VIDYA BHAWAN BALIKA VIDYA PITH

शक्तिउत्थानआश्रमलखीसरायबिहार

Class 11 commerce Sub. ECO/B Date 23.01.2021

Teacher name – Ajay Kumar Sharma

Standard Deviation

Standard Deviation is the positive square root of the mean of squared deviations from mean. So if there are five values x1 , x2 , x3 , x4 and x5 , first their mean is calculated. Then deviations of the values from mean are calculated. These deviations are then squared. The mean of these squared deviations is the variance. Positive square root of the variance is the standard deviation. (Note that standard deviation is calculated on the basis of the mean only). Calculation of Standard Deviation for ungrouped data Four alternative methods are available for the calculation of standard deviation of individual values. All these methods result in the same value of standard deviation. These are:

(i) Actual Mean Method

(ii) Assumed Mean Method

(iii) Direct Method

(iv) Step-Deviation Method

Actual Mean Method: Suppose you have to calculate the standard deviation of the following values: 5, 10, 25, 30, 50

$$\bar{X} = \frac{5+10+25+30+50}{5} = \frac{120}{5} = 24$$

First step is to calculate

Example 8

X	$d\,(x-\bar{x})$	d^2
5	-19	361
10	-14	196
25	+1	1
30	+6	36
50	+26	676
	0	1270

Then the following formula is used:

$$\sigma = \sqrt{\frac{\sum d^2}{n}}$$

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

$$\sigma = \sqrt{\frac{1270}{5}} = \sqrt{254} = 15.937$$

Do you notice the value from which deviations have been calculated in the above example? Is it the Actual Mean?

Assumed Mean Method

For the same values, deviations may be calculated from any arbitrary value $A\bar{x}$ such that $d = X - A\bar{x}$. Taking $A\bar{x} = 25$, the computation of the standard deviation is shown below:

Example 9

X	$d\ (x\text{-}A\bar{x})$	d^2
5	–20	400
10	–15	225
25	0	0
30	+5	25
50	+25	625
	–5	1275

Formula for Standard Deviation

$$\sigma = \sqrt{\frac{\Sigma d^2}{n} - \left(\frac{\Sigma d}{n}\right)^2}$$

$$\sigma = \sqrt{\frac{1275}{5} - \left(\frac{-5}{5}\right)^2} = \sqrt{254} = 15.937$$