Measures of Central Tendency & Dispersion

- If all the values assumed by a variable are constant say k, then AM also k

  eg. $\frac{3+3+3}{3} = \frac{9}{3} = 3$ etc.

- The algebraic sum of deviations of a set of obseration from their AM is zero.

  $\frac{3+4+5+6+7}{5} = \frac{25}{5} = 5$

  $$\boxed{\begin{matrix} 3-5 \\ 4-5 \\ 6-5 \\ 5-5 \\ 7-5 \end{matrix}} = 0$$

  $\Sigma(x-\bar{x}) = 0$ always for individual series

  for discrete/continuous series $\Sigma f(x-\bar{x}) = 0$

- Change in origin means - some value added or substracted obser
- ——— scale ——— multiplied or divide from obser

- In continuous series upper limit - lower limit = class length

- If question aske about CF than (+), otherwise in F (−)
- If question don't tell about less then type or more then then use less than

- Formula of AM = $\frac{\sum_{i=1}^{n} x_i}{n}$ for individual ~~& discrete seg~~ series
- ——— = $\frac{\Sigma fx}{\Sigma f \text{ or } n}$ for discrete series & continuous series

- If there are 3 observation, then the sum of deviation of the observation from AM is zero.

- AM is affected due to change in scale, as well as due to change in origin.

Page No.:
Date: / /

If two variables x and y are related as $y = a + bx$, where a and b are constants, and $\bar{x}$ is known, then
$\bar{y} = a + b\bar{x}$

eg. $\bar{x} = 10$ $\bar{y} = ?$
$2\bar{x} + \bar{y} + 7 = 0$

$2 \times 10 + \bar{y} + 7 = 0$
$20 + 7 + \bar{y} = 0$
$\bar{y} = -27$

$\bar{y} = a + b\bar{x}$
$\bar{y} = -7 + (-2 \times 10)$
$\bar{y} = -7 + (-20)$ = $\bar{y} = -27$

- If there are two groups containing n_1 and n_2 observation with respective means as $\bar{x}_1$ and $\bar{x}_2$, then combined is given by -

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

eg. Module Q. 11 Set B Pg. 14.27
let, the no. of total workers is = 100
& skilled worker (K.O.) (a) 40
So, $n_1 = 15000$ $n_2 = 10000$
$x_1 = 40$ $x_2 = 60$

$$\frac{n_1\bar{x}_1 + n_2\bar{x}_2}{n_1 + n_2} = \frac{(15000 \times 40) + (10000 \times 60)}{60 + 40}$$

$$= \frac{600000 + 600000}{100}$$

$$= \frac{1200000}{100} = 12000$$

Geometric mean-
Geometric mean is used to calculate the average of rates & Percentages.
formula = $(x_1 \times x_2 \times x_3 \times \cdots)^{1/n}$
eg. $(1 \times 9 \times 27)^{1/3} = 6.24$

Page No.:
Date: / /

- GM of discrete series is calcuted as-

$$GM = \left(x_1^{f_1} \times x_2^{f_2} \times x_3^{f_3} \times \cdots\right)^{\frac{1}{N}}$$

eg.

x	2	4	8	16
f	2	3	3	2

$$(2^2 \times 4^3 \times 8^3 \times 16^2)^{1/10} = 5.66 \text{ Ans}$$

- If all the values assumed by a variable are constant, say, K, then the GM is also K

eg. $(5\times5\times5\times5)^{1/4} = 5$

- GM of product of two numbers is the product of their GM's. In other words, if there are two variables x and y and there is another variable z, such that z = xy, then GM of x × GM of y

eg. If GM of x is 10 & GM of y is 15, then GM of xy is-

$$GM(xy) = GM \text{ of } x \times GM \text{ of } y$$
$$= 10 \times 15$$
$$= 150 \text{ Ans}$$

- GM of the ratio of two numbers is the ratio of their GM's. In other words, if there are two variables x and y and there is another variable z, such that $z = \frac{x}{y}$ then $GM \text{ of } z = \frac{GM \text{ of } x}{GM \text{ of } y}$

eg. GM of x is 10, GM of y is 15, the GM of x/y is-

$$= \frac{\cancel{10}\,2}{\cancel{15}\,3} = \frac{2}{3} \text{ Ans}$$

- ~~GM of~~ Logarithm of GM for a set of ~~obser~~ observations is the AM of the Logarithm of the observations

$$\log GM = \frac{\Sigma \log x}{n}$$

n → means n

eg. 3, 6, 12 $(3\times6\times12)^{1/3} = 6$	and $\log 6 = 0.782$	From that, AM of log of (3, 6, 12) is same as log 6

log 3 = 0.4471, log 6 = 0.7782, log 12 = 1.076

$$AM = \frac{0.4471 + 0.7782 + 1.076}{3} = 0.7782$$

simple h, jo $(3,6,12)^{1/3}$ ka GM lene me ayega wahi in sab ke log ki value leke AM nikaalne me ayega

Harmonic mean - It is used to calculate the average of speeds.

It is given by the reciprocal of the arithmetic mean of the reciprocal of the observations.

Formulae = $HM = \frac{n}{\Sigma\left(\frac{1}{x}\right)}$

eg. 2,6,10

$$\frac{3}{\frac{1}{2}+\frac{1}{6}+\frac{1}{10}} = \frac{3}{\frac{15+5+3}{30}} = \frac{3}{\frac{23}{30}}$$

$$= \frac{90}{23} \text{ Ans}$$

Continuous / Discrete series of Harmonic mean -

$$HM = \frac{N}{\Sigma\left(\frac{f}{x}\right)} \quad \text{or} \quad \frac{\Sigma f}{\Sigma\left(\frac{f}{x}\right)}$$

eg.

x	2	4	8	16
f	2	3	3	2

$$HM = \frac{2+3+3+2}{\frac{2}{2}+\frac{3}{4}+\frac{3}{8}+\frac{2}{16}} = \frac{10}{\frac{16+12+6+2}{16}} = \frac{10}{\frac{36}{16}}$$

$$\frac{160}{36} = 4.44 \text{ Ans}$$

- If all the values assumed by a variable are constant, say, K, then the Harmonic mean is also K.

eg. 9, 9, 9

$$HM = \frac{N}{\Sigma(1/x)} = \frac{3}{1/9+1/9+1/9} = \frac{3}{3/9} = \frac{27}{3} = 9$$

Ans

- If there are two groups containing n_1 and n_2 observations with respective harmonic means as H_1 and H_2 the combined HM is given by-

$$HM = \frac{n_1+n_2}{\frac{n_1}{H_1}+\frac{n_2}{H_2}}$$

eg. $H_1 = 75$ $H_2 = 65$ $= \frac{15+13}{\frac{15}{75_5}+\frac{13}{65_5}} = \frac{28}{\frac{1}{5}+\frac{1}{5}}$

$N_1 = 15$ $N_2 = 13$

$$= \frac{28}{2/5} = \frac{140}{2} = 70$$

Ans

- The HM of $1, \frac{1}{2}, \frac{1}{3}, \ldots \frac{1}{n}$ is given by -

$$\frac{2}{n+1}$$

- In order to calculate average speed, use Harmonic mean. The HM of two numbers is given by-

$$\frac{2xy}{x+y}$$

eg. exercise set B Q.14 Pg. K.27

$x = 500$ $y = 700$

$$\text{Average speed} = \frac{2xy}{x+y} = \frac{2\times500\times700}{500+700} = \frac{700000}{1200} = 583.33$$

$$\text{Or } HM = \frac{n}{\Sigma(1/x)} = \frac{2}{(1/500+1/700)} = \frac{2}{0.00343}$$

Ans

Relationship between AM, GM, HM

- If ques. asks about constant observation, then = AM = GM = HM
- If ques. asks about distinct observations, then = AM > GM > HM
- If ques. asks about rel. between AM, GM, HM, then = AM ≥ GM ≥ HM

eg. from Exercise set B Q.20 Pg. 14.27
Answer is 15 because AM = GM = HM
15 = 15 = 15

- $GM^2 = AM \times HM$
  - This relationship holds true only for positive observations.

eg. set B Q.7 Pg. 14.26

$GM^2 = AM \times HM$

$GM^2 = 5 \times 3.2$

$GM = \sqrt{16}$

$GM = 4$ Ans

Partition values (Positional Averages)

- These are values such as medians, quartiles, decile and percentiles divides a given ~~series~~ series into equal no. of parts

- median divides a series into 2 equal parts
- Quartile ——— 4 ———
- Decile ——— 10 ———
- Percentile ——— 100 ———

Page No.:
Date: / /

Median-
A median divides a series into two equal parts
eg. 2, 9, 4, 6, 10
First set in Ascending order - compulsory when find median
2, 4, 6, 9, 10
↓
is median because this divide a series into two equal parts

eg. 2, 4, 6, 9, 10, 12
↓
Take AM. $\frac{6+9}{2} = 7.5$ so, 7.5 is median

Rank - This is used to know the place of the no. like 1, 2, 3, 4. so, 1 is in the 1st rank + 2nd is in 2nd rank and so on.
eg. 2, 4, 6, 9, 10
formula of Rank = $\frac{n+1}{2}$ = $\frac{5+1}{2} = \frac{6}{2} = 3$ Ans
↓
- For the series of odd no.s
- For even no.s taking the middle two no.s + add them + divide by 2, their average is median

→ These all points works in individual series

Discrete series of Median -
- Arrange series into ascending order
- Calculate Cumulate frequency (~~cu~~ always less than)
- Calculate the rank of the median as $\frac{n+1}{2}$ (N = total of freq.)
- Check the CF which is just greater than the Rank.
- The value of x corresponding to this CF would be median.

eg.

x	F	CF
10	50	50
$\boxed{20}$	40	$\boxed{90}$ → CF greater than Rank
30	10	100
40	30	130
50	20	150
	150 = N	

median ← 20

Rank = $\frac{N+1}{2} = \frac{150+1}{2} = 75.5$

So Answer is 20 median

Continuous series median -

- Make sure that the series is exclusive
- Arrange the series in ascending order
- Calculate CF
- Calculate rank as $N/2$
- Check the CF which is just greater than Rank
- The class interval corresponding to this cumulative freq. is known as median class interval

Median is calculated by formula

$$\text{Median} = l + \frac{\text{Rank} - c}{f} \times i$$

Here,

- l is the lower limit of the median class interval
- c is the CF of the class interval preceding the median class interval
- f is the frequency of the median class interval.
- i is the class length of the median class interval.

Rank $= \frac{N}{2} = \frac{308}{2} = 154$

eg.

CI	F	CF
349.5 - 369.5	23	23
369.5 - 389.5	38	61
389.5 - 409.5	58	119
409.5 - 429.5	82	201 is just greater than 154
429.5 - 449.5	65	266
449.5 - 469.5	31	297
469.5 - 489.5	11	308
	308 = N	

So Median $= l + \frac{\text{Rank} - c}{f} \times i$

$= 409.5 + \frac{154 - 119}{82} \times 20$

$= 418.036$.

- Mean is affected due to change in scale, as well as due to a change in origin.

- If two variables x and y are related as $y = a + bx$, where a and b are constants, and x_{me} is known, then $y_{me} = a + bx_{me}$

eg. Exercise set B Q.16 Pg. 14.27

median of $x = 20$, median of y is $y = 2x - 3$

$y = a + bx$

$y = -3 + 2x$

$y = -3 + 2 \times 20$

$y = -3 + 40$

$y = 37$ Ans

Imp

- For a set of observations, the sum of absolute deviations is minimum when the deviations are calculated from median.

Quartile-

- A quartile divides a series into 4 equal parts.
- Therefore, there are three quartiles Q_1, Q_2, Q_3

$Q_1 \quad Q_2 \quad Q_3$ → four parts

- Arrange series in ascending order
- Rank of $Q_1 = \frac{n+1}{4}$
- Rank of $Q_2 = 2 \times$ Rank of Q_1
- Rank of $Q_3 = 3 \times$ Rank of Q_1

eg. 50, 56, 65, 75, 75, 80, 82, 90, 120, 130

$N = 10$

Rank $= \frac{n+1}{4} = \frac{10+1}{4} = \frac{11}{4} = 2.75$ ⇒ this also written as $2 + 0.75$

We are finding Q_1 so, 2nd term + 0.75 (3rd term − 2nd term)

$56 + 0.75(65 - 56)$

$56 + 6.75 = 62.75$ Ans

If any doubt about finding Quartile then see down
suppose Rank is 7.7
so, split it = 7 + 0.7
7th term + 0.7 (8th term − 7th term)
specific formula nai bata sakyuki wo unnecessary h yaha se jese samajh rewo bilkul correct h

Quartile's Discrete series-

- Arrange series in ascending order.
- Find cumulative frequency.
- Rank as same as in individual series Q_1, Q_2, Q_3
- Find the cumulative frequency just greater than the Rank
- The observation corresponding to this cumulative frequency is required quartile.

x	2	4	6	8	12	
F	1	2	4	3	2	N = 12
CF	1	3	7	10	12	

CF greater than Rank

Rank of $Q_1 = \frac{N+1}{4} = \frac{12+1}{4} = 3.25$

The observation corresponding to CF is 6 And it is quartile
Ans

Quartile ka continuous series

- Make sure that series is exclusive
- Arrange the series into ascending order.
- Find CF
- Rank of $Q_1 = \frac{N}{4}$, $Q_2 = 2 \times$ Rank of Q_1, $Q_3 = 3 \times$ Rank of Q_1
- Find the cumulative frequency just greater than the Rank
- The observation corresponding to this cumulative frequency is quartile class interval.

$$\text{Quartile } \cancel{\text{Rank}} = l + \frac{\text{Rank} - c}{f} \times i$$

eg. Pg. 14.29 Ex-C Q. 6 (1)

Profit	F	CF
-0.5-9.5	5	5
9.5-19.5	18	23
19.5-29.5	38	61
29.5-39.5	20	81
39.5-49.5	9	90
49.5-59.5	2	92
	92	

$Q_1 = \frac{92}{4} = 23$

$Q_3 = 23 \times 3 = 69$

$Q_3 = l + \frac{R-C}{f} \times i$

$= 29.5 + \frac{69-61}{2\cancel{0}} \times 1\cancel{0}$

$= 33.5$ in thousand

so, $33.5 \times 1000 = 33500$ Ans

Decile-

A decile divides a series into 10 equal parts

- Therefore, there are nine deciles $\Rightarrow D_1, D_2, D_3$ ---- D_9

Decile of individual series-

- Arrange the series in ascending or descending order
- Rank of $D_1 = \frac{n+1}{10}$ as same $D_2 = 2 \times D_1$ ----

eg. 50, 56, 65, 75, 75, 80, 82, 90, 120, 130

$D_1 = \frac{10+1}{10} = \frac{11}{10} = 1.1$

assumed,

$D_7 = 1.1 \times 7 = 7.7 = 7^{th}$ term $+ 0.7(8^{th}$ term $- 7^{th}$ term$)$

$= 82 + 0.7(90-82)$

$82 + 5.6$

$D_7 = 87.6$ Ans

Discrete series - Decile

- Arrange the series in ascending order
- Find CF
- Rank of $D_1 = \frac{N+1}{10}$ ---- Same ----
- Find the CF just greater than Rank.
- The observation corresponding to the CF is required Decile.

eg. same as quartile

Decile of continuous series -

- Make sure that series is exclusive
- Arrange the series in ascending order.
- Find CF
- Rank of $D_1 = \frac{N}{10}$ ———— same ————
- Find CF just greater than Rank.
- The observation corresponding to this CF is decile CI.

Percentile -

- It divides a series into 100 equal parts
- Therefore, there are 99 percentiles $P_1 P_2 P_3$ - —— P_{99}

Individual series $\frac{N+1}{100}$ Discrete series $\frac{N+1}{100}$ Continuous $\frac{N}{100}$

eg. ~~82, 56, 90, 50~~ 50, 56, 65, 75, 75, 80, 82, 90, 120, 130

$P_{82} = ?$

$$P_1 = \frac{10+1}{100} = \frac{11}{100} = 0.11$$

$$P_{82} = 0.11 \times 82 = 9.02$$

$$= 9^{th} + 0.02(10^{th} - 9^{th})$$

$$120 + 0.02(130 - 120)$$

$$120 + 0.2$$

$$= 120.20 \text{ Ans}$$

eg.

Profit	F	CF
-0.5-9.5	5	5
9.5-19.5	18	23
19.5-29.5	38	61
29.5-39.5	20	81
39.5-49.5	9	90
49.5-59.5	2	92
	N = 92	

$$P_1 = \frac{92}{100} = 0.92$$

$$P_{65} = 0.92 \times 65 = 59.8$$

$$P_{65} = 19.5 + \frac{59.8 - 23}{38} \times 10$$

29.184 in 1000

= 29184

Page No.:
Date: / /

Mode-

To value apke data me sabse jaada baar occur kar rhi wali h mode.

Mode of individual series-

It can be calculated by simple observation.

eg. 1) 25, 20, 25, 35, 25, 15, 21, 19

25 is mode

2) 9, 12, 20, 17, 20, 9, 25

20 + 9 is mode

3) 9, 12, 15, 15, 12, 9, 15, 9, 12

There is no mode because full series values are occuring in same quantity

Mode of discrete series-

- Mode of discrete series is the observations with the highest frequency.

eg.

x	F
5	25
7	35
9	45

so Ans is 9. because it occuries 45 times which is highest.

Mode of continuous series-

- make sure that series is exclusive
- Locate the class interval with highest frequency, that is the modal class interval.
- Mode is calculated by using this formula -

$$l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

Here,

l = lower limit of modal class interval

f_1 = frequency

f_0 = ——— of the preceding class interval

f_2 = ——— of succeeding class interval

i = class length / class size

Page No.:
Date: / /

eg. exercise Set-C Q.3(2) Pg. 14.28

~~Profit~~	Profit	CF	F	
~~0-5.5~~	0-5	10	10	
~~4.5-10.5~~	5-10	25	15	f_0
~~10.5-14.5~~	$\boxed{10\text{-}15}$	45	20	f_1
	15-20	55	10	f_2
	20-25	62	7	
	25-30	65	3	

Modal class = 10-15

$f_0 = 15, f_1 = 20$

$f_2 = 10$, $i = 5$

$l = 10$

$$\text{Mode} = l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$$

$$= 10 + \frac{20-15}{2\times20-15-10} \times 5$$

$$= 10 + \frac{5}{15_3} \times 5$$

= 11.66 Ans

In 000 = 11666

- Mode is affected due to change in scale, as well as due to change in origin. Ans

$y = a + bx$

$\bar{y} = a + b\bar{x}$

$y_{med} = a + bx_{med}$

$y_{mo} = a + bx_{mo}$

- If two variables x and y are related as $y = a + bx$, where a and b are constants, and x_{mo} is known then $y_{mo} = a + bx_{mo}$

eg. $y = 2 + 1.50x$

mode of x = 15

So,

$y = 2 + 1.50 \times 15$

$y = 2 + 22.5$

$y = 24.5$ Ans

Relationship between Mean, Median, Mode

Imp • For symmetric data, mean = median = mode

Imp • For skew-symmetric data (Moderately skewed data),

~~mean - median~~ mean - mode = 3(mean - median) or

mode = 3median - 3median - 2mean

- For positively skewed data, mean > median > mode
- For negatively skewed data, mean < median < mode

Measures of Dispersion-
Dispersion means the scatteredness of the data
- Every measures of dispersion has a coefficient and it is always unit free measure.

Range- scatteredness of data
eg. 2, 4, 6, 8, 10, 15, 20
Simple h, humara data 2 se 20 tak phela hua h to humari range 20-2 = 18 hai means hum 2 se 18 jaada tak jaa sakte h
- Range is calculated by substracting the smallest observation of data from largest observation.

Individual series of Range-
- Make sure that series is in ascending order.
- Range = largest obs - smallest obs.
- Coefficient of Range = $\frac{L-S}{L+S} \times 100$

eg. 50, 52, 65, 70, 70, 75, 82, 96 find Range & coefficient
Range = largest obs - smallest obs.
96 - 50 = 46 Ans

Coefficient of Range = $\frac{L-S}{L+S} \times 100 = \frac{96-50}{96+50} \times 100 = \frac{46}{146} \times 100$

Ans = 31.51

Remember that this is unit free measure

(and as same as in discrete series
no need to explanation)

Page No.:
Date: / /

Continuous series of Range

- Make sure that the series is exclusive
- Range = upper most class boundary - lower most class boundary
- Coefficient of Range = $\frac{UMCB - LMCB}{UMCB + LMCB} \times 100$

In Inclusive

ex- 0-9 | 10-19 | 20-29

lower limit upper limit

Exclusive

eg. 0-5-9.5 | 9.5-19.5 | 19.5-29.5

lower boundary upper Boundary

eg. Weight

49.5-54.5
54.5-59.5
59.5-64.5
64.5-69.5
69.5-74.5

Find Range and its coefficient?

Range = UMCB-LMCB
= 74.5 - 49.5
= 25 Ans

Coefficient = $\frac{UMCB-LMCB}{UMCB+LMCB} \times 100$

$= \frac{74.5-49.5}{74.5+49.5} \times 100$

$= \frac{25}{124} \times 100$

= 20.16 Ans

- Dispersion are only effected with change in scale not from origin.
- Range is not affected change in origin.

eg. 2, 4, 6, 8, 10 Range = 10 - 2 = 8 ×10
×10 = 20, 40, 60, 80, 100 Range = 100 - 20 = 80

means scale change karne se Range change hota h

eg. 2, 4, 6, 8, 10 Range = 10 - 2 = 8 same
+2 = 4, 6, 8, 10, 12 Range = 12 - 4 = 8
means origin se Range effect nai hota

Page No.:
Date: / /

- Range remains unaffected due to change in origin but affected in same ratio due to change in scale.

- If there are two variables x and y related to each other as $y = a + bx$ and Range of x is known then Range of y is given by $R_y = |b| \times R_x$

where | | means modulus function

eg. range of x is 2, then range of $-3x + 50$

$$y = \underset{bx}{-3x} + \underset{a}{50}$$

$$y = |-3| \times x$$

$$y = 3 \times 2$$

$$y = 6 \quad \underline{Ans}$$

Mean Deviation –

- Mean deviation is the average of the absolute deviations from an appropriate measure of central tendency.

- This appropriate measure of central tendency could be mean, median or mode

- Coefficient of mean deviation = $\frac{\text{mean deviation about A}}{A} \times 100$
(A means mean)

- Here, A is the appropriate measure of central Tendency.

mean deviation means – deviation ka mean
difference ka mean

eg. 1, 2, 3, 4, 5, 6, 7, 8, 9
what is coefficient of mean deviation about mean?

mean = $\frac{45}{9} = 5$

Coefficient of M.D. = $\frac{\text{MD About A}}{A} \times 100$

Mean deviation = $\frac{20}{9}$

$$= \frac{20/9}{5} \times 100 = 44.44 \quad \underline{Ans}$$

individual series-

mean deviation $= \frac{\Sigma |x-\bar{x}|}{n}$

Discrete series ka mean deviation-

$$\frac{\Sigma f |x-\bar{x}|}{N}$$

- Mean deviation remains unaffected due to change of origin but affted in the same ratio due to change in scale.
- If there are two variables x and y related to each other as $y = a+bx$, and mean deviation of x is known, the mean deviation of y is given by $MD_y = |b| \times MD_x$
- Mean deviation is minimum when the deviations are taken from median

Standard deviation

- It is the square root of variance.

MD = Absolute deviation ka mean

variance : Deviation ke squares ka mean

e.g. 2,3,4,5 $\quad \bar{x} = \frac{14}{4} = 3.5$

$$\text{variance} = \frac{(3.5-2)^2 + (3.5-3)^2 + (3.5-4)^2 + (3.5-5)^2}{4}$$

$$= 1.25$$

- Standard deviation is the square root of variance.
- Variance is the average of square of deviations from mean.

- Coefficient of variation $= \frac{SD}{AM} \times 100$

$$SD = \sqrt{\frac{\Sigma(x-\bar{x})^2}{n}} \quad \text{or} \quad SD = \sqrt{\frac{\Sigma x^2}{n} - (\bar{x})^2}$$

Discreate series / Continuous series

$$SD = \sqrt{\frac{\Sigma f(x-\bar{x})^2}{N}} \quad \text{or} \quad SD = \sqrt{\frac{\Sigma f x^2}{N} - (\bar{x})^2}$$

- If all the observation assumed by a variable are constant, standard deviation is zero. This is true for Range, mean deviation and Quartile deviation.

- Standard deviation of first n natural no. is calculated as-

$$SD = \sqrt{\frac{n^2-1}{12}}$$

- Standard deviation of only two no's is given by $\frac{|a-b|}{2}$

- Standard deviation remains unaffected due to a change of origin but affected in the same ratio due to a change in scale. If there are two variables x and y related to each other as $y = a + bx$, + standard deviation of x is known, then standard deviation of y is given by $SD_y = |b| \times SD_x$

$$\text{Variance of } y = (SD_y)^2$$

- If there are two groups containing n_1 and n_2 observations with the respective means as $\bar{x}_1$ and $\bar{x}_2$ and standard as s_1 and s_2, then the combined standard deviation is given by:

$$SD = \sqrt{\frac{n_1 s_1^2 + n_2 s_2^2 + n_1 d_1^2 + n_2 d_2^2}{n_1 + n_2}}$$

Here,

- $d_1 = \bar{x}_1 - \bar{x}$
- $d_2 = \bar{x}_2 - \bar{x}$

Page No.:
Date: / /

Quartile Deviation -

- Quartile deviation = $\frac{Q_3 - Q_1}{2}$

- Coefficient of Quartile deviation = $\frac{Q_3 - Q_1}{Q_3 + Q_1} \times 100$

- In measure of dispersion Quartile deviation is best for Open ended data

- Most appropriate measures of central tendency is median for a open ended data or classification.