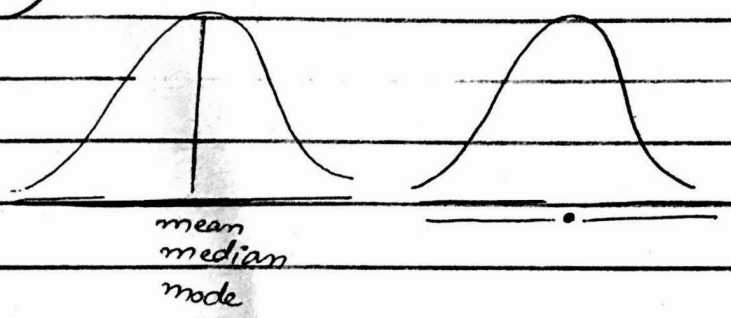
// => Measure of dispersion :



1. Absolute measure of dispersion
2. Relative measure of dispersion

Absolute measure of dispersion gives an idea about the amount of dispersion/spread in a set of data observation.

→ These quartiles measure the dispersion in same unit as the unit of original data.

→ Absolute measures can not be used to compare the variation of two or more series/data

1. Absolute measure of dispersion:
   Role of unit exist in absolute measure of dispersion data & ans/outcome in same unit
2. Relative measure of dispersion:
   No role of unit exist in relative measure of dispersion

ABSOLUTE MEASURE OF DISPERSION:

1. Range
2. Absolute deviation
3. Mean Deviation
4. Variance & standard deviation

⇓

" mean deviation $\Sigma(x_i - \bar{x}) = 0$

" median deviation $\Sigma(x_i - \tilde{x}) =$

" mode deviation $\Sigma(x_i - \hat{x})$

Range: "Difference between largest and smallest value is called range"

Range = Largest value − Smallest value

mathematically it is represented as:

$$R = X_m - X_0$$

X_m = maximum

X_0 = minimum

Example:

$X = 3, 7, 12, 5, 5, 10$

Range = $X_{max} - X_{min}$

$R = 12 - 3 = 9$

Q_2 = median → 50%, 50%

→ Difference between upper Quartile & lower Quartile is called Quartile deviation

$$Q.D = \frac{Q_3 - Q_1}{2}$$

IQR inter-quartile range $= Q_3 - Q_1$

semi-interquartile range $= \frac{Q_3 - Q_1}{2}$

Question:

3, 4, 5, 7, 9, 10, 11, 13 find range & IQR

Range $= X_m - X_0 = 13 - 3 = 10$

$Q.D = Q_3 - Q_1$

$= 6 - 2$

$= 4$

B.W

$Q_3 = \frac{3n}{4}$. 6

$\frac{3(8)}{4} = \frac{24}{4}$

$Q_1 = \frac{n}{4} = \frac{8}{4}^2$

Mean deviation :

UNGROUPED DATA	GROUPED DATA
mean deviation from mean $= \frac{\Sigma \lvert x_i - \bar{x} \rvert}{n}$	$\frac{\Sigma f \lvert x_i - \bar{x} \rvert}{\Sigma f}$
mean deviation from median $= \frac{\Sigma \lvert x_i - \tilde{x} \rvert}{n}$	$\frac{\Sigma f \lvert x_i - \tilde{x} \rvert}{\Sigma f}$
mean deviation from mode $= \frac{\Sigma \lvert x_i - \hat{x} \rvert}{n}$	$\frac{\Sigma f \lvert x_i - \hat{x} \rvert}{\Sigma f}$

X	$X - \bar{X}$	$\lvert X_i - \bar{X} \rvert$
8	$8 - 3 = 5$	5
1	$1 - 3 = -2$	2
3	$3 - 3 = 0$	0
0	$0 - 3 = -3$	3

absolute

$|\ |$

$\bar{x} = \frac{12}{4} = 3$

$\frac{\Sigma|x_i - \bar{x}|}{n} = \frac{10}{4} = 2.5$

mean deviation from median : $\frac{\Sigma|x_i - \tilde{x}|}{n}$

x
8
1
3
0

$\tilde{x} = 0\ |1\ 3|\ 8$

$\frac{1+3}{2} = \frac{4}{2} = 2$

x	$x - \tilde{x}$	$\lvert x - \tilde{x}\rvert$
8	6	6
1	-1	1
3	+1	1
0	-2	2

$\hat{x}$

$\text{m.D from median} = \frac{10}{4} = 2.5$

mean deviation from mode : $\frac{\Sigma|x_i - \hat{x}|}{n}$

x	$x_i - \hat{x}$	$\lvert x_i - \hat{x}\rvert$
8	$8-1 = 7$	7
1	$1-1 = 0$	0
3	$3-1 = 2$	2
0	$0-1 = -1$	1
1	$1-1 = 0$	0
1	$1-1 = 0$	0
4	$4-1 = 3$	3
		13

$\frac{\Sigma|x_i - \hat{x}|}{n}$

$= \frac{13}{7} = 1.85$ Ans

Date:

$$\frac{\sum f|x_i - \bar{x}|}{\sum f} \Rightarrow \frac{\sum f|x_i - \bar{x}|}{\sum f}$$

Marks obtained	f	(x) mid	f x_i
10-20	2	15	30
20-30	3	25	75
30-40	8	35	280
40-50	14	45	630
50-60	8	55	440
60-70	3	65	195
	$\sum f = 38$		$\sum f x_i = 1650$

$$\bar{x} = \frac{\sum f x_i}{\sum f}$$

$$\bar{x} = \frac{\sum f x_i}{\sum f} \Rightarrow \bar{x} = \frac{1650}{38} = 43.42$$

Y	x_i	$x_i - \bar{x}$	$\lvert x_i - \bar{x}\rvert$	$f\lvert x_i - \bar{x}\rvert$
10-20	15	15 − 43.4 = −28.4	28.4	56.8
20-30	25	25 − 43.4 = −18.4	18.4	55.2
30-40	35	35 − 43.4 = −8.4	8.4	67.2
40-50	45	45 − 43.4 = 1.6	1.6	22.4
50-60	55	55 − 43.4 = 11.6	11.6	92.8
60-70	65	65 − 43.4 = 21.6	21.6	64.8
				359.2

$$\frac{359.2}{38} = 9.45$$

$$\frac{\sum f|x_i - \bar{x}|}{\sum f}$$

$$\text{mode} = L + \frac{(f_m - f_1)}{(f_m - f_1) + (f_m - f_2)} \times h$$

Date:

$\sum f|x_i - \bar{x}|$

x	f	mid(x)	$f\|x_i - \bar{x}\|$	$f\|x_i - \bar{x}\|$
10-20	2	15	30	60
20-30	3	25	20	60
30-40	8	35	10	80
40-50	14	45	0	0
50-60	8	55	10	80
60-70	3	65	20	60

$\sum f = 38$

$\sum f|x_i - \bar{x}| = 340$

$$\text{mode} = 40 + \frac{(14-8)}{(14-8)+(14-8)} \times 10$$

$$= 40 + \frac{6}{12} \times 10 = 45$$

$$\text{Mean deviation} = \frac{\sum f|x_i - \bar{x}|}{\sum f} = \frac{340}{38} = 8.94$$

x	f	mid	F
10-20	2	15	2
20-30	3	25	5
30-40	8	35	13
40-50	14	45	27
50-60	8	55	35
60-70	3	65	38

$$\frac{\sum f|x_i - \bar{x}|}{\sum f}$$

Date:

Median

$$\tilde{x} = l + \frac{h}{f}\left(\frac{n}{2} - c\right)$$

$$= 40 + \frac{10}{14}\left(\frac{38}{2} - 13\right)$$

$$40 + \frac{10}{14}(19 - 13)$$

$$40 + \frac{60}{14}$$

$$40 + 4.28$$

Media $= 44.28$

X	f	x_i	$\lvert x_i - \bar{x} \rvert$	$f\lvert x_i - \bar{x} \rvert$	$\Sigma f = 38$
10-20	2	15	29.28	58.56	
20-30	3	25	19.28	57.84	
30-40	8	35	19.28	74.24	
40-50	14	45	0.72	10.08	
50-60	8	55	10.72	85.76	
60-70	3	65	20.72	62.16	

$$\Sigma f\lvert x_i - \bar{x} \rvert = 348.64$$

$$\text{Mean deviation} = \frac{348.64}{38} = 9.17$$