

DISPERSION

Standard Deviation

Standard Deviation

The Standard Deviation is a measure of how spread out numbers are.

Its symbol is σ (the greek letter sigma)

Calculation of S.D from Actual Mean – Individual Series

Values (X)	$X - \bar{X}$	$(X - \bar{X})^2$
14		
22		
9		
15		
20		
17		
12		
11		
$\Sigma X = ?$		$\Sigma (X - \bar{X})^2 = ?$

Calculation of S.D from Assumed Mean - Individual Series

The Table below gives the marks obtained by 10 M.Tech Students in statistics examination. Calculate Standard Deviation

Nos	1	2	3	4	5	6	7	8	9	10
Marks	43	48	65	57	31	60	37	48	78	59

R. Nos	Marks	d= X- A	d ²
1	43		
2	48		
3	65		
4	57		
5	31		
6	60		
7	37		
8	48		
9	78		
10	59		

Calculation of S.D from Actual Mean –Discrete Series

<i>Marks (X)</i>	<i>f</i>	<i>fX</i>	$d = X - \bar{X}$ $\bar{X} = 30.8$	d^2	fd^2
10	8	80	-20.8	432.64	3461.12
20	12	240	-10.8	116.64	1399.68
30	20	600	-0.8	0.64	12.8
40	10	400	9.2	84.64	846.4
50	7	350	19.2	368.84	2580.48
60	3	180	29.2	852.64	2557.92
$\Sigma X = 210$	$N = 60$	$\Sigma fX = 1850$			$\Sigma fd^2 = 10858.40$

Arithmetic Mean for Discrete Series

$$\bar{X} = \frac{\sum fX}{N}$$

Standard
Deviation

$$\bar{X} = 1850 / 60 = 30.8$$

=

$$\sigma = \sqrt{\frac{\sum fd^2}{N}}$$

$$= \sqrt{10858.40 / 60} = 13.45$$

Calculation of S.D from Assumed Mean –Discrete Series

<i>Marks (X)</i>	<i>f</i>	d=X-A (A=30)	<i>fd</i>	<i>fd²</i>
10	8			
20	12			
30	20			
40	10			
50	7			
60	3			
	N= 60		$\Sigma fd =$	$\Sigma fd^2 =$

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

$\sigma = ?$ Check the Answer with the previous sum. Both answer should be same

Calculation of S.D from Step Deviation Mean –Discrete Series

<i>Marks (X)</i>	<i>f</i>	<i>d</i> =(X-A)	<i>d'</i> = <i>d</i> / C	<i>fd'</i>	<i>fd'²</i>
10	8				
20	12				
30	20				
40	10				
50	7				
60	3				
	<i>N</i> = 60			$\Sigma fd' =$	$\Sigma fd'^2 =$

$$\sigma = \sqrt{\frac{\Sigma f d'^2}{N} - \left(\frac{\Sigma f d'}{N}\right)^2} \times C$$

$\sigma = ?$ Check the Answer with the previous sum. Both answer should be same

Calculation of S.D from Step Deviation Mean –Continuous

<i>Marks (X)</i>	<i>f</i>	<i>Mid Value (m)</i>	<i>d=(m-A)</i>	<i>d' = d / C</i>	<i>fd'</i>	<i>fd'²</i>
0-10	8					
10-20	12					
20-30	17					
30-40	14					
40-50	9					
50-60	7					
60-70	4					
	<i>N</i> = 60				$\Sigma fd' =$	$\Sigma fd'^2 =$

$$\sigma = \sqrt{\frac{\Sigma fd'^2}{N} - \left(\frac{\Sigma fd'}{N}\right)^2} \times C$$

$$\sigma = ?$$

Variance

- Square of standard deviation is called variance

- Formula:

$$\text{variance} = \sigma^2$$

$$\text{Co-efficient of Variance} = \frac{\sigma}{X} \times 100$$

Example : 2

From the following data verify which group of student is consistent in their studies and which group of students having greater variability

Marks No. of Students	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. of Students (Group A)	5	7	15	22	14	8	7	2
No. of Students (Group B)	3	8	13	21	29	22	11	3

Marks	Group A (f)	Midvalue (X)	$d' = (X-A) / C$ (A=45,C=10)	fd'	fd'^2
0-10	5	5	-4	-20	80
10-20	7	15	-3	-21	63
20-30	15	25	-2	-30	60
30-40	22	34	-1	-22	22
40-50	14	45	0	0	0
50-60	8	55	1	8	8
60-70	7	65	2	14	28
70-80	2	75	3	6	18
	N=80			$\Sigma fd' = -65$	$\Sigma fd'^2 = 279$

$$\bar{X} = A \pm \frac{\Sigma f d'}{N} * C$$

$$\sigma = \sqrt{\frac{\Sigma f d'^2}{N} - \left(\frac{\Sigma f d'}{N}\right)^2} \times C$$

$$\sigma = ?$$

Co-efficient of Variance
(Group A) = ?

Example: 3

In two factories A and B engaged in the same industry in the area, the average weekly wages (in Rs.) and the standard deviations are as follows:

	Factory A	Factory B
No. Of Employees	476	524
Mean Wages	34.5	28.5
Standard Deviation	5	4.5

- (a) Which factory A or B pays out a larger amount as weekly wages?
- (b) Which factory A or B has greater variability in industrial wages?