Measures of Dispersion, Moments, Skewness and Kurtosis

Measures of Dispersion: Sometimes when two or more different data sets are to be compared using measure of central tendency or averages, we get the same result.

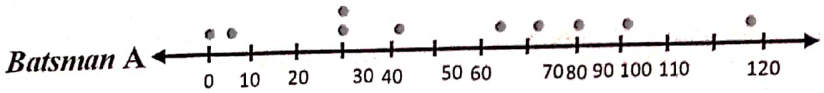
Consider the runs scored by two batsmen in their last ten matches as follows:

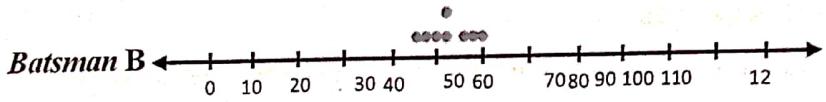
Batsman A: 30, 91, 0, 64, 42, 80, 30, 5, 117, 71
Batsman B: 53, 46, 48, 50, 53, 53, 58, 60, 57, 52

Clearly, mean of the runs scored by both the batsmen A and B is same i.e. 53

Can we say that the performance of two players is same? Clearly No, because the variability in the scores of batsman A is from 0 to 117, whereas, the variability of the runs scored by batsman B is from 46 to 60.

Let us now plot the above scores as dots on a number line. We find the following diagrams:





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We can see that the dots corresponding to batsman B are close to each other and is clustering around the measure of central tendency (mean), while those corresponding to batsman A are scattered or more spread out. Thus, the measures of central tendency are not sufficient to give complete information about a given data. In such a situation the comparison becomes very difficult. We therefore, need some additional information for comparison, concerning with, how the data is dispersed about (more spread out) the average. This can be done by measuring the dispersion. Like „measures of central tendency" we want to have a single number to describe variability. This single number is called a **'measure of dispersion'**.

Dispersion: "The variability (spread) that exists between the value of a data is called dispersion"

OR

"The extent to which the observations are spread around an average is called dispersion or scatter ".

As we know that, there are quite a few ways of measuring the central tendency of a data set i.e. A.M, G.M, H.M, Mode and Median. Similarly, we have different ways of measuring and comparing the dispersion of the distribution(s). There are two important types of measures of dispersion.

- **Types of Measures of Dispersion:**
- **There are two types of measure of dispersion**

I) Absolute Measure of Dispersion

II) Relative Measure of Dispersion

- **Absolute Measure of Dispersion: "An absolute measure of dispersion measures the variability in terms of the same units of the data"** e.g. if the units of the data are Rs, meters, kg, etc. The units of the measures of dispersion will also be Rs, meters, kg, etc.

The common absolute measures of dispersion are:

- Range
- Quartile Deviation or Semi Inter-Quartile Range
- Average Deviation or Mean Deviation
- Standard Deviation

- **Relative Measure of Dispersion: "A relative measure of dispersion compares the variability of two or more data that are independent of the units of measurement"**

- In other word **"A relative measure of dispersion, expresses the absolute measure of dispersion relative to the relevant average and multiplied by 100 many times" i.e.**

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$$Relative\ Dispersion = \frac{Absolute\ Dispersion}{Average}$$

$$Relative\ Dispersion = \frac{Absolute\ Dispersion}{Average} \times 100$$

This is a pure number and independent of the units in which the data has been expressed. It is used for the purpose to compare the dispersion of a data with the dispersion of another data.

The common relative measures of dispersion are:

- Coefficient of Dispersion or Coefficient of Range
- Coefficient of Quartile Deviation
- Coefficient of Mean Deviation
- Coefficient of Standard Deviation or Coefficient of Variation (C.V)

The major difference b/w Absolute and Relative Measures of Dispersion is that the Absolute measure of dispersion measures only the variability of the data, further it has the unit of measurement; on the other hand Relative measure of dispersion is used to compare the variation of two or more distributions, further it is unit less.

- **Range: "The difference between the largest and the smallest value in a set of data is called range"**

OR

"In continuous grouped data the difference between the upper class boundary of the highest class and lower class boundary of the lowest class is called range"

Formula: $R = X_m - X_0$ *OR* $R = Largest\ value - smallest\ value$

Where R is the range, X_m is the largest value and X_0 is the smallest value.

- **Coefficient of Range or Coefficient of Dispersion:** The coefficient of range or coefficient of dispersion is a relative measure of dispersion and is given by:

$$Coefficient\ of\ Range = \frac{X_m - X_0}{X_m + X_0}$$

- **Numerical example of Range and Coefficient of range**

Ex # The marks obtained by 9 students are given below:

x_i	45	32	37	46	39	36	41	48	36

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$$R = X_m - X_0$$

$$X_m = 48, \quad X_0 = 32$$

$$R = 48 - 32 \Rightarrow R = 16 \text{ marks}$$

- Coefficient of Range

$$C.o.f = \frac{X_m - X_0}{X_m + X_0}$$

$$C.o.f = \frac{48-32}{48+32} \Rightarrow C.o.f = \frac{16}{80} \Rightarrow C.o.f = 0.2$$

- **Quartile Deviation or Semi-inter-quartile Range:** "half of the difference between the upper quartile and lower quartile is called the semi-inter quartile range or quartile deviation"i.e.

$$Quartile\ deivation = \frac{Q_3 - Q_1}{2}$$

- **Coefficient of Quartile Deviation:** The coefficient of quartile deviation is a relative measure of dispersion and is given by:

$$Coefficient\ Q.D = \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

- **Numerical example of quartile deviation and coefficient of quartile deviation**

Ex # calculate quartile deviation and coefficient of quartile deviation for ungrouped data. The marks obtained by 9 students are given below

x_i	45	32	37	46	39	36	41	48	36

$$Quartile\ deviation = \frac{Q_3 - Q_1}{2}$$

"n=9" is odd then we use odd case formulae

$Q_1 = Marks\ obtained\ by \left[\left(\frac{n}{4}\right)+1\right]^{th} student$ $\quad Q_1 = 36$ marks, $Q_3 = 45$

$$Quartile\ deviation = \frac{45-36}{2} = 4.5 \text{ marks} \quad \text{(Answer).}$$

- Coefficient of Quartile deviation:

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$$Cofficient\ of\ Q.D = \frac{Q_3 - Q_1}{Q_3 + Q_1}$$

$$Cofficient\ of\ Q.D = \frac{45-32}{45+32} = 0.11 \quad \text{(Answer).}$$

Ex # calculate quartile deviation and coefficient of quartile deviation for continuous grouped data.

Class boundaries	Midpoints (x_i)	Frequency (f_i)	Cumulative frequency $(c.f)$
29.5---39.5	34.5	8	8
39.5---49.5	44.5	87	95
49.5---59.5	54.5	190	285
59.5---69.5	64.5	304	589
69.5---79.5	74.5	211	800
79.5---89.5	84.5	85	885
89.5---99.5	94.5	20	905
		$\sum_{i=1}^{n} f_i = 905$	

$$Q_1 = l + \frac{h}{f}\left(\frac{n}{4} - C\right) \Rightarrow Q_1 = 56.40 \text{ marks}$$

$$Q_3 = l + \frac{h}{f}\left(\frac{3n}{4} - C\right) \Rightarrow Q_3 = 73.76 \text{ marks}$$

Calculate Quartile deviation and coefficient of quartile deviation from above results?

- **Mean Absolute Deviation or Mean Deviation (Average Deviation):** *"The arithmetic mean of the absolute deviation from an average (mean, median etc.) is called mean deviation or average deviation"*

	Ungrouped Data	Grouped Data
M.D from Mean	$M.D = \frac{\sum \lvert x_i - \bar{x} \rvert}{n}$	$M.D = \frac{\sum f \lvert x_i - \bar{x} \rvert}{n}$
M.D from Median	$M.D = \frac{\sum \lvert x_i - Med \rvert}{n}$	$M.D = \frac{\sum f \lvert x_i - Med \rvert}{n}$

Coefficient of Mean Deviation: The coefficient of mean deviation is a relative measure of dispersion and is given by:

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$$Coefficient\ of\ M.D = \frac{M.D(from\ mean)}{Mean}$$

$$Coefficient\ of\ M.D = \frac{M.D(from\ median)}{Median}$$

❖ **Numerical example of Mean deviation and Coefficient of Mean deviation for both ungrouped and grouped data.**

➢ Calculate the mean deviation and coefficient of mean deviation from (i) the mean, (ii) the median , in the ungrouped data case, of the following set of examination marks:

x_i	45 32 37 46 39 36 41 48 36

n= 9

x_i	$x_i - \bar{x}$, $\bar{x} = 40$	$\lvert x_i - \bar{x} \rvert$	$\lvert x_i - median \rvert$, $median = 39$
32	−8	8	7
36	−4	4	3
36	−4	4	3
37	−3	3	2
39	−1	1	0
41	1	1	2
45	5	5	6
46	6	6	7
48	8	8	9
$\sum x_i$ =360		$\sum \lvert x_i - \bar{x} \rvert$ = 40	$\sum \lvert x_i - median \rvert$=39

$$\bar{x} = \frac{\sum x_i}{n} = \frac{360}{9} = 40 \text{ marks},$$

$$Median = marks\ obtained\ by \left(\frac{n+1}{2}\right)^{th} student \qquad Median = 39 \text{ marks}$$

➢ Mean deviation from mean is given by

$$M.D = \frac{\sum \lvert x_i - \bar{x} \rvert}{n} \Rightarrow M.D = \frac{40}{9} \Rightarrow M.D = 4.4 \text{ marks} \qquad \text{(Answer).}$$

➢ Mean deviation from median is given by

$$M.D = \frac{\sum \lvert x_i - median \rvert}{n} \Rightarrow M.D = \frac{39}{9} \Rightarrow M.D = 4.3 \text{ marks} \qquad \text{(Answer).}$$

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- Calculate coefficient of mean deviation for both mean and median.

$$C.o.M.D = \frac{M.D}{mean\ (\bar{x})} \Rightarrow C.o.M.D = \frac{4.4}{40} \Rightarrow C.o.M.D = 0.11 \quad \text{(Answer).}$$

$$C.o.M.D = \frac{M.D}{median} \Rightarrow C.o.M.D = \frac{4.3}{39} \Rightarrow C.o.M.D = 0.11 \quad \text{(Answer).}$$

- Calculate mean deviation and coefficient of mean deviation from mean in continuous grouped case, showing the weights of 60 apples.

Weights (grams)	65--84	85--104	105--124	125--144	145--164	165--184	185--204
Frequency	09	10	17	10	05	04	05

Weight (grams)	Midpoints (x_i)	Frequency (f_i)	$f_i x_i$	$\lvert x_i - \bar{x} \rvert$	$f_i \lvert x_i - \bar{x} \rvert$
65----84	74.5	09	670.5	−48.0	432.0
85----104	94.5	10	945.0	−28.0	280.0
105----124	114.5	17	1946.5	−8.0	136.0
125----144	134.5	10	1345.0		120.0
145----164	154.5	05	772.5	12.0	160.0
165----184	174.5	04	698.0		208.0
185----204	194.5	05	972.5	32.0	360.0
				52.0	
				72.0	
		$\sum_{i=1}^{n} f_i = 60$	$\sum_{i=1}^{n} f_i x_i =$ 7350.0		$\sum f_i \lvert x_i - \bar{x} \rvert$ = 1696.0

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i} \Rightarrow \bar{x} = \frac{7450.0}{60} \Rightarrow \bar{x} = 122.5 \text{ grams}$$

$$M.D = \frac{\sum f_i \lvert x_i - \bar{x} \rvert}{\sum f_i} \Rightarrow M.D = \frac{1696.0}{60} \Rightarrow M.D = 28.27 \text{ grams} \quad \text{(Answer).}$$

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Standard Deviation: "The positive square root of variance is called as standard deviation".

OR

"The positive square root of the arithmetic mean of the squared deviations from the mean is called the standard deviation"

	Ungrouped Data	Grouped Data
S.D for Population	$\sigma = \sqrt{\frac{\sum (xi-\mu)^2}{N}}$	$\sigma = \sqrt{\frac{\sum f(xi-\mu)^2}{N}}$
S.D for Sample	$S = \sqrt{\frac{\sum (xi-\bar{x})^2}{n}}$	$S = \sqrt{\frac{\sum f(xi-\bar{x})^2}{n}}$

❖ **Methods of Calculating Variance and Standard Deviation.**

Methods	Ungrouped Data	
	Variance	Standard Deviation
Direct Method	$S^2 = \frac{\sum xi^2}{n} - \left(\frac{\sum xi}{n}\right)^2$	$S = \sqrt{\frac{\sum xi^2}{n} - \left(\frac{\sum xi}{n}\right)^2}$
Short cut Method	$S^2 = \frac{\sum D^2}{n} - \left(\frac{\sum D}{n}\right)^2$	$S = \sqrt{\frac{\sum D^2}{n} - \left(\frac{\sum D}{n}\right)^2}$
Step-deviation Method	$S^2 = h^2\left[\frac{\sum ui^2}{n} - \left(\frac{\sum ui}{n}\right)^2\right]$	$S = h\sqrt{\frac{\sum ui^2}{n} - \left(\frac{\sum ui}{n}\right)^2}$
Methods	Grouped Data	
	Variance	Standard Deviation
Direct Method	$S^2 = \frac{\sum fxi^2}{n} - \left(\frac{\sum fxi}{n}\right)^2$	$S = \sqrt{\frac{\sum fxi^2}{n} - \left(\frac{\sum fxi}{n}\right)^2}$
Short cut Method	$S^2 = \frac{\sum fD^2}{n} - \left(\frac{\sum fD}{n}\right)^2$	$S = \sqrt{\frac{\sum fD^2}{n} - \left(\frac{\sum fD}{n}\right)^2}$
Step-deviation Method	$S^2 = h^2\left[\frac{\sum fui^2}{n} - \left(\frac{\sum fui}{n}\right)^2\right]$	$S = h\sqrt{\frac{\sum fui^2}{n} - \left(\frac{\sum fui}{n}\right)^2}$

Coefficient of Standard Deviation OR Coefficient of Variation: The coefficient of standard deviation is a relative measure of dispersion and is given by:

$$Coefficient\ of\ S.D = \frac{Standard\ Deviation}{Mean}$$

The coefficient of standard deviation is also called the coefficient of variation, denoted by C.V and is given by:

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$$C.V = \frac{Standard\ Deviation}{Mean} \times 100$$

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Coefficient of Variation was introduced by **Karl Pearson**. It is used to compare the variation or to compare the performance of two sets of data. A large value of C.V indicates that there is greater variability and vice versa. Similarly, the smaller the C.V the more consistent is the performance and vice versa.

- Numerical example of Standard deviation (S.D), Variance and Coefficient of Variation (C.V) in case of ungrouped data, using direct method:

Ex # Calculate the variance, S.D and C.V from the following marks obtained by 9 students.

x_i	45 32 37 46 39 36 41 48 36

x_i	$x_i-\bar{x}$	$(x_i-\bar{x})^2$	x_i^2
45	5	25	2025
32	−8	64	1024
37	−3	09	1369
46	6	36	2116
39	−1	01	1521
36	−4	16	1296
41	1	01	1681
48	8	64	2304
36	−4	16	1296
$\sum x_i=360$		$\sum(x_i-\bar{x})^2=232$	$\sum x_i^2=14632$

$$\bar{x}=\frac{\sum x_i}{n} \Rightarrow \bar{x}=\frac{360}{9} \Rightarrow \bar{x}=40 \text{ marks}$$

Variance or $S^2=\dfrac{\sum(x_i-\bar{x})^2}{n} \Rightarrow S^2=\dfrac{232}{9} \Rightarrow S^2=25.78\ (marks)^2$

Standard deviation or S.D or $S=\sqrt{\dfrac{\sum(x_i-\bar{x})^2}{n}} \Rightarrow S=\sqrt{25.78} \Rightarrow S=5.08$ marks

(Answer).

Using the alternative method.

Calculate Variance:

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$$S^2 = \frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n}\right)^2 \quad \Rightarrow S^2 = \frac{14632}{9} - \left(\frac{360}{9}\right)^2 \quad \Rightarrow S^2 = 1625.78 - 1600$$

$\Rightarrow S^2 = 25.78 \ (marks)^2$ (Answer).

Calculate Standard deviation:

$$S = \sqrt{\frac{\sum x_i^2}{n} - \left(\frac{\sum x_i}{n}\right)^2} \quad \Rightarrow S = \sqrt{\frac{14632}{9} - \left(\frac{360}{9}\right)^2} \quad \Rightarrow S = \sqrt{25.78} \quad \Rightarrow S = 5.08 \text{ marks}$$

(Answer).

- Calculate Coefficient of Variation (C.V):

$$C.V = \frac{S.D}{\bar{x}} \times 100 \quad \Rightarrow C.V = \frac{5.08}{40} \times 100 \quad \Rightarrow C.V = 12.70 \qquad \text{(Answer).}$$

- **Calculate the Variance, Standard deviation and Coefficient of Variation from the following weight of 60 apples in Continuous grouped data:**

Weight (grams)	Midpoints (x_i)	Frequency (f_i)	$f_i x_i$	$f_i x_i^2$
65----84	$(65+84)/2 = 74.5$	09	$9 \times 74.5 = 670.$	49 952.25
85----104	94.5	10	5	89 302.50
105----124	114.5	17	945.0	222 874.25
125----144	134.5	10	1946.5	180 902.50
145----164	154.5	05	1345.0	119 351.25
165----184	174.5	04	772.5	121 801.00
185----204	194.5	05	698.0	189 151.25
			972.5	
		$\sum_{i=1}^{n} f_i = 60$	$\sum_{i=1}^{n} f_i x_i = 735$	$\sum f_i x_i^2 = 973\ 335.00$
			0.0	

Calculate Variance:

$$S^2 = \frac{\sum f_i x_i^2}{\sum f_i} - \left(\frac{\sum f_i x_i}{\sum f_i}\right)^2 \qquad \Rightarrow S^2 = \frac{973335.00}{60} - \left(\frac{7350.0}{60}\right)^2$$

$\Rightarrow S^2 = 16222.25 - 15006.25$

$\Rightarrow S^2 = 1216 \ (grams)^2$ (Answer).

Calculate Standard deviation:

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$$S=\sqrt{\frac{\sum f_i x_i^2}{\sum f_i}-\left(\frac{\sum f_i x_i}{\sum f_i}\right)^2} \Rightarrow S=\sqrt{1216} \Rightarrow S=34.87 \text{ grams}$$ (Answer).

Calculate Coefficient of Variation:

$$C.V=\frac{S.D}{\bar{x}}\times 100 \Rightarrow C.V=\frac{34.87}{122.5}\times 100 \Rightarrow C.V=28.46$$ (Answer).

Question # Calculate Variance, Standard deviation and Coefficient of Variation using direct, shortcut and step deviation method for Continuous grouped data, the data are given below:

Income	35--39	40--44	45--49	50--54	55--59	60--64	65--69
Frequency	13	15	17	28	12	10	05

Properties of Variance

- Variance of a constant is zero i.e. Var(c) = 0, where "c" is any constant.

Proof: By definition of variance:

$$Var(x) = \frac{\sum(x-\bar{x})^2}{n}$$

$$\Rightarrow Var(c) = \frac{\sum(c-c)^2}{n}=0 \qquad (\text{if } x\to c \Rightarrow \bar{x}\to c)$$

- The variance is unaffected by the change of origin i.e. when a constant is added to or subtracted from each value of a variable, the variance remains unchanged i.e. $Var(x\pm c) = Var(x)$

Proof: By definition of variance:

$$Var(x) = \frac{\sum(x-\bar{x})^2}{n}$$

$$\Rightarrow Var(x-c) = \frac{\sum[(x-c)-(\bar{x}-c)]^2}{n} \qquad (\text{if } x\to x-c \Rightarrow \bar{x}\to \bar{x}-c)$$

$$= \frac{\sum(x-c-\bar{x}+c)^2}{n}$$

$$= \frac{\sum(x-\bar{x})^2}{n}$$

$$= Var(x)$$

Similarly, $Var(x+c) = Var(x)$

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- Variance is affected by the change of scale i.e. when each observation of a variable is multiplied or divided by a constant, then variance is multiplied or divided by square of that constant i.e.

$$Var(cx) = c^2 Var(x) \quad \text{OR} \quad Var\left(\frac{x}{c}\right) = \frac{1}{c^2} Var(x)$$

Proof: By definition of variance:

$$Var(x) = \frac{\sum (x-\bar{x})^2}{n}$$

$$\Rightarrow Var(cx) = \frac{\sum [(cx)-(c\bar{x})]^2}{n} \quad (\text{if } x \to cx \Rightarrow \bar{x} \to c\bar{x})$$

$$= \frac{\sum (cx - c\bar{x})^2}{n}$$

$$= \frac{\sum c^2 (x-\bar{x})^2}{n}$$

$$= c^2 \frac{\sum (x-\bar{x})^2}{n}$$

$$= c^2 Var(x)$$

Similarly $$Var\left(\frac{x}{c}\right) = \frac{1}{c^2} Var(x)$$

- The variance of the sum or difference of two independent variables is equal to the sum of their respective variances i.e. $Var(x \pm y) = Var(x) + Var(y)$

Proof: By definition of variance:

$$Var(x) = \frac{\sum (x-\bar{x})^2}{n} \quad \text{And} \quad Var(y) = \frac{\sum (y-\bar{y})^2}{n}$$

$$\Rightarrow Var(x-y) = \frac{\sum [(x-y)-(\bar{x}-\bar{y})]^2}{n}$$

$$= \frac{\sum (x - y - \bar{x} + \bar{y})^2}{n} = \frac{\sum [(x-\bar{x}) - (y-\bar{y})]^2}{n}$$

$$= \frac{\sum \left[(x-\bar{x})^2 + (y-\bar{y})^2 - 2(x-\bar{x})(y-\bar{y})\right]}{n}$$

$$= \frac{\sum (x-\bar{x})^2}{n} + \frac{\sum (y-\bar{y})^2}{n} - \frac{2\sum (x-\bar{x})(y-\bar{y})}{n}$$

Where the term $\frac{\sum (x-\bar{x})(y-\bar{y})}{n}$ is called the covariance and we know that for independent variables covariance is zero.

$$\therefore \quad Var(x-y) = \frac{\sum (x-\bar{x})^2}{n} + \frac{\sum (y-\bar{y})^2}{n}$$

$$\Rightarrow \quad Var(x-y) = Var(x) + Var(y)$$

Similarly, $$Var(x-y) = Var(x) + Var(y)$$

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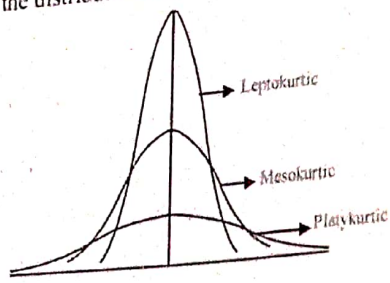
Kurtosis is measured by the moment ratio b_2 or β_2

- If $\beta_2 > 3$, then the distribution is known as leptokurtic
- If $\beta_2 = 3$, then the distribution is known as mesokurtic
- If $\beta_2 < 3$, then the distribution is known as platykurtic.



Q: Explain the difference between absolute and relative measure of dispersion.

Absolute Measure of Dispersion: "An absolute measure of dispersion is one that measures the dispersion in terms of the same units or in the square of units as the units of the data" e.g. if the units of the data are Rs, meters, kg, etc. The units of the measures of dispersion will also be Rs, meters, kg, etc.

The common absolute measures of dispersion are:

- Range
- Quartile Deviation
- Mean Deviation
- Standard Deviation

Relative Measure of Dispersion: "A relative measure of dispersion is one: that is expressed in the form of a ratio or percentage and independent of the units of measurements"
This is a pure number and independent of the units in which the data has been expressed. It is used for the purpose to compare the dispersion of one data set with the dispersion of another.

The common relative measures of dispersion are:

- Coefficient of Dispersion or Coefficient of Range
- Coefficient of Quartile Deviation
- Coefficient of Mean Deviation
- Coefficient of Standard Deviation or Coefficient of Variation (C.V)

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Characteristics of a good measure of dispersion

An ideal measure of dispersion is expected to possess the following properties

1. It should be rigidly defined
2. It should be based on all the items.
3. It should not be unduly affected by extreme items.
4. It should lend itself for algebraic manipulation.
5. It should be simple to understand and easy to calculate

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Merits and Demerits of Range

Merits

1. It is simple to understand.
2. It is easy to calculate.
3. In certain types of problems like quality control, weather forecasts, share price analysis, etc.,

   range is most widely used.

Demerits

1. It is very much affected by the extreme items.
2. It is based on only two extreme observations.
3. It cannot be calculated from open-end class intervals.
4. It is not suitable for mathematical treatment.
5. It is a very rarely used measure.

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Merits and Demerits of Standard Deviation

Merits

1. It is rigidly defined and its value is always definite and based on all the observations and the actual signs of deviations are used.
2. As it is based on arithmetic mean, it has all the merits of arithmetic mean.
3. It is the most important and widely used measure of dispersion.
4. It is possible for further algebraic treatment.
5. It is less affected by the fluctuations of sampling and hence stable.
6. It is the basis for measuring the coefficient of correlation and sampling.

Demerits

1. It is not easy to understand and it is difficult to calculate.
2. It gives more weight to extreme values because the values are squared up.
3. As it is an absolute measure of variability, it cannot be used for the purpose of comparison.

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Questions

1. Which measure is affected most by the presence of extreme values.

a) Range b) Standard Deviation

b) Quartile Deviation d) Mean deviation

Ans: Standard Deviation

2. Variance is square of _____

a) Range b) Standard Deviation

c) Quartile Deviation d) Mean deviation

Ans: Standard Deviation

3. If the CV of variety I is 30% and variety II is 25% then Variety II is more consistent.

Ans: True

4. For the set of data 5, 5, 5,5,5,5 the Standard deviation value is zero.

Ans: True

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5. The absolute measures of dispersion will have the original units.

Ans: True

6. The mean deviation value for a set of data can take even negative value.

Ans: False

7. Define dispersion.

8. Define C.V. What are its uses?

9. What are the differences between absolute measure and relative measure of dispersion?

10. How to calculate the standard deviation for raw and grouped data?

Scanned with CamScanner