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eg: find model value of:

X: 50 60 90 80 100 80 40 50 80 150

Here,

80 Repeats maximum number of times, so

mode = 80 Ans.

2. find mode value of.

x:	50	80	60	30	100	150
f:	7	9	10	8	4	6

Here: Maximum frequency value is 10 so

mode = 60 Ans.

Find the value of mode.

Class	0-9	10-29	30-39	50-69
f	6	16	12	20

Soln:-

Calculation of mode:

Class	f	
-0.5 - 9.5	6	
9.5 - 10.5	8	
19.5 - 29.5	8	f_0
29.5 - 39.5	12	f_1
39.5 - 49.5	10	f_2
49.5 - 59.5	10	
59.5 - 69.5	10	

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Here,

Maximum frequency is 12 so middle class = 29.5 - 39.5

Here,

$l = 29.5$, $f_1 = 12$, $f_0 = 8$ $f_2 = 10$ $h = 10$

we have,

$$M_0 = l + \frac{f_1 - f_2}{2f_1 - f_0 - f_2} \times h$$

$$= 29.5 + \frac{12-8}{2\times 12 - 8 - 10} \times 10$$

$$= 29.5 + \frac{40}{6}$$

$$\boxed{M_0 = 36.167}$$

Ex:- Find mode value of:

Class	0-18	18-20	20-30	30-40	40-50	50-60
f	7	9	10	10	6	4

soln:-

This is Bi-model case so we find mode by using formula,

M_0 = 3 median - 2 mean

Calculation table.

Class	f	mid-value	C.f	fx
0-10	7	5	7	35
10-20	9	15	16	135
20-30	10	25	26	250
30-40	10	35	36	350
40-50	6	45	42	270
50-60	4	55	46	220
	N=46			$\Sigma fx = 1260$

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Mean $(\bar{x}) = \frac{\Sigma fx}{N} = \frac{1260}{46} = 27.39$

for median :. position of median class

The c.f just greater than 23 is 26 so
class = 20-30
$l = 20$, $f = 10$, $c.f = 16$, $h = 10$, $\frac{N}{2} = 23$

$$M_d = l + \frac{\frac{N}{2} - c.f}{f} \times h$$

$$= 20 + \frac{23-16}{\cancel{10}} \times \cancel{10}$$

$$= 20 + 7$$
$$= 27$$

We know that,

$$M_o = 3M_d - 2\bar{x}$$
$$= 3 \times 27 - 2 \times (27.39)$$
$$= 81 - 54.78$$
$$= 26.22 \text{ Ans.}$$

location of mode graphically.

class	0-10	10-20	20-30	30-40	40-50	50-60
f	7	10	12	15	14	5

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Geometric mean: To find the average percentage we use geometric mean. It is denoted by G.M and is given by,

$$G.M = \text{Antilog}\left(\frac{\Sigma \log x}{n}\right) \text{ — for individual series.}$$

$$= \text{Antilog}\left(\frac{\Sigma f \log x}{N}\right) \text{ — for discrete \& continuous series.}$$

For eg: find G.M of x: 50 60 40 80 100 150 300

Soln:-

Calculation table:

x	$\log x$
50	1.69
60	1.77
40	1.6
80	1.9
100	2
150	2.17
300	2.47
~~n=7~~	$\Sigma \log x = 13.6$

$n = 7$

we have,

$$G.M = \text{Antilog}\left[\frac{\Sigma \log x}{n}\right] = \text{Antilog}\left[\frac{13.6}{7}\right]$$

$$= 0.288$$

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Harmonic mean:

To find the average of speed velocity we use harmonic mean. It is denoted by H.M and is given by,

$$H.M = \frac{n}{\Sigma \frac{1}{x}} \quad \text{– for individual series}$$

$$= \frac{N}{\Sigma f \cdot \frac{1}{x}} \quad \text{– for discrete \& continuous series}$$

Calculate H.M of x: 10 15 20 40 60 80 100

Soln:-

Calculation table.

x	$\frac{1}{x}$
10	0.1
15	0.06
20	0.05
40	0.025
60	0.016
80	0.0125
100	0.01
	$\Sigma \frac{1}{x} = 0.2735$

$n = 7.$

$$H.M = \frac{n}{\Sigma \frac{1}{x}}$$

$$= \frac{7}{0.2735} = 25.59$$

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For discrete series x.

Soln:

Calculation table.

x	f	$\frac{f}{x}$

$$H.M = \frac{N}{\Sigma \frac{f}{x}}$$

For continuous series :

Soln:

Calculation table.

class	f	mid-value (x)	$\frac{f}{x}$

we have,

$$H.M = \frac{N}{\Sigma \frac{f}{x}}$$

Measures of dispersion:

Dispersion mean scatterness ~~scarteness~~ of the data from central value various measures of dispersion are:

1) Range (R)
2) Semi- interquartile range or quartile deviation
3) Mean - deviation (M.D)
4) Standard deviation (SD or σ).

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1) Range:

It is the difference between largest value (l) and smallest value (s)

$\therefore$ Range $= l - s$

~~coeffient~~ coefficient of Range $= \frac{l-s}{l+s}$

For eg:

Find range and coefficient of range of

x: 50, 90, 80, 150, 60, 40, 100

Soln:-

Here,

maximum Value (l) := 150

Smallest value (s) := 40

Range (R) $= l - s$

$= 150 - 40$

$= 110$

Coefficient of range $= \frac{l-s}{l+s}$

$= \frac{150-40}{150+40}$

$= \frac{110}{190}$

$= 0.57$

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2. Find range and coefficient of range.

x :	50	60	100	120	150	40
f :	10	9	10	8	9	

Soln:

largest item $(L) = 150$
Smallest $(S) = 40$

$\therefore$ Range $= L - S$
$= 150 - 40$
$= 110$

Coefficient of range $= \frac{L-S}{L+S} = \frac{150-40}{150+40}$
$= \frac{110}{190} = 0.57$

Calculate the range and coefficient.

Class :	10-20	20-30	30-40	40-50	50-60
f :	7	9	12	8	7

Soln:

largest value (L) = upper limit of highest class
$= 60$

Smallest value (S) = lower limit of smallest class
$= 10$

we have,

$R = L - S$
$= 60 - 10 = 50$

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Coefficient of range $= \frac{L-S}{L+S} = \frac{60-10}{60+10} = \frac{50}{70} = 0.71$

Quartile deviation:

The difference between third quartile (Q_3) and (Q_1) first quartile (Q_1) is called interquartile range and half of inter quartile range is called inter quartile range or quartile deviation.

It is denoted by Q.D

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

Coefficient of quartile deviation $= \frac{Q_3 - Q_1}{Q_3 + Q_1}$

eg. 1. Find Q.D and its coefficient of

x: 40 30 60 80 90 150 120

soln:

Arranging the data in ascending order.

30, 40, 60, 80, 90 120, 150

$n = 7$

for Q_1 position of $Q_1 = \left(\frac{n+1}{4}\right) = \left(\frac{7+1}{4}\right) = \frac{8}{4} = 2$

Q_1 = value of 2nd item

$= 40$

for Q_3 position of $Q_3 = \frac{3(n+1)}{4} = \frac{3(7+1)}{4} = \frac{3 \times 8}{4}$

$= 6$

Q_3 = value of 6th item $= 120$

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

$$= \frac{120-40}{2} = \frac{80}{2} = 40$$

$$\text{Coefficient of } Q.D = \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{120-40}{120+40}$$

$$= \frac{80}{160} = 0.5$$

2. Find Q.D and its coefficient of :

x:	40	30	60	80	90	150	120
f:	5	7	9	8	6	5	9

Soln:-

Calculation of Q_1 & Q_3

x	f	c.f
~~30~~ 40	7	7
40	5	12
60	9	21
80	8	29
90	6	35
120	9	44
150	5	49

N = 49.

For Q_1

$$\text{Position of } Q_1 = \frac{N+1}{4} = \frac{49+1}{4} = 12.5$$

~~for Q.~~ $\therefore Q_1 = 60$

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For Q_3, position of $Q_3 = 3\left(\frac{N+1}{4}\right) = \frac{3 \times 50}{4} = \frac{150}{4}$

$= 37.5$

$\therefore Q_3 = 120$

we know that,

$Q.D = \frac{Q_3 - Q_1}{2} = \frac{120-60}{2} = \frac{60}{2} = 30$

Coefficient of $Q.D = \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{120-60}{120+60} = \frac{60}{180}$

$= 0.33$

3. Find Q.D and its coefficient of:

Class :	0-10	10-20	20-30	30-40	40-50
f	7	9	10	8	6

Calculation table.

Class	f	c.f
0-10	7	7
10-20	9	16
20-30	10	26
30-40	8	34
40-50	6	40
	$N = 40$	

For Q_1.

Position of $Q_1 = \frac{N}{4} = \frac{40}{4} = 10$

Q_1. class = 10-20

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$l = 10,\ f = 9 \quad c.f = 7,\ h = 10$

$$Q_1 = \frac{l + \frac{N}{4} - c.f}{f} \times h$$

$$= \frac{10 + \frac{10 - 7}{9}}{9} \times 10$$

$$Q_1 = 13.33$$

for Q_3 = Position of Q_3 class $= \frac{3N}{4} = \frac{3 \times 40}{4}$

$= 30$

Q_3 class $= 30 - 40$

$l = 30,\ f = 8,\ c.f = 26,\ h = 10$

$$\frac{3N}{4} = 30$$

$$Q_3 = l + \frac{\frac{3N}{4} - c.f}{f} \times h$$

$$= 30 + \frac{30 - 26}{8} \times 10$$

$$= 30 + 5$$

$$= 35$$

$$Q.D = \frac{Q_3 - Q_1}{2} = \frac{35 - 13.33}{2}$$

$$= 10.835$$

$$\text{coef. of } Q.D = \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{35 - 13.33}{35 + 13.33}$$

$$= \frac{21.67}{48.33}$$

$$= 0.44$$

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Measure of mean deviation:

It is also known as absolute deviation and can be calculated either from mean or median or mode.

Calculation of mean deviation.

1. For individual series:

~~Median~~ Mean deviation from mean $(\bar{x}) = \frac{\Sigma |x - \bar{x}|}{n}$

Mean deviation from median

Mean deviation from mode

- For discrete and continuous series

Mean deviation from mean $= \frac{\Sigma f |x - \bar{x}|}{N}$

Mean deviation from median $= \frac{\Sigma f |x - m_d|}{N}$

Mean deviation from mode $= \frac{\Sigma f |x - m_o|}{N}$

where x = mid-value incase of continuous series.

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For eg:

Calculate mean deviation from mean median and mode of

x: 40 30 20 80 60 100 120 80

Soln:

Arranging the ~~Ean~~ data in ascending order.

20 30 40 60 80 80 100 120

$n = 8$

$$\bar{x} = \frac{\Sigma x}{n} = \frac{20+30+40+60+80+80+100+120}{8}$$

$$= \frac{530}{8}$$

$$= 66.25$$

For median

position of median $= \frac{(n+1)}{2}^{th}$ item $= \frac{8+1}{2} = 4.5^{th}$ item

$$\therefore Md = \frac{4^{th}+5^{th}}{2} = \frac{60+80}{2} = \frac{140}{2} = 70$$

mode = maximum repeated value.

~~Gatku~~

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Calculation table.

x	$\lvert x-\bar{x}\rvert$	$x-m_d$	$x-m_o$
~~40~~	$\lvert x-66.25\rvert$	$\lvert x-70\rvert$	$\lvert x-80\rvert$
30	36.25	40	50
20	46.25	50	60.
80	13.75.	10	0
60	6.25	10	20
100	33.75	30	20
120	53.75	50	40
80	13.75	10	0
40	26.25	30	40
	$\Sigma\lvert x-\bar{x}\rvert = 230$	$\Sigma(x-m_d) = 230$	$\Sigma(x-m_o) = 230$

We know that.

M.D from mean $(\bar{x}) = \frac{\Sigma\lvert x-\bar{x}\rvert}{N} = \frac{230}{8} = 28.75$

M.D from median $(m_d) = \frac{\Sigma(x-m_d)}{n} = \frac{230}{8} = 28.75$

M.D from mode $(m_o) = \frac{\Sigma\lvert x-m_o\rvert}{n} = \frac{230}{8} = 28.75$

Note :-

coefficient of M.D from $\bar{x}$ = $\frac{\text{M.D from } \bar{x}}{\bar{x}}$

coefficient of M.D from m_d = $\frac{\text{M.D from } m_d}{m_d}$

coefficient of M.D from m_o = $\frac{\text{M.D from } m_o}{M_o}$

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Coefficient of M.D from $\bar{x}$ = $\frac{\text{M.D from } \bar{x}}{\bar{x}}$

$= \frac{28.75}{66.25}$

$= 0.43$

Coeff. of M.D from median = $\frac{\text{M.D from } M_d}{M_d}$

$= 0.43$

Coeff. of M.D from M_o = $\frac{\text{M.D from } M_o}{M_o}$

$= 0.43$

For discrete series:-

Q: Calculate mean deviation from mean median and mode of.

X:	20	80	60	30	90	100	120
f:	7	8	4	6	6	5	4

Also calculate their respective coefficients.

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Standard deviation :

Standard deviation is the positive square root of arithmetic mean of sum of square deviation taken from arithmetic mean. It is denoted by σ and is given by,

$$S.d\ (\sigma) = \sqrt{\frac{\Sigma (x-\bar{x})^2}{n}} \quad \text{for Individual series}$$

$$= \sqrt{\frac{\Sigma x^2}{n} - \frac{\Sigma \bar{x}^2}{n}}$$

$$S.d\ (\sigma) = \sqrt{\frac{\Sigma f (x-\bar{x})^2}{N}} \quad \text{for descrete and continuous series}$$

$$= \sqrt{\frac{\Sigma fx}{N} - \frac{\Sigma f\bar{x}^2}{N}}$$

$$\text{Coefficient of s.d} = \frac{\sigma}{\bar{x}}$$

$$\text{Coefficient of variation (C.V)} = \frac{\sigma}{\bar{x}} \times 100$$

Variance = square of s.d

$\therefore$ Variance $= \sigma^2$

Combine standard deviation:

let n_1 and n_2 be the number of observation with means and standard deviations $\bar{x}_1$ & $\bar{x}_2$ and σ_1 & σ_2 respectively. Then combined s.d is denoted by σ_{12} and is given by.

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Combined s.d $(\sigma_{12}) = \sqrt{\dfrac{n_1\sigma_1^2 + n_2\sigma_2^2 + n_1 d_1^2 + n_2 d_2^2}{n_1 + n_2}}$

$$\sigma_{12} = \frac{n_1(\sigma_1^2 + d_1^2) + n_2(\sigma_2^2 + d_2^2)}{n_1 + n_2}$$

where $d_1 = \bar{x}_1 - \bar{x}_{12}$.
$d_2 = \bar{x}_2 - \bar{x}_{12}$

Foreg: Calculate S.d variable and coefficient of variation C.V of:

x: 10 60 50 40 20 30 70

x	x^2
10	100
60	3600
50	2500
40	1600
20	400
30	900
70	4900
$\Sigma x = 280$	$\Sigma x^2 = 14000$

Mean $= \dfrac{\Sigma x}{n} = \dfrac{280}{7} = 40$

S.d $(\sigma) = \sqrt{\dfrac{\Sigma x^2}{n} - \dfrac{\Sigma \bar{x}^2}{n}}$

$= \sqrt{\dfrac{14000}{7} - \dfrac{280\,40^2}{7}}$

$= \sqrt{2000 -}$

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$$\text{S.d } (\sigma) = \sqrt{\frac{\Sigma (x-\bar{x})^2}{n}}$$

$$\text{S.d } (\sigma) = \sqrt{\frac{\Sigma x^2}{n} - \frac{\Sigma \bar{x}^2}{n}}$$

$$= \sqrt{\frac{14000}{7} - \left(\frac{280}{7}\right)^2}$$

$$= \sqrt{2000 - 1600}$$

$$= \sqrt{400}$$

$$= 20.$$

$$\text{Variance} = \sigma^2$$

$$= (20)^2$$

$$= 400$$

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

$$= \frac{20}{40} \times 100$$

$$= 50\%$$

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for eg:

x :	10	60	50	40	20	30	~~40~~ 70
f :	5	6	3	10	8	4	9

Calculation table:

x	f	fx	$fx^2 = fx \cdot x$
10	5	50	500
60	6	360	21600
50	3	150	7500
40	10	400	16000
20	8	160	3200
30	4	120	3600
70	9	630	44100
	$N = 45$	$\Sigma fx = 1870$	$\Sigma fx^2 = 96500$

We know that

$$\text{S.d } (\sigma) = \sqrt{\frac{\Sigma fx^2}{N} - \left(\frac{\Sigma fx}{N}\right)^2}$$

$$= \sqrt{\frac{96500}{45} - \left(\frac{1870}{45}\right)^2}$$

$$= \sqrt{2144.44 - 1726.86}$$

$$= \sqrt{417.57}$$

$$= 20.43$$

Variance = ~~20.43~~ $\sigma^2 = 20.43^2$

$= 417.57$

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

$$\bar{x} = \frac{\Sigma fx}{n} = \frac{1870}{45} = \cancel{267.14}\ 41.55$$

$$= \frac{20.43}{41.55} \times 100$$

$$= 49.16\%$$

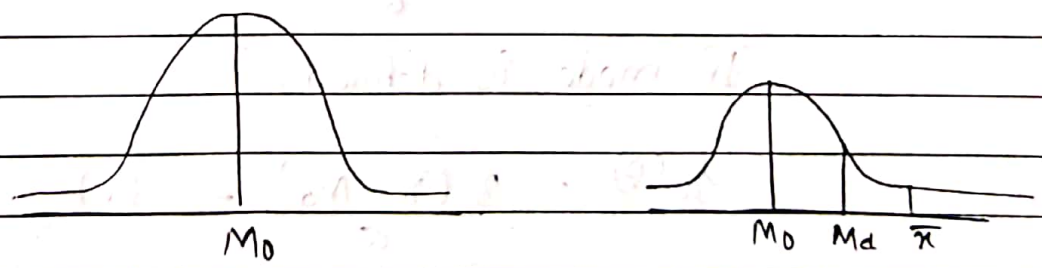
Measure of skewness moments.

Skewness:-

Skewness is the lack of symmetry.

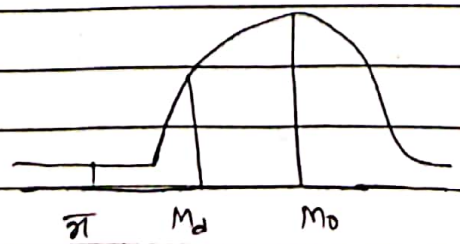
Types of skewness

1) No skewness (symmetrical curve)
2) Positive skewness (Right skewed curve)
3) Negative skewness (left skewed curve)



$(M_0 = M_d = \bar{x})$

No skewed (symmetrical) (Right skewed curve)



$(\bar{x} < M_d < \bar{x})$

left skewed (Negative

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Methods of measuring skewness

1) Karl-pearason's coefficient of skewness
2) Bowley's coefficient of skewness
3) Measure of skewness based on moments
4) ~~Kart~~ Kelly's measure of skewness.

1) Karl-pearason's measure of skewness:

Skewness based on mean, median, mode and S.D

Coefficient of skewness by karlpearasson's is denoted by $S_k^{(P)}$ and is given as,

$$\text{Skewness} = \left.\begin{array}{l}\text{Mean} - M_o \\ \text{Mean} - \text{median}\end{array}\right\} \text{absolute measure}$$

Relative measure:

Coefficient of skewness by karlpearason's

$$S_k^{(P)} = \frac{\bar{x} - M_o}{\sigma} \quad \text{—— (I)}$$

If mode is defined,

$$S_k^{(P)} = \frac{3(\bar{x} - M_d)}{\sigma} \quad \text{— (II)}$$

If we use formula first, $S_k^{(P)}$ lies between -1 to +1 and if we use formula II $S_k^{(P)}$ lies between -3 to +3.

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2) Bowley's measure of skewness.

Skewness based on quartiles:

Skewness $= Q_3 + Q_1 - 2M_d$

Bowley's coefficient of skewness is denoted by $Sk^{(B)}$ and is given as

$$Sk^{(B)} = \frac{Q_3 + Q_1 - 2M_d}{Q_3 - Q_1}$$

($Sk^{(B)}$ lies between -1 to $+1$)

Kelly's measure of skewness:-

Skewness based on deciles and percentiles):

$$\text{Skewness} = \frac{D_9 + D_1 - 2D_5}{\cancel{P_9}}$$

$$= P_{90} + P_{10} - 2P_{50}$$

Kelly's coefficient of skewness is denoted by $Sk^{(K)}$ and is given by,

$$Sk^{(K)} = \frac{D_9 + D_1 - 2D_5}{D_9 - D_1}$$

$$= \frac{P_{90} + P_{10} - 2P_{50}}{P_{90} - P_{10}}$$

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Steam and ~~leav~~ leaf.

Construct the steam and leaf plot for the following.

23, 60 79 32 57 74 52 70 82 36 80 77 81 95 41 65 92.

Steam	leaves	frequency.
2	3	1
3	2, 6	2
4	1	1
5	2, 7	2
6	0, 5	2
7	0, 4, 7, 9	4
8	0, 1, 2	3
9	2, 5	2

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Stem leaf Display

Construct the stem and leaf plot for the following.

23, 60 79 32 57 74 52 70 82 36 80 77 81 95
41, 65, 92

Steam	leaves	frequency
2	3	1
3	2, 6	2
4	1	1
5	2 7	2
6	0, 5	2
7	0, 4, 7, 9	4
8	0, 1, 2	3
9	2, 5	2

Q.No.
41. The first four moment about an arbitrary origin of a frequency distribution are -2, 14, -20, 50. Find first four central moments.

Soln:

Given,

first four raw moments,

$\mu_1' = -2$

$\mu_2' = 14$

$\mu_3' = -20$

$\mu_4' = 50$

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First four central moments = ?

$\mu_1 = \mu_1' - \mu_1' = 0$

$\mu_2 = \mu_2' - (\mu_1')^2$

$= 14 - 4$

$= 10$

$\mu_3 = \mu_3' - 3\mu_2' \cdot \mu_1' + 2(\mu_1')^3$

$= -20 - 3(14).(-2) + 2(-2)^3$

$= -20 + 84 - 16$

$= 48$

$\mu_4 = \mu_4' - 4\mu_3'\mu_1' + 6\mu_2'\mu_1'^2 - 3(\mu_1')^4$

$= 50 - 4(-20)(-2) + 6(14).(-2)^2 - 3(-2)^4$

$= 50 - 160 + 336 - 48$

$= 178$

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44. If the S.D of a symmetrical distribution is 11, what must be the value of fourth moment about the mean in order that the distribution be (i) mesokurtic (ii) Platykurtic (iii) lepokurtic.

Soln:

$S.D = (\sigma) = 11$

$\mu_4 = ?$

i) For Mesokurtic condition,

$\beta_2 = 3$

$\frac{\mu_4}{\mu_2^2} = 3$

$\mu_2 = \sigma^2$

$\mu_2 = 11^2$

$\therefore \mu_2 = 121$

Now,

$\frac{\mu_4}{\mu_2^2} = 3$

$\frac{\mu_4}{(121)^2} = 3$

$\mu_4 = 43923$

(ii) For platykortic condition.

$\beta_2 < 3$

$\frac{\mu_4}{\mu_2^2} < 3$

$\frac{\mu_4}{(121)^2} < 3$

$\mu_4 < 3 \times (121)^2$

$\mu_4 < 43923$

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For Leptokurtic.

$\beta_2 > 3$

$\frac{\mu_4}{\mu_2^2} > 3$

$\frac{\mu_4}{(121)^2} > 3$

$\mu_4 > 43923$

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47. Compute the measure of central tendency, dispersion, skewness and kurtosis in computer are given below from following distribution.

Wage(Rs)	Below 97	98-102	103-107	108-112	113-117	118-122	123-127	128 and above
No of employee	2	5	12	17	14	6	3	1.

Wage(Rs)	No. of employee (f)	Mid value f(x)	$d' = \frac{x-A}{h}$ $\frac{x-110}{5}$	fd'	fd'^2	fd'^3	fd'^4
93-97	2	95	-3	-6	18	-54	162
98-102	5	100	-2	-10	20	-40	80
103-107	12	105	-1	-12	12	-12	12
108-112	17	105	0	0	0	0	0
113-117	14	110	1	14	14	14	14
118-122	6	115	2	12	24	48	96
123-127	3	120	3	9	27	81	243
128-132	1	125	4	4	16	64	256
	N = 60			$\Sigma fd' = 11$	$\Sigma fd'^2 = 131$	$\Sigma fd'^3 = 101$	$\Sigma fd'^4 = 863$.

First four raw moment are.

$$\mu_1' = \frac{\Sigma fd'}{N} \times h = \frac{11}{60} \times 5 = 0.92$$

$$\mu_2^2 = \frac{\Sigma fd'^2}{N} \times h^2 = \frac{131}{60} \times 5^2 = 54.58$$

$$\mu_3^3 = \frac{\Sigma fd'^3}{N} \times h^3 = \frac{101}{60} \times 5^3 = 210.42$$

$$\mu_4^4 = \frac{\Sigma fd'^4}{N} \times h^4 = \frac{863}{60} \times 5^4 = 8989.58.$$

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Measure of central tendency $(\bar{x}) = A + \mu_1' = 110 + 0.92$

$\bar{x} = 110.92$

First four central moments are,

$\mu_1 = \mu_1' - \mu_1' = 0$

$\mu_2 = \mu_2' - (\mu_1')^2 = 54.58 - (0.92)^2 = 53.73$

$\mu_3 = \mu_3' - 3\mu_2'\mu_1' + 2(\mu_1')^3$

$= 210.42 - 3 \times 54.58 \times 0.92 + 2(0.92)^3$

$= 61.34.$

$\mu_4 = \mu_4' - 4\mu_3'\mu_1' + 6\mu_2'\mu_1'^2 - 3(\mu_1')^4$

$= 8989.58 - 4 \times 210.42 \times 0.92 + 6 \times 54.58 \times (0.92)^2 - 3 \times (0.92)^4$

$= 8490.07.$

Measure of dispersion $(\sigma) = \sqrt{\mu_2} = \sqrt{53.73} = 7.33$

Measure of skewness $(\beta_1) = \frac{\mu_3^2}{\mu_2^3} = \frac{(61.34)^2}{(53.73)^3} = 0.02$

Measure of kurtosis $(\beta_2) = \frac{\mu_4}{\mu_2^2} = \frac{8490.07}{(53.73)^2} = 2.94$

Conclusion,

Hence the distribution is positively skewed and platykurtosis.

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