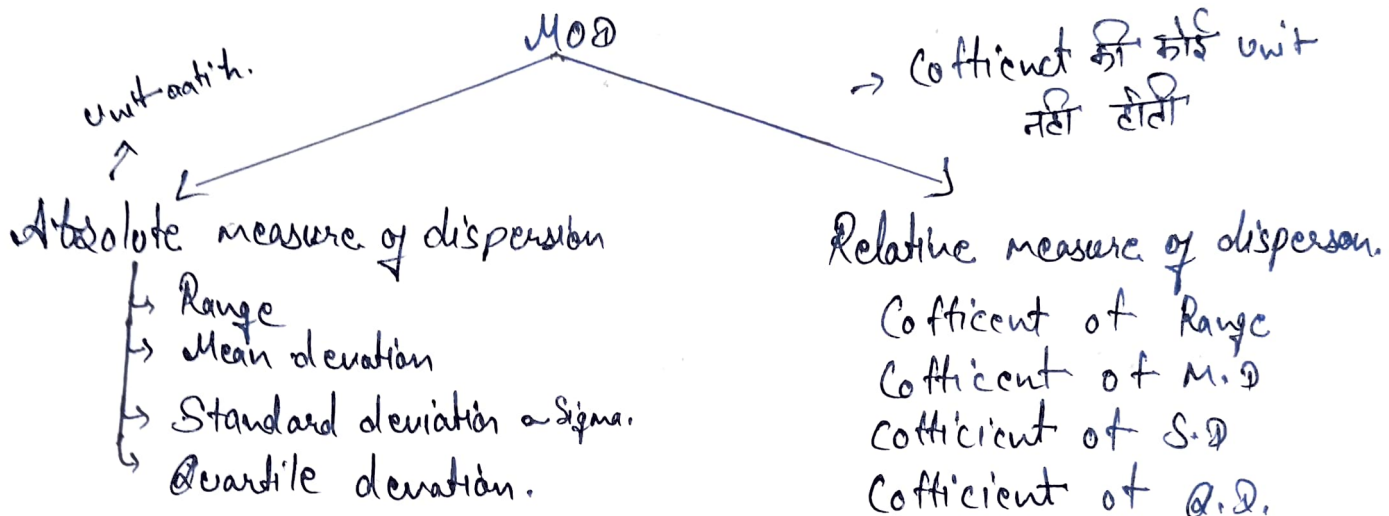


Measures of Dispersion (MOD) IInd order Average.

- * Measure of Dispersion measure scatterness of observation.
- * These measure can be classified in two ways.



Range \Rightarrow weight
5, 50, 6

Formula. \Rightarrow Highest - lowest
 $50 - 5$
 $+ 5 \text{ kg (unit)}$

- Absolute
- Smaller calculation
- Unit Measure
- Combination of two data or relative measure are not used.

Relative इसमें Coefficient निकाला जाता है

- Difficult Calculation.
- Unit free measure.
- Combination of two data relative measures are used.

① Range \rightarrow Positive रहती है।

$$R = H - L$$

$$\text{Coefficient of Range} = \frac{H - L}{H + L} \times 100$$

Q. CM unit height.
50, 4, 90, 16, 20, 30

R ⇒ 90 - 4 ⇒ 86 cm.

Q. Find Coefficient of Range

$$\frac{90-4}{90+4} \times 100 \Rightarrow \frac{86}{94} \times 100 \Rightarrow 91.48\%$$

Q. $2\frac{1}{3}$, $9\frac{1}{2}$ = $2\frac{1}{4}$

a = 12 बार ✓

- 1

÷ 4

+ 1

x = 12 बार.

Q. 50, -40, -20, 90

R ⇒ 90 - (-40) = 90 + 40 ⇒ 130

Q. -5, -9, -4, -1, -2

R ⇒ -1 - (-9) = -1 + 9 ⇒ 8

Q. Range Sol. R ⇒ 90 - 5
Range ⇒ 85

Coefficient ⇒ $\frac{90-5}{90+5} \times 100$

⇒ $\frac{85}{95} \times 100$

Coefficient = 89.47.

x	f
5	3
15	15
55	81
60	16
90	9
14	4

Exclusive

x	f
10 - 20	3
20 - 30	4
30 - 40	5
40 - 50	7
50 - 60	9

R ⇒ 60 - 10 ⇒ 50

Coefficient $\frac{60-10}{60+10} \times 100$

$\frac{50}{70} \times 100$

Coefficient ⇒ 71.42

Inclusive

x	f
44 - 48	3
49 - 53	4
54 - 58	5
59 - 63	7
64 - 68	9

43.5 - 48.5

48.5 - 53.5

53.5 - 58.5

58.5 - 63.5

63.5 - 68.5

Range ⇒ $\frac{L}{2} \Rightarrow 0.5$

$\frac{L}{2}$ (-) (+)

Range ⇒ 68.5 - 43.5 (H-L)

Range ⇒ 25

a. Range \Rightarrow 10 each data added by 6 new Range
Range \Rightarrow 10 (not affected of origin).

b. Range \Rightarrow 20 each data $\times 5$ then \div by 20

$$20 \times 5 \Rightarrow 100$$

$$\frac{100}{20} = 5$$

Range $\Rightarrow 5$

* Range is absolute measure of dispersion.

Range is quickest measure of dispersion.

Range is not based on all observation.

Range will always be positive.

For equal observation k, k, k

MD
SD
AD } \oplus

$$\text{Range} \Rightarrow 0$$

$$\text{MD} \Rightarrow 0$$

$$\text{SD} \Rightarrow 0$$

$$\text{AD} \Rightarrow 0$$

Change of origin \times (affect)

Change of scale \checkmark

$\therefore \rightarrow$ Linear equation property \Rightarrow

$$y = a + bx$$

Range of x is given $\Rightarrow R_x$

$$R_y = \left| \frac{x}{y} \right| \times R_x$$

$$R_y = \left| \frac{b}{1} \right| \times R_x$$

a. $y = 2 + 3x$

$$R_x \Rightarrow 6$$

$$R_y \Rightarrow \frac{3}{1} \times 6$$

$$R_y \Rightarrow 18$$

a. $2x + 3y + 5 = 0$

$$\text{Range } x \Rightarrow 27$$

$$\text{Range } y \Rightarrow \frac{2}{3} \times 27$$

$$R_y = 18$$

Q. $5x + 6y + 12 = 0$ $R_x \Rightarrow 2$

$R_y = \frac{5}{6} \times 2 \Rightarrow \frac{5}{3}$

Q. $4x - 7y + 9 = 0$ $R_y = 16$

$R_x = \frac{7}{4} \times 16$

$R_x \Rightarrow 28$

Q. Range of x is 4 find range of $2 - 3x$

$R_y = \frac{3}{1} \times 4 \Rightarrow 12$

$R_y \Rightarrow 12$

Q. Range of x is b find range of $\frac{x-a}{b}$

$y = \frac{x-a}{b}$

$yb \Rightarrow x-a$

$R_y \Rightarrow \frac{1}{b} \times b$

$R_y \Rightarrow 1$

Mean deviation

\therefore MD about Mean.

$\Sigma \left| \frac{x - \bar{x}}{n} \right|$

Coefficient $\Rightarrow \frac{MD}{Mean} \times 100$

Q.

x	$x - \bar{x}$
5	4
8	1
10	1
10	1
12	3
9	0
4	10

$\bar{x} \Rightarrow \frac{54}{6}$

$\bar{x} \Rightarrow 9$

MD $\Rightarrow \frac{10}{6} \Rightarrow 1.66$

Coefficient $\Rightarrow \frac{1.66}{9} \times 100$

Coefficient $\Rightarrow 18.44$

Q.

x	$x - \bar{x}$
53	5
52	6
61	3
60	2
64	6
290	22

$\bar{x} \Rightarrow \frac{290}{5} \Rightarrow 58$

MD $\Rightarrow \frac{22}{5} \Rightarrow 4.4$

Coefficient $\Rightarrow \frac{4.4}{58} \times 100$

Coefficient $\Rightarrow 7.58$

(ii) MD about median

$\Sigma (x - M)$

Coefficient $\Rightarrow \frac{MD}{Median} \times 100$

Q.

x	$x - M$
	6
5	5
6	2
9	0
Median - 11	5
16	9
20	19
30	46

$$MD = \frac{46}{7} \Rightarrow 6.57$$

$$\text{Coefficient} \Rightarrow \frac{6.57}{11} \times 100$$

$$\Rightarrow 59.72$$

$$\text{Coefficient} \Rightarrow 59.72$$

Q.

x	$x - M$
6	24
11	19
15	15
20	10
40	10
45	15
50	20
90	60
	173

$$\text{Median} \Rightarrow \frac{20+40}{2}$$

$$M \Rightarrow 30$$

$$MD \Rightarrow \frac{173}{8} \Rightarrow 21.62$$

$$\text{Coefficient} \Rightarrow \frac{21.62}{30} \times 100$$

$$\text{Coefficient} \Rightarrow 72.08$$

• MD about mode

$$\varepsilon \left| \frac{x - z}{n} \right|$$

$$MD \text{ Coefficient} \Rightarrow \frac{MD}{\text{mode}} \times 100$$

⇓

↪

Q.

x	$(x - z)$
$\frac{4}{11}$	$\frac{4}{11}$, mode $\Rightarrow \frac{8}{11}$
$\frac{6}{11}$	$\frac{2}{11}$, MD $\Rightarrow \frac{15}{11} \Rightarrow \frac{1.36}{1} \Rightarrow 0.194$
$\frac{8}{11}$	0, MD coefficient $\Rightarrow \frac{0.194 \times 100}{8}$
$\frac{8}{11}$	0, $\Rightarrow \frac{0.194 \times 11 \times 100}{8}$
$\frac{8}{11}$	0, MD coefficient $\Rightarrow 26.67$
$\frac{2}{11}$	$\frac{6}{11}$
$\frac{5}{11}$	$\frac{3}{11}$

MD for Discrete series.

About Mean	About Median	About Mode
$MD \Rightarrow \frac{\sum f x - \bar{x} }{\sum f}$ $\bar{x} \Rightarrow \frac{\sum fx}{f}$	$MD \Rightarrow \frac{\sum f(x - m)}{\sum f}$ $m \Rightarrow \frac{N+1}{2}$ value	$MD \Rightarrow \frac{\sum f x - Z }{\sum f}$ $Z = \text{high frequency.}$

① MD about Mean.

x	f	fx	$x - \bar{x}$	$x \cdot f$
2	2	4	5.2	10.4
4	3	12	3.2	9.6
8	3	24	0.8	2.4
16	2	32	8.8	17.6
	10	72		40

Mean $\Rightarrow \frac{fx}{f}$

$M \Rightarrow \frac{72}{10} \Rightarrow 7.2$

$MD \Rightarrow \frac{\sum xf}{f} = \frac{40}{10} \Rightarrow 4$

MD coefficient $\Rightarrow \frac{4}{7.2} \times 100$

MD coefficient $\Rightarrow 55.55$

MD about Median

x	f	cf	$x - M$	$x \cdot f$
4	2	2	5.2	8
16	4	6	3.2	64
20	8	14	1.2	60
32	16	30	0	0
50	9	39	18	162
				370

$$\text{Median} \Rightarrow \frac{N+1}{2} \Rightarrow \frac{29}{2} \Rightarrow 14.5$$

$$\text{median} \Rightarrow 32$$

$$M.D \Rightarrow \frac{370}{28} \Rightarrow 13.21$$

$$M.D \text{ coefficient} \Rightarrow \frac{13.21}{32} \times 100$$

$$M.D \text{ coefficient} \Rightarrow 41.28$$

Q.

X	f	(F)	X - M	Xf
2	2	2	8	16
6	7	9	4	28
9	3	12	1	3
10	5	17	0	0
12	4	21	2	8
15	6	27	5	30
	27			<u>85</u>

$$\text{Median} \Rightarrow \frac{27+1}{2} \Rightarrow 14 \text{ median} \Rightarrow 10.$$

$$M.D \Rightarrow \frac{85}{27} \Rightarrow 3.14$$

$$M.D \text{ coefficient} \Rightarrow \frac{3.14}{10} \times 100 \Rightarrow 31.4.$$

Q.

X	f	fx	X - \bar{x}	Xf
50	7	350	5	35
60	7	420	5	35

$$\text{Median} \Rightarrow \frac{7+7}{14} \Rightarrow 5$$

$$\text{Median} \Rightarrow 55$$

$$M.D \Rightarrow \frac{70}{14} \Rightarrow 5$$

$$M.D \text{ coefficient} \Rightarrow \frac{5}{55} \times 100$$

$$M.D \text{ coefficient} \Rightarrow 9.09$$

* MD is an absolute major of disperson.

MD is absolute deviation method

MD is based on all observation.

MD will always be positive

for equal observation k, k, k , MD will be 0

Change of origin \times

Change of scale \checkmark

linear equation property $\rightarrow x = a + bx$

$$Mx \Rightarrow \frac{x}{y} \times Mx \text{ of } x$$

$$\text{MD coefficient of } x \Rightarrow \frac{MD x}{x} \times 100$$

$$\text{MD coefficient of } y \Rightarrow \frac{MD y}{y} \times 100$$

Q. MD \Rightarrow 10 each data added by 6 new MD
New MD \Rightarrow 10 (because not effect of origin).

Q. MD \Rightarrow 20 each data \div 5 then \times 2 new MD \Rightarrow 8.

$$\frac{20}{5} \Rightarrow 4 \times 2 = 8 \text{ Ans}$$

$$\begin{array}{cccc} \text{Q.} & a & b & c & d \\ & 7a & 7b & 7c & 7d \end{array}$$

$$MD \Rightarrow k$$

$$MD \Rightarrow 7k$$

$$\text{Q. } 4x - 5y + 2 \Rightarrow 0 \quad MD x = 10$$

$$MD y \Rightarrow \frac{4}{5} \times 100 \Rightarrow 8$$

Q. MD of x is 4 MD of $\frac{3x-2}{5} = 2$

$$MD y \Rightarrow \frac{3}{5} \times 4 \quad / \quad y \Rightarrow \frac{3x-2}{5}$$

$$\frac{12}{5} \Rightarrow 2.4$$

$$5y \Rightarrow 3x - 2$$

Q. $2x + 3y - 7 = 0$ MD $x = 0.3$ $\bar{x} = 1$

MD $y \Rightarrow \frac{2}{3} \times 0.3 \Rightarrow 0.2$

Mean $\Rightarrow 2 + 3y - 7 = 0$

$3y = 5$

$y \Rightarrow 1.66$

Coefficient of MD of y

$$\frac{\text{MD } y}{\bar{y}} \times 100$$

$$\frac{0.2}{1.66} \times 100 \Rightarrow 11.99$$

$\Rightarrow 12$ (Approx)

Standard deviation $\Rightarrow a$

σ out mean square deviation. $a = \sqrt{\quad}$

$$a = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

do $x \Rightarrow x - \bar{x}$

$$a \Rightarrow \sqrt{\frac{\sum dx^2}{n}}$$

variable $\Rightarrow a^2$

C.V \Rightarrow Coefficient of variation

$$\text{C.V} \Rightarrow \frac{\text{SP}}{\text{MEAN}} \times 100$$

x	$(x - \bar{x})^2$
53	25
52	36
61	9
60	4
64	36
290	110

$\bar{x} \Rightarrow \frac{290}{5} \Rightarrow 58$

$$a \Rightarrow \sqrt{\frac{\sum dx^2}{n}}$$

$$a \Rightarrow \sqrt{\frac{110}{5}}$$

$a \Rightarrow 2.2$

$a \Rightarrow 4.69$

C.V $\Rightarrow \frac{4.69}{58} \times 100$

C.V $\Rightarrow 8.08$

Q.

x	$(x - \bar{x})^2$
5	16
8	1
10	1
10	1
12	9
9	0
<u>54</u>	<u>28</u>

$$\bar{x} \Rightarrow \frac{54}{6} = 9$$

$$\sigma \Rightarrow \sqrt{\frac{28}{6}}$$

$$\sigma \Rightarrow \sqrt{4.66}$$

$$\sigma \Rightarrow 2.16$$

$$C.V \Rightarrow \frac{2.16}{9} \times 100$$

$$C.V \Rightarrow 24$$

$$\text{variance} \Rightarrow \sigma^2 \Rightarrow \left(\sqrt{\frac{28}{6}}\right)^2$$

$$\Rightarrow \frac{28}{6}$$

$$\Rightarrow 4.66$$

\rightarrow SD is half of range for two numbers

$$40, 15$$

$$SD = ?$$

$$\sigma \Rightarrow \frac{a - b}{2}$$

$$\sigma \Rightarrow \frac{40 - 15}{2}$$

$$\sigma \Rightarrow 12.5$$

Q. 1, 2, 3, 4, 5 ----- n natural no.

$$1, 2, 3, 4, 5 \dots 25$$

$$\sigma = \sqrt{\frac{625 - 1}{12}}$$

$$\sigma \Rightarrow \sqrt{\frac{624}{12}}$$

$$\sigma \Rightarrow \sqrt{52}$$

$$\sigma \Rightarrow 7.21$$

Q. 1, 2, 3, 4, 5, 6 ----- 35

$$\bar{x} \Rightarrow \frac{1 + 35}{2} \Rightarrow 18$$

$$\sigma \Rightarrow \sqrt{\frac{1225 - 1}{12}}$$

$$\sigma \Rightarrow 10.9$$

$$C.V \Rightarrow \frac{\sigma}{\bar{x}} \times 100$$

$$\Rightarrow \frac{10.9}{18} \times 100$$

$$\Rightarrow 56.05 \text{ \%}$$

Q. (C.4) \Rightarrow 80%. SD of natural no \Rightarrow 2
 find n .

$$a = 16$$

$$\bar{x} = 2$$

$$\frac{\sqrt{n^2 - 1}}{1} \Rightarrow 2$$

$$C.4. \Rightarrow \frac{a}{\bar{x}} \times 100$$

$$\frac{n^2 - 1}{n^2 + 1^2} \Rightarrow 48$$

$$80 \Rightarrow \frac{16}{\bar{x}} \times 100$$

$$n^2 \Rightarrow 49$$

$$\bar{x} \Rightarrow \frac{1600}{80}$$

$$n \Rightarrow \sqrt{49}$$

$$\bar{x} \Rightarrow 20$$

$$n \Rightarrow 7$$

\star

$$a \Rightarrow \frac{\sum dx^2}{n}$$

$$a \Rightarrow \frac{\sum x^2 - n\bar{x}^2}{n}$$

$\sum dx^2 \Rightarrow$ Sum of square of deviation of x

$\sum x^2 \Rightarrow$ Sum of square of observation

$$a^2 \Rightarrow \frac{\sum x^2}{n} - \bar{x}^2$$

$$a^2 + \bar{x}^2 = \frac{\sum x^2}{n}$$

$$\sum x^2 = n(a^2 + \bar{x}^2)$$

Q. Combined SD

Male

Female

n_1

n_2

a_1

a_2

So mean \bar{x}_1

\bar{x}_2

SD of all

$$I \quad \sum x^2 = n_1(a_1^2 + \bar{x}_1^2)$$

$$II \quad \sum x^2 \Rightarrow n_2(a_2^2 + \bar{x}_2^2)$$

add \Rightarrow I + II

$$\bar{x}_T \Rightarrow \frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2}$$

$$\sum x^2 \Rightarrow n(a^2 + \bar{x}^2)$$

Q.	Boys	Girls
	40	60
SD	.5	8
Average	30	20

$$\sum n^2 = n(a^2 + \bar{x}^2)$$

$$\Rightarrow 40(25 + 900) = 37000$$

$$\sum n^2 \Rightarrow 60(64 + 400) = \frac{27840}{64840}$$

Combined of 100 person

$$\bar{x}_T \Rightarrow \frac{40 \times 30 + 60 \times 20}{10}$$

$$\bar{x}_T \Rightarrow 29$$

$$\sum n^2 \Rightarrow n(a^2 + \bar{x}_T^2)$$

$$64840 \Rightarrow 100(a^2 + 576)$$

$$64840 \Rightarrow a^2 + 576$$

$$a^2 \Rightarrow 712$$

dobt. $a \Rightarrow 2.68$.

Q.	Male	female
	30	20
SD	10	12
Average	4800	5000

$$\sum n^2 \Rightarrow n(a^2 + \bar{x}^2)$$

$$\Rightarrow 30(25 + 23040000)$$

$$\Rightarrow 691200750 - \textcircled{1}$$

$$\Rightarrow 20(12^2 + 5000^2)$$

$$\Rightarrow 20 \times 144 + 25000000$$

$$\Rightarrow 500002880 - \textcircled{2}$$

$$\Rightarrow \textcircled{1} + \textcircled{2}$$

$$\Rightarrow 1191203630$$

$$\bar{x} \Rightarrow \frac{30 \times 4800 + 20 \times 5000}{50}$$

$$\bar{x} \Rightarrow 194000 + 100000$$

$$\bar{x} \Rightarrow \frac{294000}{50}$$

$$\bar{x} \Rightarrow 4880$$

$$\sum x^2 \Rightarrow n (a^2 + \bar{x}^2)$$

$$(1191203630) \Rightarrow 50 (a^2 + (4880)^2)$$

$$23824073 \Rightarrow a^2 + 23814400$$

$$9717.6 \Rightarrow a^2$$

$$a^2 \Rightarrow 9717.6$$

$$a \Rightarrow 98.58$$

Q. SD = 10 each data added by 4 New SD = 10

Q. SD = 20 each data \div by 4 New SD = 5

Q.

a	b	c	SD = 1k
7a	7b	7c	SD = 7k

variance = ?
 $a = 7k$
 $a^2 = 7k^2$
 $a^2 = 49k^2$

Q. $2x + 3y - 7 = 0$ SD of x 's & SD of y 's = ?

$$\frac{2}{3} \times 9 = 6$$

Q. SD of x 's & 4

$$5x - 4y + 2 = 0$$

$$SD = \frac{5}{4} \times 4 = 5$$

$$\text{variance of } y = (5)^2$$

$$\Rightarrow 25$$

Q. SD of x 's is 16 variance of $2 - 3x$

$$y = 2 - 3x$$

$$4y = \frac{3}{1} \times 16 = 48$$

$$\text{variance of } (48)^2$$

$$\text{variance} = 2304$$

Q. SD of x is b

Find SD of $\frac{x-a}{b}$

$$y = \frac{x-a}{b}$$

$$yb = x - a$$

$$ay = \frac{1}{b} \times b$$

$$ay = 1$$

Q. Variance of x is 100 variance of $3 - 5x = ?$

$$ay = \frac{5}{1} \times 10 \Rightarrow 50$$

$$ay \Rightarrow 2500$$

Q. 9, 5, 8, 2, 6

y : 10 sample $90, 50, 80, 20, 60 - 2.45 \times 10 \Rightarrow 24.5$

-10 sample $\Rightarrow -1, -5, -2, -8, -4 - 2.45 \Rightarrow 2.4$

$$\bar{x} \Rightarrow \frac{30}{5} \Rightarrow 6$$

(change of origin)

x	$x - a^2$
9	9
5	1
8	4
2	16
6	0
	30

$$s \Rightarrow \sqrt{\frac{30}{5}}$$

$$s \Rightarrow 2.45$$

Q. Mean of a and b is 2
SD of a and b is 2

$$\frac{a+b}{2} = 2$$

$$\frac{a-b}{2} = 2$$

$$\frac{a+b}{2} = 6$$

$$a+b = 6 \quad (1)$$

$$a-b = 4 \quad (2)$$

$$2a = 10$$

$$a = 5$$

then $a+b \Rightarrow 6$

$$5+b \Rightarrow 6$$

$$b \Rightarrow 6-5$$

$$b \Rightarrow 1$$

Note: when two digit then

$$\Rightarrow \frac{a+b}{2}$$

$$\Rightarrow \frac{a-b}{2}$$

Town A	Town B
101	151
102	152
103	153
104	154
⋮	⋮
200	250

$$u = k, v = k^2$$

$$v_A : v_B = ?$$

$$k^2 : k^2$$

$\Rightarrow (1)$

Identities: \Rightarrow

$$(a+b)^2 = a^2 + b^2 + 2ab$$

$$(a-b)^2 = a^2 + b^2 - 2ab$$

$$a^2 - b^2 = (a+b)(a-b)$$

$$(a+b)^3 = a^3 + b^3 + 3ab(a+b)$$

$$(a-b)^3 = a^3 - b^3 - 3ab(a-b)$$

$$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$a^3 - b^3 = (a-b)(a^2 + ab + b^2)$$

$$a-b = \sqrt{(a+b)^2 - 4ab}$$

Q. $a, b, 2$ Mean 3

$$SD = \frac{2}{\sqrt{3}}$$

$$a \times b = ?$$

$$\frac{a+b+2}{3} = 3$$

$$a+b+2=9$$

$$a+b=7$$

$$E x^2 = n(a^2 + \bar{x}^2)$$

$$a^2 + b^2 + 4 = 3\left(\frac{7}{3} + 9\right)$$

$$a^2 + b^2 + 4 = 3\left(\frac{31}{3}\right)$$

$$a^2 + b^2 + 4 = 31$$

$$a^2 + b^2 = 27$$

$$(a+b)^2 = a^2 + b^2 + 2ab$$

$$49 = 27 + 2ab$$

$$2ab = 49 - 27$$

$$2ab = 22$$

$$ab = 11 \text{ ans}$$

Q. The mean and SD of 100 observation is 40 and 5.1 but by mistake one value is wrongly taken as 50 instead of 40 New mean, New SD.

Sol:

$$100 - 40 \overset{\text{Average}}{=} 4000$$

$$\begin{array}{r} - 50 \\ + 40 \\ \hline 3990 \end{array}$$

$$\bar{x}_R = \frac{3990}{100}$$

$$\bar{x} = 39.90$$

$$\Sigma x^2 = n(a^2 + \bar{x}^2) \text{ (Wrong)}$$

$$\Rightarrow 100 (.26.01 \times 1600)$$

$$\Rightarrow 162601. \Sigma x^2$$

$$\begin{array}{r} - 2500 \\ + 1600 \\ \hline 161701 \Sigma x^2 \end{array}$$

$$161701 = 100 (a^2 + 1592.01)$$

$$1617.01 = a^2 + 1592.01$$

$$a^2 = 25$$

$$a = 5$$

* SD is an absolute measure of dispersion

SD is based on all observation.

SD will always be positive variance = (+)

SD is best measure of dispersion.

SD is based on mean only.

SD is difficult measure of dispersion

SD is based on desirable mathematical properties

Change of origin \times

Change of scale \checkmark

Change of linear equation \checkmark

$$y = ax + bx$$

$$ay = \left| \frac{x}{y} \right| \times ax$$

Quartile deviation.

$$QD = \frac{Q_3 - Q_1}{2}$$

$Q_3 - Q_1$ = Interquartile range

$Q_3 - Q_1$ = Inter Decile range

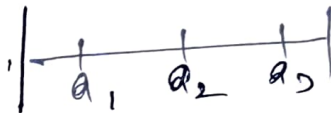
QD = Semi Inter quartile range.

$$QD \text{ coefficient} = \frac{Q_3 - Q_1}{Q_3 + Q_1} \times 100$$

$$QD \text{ Coefficient} = \frac{QD}{\text{Median}} \times 100$$

$$Q_1 = 1 \left(\frac{n+1}{4} \right)$$

$$Q_3 = 3 \left(\frac{n+1}{4} \right) \text{ value}$$



$$Q_2 = \frac{Q_1 + Q_3}{2} \text{ median}$$

Change of origin \times
Change of scale \checkmark

$$O.P_y = \left| \frac{x}{y} \right| \times QD_x$$

- ★ QD is absolute measure of dispersion
- QD is not based on all observation
- QD is affected by presence of extreme values.
- QD is appropriate for open end classification.

Q 5, 50, 25, 36, 90, 20, 18, 40, 100

only 5, 18, 20, 25, 36, 40, 50, 90, 100

$$Q_1 = \frac{19+1}{4}$$

$$Q_1 = \frac{9+1}{4} = 2.5$$

$$Q_1 = 18 + 0.5(20-18)$$

$$Q_1 = 18 + 1$$
$$= 19$$

$$Q_3 \Rightarrow 3 \left(\frac{9+1}{4} \right) = \frac{30}{4} = 7.5 \text{ times}$$

$$7^{\text{th}} + 0.5(8^{\text{th}} - 7^{\text{th}})$$

$$50 + 0.5 \times 40$$

$$\Rightarrow 70$$

$$Q_2 = \frac{70-19}{70+19} \times 100$$

$$Q_2 \Rightarrow \frac{51}{89} \times 100$$

$$Q_2 \Rightarrow 57.30$$

Q.3

X	f	C.F
5	3	3
10	4	7
12	5	12
16	7	19
20	9	28
25	8	36
30	4	40

N=40

$$Q_1 = \frac{N+1}{4} \text{ value}$$

$$\frac{40+1}{4} = 10.25 \text{ value}$$

$$Q_1 = 12$$

$$Q_3 = 3 \left(\frac{n+1}{4} \right)$$

$$3 \left(\frac{41}{4} \right)$$

$$\Rightarrow 30.75 \text{ value}$$

$$Q_1 \text{ median} = 12$$

$$Q_3 \text{ median} = 25$$

$$QD = \frac{25 - 12}{2} \Rightarrow 6.5$$

$$QD \text{ coefficient} = \frac{25 - 12}{25 + 12} \times 100$$

$$QD \text{ coefficient} = 35 - 12$$

~~$$SD = 5$$~~

~~$$QD = ?$$~~

— Relative

$$4SD = 5MD = 6QD$$

$$4SD = 5MD = 6QD$$

$$SD = 5$$

$$QD = ?$$

Solve

$$4SD = 6QD$$

$$4(5) = 6QD$$

$$QD = \frac{20}{6}$$

$$QD = 3.33$$

$$SD = \frac{5}{4} MD \quad MD = \frac{6}{5} QD \quad SD = \frac{6}{4} QD$$

$$SD = \frac{3}{2} QD$$

$$SD > MD$$

$$MD > QD$$

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★ ★ Total Formulas

$$\textcircled{1} \quad \bar{x} = \frac{\sum x}{n}$$

$$\textcircled{2} \quad \frac{\text{1st} + \text{2nd}}{2}$$

$$\textcircled{3} \quad \bar{x} = A + \frac{\sum dx}{n}$$

$$\textcircled{4} \quad \bar{x} = \frac{\sum fx}{\sum f}$$

$$\textcircled{5} \quad \bar{x} = \frac{2n+1}{3}$$

$$\textcircled{6} \quad \text{Median} = \text{Mid}$$

$$\textcircled{7} \quad m = \frac{N+1}{2}$$

$$\textcircled{8} \quad \frac{d_1 + \frac{N}{2} - c \times i}{h}$$

$$\textcircled{9} \quad \bar{y} = a + b\bar{x}$$

$$\textcircled{10} \quad gn = a + b \cdot km$$

$$\textcircled{11} \quad \bar{x} \uparrow \Rightarrow \frac{n_1 \bar{x}_1 + n_2 \bar{x}_2}{n_1 + n_2}$$

- (12) $z = \text{High (Mode)}$
- (13) $z_i + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times d$
- (14) $z = 3M - 2\bar{x}$
- (15) $yz = a + bx_z$
- (16) $H.M = \frac{n}{\frac{1}{a} + \frac{1}{b} + \dots}$
- (17) $H.M = \frac{N}{\frac{f_1}{x_1} + \frac{f_2}{x_2} + \dots}$
- (18) Combination

$$\frac{n_1 + n_2}{\frac{n_1}{H_1} + \frac{n_2}{H_2}}$$
- (19) $G.M = (a \times b \times c \dots)^{\frac{1}{n}}$
- (20) $G.M = (x_1^{f_1} \times x_2^{f_2} \dots)^{\frac{1}{n}}$
- (21) Combined G.M = $(a_1^{n_1} + b_2^{n_2})^{\frac{1}{n_1+n_2}}$

- (22) Range \Rightarrow Highest - lowest
- (23) Coefficient = $\frac{H-L}{H+L} \times 100$
- (24) $R_y = \left| \frac{x}{y} \right| \times R_x$
- (25) $MD = \frac{\sum |x - \bar{x}|}{n}$
- (26) Coefficient = $\frac{MD}{\text{MEAN}} \times 100$
- $MD_y = \left| \frac{x}{y} \right| \times MD_x$
- $a = \sqrt{\frac{\sum d x^2}{n}}$
- $a = \frac{a-b}{2}$
- $a = \sqrt{\frac{n^2 - 1}{12}}$
- $\sum x^2 = n(a^2 + \bar{x}^2)$
- $a_y = \left| \frac{x}{y} \right| \times a_x$
- $Q_0 = \frac{Q_3 - Q_1}{2}$
- Coefficient $\Rightarrow \frac{Q_3 - Q_1}{Q_3 + Q_1} \times 100$