Measure of central tendency

All the values tend to cluster in the central part of the data it is called measure of central tendency.
It also indicates the location or position of the data so it is also called measure of location or position.

Average

A single value in the centre of the whole given data it is called an average.

Desirable properties of a an ideal Average

i) It should be rigidly defined.
ii) It should be based on all the observations.
iii) It should be easy to calculate and simple to understand.
iv) It should not be unduly affected by extreme values.
v) It should be capable of further mathematical treatment.
vi) It should have sampling stability.

Types of Average

i)Arithmetic mean
ii) Geometric mean
iii) Harmonic mean
iv) Mode
v) Median (Quartiles, Deciles, Percentiles)

Arithmetic mean

The Arithmetic mean or simply mean of the series x_1, x_2, x_3, …, xi,…,x_n is defined as dividing the sum of all the values by their numbers. It is denoted by $\bar{x}$ and read as x-bar.
Or
Sum of all the values dividing by their numbers. It is called A.M and denoted by $\bar{x}$ and read as x-bar.

Method of calculation

Un-group data | **Group data**

i) Simple method/D

$$\bar{x} = \frac{\sum x}{n} \quad sample\ mean \qquad\qquad \bar{X} = \frac{\sum fx}{\sum f}$$

OR

$$u = \frac{\sum X}{N} \quad poplation\ mean$$

ii) Short-cut method/Change of origin method

$$\bar{x} = A + \frac{\sum D}{n} \qquad\qquad \bar{x} = A + \frac{\sum fD}{\sum f}$$

Where
$D = X - A$
$A = Arbitrary$

iii) Coding method/ Change of origin and scale method

$$\bar{x} = A + \frac{\sum u}{n} \times h \qquad\qquad \bar{x} = A + \frac{\sum fu}{\sum f} \times h$$

Where

$$u = \frac{X - A}{h}$$

$A = Arbitrary$
$h = class\ interval$

Merits of Arithmetic mean

i) It should be rigorously defined.
ii) It is based on all the observations.
iii) It is easy to calculate and simple to understand.
iv) It provides a good basis for comparison.
v) It is capable of further mathematical treatment.
vi) It is based on a mathematical formula.
vii) It is best average for less dispersion type of data.
viii) It Can be calculated if any value is zero or –ve.
ix) It stable in repeated sampling experiments.

Demerits of Arithmetic mean

i) It is affected by extreme values.
ii) Cannot be calculated from open-end table.
iii) Not best average for rates and ratios.
iv) Not best average for skewed type data.
v) Cannot be calculated if any value is missing.
vi) Cannot be calculated by graphically.
vii) Sometimes strange answer.
viii) Not true average.
ix) Give weights to large values.

Example.1: Find the mean from following ungroup data by simple method.
1,5,1,0,2,5,7,4,5,3,5,4,4,7,8,9,10,9,3,5,3,6,4,8,5,6,3,4,2,3

Solution: $\bar{x}=\dfrac{\sum x}{n}=\dfrac{141}{30}=4.7$

Example.2: Find the mean from following ungroup data by short-cut and coding method.
5,10,15,20,25
Solution:

X	D=X-A	U=$\dfrac{X-A}{h}$
5	-10	-2
10	-5	-1
15	0	0
20	5	1
25	10	2
$\sum x$=75	$\sum D=0$	$\sum U=0$

i) $\bar{x}=\dfrac{\sum x}{n}=\dfrac{75}{5}=15$

ii) $\bar{x}=A+\dfrac{\sum D}{n}=15+\dfrac{0}{5}=15$

iii) $\bar{x}=A+\dfrac{\sum U}{n}\times h=15+\dfrac{0}{5}\times 5=15$

Example.3: Find A.M from the following data by 1) Direct ii) Short-cut iii) Coding method

Classes:	10-14	15-19	20-24	25-29	30-64
Frequencies:	2	4	6	8	3

Classes	f	x	fx	D	fD	U	fu
10-14	2	12	24	-10	-20	-2	-4
15-19	4	17	68	-5	-20	-1	-4
20-24	6	22	132	0	0	0	0
25-29	8	27	216	5	40	1	8
30-34	3	32	96	10	30	2	6
Total	23		536	0	30	0	6

$\bar{x}=\dfrac{\sum fx}{\sum f}=23.30$

$\bar{x}=A+\dfrac{\sum fD}{\sum f}=22+\dfrac{30}{23}=23.30$

$\bar{x}=A+\dfrac{\sum fU}{\sum f}\times h=22+\dfrac{6}{23}\times 5=23.30$

Properties of Arithmetic mean

The Arithmetic mean has the following four properties:

i)The sum of the deviations of the observations X's from $\overline{X}$ is always equal to zero.

Or

Sum of deviation from mean always equal to zero.

i.e. $\sum_{i=1}^{n}\left(X-\overline{X}\right)=0$

Proof: L.H.S $=\sum_{i=1}^{n}\left(X-\overline{X}\right)$

$$=\sum X-\sum \overline{X}$$

Where $\overline{X}=\frac{\sum X}{n}$

$$=\sum X-n\overline{X}$$

$$=\sum X-\sum X$$

$$=0$$

$=$ R.H.S

ii) The sum of squared deviations of the observations X's from $\overline{X}$ is less than or equal to the sum of squared deviations X's from 'a'.

Or

Sum of square deviation from mea is minimum or least.

i.e. $\sum_{i=1}^{n}\left(X-a\right)^2\le\sum_{i=1}^{n}\left(X-\overline{X}\right)^2$

Proof:

let 'a' be an arbitrary origin

$$\sum\left(X_i-a\right)^2=\sum\left[\left(X_i-\overline{X}\right)+\left(\overline{X}-a\right)\right]^2$$
$$=\sum\left[\left(X-\overline{X}\right)^2+\left(\overline{X}-a\right)^2+2\left(\overline{X}-a\right)\left(X_i-\overline{X}\right)\right]$$
$$=\sum\left(X_i-\overline{X}\right)^2+\sum\left(\overline{X}-a\right)^2+2\left(\overline{X}-a\right)\sum\left(X_i-\overline{X}\right)$$

Where $\sum_{i=1}^{n}\left(X-\overline{X}\right)=0$

$$=\sum\left(X_i-\overline{X}\right)^2+\sum\left(\overline{X}-a\right)^2+2\left(\overline{X}-a\right)(0)$$
$$=\sum\left(X_i-\overline{X}\right)^2+\sum\left(\overline{X}-a\right)^2+0$$
$$=\sum\left(X_i-\overline{X}\right)^2+n\left(\overline{X}-a\right)^2$$

Clearly $\sum\left(X_I-a\right)^2>\sum\left(X_i-\overline{X}\right)^2$ by the amount $n\sum\left(\overline{X}-a\right)^2$ equality holds when $\overline{X}=a$

Hence $\sum\left(X_i-\overline{X}\right)^2$ is always less then $\sum\left(X_I-a\right)^2$ if $a\ne\overline{X}$

This property is called minimal property of Arithmetic mean

iii) **(Combined mean)** If $\overline{X}_1,\overline{X}_2,\overline{X}_3,\ldots,\overline{X}_i,\ldots,\overline{X}_k$ are means of K subgroups data having frequencies $n_1,n_2,n_3,\ldots,n_i,\ldots,n_k$ where i=1,2,3,…,k and $\sum_{i=1}^{k}n=n$ then combined mean $\overline{X}_c$ is given as $\overline{X}_c=\frac{\sum n_i\overline{X}_i}{\sum n_i}$

iv) If $Y_i=a+bX_i$ Then $\overline{Y}=a+b\overline{X}$

Proof:
Where a and b are any two numbers

$$Y_i = a + bX_i$$

Summing over all values

$$\sum Y_i = \sum (a + bX_i)$$

$$\sum Y_i = na + b\sum X_i$$

Dividing both sides by 'n'

$$\sum Y/n = na/n + b\sum X_i/n$$

$$\overline{Y} = a + b\overline{X} \text{ proved}$$

Q. The mean weights of four groups of students consisting of 15,20,10 and 18 students were 162,148,153 and 140 pounds respectively. Find mean weight of all the students.

Solution: where $n_1 = 15$ $n_2 = 20$ $n_3 = 10$ $n_4 = 18$

$\bar{x}_1 = 162$ $\bar{x}_2 = 148$ $\bar{x}_3 = 153$ $\bar{x}_4 = 140$

$$\bar{x}_c = \frac{\sum_{i=1}^{k} n_i \bar{x}_i}{\sum_{i=1}^{k} n_i} = \frac{n_1\bar{x}_1 + ... + n_4\bar{x}_4}{n_1 + ... + n_4} = \frac{9440}{63} = 149.84$$

Weighted mean

Sometimes, some items are not of equal important. To make them equal important, we assign some numerical values to such items .Such numerical values are called weights. The Arithmetic mean calculated from such type of data is called weighted Arithmetic mean. It is denoted by $\overline{X}_w$.

$$\overline{X}_w = \frac{W_1X_1 + W_2X_2 + W_3X_3 + ... + W_nX_n}{W_1 + W_2 + W_3 + ... + W_n} = \frac{\sum W_iX_i}{\sum W_i} \qquad i=1,2,3,\ldots,n$$

Q.10: Salman obtained the following marks in a certain examination. Find the weighted mean if weights 4,3,3,2 and 2 respectively are allotted to the subjects.

English	Urdu	Math	Stat	Physics
73	82	80	57	62

Solution:

$$\overline{X}_w = \frac{W_1X_1 + W_2X_2 + W_3X_3 + ... + W_nX_n}{W_1 + W_2 + W_3 + ... + W_n}$$

$$= \frac{\sum W_iX_i}{\sum W_i} = \frac{1016}{14} = 72.57$$

Geometric mean

The Geometric mean of the series x_1, x_2, x_3, …, xi,…,x_n is defined as the nth root of the product of the +ve values

i.e. $G.M = \sqrt[n]{(X_1 * X_2 * X_3, ..., X_i, ...X_n)}$

$$G.M = (X_1 * X_2 * X_3, ..., X_i, ..., X_n)^{\frac{1}{n}} \text{ or } G.M = Anti\log\frac{\sum \log x}{n}$$

Method of calculation

Un-group data

$$G.M = (X_1 * X_2 * X_3, ..., X_i, ..., X_n)^{\frac{1}{n}}$$

$$G.M = Anti\log\frac{\sum \log x}{n}$$

Group data

$$G.M = Anti\log\frac{\sum f\log x}{\sum f}$$

$$G.M = \left(X_1^{f_1} * X_2^{f_2} * X_3^{f_3}, ..., X_i^{f_i}, ..., X_n^{f_n}\right)^{\frac{1}{\sum f}}$$

Merits of Geometric mean

i) It should be rigorously defined.
ii) It is based on all the observations.
iii) It is based on a mathematically formula.
iv) Stable average.
v) Not affected by extreme values.
vi) True average.
vii) Used in advance statistics.
viii) Best average for rates, ratios and percentage.

Demerits of Geometric mean

i) Cannot be calculated from open-end table.
ii) Not best average for skewed type data.
iii) Cannot be calculated if any value is missing.
iv) Cannot be calculated by graphically.
v) Sometimes strange answer.
vi) Difficult to calculate.
vii) Cannot be calculated if any value is zero.
viii) Cannot be calculated if any value is -ve.

Q: Find Geometric Mean by basic definition and logarithms methods

X: 32 35 36 37 39 41 43

Solution:

logX: 1.5051 1.5441 1.5563 1.5682 1.5911 1.6127 1.6335 $\sum \log X = 11.011$

$$G.M = Anti\log \frac{\sum \log x}{n} = Anti\log \frac{11.011}{7} = Anti\log(1.573) = 37.41$$

Q:The reciprocal of 8 values of x are given below.Calculate G.M

0.0500,0.0454,0.0400,0.0333,0.0285,0.0232,0.0213,0.0200

Solution:

(1/x)	X	Logx
0.05	20	1.30103
0.0454	22.02643	1.342944
0.04	25	1.39794
0.0333	30.03003	1.477556
0.0285	35.08772	1.545155
0.0232	43.10345	1.634512
0.0213	46.94836	1.67162
0.02	50	1.69897
Total		12.06973

$$G.M = Anti\log \frac{\sum \log x}{n}$$

$$G.M = Anti\log \frac{12.06973}{7} = Anti\log(1.5081)$$

$$G.M = 32.22$$

Q: Calculate Geometric mean for the following data.

classes	f	X	Logx	f(logx)
10-19	15	14.5	1.161368	17.42052
20-29	35	24.5	1.389166	48.62081
30-39	45	34.5	1.537819	69.20186
40-49	25	44.5	1.64836	41.209
50-59	12	54.5	1.736397	20.83676
Total	132			197.289

$$G.M = Anti\log \frac{\sum f \log x}{\sum f}$$

$$G.M = Antil\log \frac{197.289}{132} = Anti\log(1.4946) = 31.23$$

Harmonic mean

The Harmonic mean of the series x_1, x_2, x_3, …, xi,…,x_n is defined as the reciprocal of the average and reciprocals of the values.

i.e.

$$H.M = reciprocal\ of\ \frac{\frac{1}{x_1} + \frac{1}{x_2} + \frac{1}{x_3} + ... + \frac{1}{x_n}}{n}$$

$$= reciprocal\ of\ \frac{\sum(\frac{1}{x_i})}{n}$$

$$= \frac{n}{\sum(\frac{1}{x_i})}$$ For ungroup data

$$H.M = \frac{\sum f}{\sum f(\frac{1}{x_i})} \quad n = \sum f$$ Or $$H.M = \frac{n}{\sum f(\frac{1}{x_i})}$$ For group data

Q: Show that for the following data H.M<G.M<A.M or A.M>G.M>H.M

classes	f	X	fx	Logx	Flogx	1/x	f(1/x)
9.3-9.7	2	9.5	19	0.9777	1.9554	0.1053	0.2105
9.8-10.2	5	10	50	1	5	0.1	0.5
10.3-10.7	12	10.5	126	1.0212	12.254	0.0952	1.1429
10.8-11.2	17	11	187	1.0414	17.704	0.0909	1.5455
Total	36		382		36.913		3.3988

$$\bar{x} = \frac{\sum fx}{\sum f} = \frac{382}{36} = 10.611$$

$$H.M = \frac{\sum f}{\sum f(\frac{1}{x_i})} = \frac{36}{3.3988} = 10.59$$

$$G.M = Anti\log\frac{\sum f\log x}{\sum f} = Anti\log(36.913/36) = Anti\log(1.025) = 10.60$$

10.61>10.60>10.59

Hence prove that H.M<G.M<A.M or A.M>G.M>H.M

Merits of Harmonic mean

i)It should be rigorously defined.
ii)It is based on all the observations.
iii) Best average for rates, ratios and speed..
iv)Based on a mathematical formula.
v)It is not much affected by sampling variability.

Demerits of Harmonic mean

i) It is affected by extreme values.
ii) Cannot be calculated from open-end table.
iii) Not best average for skewed type data.
iv) Cannot be calculated if any value is missing.
v) Cannot be calculated by graphically.
vi) Sometimes strange answer.
vii) Difficult to calculate.
viii) Cannot be calculated if any value is zero.

Median

The Median of the series x_1, x_2, x_3, …, x_i,…,x_n is defined as the middle value of the arrange series if the number of values is odd and the average of the two middle values if the number of values is even. The Median is denoted by $\tilde{X}$

$$Median = \tilde{X} = The\ value\ of\ \frac{n+1}{2} th\ item$$

For ungroup data and discrete frequency distribution.

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

Where

h= class interval, l= lower class boundary of median group. , $n = \sum f$

f= frequency corresponding to median group and c= cumulative frequency corresponding to the group preceding the median group.

Merits

i) Best average if some values are missing.
ii) Can be calculated from open-end.
iii) Can be calculated from graphically.
iii) Can be calculated if any value is –ve or zero.
iv) Easy to calculate and understand.
v) Calculated every type of data.
vi) Best average of skewed type of data.

Demerits

i) Not best average for ratios and rates.
ii) Not based on all the values.
iii) Ignore large or small values.
iv) Effected by extreme values.
v) Arranging the data is difficult

Mode

The Median of the series $x_1, x_2, x_3, \ldots, xi, \ldots, x_n$ is defined as the most repeated value in the data. It is denoted by $\hat{X}$ .A series has more than one mode or no mode in the data.
For ungroup data and discrete frequency distribution

$$\hat{X} = l + \frac{f_m - f_1}{f_m - f_1 + f_m - f_2} \times h$$

Where h= class interval of the modal group, L= lower class boundary of modal class.
f_m = highest frequency in the data f_1 = frequency associated with the class proceeding the modal class.
f_2 = frequency associated with the class following the modal class.

Merits

i) Speedily calculated.
ii) Best average if some values are missing.
iii) Can be calculated from open-end or graphically.
iv) Can be calculated if any value is –ve or zero.
v) Easy to analysis or interpret.
vi) Easy to calculate.
vii) Easy to understand

Demerits

i) Not best average for ratios and rates.
ii) Not best average for skewed type of data.
iii) Not based on all the values.
iv) Ignore large or small values.

Quartiles

The three values which divide the array data into four equal parts are called quartiles.

$Q_1 = The\,value\,of\,(\frac{n+1}{4})th\ item$ It is called lower quartile

$Q_2 = The\,value\,of\,2(\frac{n+1}{4})th\ item$ It is equal to median

$Q_3 = The\,value\,of\,3(\frac{n+1}{4})th\ item$ it is called upper quartile

for ungroup data and discrete frequency distribution

$Q_1 = l + \frac{h}{f}\left(\frac{n}{4} - c\right)$ Lower quartile

Where h= class interval L= lower class boundary of quartile group group.
f= frequency corresponding to quartile group and $n = \sum f$
c= cumulative frequency corresponding to the group preceding the quartile group.

$Q_3 = l + \frac{h}{f}\left(\frac{3n}{4} - c\right)$ Upper quartile

Deciles

The nine values which divide the array data into four equal parts are called quartiles.

$D_1 = The\,value\,of\,(\frac{n+1}{10})th\ item$

$D_2 = The\,value\,of\,2(\frac{n+1}{10})th\ item$ up to so on

$D_9 = The\,value\,of\,9(\frac{n+1}{10})th\ item$

For ungroup data and discrete frequency distribution

$$D_1 = l + \frac{h}{f}\left(\frac{n}{10} - c\right)$$

$$D_2 = l + \frac{h}{f}\left(\frac{2n}{10} - c\right)$$ Up to so on

$$D_9 = l + \frac{h}{f}\left(\frac{9n}{10} - c\right)$$

Where h= class interval, L= lower class boundary of deciles group.

f= frequency corresponding to deciles group and $n = \sum f$

c= cumulative frequency corresponding to the group preceding the deciles group.

Percentiles

The ninety nine values which divide the array data into equal 100(hundred) parts are called quartiles.

$p_1 = The\,value\,of\,(\frac{n+1}{100})th\ item$

$p_2 = The\,value\,of\,2(\frac{n+1}{100})th\ item$ Up to so on

$p_{99} = The\,value\,of\,99(\frac{n+1}{100})th\ item$

For ungroup data and discrete frequency distribution

$$p_1 = l + \frac{h}{f}\left(\frac{n}{100} - c\right)$$

$$p_2 = l + \frac{h}{f}\left(\frac{2n}{100} - c\right)$$ Up to so on

$$p_{99} = l + \frac{h}{f}\left(\frac{99n}{100} - c\right)$$ For group data.

Where

h= class interval

L= lower class boundary of percentile group group.

f= frequency corresponding to percentile group and $n = \sum f$

c= cumulative frequency corresponding to the group preceding the percentile group.

Q: A set of numbers consists of six6's,seven7's,eight8's,nine9's and ten10's.what is the median ,Mode,lower and upper Quartiles , D_5 and P_5

Solution:

X	f	c.f
6	6	6
7	7	13
8	8	21
9	9	30
10	10	40

Mode=f_m=10=then corresponding value of x is mode which is 10

Median=The value of $(\frac{n+1}{2})th$ item=(41/2)th=21.5th value=9

Q_1=The value of $(\frac{n+1}{4})th$ item=(41/4)th=10th value=7

Q_3=The value of $3(\frac{n+1}{4})th$ item=(41/4)th=30.75th value=10

D_5=The value of $5(\frac{n+1}{10})th$ item=(41/10)th=20.5th value=8

P_5=The value of $5\,(\frac{n+1}{100})th$ item=(41/100)th=2.05th value=6

P_{15}=the value of $15\,(\frac{n+1}{100})th$ item= (41/100)th=6.15yh value=7

Q: Following are the marks obtained by 20 students, Calculate, Mode, Median,Q_1,Q_3,D_6,P_{47}

38,60,41,40,29,40,51,56,40,56,39,40,54,40,53,54,37,53,45,50.

Solution: First we arrange the data in ascending order

Arrange

29,37,38,39,40,40,40,40,40,41,45,50,51,53,53,54,54,56,56,60

Mode=Most repeated value= 40 Ans

Median=The value of $(\frac{n+1}{2})th$ item = (21/2)th=10.5th value

=10th value+0.5(11th value-10th value)=41+0.5(45-41)=41+0.5(4)=41+2=41Ans

Q_1=The value of $(\frac{n+1}{4})th$ item = (21/4)th=5.25th value

=5th value+0.25(6th value-5th value)=40+0.25(40-40)=41+0.25(0)=40+0=40Ans

Q_3=The value of $3\,(\frac{n+1}{4})th$ item =3 (21/4)th=3(5.25)th value=15.75th value

=15th value+0.75(16th value-15th value)=53+0.75(54-53)=53+0.75(1)=53+0.75=53.75Ans

D_6=The value of $6\,(\frac{n+1}{10})th$ item =6 (21/10)th=3(2.1)th value=12.6th value

=12th value+0.6(13th value-12th value)=50+0.6(51-50)=53+0.6(1)=50+0.6=50.6Ans

P_{47}=The value of $47\,(\frac{n+1}{100})th$ item =47 (21/100)th=47(0.21)th value=9.87th value

=9th value+0.87(10th value-9th value)=41+0.87(45-41)=41+0.87(4)=41+3.48=44.48Ans

Q: Calculate Mode and 39th percentiles from the following group data.

Solution:

classes	F	c.b	c.f
10-19	15	9.5-19.5	15
20-29	35	19.5-29.5	50
30-39	45	29.5-39.5	95
40-49	25	39.5-49.5	120
50-59	12	49.5-59.5	132
Total	$\sum f$ 132=n		

$$\hat{X} = l + \frac{f_m - f_1}{f_m - f_1 + f_m - f_2} \times h$$

f_m=45,f_1=35,f_2=25,l=29.5,h=10

$$\hat{X} = 29.5 + \frac{45-25}{45-25+45-35} \times 10 = 29.5 + \frac{10}{20} \times 10 = 29.5 + 5 = 34.5$$

$$p_{39} = l + \frac{h}{f}\left(\frac{39n}{100} - c\right) \qquad \frac{39n}{100} th valu = \frac{39*132}{100} th vale = 51.48 th valu$$

Where h=10,c=50,f=45,l=29.5

$$p_{39} = l + \frac{h}{f}\left(\frac{39n}{100} - c\right) = 29.5 + \frac{10}{45}(51.48-50) = 29.5 + 0.222(1.48) = 29.5 + .3286 = 29.83$$

Q: Find out the average rate of

i)motion in the case of a person who rides the first mile at the rate of 10 miles an hour, the next mile at the rate of 8 miles per hour, and the third mile at the rate of 6 miles per hour;

ii)Increase in population, which in the first decade has increased 20%,in the next 25% and in the third 44%.

Solution

i)

As we know that average speed

X	(1/x)
10	0.1
8	0.125
6	0.1667
Total	0.3917

$$H.M = \frac{n}{\sum \frac{1}{x}} = \frac{3}{0.3917} = 7.66 \ m/h$$

ii)

X	logx
120	2.0792
125	2.0969
144	2.1584
Total	6.3345

Average rate of increase is G.M

$$G.M = Anti\log\frac{\sum \log x}{n} = Anti\log(6.3345/3) = Anti\log(2.1115) = 129.28$$

Average rate of increase in population=129.28-100=29.28%

Q.A student calculated the value of mean as 20 from 25 observation .It was later discovered at the time of checking that he had copied down two values as 7 and 18 while the correct values were 13 and 17.Find the correct value of the arithmetic mean.

Solution: Where uncorrected mean=20 n=25 corrected values 13 and 17 wrong values 7 and 18.

$$\overline{X} = \frac{\sum x}{n}$$

$$20 = \frac{\sum x}{25}$$

Uncorrected $\sum x$=500

Corrected $\sum x$=uncorrected $\sum x$-wrong values corrected values

=500-(7+18)+(13+17)=500-25+30=505

$$corrected\overline{X} = \frac{corrected\sum x}{n} = \frac{505}{25} = 20.2$$

Q: In moderately asymmetrical distribution the mode and mean are 32.1 and 35.4 respectively. compute the median

Solution: Mode =3Mediad-2Mean

Median=(Mode+2Mean)/3

=(32.1+2(35.4))/3=34.3

Q: If the median and mean of moderately asymmetrical series are respectively 18.67 and 20.0. Compute most probable value of mode.

Ans: Mode =3Mediad-2Mean=3(18.67)-2(20)=16.01

Q.54: The reciprocal of 11values of x are given below. Calculate Median

0.0500,0.0454,0.0400,0.0333,0.0285,0.0232,0.0213,0.0200,0.0182,0.0151,0.0143.

Solution:

(1/x)	X
0.05	20
0.0454	22.02
0.04	25
0.0333	30.03
0.0285	35.08
0.0232	43.10
0.0213	46.94
0.02	50
0.0182	54.94
0.0151	66.22
0.0143	69.93

Median= the value of $\frac{n+1}{2}$ th item

= the value of (11+1)/2 th item

=the value of 6^{th} item

=43.10 Ans.

Q: Given that $D_i = X_i - A, i = 1,2,3,...,n$ **then prove that** $\overline{X} = A + \frac{\sum D}{n}$

Proof:

Where $D_i = X_i - A$

$X_i = A + D_i$

Applying summing on both sides

$\sum X_i = \sum(A + D_i) = nA + \sum D_i$

Dividing both sides by “n”

$$\frac{\sum X_i}{n} = \frac{nA}{n} + \frac{\sum D_i}{n}$$

$$\bar{X} = A + \frac{\sum D_i}{n}$$

Hence proved

Q: Given that $u_i = \frac{X_i - A}{h}$ **,** $i = 1,2,3,\ldots,n$ **then prove that** $\bar{X} = A + h\bar{u}$ **and h is class interval.**

Proof:

Where $u_i = \frac{X_i - A}{h}$

$$X_i = A + hu_i$$

Applying summing on both sides

$$\sum X_i = \sum (A + hu_i) = nA + h\sum u_i$$

Dividing both sides by “n”

$$\frac{\sum X_i}{n} = \frac{nA}{n} + \frac{\sum u_i}{n} \times h$$

$$\bar{X} = A + \frac{\sum u_i}{n} \times h$$

$$\bar{X} = A + h\bar{u}$$

Hence proved