

Variance and coefficient of Variation (C.V.)

Q. find which team A or B is more consistent in its performance:

No. of Goal Scored in a match	Team A	Team B
0	27	17
1	9	9
2	8	6
3	5	5
4	4	3

Assumed mean, $A = 2$

$$\bar{X}_B = A + \frac{\sum fd}{\sum f}$$

$$\bar{X}_B = 2 + \left(\frac{-32}{40} \right)$$

$$\bar{X}_B = 2 - 0.8$$

$$\bar{X}_B = 1.2$$

$$\text{C.V. A} = 123.6\% \quad \text{①}$$

Solⁿ → For Team B

X	f	d = X - A d = X - 2	d ²	fd	fd ²
0	17	-2	4	-34	68
1	9	-1	1	-9	9
2	6	0	0	0	0
3	5	1	1	5	5
4	3	2	4	6	12
$\sum f = 40$				$\sum fd = -32$	$\sum fd^2 = 94$

$$\text{C.V. B} = \frac{\sigma_B}{\bar{X}_B} \times 100$$

$$\text{C.V. B} = \frac{1.308}{1.2} \times 100$$

$$\text{C.V. B} = 109\% \quad \text{②}$$

from ① & ②
 $\text{C.V. B} < \text{C.V. A}$
 Team B is more consistent.

Measure of Dispersion : Mean Deviation (M.D.)

M.D. of a set of observations of a Series is the arithmetic mean of all deviations, without their algebraic sign, taken from its central value (mean or median or mode).

Q. What Average should be taken as central value?
mean

Q. Why Algebraic signs are ignored?
Algebraic sum of deviation of a set of values from their mean is always zero

Individual series

X	$X - \bar{X}$ $X - 30$	$ X - \bar{X} $
10	-20	20
20	-10	10
30	0	0
40	10	10
50	20	20
$\Sigma X = 150$	$\Sigma (X - \bar{X}) = 0$	$\Sigma X - \bar{X} = 60$

$$\bar{X} = \frac{\Sigma X}{n} = \frac{150}{5} = 30$$

$$\begin{aligned} \text{M.D. about mean} \\ &= \frac{\Sigma |X - \bar{X}|}{n} = \frac{60}{5} = 12 \end{aligned}$$

Measure of Dispersion : Mean Deviation (M.D.)

② Discrete series

find M.D. about mean

x	f	fx	(x - \bar{x})	x - \bar{x}	f x - \bar{x}
2	2	4	-6	6	12
4	2	8	-4	4	8
6	4	24	-2	2	8
8	5	40	0	0	0
10	3	30	2	2	6
12	2	24	4	4	8
14	1	14	6	6	6
16	1	16	8	8	8
N = $\sum f$		$\sum fx$			$\sum f x - \bar{x} $
= 20		= 160			= 56

$$\text{mean, } \bar{x} = \frac{\sum fx}{\sum f} = \frac{160}{20} = 8$$

$$\text{M.D. about mean} = \frac{\sum f|x - \bar{x}|}{\sum f} = \frac{56}{20} = 2.8$$

Individual series

x	x - \bar{x}	x - \bar{x}
10	-20	20
20	-10	10
30	0	0
40	10	10
50	20	20
$\sum x$	$\sum (x - \bar{x})$	$\sum x - \bar{x} $
150	= 0	= 60

$$\bar{x} = \frac{\sum x}{n} = \frac{150}{5} = 30$$

$$\text{M.D. about mean} = \frac{\sum |x - \bar{x}|}{n} = \frac{60}{5} = 12$$

Measure of Dispersion : Mean Deviation (M.D.)

Continuous series

find M.D. about mean

class	f	mid-value (x)	fX	$x - \bar{x}$	$ x - \bar{x} $	$f x - \bar{x} $
0-10	15	5	75	-35.16	35.16	452.4
10-20	15	15	225	-20.16	20.16	302.4
20-30	23	25	575	-10.16	10.16	233.68
30-40	22	35	770	-0.16	0.16	3.52
40-50	25	45	1125	9.84	9.84	246
50-60	10	55	550	19.84	19.84	198.4
60-70	5	65	325	29.84	29.84	149.2
70-80	10	75	750	39.84	39.84	398.4
	$\Sigma f = N$ = 125		ΣfX = 4395			$\Sigma f x - \bar{x} $ = 1984

$$\text{mean, } \bar{x} = \frac{\Sigma fX}{\Sigma f} = \frac{4395}{125} = 35.16$$

$$\text{M.D.} = \frac{\Sigma f|x - \bar{x}|}{\Sigma f} = \frac{1984}{125} = 15.872 \text{ Ans}$$

x = mid-value