14B. MEASURES OF DISPERSION

CONCEPT 01 : BASICS OF DISPERSION

Meaning	Dispersion of a given set of observations is defined as the amount of deviation of the observations, usually, from appropriate Measure of Central Tendency.	
Types of Measures of Dispersions	**ABSOLUTE MEASURES**	**RELATIVE MEASURES**
	▪ They is dependent on the unit of the variable. ▪ They are not useful for comparing two or more distributions. ▪ It includes : (a) Range (b) Mean Deviation (c) Standard Deviation (d) Quartile Deviation	▪ They is independent of the unit. ▪ They are useful for comparing two or more distributions. ▪ It includes : (a) Coefficient of Range (b) Coefficient of Mean Deviation (c) Coefficient of Variation (d) Coefficient of Quartile Deviation

CONCEPT 02 : RANGE & COEFFICIENT OF RANGE

	RANGE	COEFFICIENT OF RANGE
Unclassified Data	$L - S$ where, L = Largest Observation; & S = Smallest Observation	$\frac{L - S}{L + S} \times 100$
Grouped Frequency Distribution	$UCB - LCB$ where, UCB = Uppermost Class Boundary; & LCB = Lowermost Class Boundary ***Note : Make sure the data is Exclusive.***	$\frac{UCB - LCB}{UCB + LCB} \times 100$

CONCEPT 03 : MEAN DEVIATION & COEFFICIENT OF MEAN DEVIATION

	MEAN DEVIATION	COEFFICIENT OF MEAN DEVIATION
Meaning	▪ It is defined as the AM of absolute deviations of the observations from an appropriate Measure of Central Tendency. ▪ It takes its Minimum Value when deviations are taken from Median.	-
Unclassified Data	$\frac{1}{n}\sum\lvert x_i - A\rvert$ where, A is taken as Mean / Median accordingly	$\frac{\text{Mean Deviation about A}}{A} \times 100$
Grouped Frequency Distribution	$\frac{1}{N}\sum f_i\lvert x_i - A\rvert$ where, $N = \sum f_i$	

CONCEPT 03 : STANDARD DEVIATION & COEFFICIENT OF VARIATION

	STANDARD DEVIATION (σ)	COEFFICIENT OF VARIATION
Meaning	▪ It is defined as the root mean square deviation when deviations are taken from AM. ▪ It is denoted as S.D. or σ. ▪ The square of SD is known as Variance (σ^2).	-
Unclassified Data	$\sqrt{\frac{\sum(x_i - \bar{x})^2}{n}}$ OR $\sqrt{\frac{\sum x_i^2}{n} - \bar{X}^2}$	$\frac{SD}{AM} \times 100$
Grouped Frequency Distribution	$\sqrt{\frac{\sum f_i(x_i - \bar{x})^2}{N}}$ OR $\sqrt{\frac{\sum f_i x_i^2}{N} - \bar{X}^2}$	

Important Results	▪ SD of any two numbers = $\frac{\text{Range}}{2}$ ▪ SD of first 'n' Natural Numbers = $\sqrt{\frac{n^2-1}{12}}$ ▪ **Combined SD** $\sqrt{\frac{n_1s_1^2+n_2s_2^2+n_1d_1^2+n_2d_2^2}{n_1+n_2}}$	

CONCEPT 04 : QUARTILE DEVIATION & COEFFICIENT OF QUARTILE DEVIATION		
	QUARTILE DEVIATION	**COEFFICIENT OF QUARTILE DEVIATION**
Formula	$\frac{Q_3-Q_1}{2}$ Inter Quartile Range = $Q_3 - Q_1$ Hence, Q_D = Semi-Inter Quartile Range	$\frac{Q_3-Q_1}{Q_3+Q_1} \times 100$ **OR** $\frac{Q_D}{\text{Median}} \times 100$

CONCEPT 05 : SOME IMPORTANT RESULTS		
Result 01	If all the observations are constant, then Range = MD = SD = QD =	**0**
Result 02	Effect of Change of Origin on Range, MD, SD & QD	**No Effect**
Result 03	Effect of Change of Scale on Range, MD, SD & QD *If for any two constants a & b, two variables x and y are given by y = a + bx, then* ▪ $R_y = \lvert b\rvert R_x$ ▪ $\sigma_y = \lvert b\rvert \sigma_x$ ▪ $MD_y = \lvert b\rvert MD_x$ ▪ $QD_y = \lvert b\rvert QD_x$	**In the Same Ratio**
Result 04	Relationship between SD, MD & QD ***Note :*** *SD:MD:QD = 15:12:10*	**4SD = 5MD = 6QD**
Result 05	**Best Measures** (a) Overall (b) For Open End Class	 **SD** **QD**
Result 06	Which measure is quickest to compute?	**Range**
Result 07	Which measure is not Based on all observations?	**Range**
Result 08	Which measure is difficult to comprehend & less mathematical?	**MD**
Result 09	Which measure is easy to comprehend & rigidly defined?	**MD, SD & QD**
Result 10	Which measure is less affected by Extreme Observations & Sampling Fluctuations?	**QD**