Measures of dispersion:

The following are the measures of dispersion:

(1) **Range:** Range is the difference between the extreme values of the variate

∴ Range = $L - S$, L = largest value
S = Smallest value.

The co-efficient of range = $\frac{L-S}{L+S}$.

(2) **Quartile deviation:**

The term $\frac{1}{2}(Q_3 - Q_1)$ is called the semi-inter quartile range or the quartile deviation.

And, co-efficient of quartile deviation
$= \frac{Q_3 - Q_1}{Q_3 + Q_1}$

where Q_1 is the lower quartile and Q_3 is the upper quartile.

(3) Average deviation or Mean deviation:

If $x_1, x_2, x_3 \ldots x_n$ occur $f_1, f_2, \ldots f_n$ times and $N = \sum f_i$, the mean deviation from A (A is mean or median) is given by,

$$\text{Mean deviation} = \frac{1}{N} \sum_{i=1}^{n} f_i |x_i - A|$$

And,

Co-efficient of mean deviation

$$= \frac{\text{Mean deviation}}{\text{Average from which it is calculated}}$$

(4) Standard deviation:

The standard deviation is denoted by σ and is defined as,

$$\sigma = \sqrt{\frac{1}{N} \sum f_i (x_i - \bar{x})^2}$$

The square of the standard deviation

is σ^2 is called variance.

The co-efficient of standard deviation $= \frac{\sigma}{\bar{x}}$

The co-efficient of variance

$= \frac{\sigma}{\bar{x}} \times 100$.

In problem, we can use the formula

$$\sigma = \sqrt{\frac{1}{N}\sum f_i x_i^2 - \left(\frac{1}{N}\sum f_i x_i\right)^2}$$

Ex:→ Find the mean deviation from the median of the following distribution.

Marks :	0-10	10-20	20-30	30-40
No of students :	5	8	15	16

Marks :	40 - 50
No of students :	6

Soln

Marks	Mid value (x_i)	f	C.F(C)	$\lvert x - M_d \rvert$	$f_i \lvert x_i - M_d \rvert$
0 - 10	5	5	5	23	115
10 - 20	15	8	13	13	104
20 - 30	25	15	28	3	45
30 - 40	35	16	44	7	112
40 - 50	45	6	50	17	102
		N = 50			$\sum f \lvert x - M_d \rvert = 478$

Here, $\frac{N}{2} = 25$, $\therefore$ Median class is 20 - 30.

$\therefore l = 20$, $f = 15$, $C = 13$, $h = 10$.

$\therefore$ Median $= l + \frac{h}{f}\left(\frac{N}{2} - C\right)$

$= 20 + \frac{10}{15}(25 - 13) = 28$.

$\therefore$ Mean deviation from median

$= \frac{1}{N} \sum f \lvert x - M_d \rvert$

$= \frac{478}{50} = 9.56$.

Co-efficient of mean deviation $= \frac{9.56}{28} = .34$