}{N}$ $M = l + \frac{C}{f}\left(\frac{N}{2} - m\right)$

IV) Variation (σ^2) and Standard Deviation (σ):

Data type	Variation (σ^2)	Standard Deviation(σ)
a) Grouped data (Discrete)	$\sigma^2 = \frac{\Sigma(x_i - \bar{x})^2}{n}$ (or) $\sigma^2 = \frac{\Sigma x_i^2}{n} - \bar{x}^2$	$\sigma = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n}}$ $\sigma = \sqrt{\frac{\Sigma x_i^2}{n} - \bar{x}^2}$
b) Grouped data (Continuous)	$\sigma^2 = C^2\left[\frac{\Sigma f_i d_i^2}{N} - \bar{d}^2\right]$ C = Width of the interval $N = \Sigma f_i$ $d_i = \frac{x_i - A}{C}$,A=Assumed mean $\bar{d} = \frac{\Sigma f_i d_i}{N}$	$\sigma = C\sqrt{\left[\frac{\Sigma f_i d_i^2}{N} - \bar{d}^2\right]}$ C = Width of the interval $N = \Sigma f_i$ $d_i = \frac{x_i - A}{C}$,A=Assumed mean $\bar{d} = \frac{\Sigma f_i d_i}{N}$

V) Coefficient of variation C.V = $\frac{S.D}{Mean} \times 100$ (or) $C.V = \frac{\sigma}{\bar{x}} \times 100$