MARUDHAR KESARI JAIN COLLEGE FOR WOMEN, VANIYAMBADI

PG & RESEARCH DEPARTMENT OF MATHEMATICS

CLASS : I BCA

SUBJECT CODE : STATISTICAL METHODS AND IT APPLICATIONS I

SUBJECT NAME : 23UECA12A

SYLLABUS

UNIT- II

Measures of location: Arithmetic mean, median, mode, geometric mean and Harmonic mean and their properties.

2. Measures of Location (central tendency)

There are three types of central frequency

* Median
* Mean
* Mode.

Mean

Sum of all the values and divided it by the total number of values is called mean.

Median

Write all the values in Ascending Order and find out the middle values is called as median

Mode

The mode is simply the most frequently assigning values.

Average

Average is an attempt to find one single figure to describe whole of the figure.

Arithmetic Mean:

$$\text{Arithmetic Mean} = \frac{\text{Sum of the observation}}{\text{Total no. of observation}}$$

Methods for finding Arithmetic mean.

There are three types

* Direct Method
* Shortcut Method
* Step Deviation Method.

Individual

Direct Method

$$\bar{X} = \frac{\Sigma x}{n}$$

Here $\bar{x}$ = mean

Σx = Sum of Variables

N = no. of observation

Short cut method

$$\bar{X} = A \pm \frac{\Sigma d}{N} \qquad d = x - A$$

where

$\bar{X}$ = Arithmetic mean

Smallest value

A = Assumed mean

Σd = Sum of deviation

N = no. of observation

Problem:

Calculate mean from following Data

48, 50, 60, 22, 26, 25

Mean

$$= \frac{48 + 50 + 60 + 22 + 26 + 25}{6}$$

$$= \frac{231}{6}$$

mean = 38.5

Direct

$$\bar{X} = \frac{\Sigma x}{n}$$

$$\bar{x} = \frac{48 + 50 + 60 + 22 + 26 + 25}{6}$$

$$\bar{x} = 38.5$$

Shortcut

x	A	d = x - A
48	22	26
50	22	28
60	22	38
22	22	0
26	22	4
25	22	3
		99/6
		=16.5

$$\bar{x} = A + \frac{\Sigma d}{n}$$

$$\bar{x} = 22 + \frac{99}{6}$$

$$= 22 + 16.5$$

$$\bar{x} = 38.5$$

Discrete

Direct

$$\bar{X} = \frac{\Sigma f(x)}{N}$$

$\bar{X}$ = Arithmetic mean

$\Sigma f(x)$ = Sum of the product

N = No. of. items (or) frequency.

Shortcut

$$\bar{X} = A \pm \frac{\Sigma fd}{\Sigma f} \qquad d = x - A$$

$\bar{X}$ = Arithmetic mean

A = Assumed mean

f = frequency

N = No. of. items

Problem

Calculate mean from the following data

Value	1	2	3	4	5	6	7	8	9	10
frequency	21	30	28	40	26	34	40	9	15	57

Direct

$$\bar{x} = \frac{\sum f(x)}{N}$$

X	f	fx
1	21	21
2	30	60
3	28	84
4	40	160
5	26	130
6	34	204
7	40	280
8	9	72
9	15	135
10	57	570
	$\sum f = 300$	$\sum fx = 1716$

$$\bar{X} = \frac{\Sigma fx}{N}$$

$$= \frac{1716}{300}$$

$$= 5.72$$

$$\bar{X} = 5.72$$

Shortcut

$$\bar{X} = A \pm \frac{\Sigma fd}{\Sigma f}$$

$$d = x - A$$

X	f	A	$d = x - A$	fd
1	21	5	-4	-84
2	30	5	-3	-90
3	28	5	-2	-56
4	40	5	-1	-40
5	26	5	0	0
6	34	5	1	34
7	40	5	2	80
8	9	5	3	87
9	15	5	4	60
10	57	5	5	285
	$\Sigma f = 300$			$\Sigma fd = 216$

$$\bar{X} = 5 + \frac{216}{300}$$

$$= 5 + 0.72$$

$$\bar{X} = 5.72$$

Continuous Series

1) Direct Method

$$\bar{X} = \frac{\Sigma fm}{N}$$

M - mid point

$N = \Sigma f$

2) Short cut method

$$\bar{X} = A \pm \frac{\Sigma fd}{\Sigma f}$$

$d = m - A$

M - Assumed mean

Σfd - Sum of deviation

N - Sum of the frequency

3) Step deviation

$$\bar{X} = A \pm \frac{\Sigma fd}{\Sigma f} \times i$$

$$d = \frac{m - A}{i}$$

A - assumed mean

Σfd = Sum of deviation

Σf = Sum of frequencies

i = length of the class interval

Problem

from the following data find out the mean profits

Profit for shop	No. of shops
100 - 200	10
200 - 300	18
300 - 400	20
400 - 500	26
500 - 600	30
600 - 700	28
700 - 800	18
(x)	(f)

Direct method

x	m $\frac{a+b}{2}$	f	fm
100 - 200	150	10	1500
200 - 300	250	18	4500
300 - 400	350	20	7000
400 - 500	450	26	11700
500 - 600	550	30	16500
600 - 700	650	28	18200
700 - 800	750	18	13500

$$\bar{x} = \frac{\Sigma fm}{N} \qquad N = \Sigma f$$

$$\bar{x} = \frac{12900}{150}$$

$$\bar{x} = 486$$

Shortcut method

x	$m = \frac{a+b}{2}$	A	$d = m - A$	f	fd
100-200	150	450	-300	10	-3000
200-300	250	450	-200	18	-3600
300-400	350	450	-100	20	-2000
400-500	450	450	0	26	0
500-600	550	450	100	30	3000
600-700	650	450	200	28	5600
700-800	750	450	300	18	5400
				$\Sigma f = 150$	$\Sigma fd = 5400$

$$\bar{x} = A + \Sigma fd / \Sigma f$$

$$\bar{x} = 450 + \frac{5400}{150}$$

$$= 450 + 36$$

$$\bar{x} = 486$$

Step Deviation

$$\bar{x} = A \pm \frac{\Sigma fd}{\Sigma f} \times i$$

where $d = \frac{m - A}{i}$

x	$m = \frac{a+b}{2}$	A	$d = \frac{m-A}{i}$	f	fd
100-200	150	450	-3	10	-30
200-300	250	450	-2	18	-36
300-400	350	450	-1	20	-20
400-500	450	450	0	26	0
500-600	550	450	1	30	30
600-700	650	450	2	28	56
700-800	750	450	3	18	54
				$\Sigma f = 150$	$\Sigma fd = -54$

$$\bar{x} = A \pm \frac{\Sigma fd}{\Sigma f} \times i$$

where, $i = 100$

i - length of the class interval.

$$\bar{x} = 450 + \frac{54}{150} \times 100$$

$$= 450 + 0.36 \times 100$$

$$= 450 + 36$$

$$\bar{x} = 486.$$

Home work

Value	1	2	3	4	5	6	7	8	9	10
frequency	40	50	55	78	58	60	73	35	43	48

Direct

$$\bar{x} = \frac{\Sigma f(x)}{N}$$

x	f	fx
1	40	40
2	50	100
3	55	165
4	78	312
5	58	290
6	60	360
7	73	511
8	35	280
9	43	387
10	48	480

$\Sigma f = 540$ $\Sigma fx = 2925$

$N = \Sigma f$

$$\bar{x} = \frac{2925}{540}$$

$$\bar{x} = 5.416$$

Short cut

x	f	A	d = x - A	fd
1	40	5	-4	-160
2	50	5	-3	-150
3	55	5	-2	-110
4	78	5	-1	-78
5	58	5	0	0
6	60	5	1	60
7	73	5	2	146
8	35	5	3	105
9	43	5	4	172
10	48	5	5	240

$$\bar{x} = A \pm \frac{\Sigma fd}{\Sigma f}$$

$\Sigma fd = 225$

$$= 5 + \frac{225}{540} \qquad = 5 + 0.416 = 5.416$$

Calculate Mean from the following data

Value	frequency
Less than 10	4
Less than 20	10
Less than 30	15
Less than 40	25
Less than 50	30
Less than 60	35
Less than 70	45
Less than 80	65

Value	frequency
0 – 10	4
10 - 20	10 - 4 = 6
20 - 30	15 - 10 = 5
30 - 40	25 - 15 = 10
40 - 50	30 - 25 = 5
50 - 60	35 - 30 = 5
60 - 70	45 - 30 = 10
70 - 80	65 - 45 = 20

Direct :

$$\bar{x} = \frac{\Sigma fm}{\Sigma f}$$

x	m	f	fm
0-10	5	4	20
10-20	15	6	90
20-30	25	5	125
30-40	35	10	350
40-50	45	5	225
50-60	55	5	275
60-70	65	10	650
70-80	75	20	1500
		$\Sigma f = 65$	$\Sigma fm = 3235$

$$\bar{x} = \frac{3235}{65}$$

$$\bar{x} = 49.769$$

Shortcut

$$\bar{x} = A \pm \frac{\Sigma fd}{\Sigma f} \quad d = m - A$$

x	M	A	d = m - A → A	f	fd
0-10	5	-30	35	4	-120
10-20	15	-20	35	6	-120
20-30	25	-10	35	5	-50
30-40	35	0	35	10	0
40-50	45	10	35	5	50
50-60	55	20	35	5	100
60-70	65	30	35	10	300
70-80	75	40	35	20	800
				$\Sigma f = 65$	$\Sigma fd = 960$

$$\bar{X} = 35 + \frac{960}{65}$$

$$\bar{X} = 35 + 14.769$$

$$\bar{X} = 49.769$$

Step Deviation

$$d = \frac{m - A}{i}$$

$$\bar{X} = A \pm \frac{\Sigma fd}{\Sigma f} \times i$$

$$\bar{X} = 35 + \frac{960}{65} \times 10$$

$$= 35 + (14.76 \times 10)$$

$$= 35 + 14.76$$

$$= 49.76$$

x	m	A	m-A	$d = \frac{m-A}{i}$	f	fd
0-10	5	35	-30	-3	4	-12
10-20	15	35	-20	-2	6	-12
20-30	25	35	-10	-1	5	-5
30-40	35	35	0	0	10	0
40-50	45	35	10	1	5	5
50-60	55	35	20	2	5	10
60-70	65	35	30	3	10	30
70-80	75	35	40	4	20	80
					$\Sigma f = 65$	$\Sigma fd = 96$

Calculate average wage paid to workers

wages	no. of. workers
more than 75	150
more than 85	140
more than 95	115
more than 105	95
more than 115	70
more than 125	60
more than 135	40
more than 145	25

wages	no. of workers
75-85	10
85-95	25
95-105	20
105-115	25
115-125	10
125-135	20
135-145	15
145-155	25

continuous

Direct

$$\bar{x} = \frac{\Sigma fm}{\Sigma f}$$

x	m	f	fm
75-85	80	10	800
85-95	90	25	2,250
95-105	100	20	2000
105-115	110	25	2750
115-125	120	10	1,200
125-135	130	20	2,600
135-145	140	15	2,100
145-155	150	25	3,750
		$\Sigma f = 150$	$\Sigma fm = 17,450$

$$\bar{x} = \frac{17450}{150} = 116.333$$

Shortcut

x	m	A	d = m-A	f	fd
75-85	80	110	-30	10	-300
85-95	90	110	-20	25	-500
95-105	100	110	-10	20	-200
105-115	110	110	0	25	0
115-125	120	110	10	10	100
125-135	130	110	20	20	400
135-145	140	110	30	15	450
145-155	150	110	40	25	1000
				$\Sigma f = 150$	$\Sigma fd = 950$

$$\bar{x} = 110 + \frac{950}{150}$$

$$\bar{x} = 110 + 6.333$$

$$\bar{x} = 116.333$$

Step deviation

x	m	A	m-A	$d = \frac{m-A}{i}$	f	fd
75-85	80	110	-30	-3	10	-30
85-95	90	110	-20	-2	25	-50
95-105	100	110	-10	-1	20	-20
105-115	110	110	0	0	25	0
115-125	120	110	10	1	10	10
125-135	130	110	20	2	20	40
135-145	140	110	30	3	15	45
145-155	150	110	40	4	25	100
					$\Sigma f = 150$	$\Sigma fd = 95$

$$\bar{x} = A \pm \frac{\Sigma fd}{\Sigma f} \times i$$

$$= 110 \pm \frac{95}{150} \times 10$$

Exclusive

Find the mean of the following data

class interval	frequency
0-9	2
10-19	15
20-29	10
30-39	8
40=49	3
50-59	1

Direct

x	m	f	fm
0-9	4	2	8
10-19	14	15	210
20-29	24	10	240
30-39	34	8	272
40-49	44	3	132
50-59	54	1	54
		39	916

$$\bar{x} = \frac{\Sigma fm}{\Sigma f}$$

$$= \frac{916}{39}$$

$$\bar{x} = 23.4$$

Step deviation method:

x	m	A	d = m - A	f	$d = \frac{m-A}{i}$	fd
0 - 9	4	24	-20	2	2.2	-44
10 - 19	14	24	-10	15	1.1	-16.5
20 - 29	24	24	0	10	0	0
30 - 39	34	24	10	8	1.1	8.8
40 - 49	44	24	20	3	2.2	6.6
50 - 59	54	24	30	1	3.3	3.3
				$\Sigma f = 39$		$\Sigma fd = 2.2$

$$\bar{X} = A \pm \frac{\Sigma fd}{\Sigma f} \times i$$

$$= 24 \pm \frac{2.2}{39} \times 9$$

$$= 24 - 0.056 \times 9$$

$$= 24 - 0.507$$

$$\boxed{\bar{X} = 23.4}$$

Short cut

X	m	A	d = m - A	f	fd
0-9	4	24	-20	2	-40
10-19	14	24	-10	15	-150
20-29	24	24	0	10	0
30-39	34	24	10	8	80
40-49	44	24	20	3	60
50-59	54	24	30	1	30
				39	20

$$\bar{X} = A \pm \frac{\Sigma fd}{\Sigma f}$$

$$= 24 \pm \frac{20}{39}$$

$$= 24 - 0.51$$

$$\bar{X} = 23.4$$

Median

median may be defined as the value of the items which divides the series into two equal parts one half containing values greater than it and other half containing values less than (where N is no. of. items)

Individual

$$\text{Median} = \text{Size of } \left(\frac{N+1}{2}\right)^{th} \text{ item} \quad (\text{odd})$$

Or

$$\text{Size of } \left(\frac{N}{2}\right)^{th} \text{ item} + \text{Size of } \left(\frac{N+1}{2}\right)^{th} \text{ item} \quad (\text{even})$$

$$\frac{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}{2}$$

N - no. of items

Find Out the median of the following data

10, 15, 9, 25, 19

9, 10, 15, 19, 25 → ascending order

$\left(\frac{n+1}{2}\right)^{th}$

$\left(\frac{5+1}{2}\right)^{th}$

$\frac{6}{2}$

$= 3^{th}$ item

$= 15$

Find out the median of 8, 10, 5, 9, 12, 11

5, 8, 9, 10, 11, 12 → ascending order

$$\frac{\left(\frac{n}{2}\right)^{th} + \left(\frac{n}{2}+1\right)^{th}}{2}$$

$$\frac{\left(\frac{6}{2}\right)^{th} + \left(\frac{6}{2}+1\right)}{2}$$

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

$$\frac{(3^{th}\text{ item} + (4)^{th}\text{ item}}{2}$$

$$= \frac{9+10}{2}$$

$$= \frac{19}{2}$$

$$= 9.5$$

Discrete

Median = Size of $\left(\frac{N+1}{2}\right)^{th}$ item

(or)

$$\frac{\text{Size of } \left(\frac{N}{2}\right)^{th} \text{ item} + \text{Size of } \left(\frac{N}{2}+1\right)^{th} \text{ item}}{2}$$

where $N = \Sigma f$

calculate median for the following

Size of Shoes	5	53	6	6.5	7	7.5	8
Frequency	10	16	28	15	30	40	34

Size of Shoes	Frequency	Ct
5	10	10
5.5	16	26
6	28	54
6.5	15	69
7	30	99
7.5	40	139
8	34	173

median = size of $\left(\frac{\Sigma f+1}{2}\right)^{th}$

$= \left(\frac{174}{2}\right)^{th} = (87)^{th}$ item

median is 7.

Continuous:

$$\text{Median} = l + \frac{\left(\frac{n}{2}\right) - cf}{f} \times i$$

Where,

l = lower limit of the median class

f = frequency of median class

cf = Cumulative frequency of preceding class

i = class interval of Median class

Calculate median from the following table

Marks	frequency
10 - 25	6
25 - 40	20
40 - 55	44
55 - 70	26
70 - 85	3
85 - 100	1

$$\bar{x} = l + \frac{\left(\frac{N}{2}\right) - cf}{f} \times i$$

X	f	cf
10-25	6	6
25-40	20	26 → cf
40-55	44	70
55-70	26	96
70-85	3	99
85-100	1	100

$\Sigma f = 100$

$\frac{N}{2} = \frac{100}{2} = 50,$

$cf = 26$

$f = 44$

$i = 15$

$l = 40$

$$\bar{x} = l + \frac{\left(\frac{N}{2}\right) - cf}{f} \times i$$

$$= 40 + \frac{50 - 26}{44} \times 15$$

$$= 40 + \frac{24}{44} \times 15$$

$$= 40 + \frac{6}{11} \times 15$$

$$= 40 + \frac{90}{11}$$

$$= 40 + 8.18$$

$$\bar{x} = 48.18$$

Correcting incorrect mean

Correct Σx = wrong Σx - wrong item + correct item

The average marks secured by 36 students was 52 but it was discovered that the item 64 misread as 46. Find the correct mean of marks.

$$52 = \frac{\Sigma x}{N} \quad , \quad 52 = \frac{\Sigma x}{36}$$

$$52 \times 36 = \Sigma x$$

$$\Sigma x = 1872$$

Correct item = 64

wrong item = 46

Correct Σx = 1872 - 46 + 64

= 1890

Combined Arithmetic mean

$$\bar{X}_{12} = \frac{N_1 \bar{x}_1 + N_2 \bar{x}_2}{N_1 + N_2}$$

$$\bar{X}_{123} = \frac{N_1 \bar{x}_1 + N_2 \bar{X}_2 + N_3 \bar{X}_3}{N_1 + N_2 + N_3}$$

$\bar{X}_{12}$, $\bar{X}_{123}$ are combined mean.

1. There are two branches of a company employing 100 and 80 Persons respectively. If the arithmetic mean of the monthly salary Paid by the two companies are 275 and 225 respectively. find the arithmetic mean of the salary of the employees of the companies as a whole.

$N_1 = 100,$

$N_2 = 80$

$\bar{X}_1 = 275$

$\bar{X}_2 = 225$

$$\bar{X} = \frac{N_1 \bar{X}_1 + N_2 \bar{X}_2}{N_1 + N_2}$$

$$= \frac{100(275) + 80(225)}{100 + 80}$$

$$= \frac{27500 + 18000}{180}$$

$$= \frac{45500}{18}$$

$$= 252.77$$

Find out the missing value of variate for the following distribution whose mean is 31.87.

x	12	20	27	33	?	54
f	8	16	48	90	30	8

x	f	fx
12	8	96
20	16	320
27	48	1296
33	90	2970
x	30	$30x$
54	8	432

$\Sigma f = 200$ $\quad \Sigma fx = 5114 + 30x$

$\bar{X} = 31.87$

$\bar{X} = \frac{\Sigma fx}{\Sigma f}$

$31.87 = \frac{5114 + 30x}{200}$

$200 \times 31.87 = 5114 + 30x$

$6374 = 5114 + 30x$

$6374 - 5114 = 30x$

$1260 = 30x$

$$\frac{1260}{30} = x$$

$$x = 42.$$

Geometric Mean:

Geometric mean is defined as the N^{th} root of the product of N items.

Individual series

Geometric mean is the antilog of the arithmetic average of the logarithms of different item.

$$G.M = \sqrt[n]{x_1 \times x_2 \times x_3 \ldots\ldots \times x_n}$$

where, n = number of items

$x_1, x_2, \ldots\ldots, x_n$ are various item.

Form

$$G.M = \text{Antilog of } \frac{\Sigma \log x}{N}$$

(1) Calculate geometric mean from the following data 50, 72, 54, 82, 93.

x	log x
50	1.6989
72	1.8571
54	1.7323
82	1.9133
93	1.9684
	$\Sigma \log x = 9.1702$

G.M = Antilog $\left[\frac{\Sigma \log x}{N}\right]$

= Antilog $\left[\frac{9.1702}{5}\right]$

= Antilog [1.83404]

= 68.233.

Geometric mean = 68.233.

Discrete

G.M = Anti log $\left[\frac{\Sigma f \log x}{N}\right]$

① The following table given the weight of the 20 persons in the sample survey calculate the G.M.

weight	130	135	140	145	146	148	149	146
no. of Persons	3	4	6	6	3	5	2	1

x	log x	f	f log x
130	2.1139	3	6.341
135	2.1303	4	8.521
140	2.1461	6	12.876
145	2.161	6	12.966
146	2.164	3	6492
148	2.170	5	10.850
149	2.173	2	4.346

$\Sigma f = 20$ $\Sigma f \log x = 64.568$

G.M = Antilog $\left[\frac{64.368}{30}\right]$

= Antilog [2.1522]

G.M = 141.9711.

Continuous:

$$G.M = \text{Antilog}\left[\frac{\Sigma f \log m}{N}\right], \quad N = \Sigma f$$

① calculate GM for following data

Yield	7.5-10.5	10.5-13.5	13.5-16.5	16.5-19.5	19.5-22.5
no. of farm	5	9	19	23	7

22.5-25.5	25.5-28.5
4	1

$$\bar{x} = \text{Antilog}\left[\frac{\Sigma f \log M}{\Sigma f}\right]$$

x	m	log m	f	f log m
7.5-10.5	9	0.9542	5	4.7711
10.5-13.5	12	1.0791	9	9.7119
13.5-16.5	15	1.1760	19	22.344
16.5-19.5	18	1.2552	23	28.8696
19.5-22.5	21	1.3222	7	9.2554
22.5-25.5	24	1.3802	4	5.5208
25.5-28.5	27	1.4313	1	1.4313
			$\Sigma f = 68$	$\Sigma f \log m = 81.904$

$\Sigma f \log m = 81.904$

$\Sigma f = 68$

$\bar{x} = \text{Antilog}\left[\frac{81.904}{68}\right]$

$= \text{Antilog}\ (1.2044)$

$\bar{x} = 16.0103$

Geometric mean = 16.0103

INDIVIDUAL - HARMONY

$$\bar{x} = \frac{N}{\frac{1}{x_1} + \frac{1}{x_2} + \cdots \frac{1}{x_n}}$$

$$\bar{x} = \frac{N}{\Sigma \frac{1}{x}}$$

① The monthly income of 10 families in ₹ is a certain village are given below.

family	income
1	85
2	70
3	10
4	75
5	500
6	8
7	42
8	250.
9	40
10	36

$$\bar{x} = \frac{N}{\sum \frac{1}{x}}$$

x	$\frac{1}{x}$
85	0.0117
70	0.0142
10	0.1
75	0.013
500	0.002
8	0.125
42	0.023
250	0.004
40	0.025
36	0.027
	0.3449

$$\bar{x} = \frac{N}{\sum \frac{1}{x}}$$

$$= \frac{10}{0.3449}$$

$$\bar{x} = 28.9939$$

Harmonic mean = 0.3449.

Harmonic Discrete

(1) Calculate HM for the given data

Size of items	6	7	8	9	10	11
Frequency	4	6	9	5	2	8

Size of item (x)	f	$\frac{1}{x}$	$f\left(\frac{1}{x}\right)$
6	4	0.166	0.664
7	6	0.142	0.852
8	9	0.125	1.125
9	5	0.111	0.555
10	2	0.1	0.2
11	8	0.090	0.72
	$\Sigma f = 34$		$\Sigma f\left(\frac{1}{x}\right) = 4.166$

$$H.M = \frac{N}{\Sigma f\left(\frac{1}{x}\right)} = \frac{\Sigma f}{\Sigma f\left(\frac{1}{x}\right)}$$

$$= \frac{34}{4.166}$$

$$H.M = 8.161$$

Continuous Harmonic

① calculate the HM for the given data

Marks	30-40	40-50	50-60	60-70	70-80	80-90	90-100
Frequency	15	13	8	6	15	7	6

$$\bar{X} = \frac{N}{\Sigma f\left(\frac{1}{m}\right)}$$

X	f	m	$\frac{1}{m}$	$f\frac{1}{m}$
30-40	15	35	0.028	0.42
40-50	13	45	0.0222	0.286
50-60	8	55	0.018	0.144
60-70	6	65	0.015	0.09
70-80	15	75	0.013	0.195
80-90	7	85	0.011	0.077
90-100	6	95	0.010	0.06

$\Sigma f = 70$

$\Sigma f\frac{1}{m} = 1.272$

$$\bar{x} = \frac{N}{\Sigma f\left(\frac{1}{m}\right)}$$

$$\bar{x} = \frac{40}{1.272} = 55.031$$

Deciles:

The values which divides an array into ten equal parts are called as Deciles.

D_1 = Value of $\left(\frac{N+1}{10}\right)^{th}$ item

D_2 = Value of $\left(2\left(\frac{N+1}{10}\right)\right)^{th}$ item

D_n = Value of $\left(9\left(\frac{N+1}{10}\right)\right)^{th}$ item

Mode:

Individual:

Calculate the mode of the following data

Soln: 2, 3, 7, 3, 4, 2, 3, 5

mode = 3

Discrete:

calculate the mode from the following table

Size x	10	11	12	13	14	15	16	17	18
f	10	12	15	19	20	8	4	3	2

Grouping

Size	C1	C2	C3	C4	C5	C6
10	10	22		37		
11	12		27			
12	15	34			46	
13	19		39			54
14	20	28		47	32	
15	8		12			
16	4	7		9		15
17	3		5			
18	2					

27
19
46

Analyse

T	Size	C1	C2	C3	C4	C5	C6
0	10						
1	11					1	
3	12		1			1	1
5	13		1..	1	1	1	1
4	14	1.		1	1		1
1	15				1		
0	16						
1	17						
0	18.						

mode = 13

Home work

① calculate the mode from the following table

Size x	4	5	6	7	8	9	10
f	40	48	52	57	66	63	67

② find out the median from the following

57, 58, 61, 42, 38, 65, 72, 66.

③ from the following data calculate the median marks.

marks	10-19	20-29	30-39	40-49	50-59
frequency	4	15	18	25	30

marks	60-69	70-79	80-89	90-99
frequency	20	16	7	2

4) following table shows age distribution of person in a particular region

Age (yrs)	below 10	20	30	40	50	60	70	70 above
no. of person	2	5	9	12	14	15	15.5	15.6

5) find mean from the following data.

values	frequency
0-20	8
20-40	12
40-60	130
60-80	20
80-100	10

6) find median from the following data & mean.

mean

CI, M, f, d', fd'

median CI, M., f, cf

mid value	frequency
115	6
125	25
135	48
145	72
155	116
165	60
175	38
185	22
195	3

Mean of 20 values is 45. If one of this value is to be taken 64 instead of 46. find the correct mean.

The mean age of a group of hundred person was found in 32.02 later it was discovered that age 57 was misreade as 27. find the correct mean

There are 2 branches of companies employing 280 and 320 persons respectively. If the arithmetic mean of the monthly salaries, paid by the 2 companies are Rs. 750 and 937.5 respectively.

find the arithmetic mean of the salary of the employee of the company as a whole.

10. find GM and HM for following data

Marks	0-10	10-20	20-30	30-40	40-50
no. of Students	5	7	15	25	8

Merits of an Arithmetic Mean

* It is well defined
* It is based on all the observation
* It is suitable for algebraic treatment
* It is easy to compute
* It is least affected by fluctation of Sampling

De - Merits of an Arithmetic Mean

* It is affected by extreme items
* It cannot be determined if a single observation is not known or the extreme classes in a frequency distribution are not defined.
* It cannot be determined by inspection.

Merits of median:

* It is easy to understand it is easily determined.
* It is an affected by extreme values.

Demerits of median

* It is not well defined
* It is not based on allitems.
* It cannot be accurate
* It is not suitable for algebraic treatment
* It is affected by sampling fluctuations.

Merits of mode

* It is easy to understand
  Easy to calculate
* In certain cases, It can be found out by in inspection
* Actual value of is occurs most frequency in the series
* It is not affected by extreme value as in the average.

* It is Simple

* The Value of mode can be determined by the grouping method

Demerits of Mode:

* It is not Suitable for further mathematical treatment

* It is not give weight to exteeme item

* It is Stable only when the Sample is large.

Merits of Geometric Mean

* It is based on all observation

* It is rigidly defined

* It is Capable of further algebraic treatment.

* It is less effected by extreme Values.

Demerits of Geometric Mean

* It is difficult to understand
* Non mathematical Persons Cannot be Calculations
* It has restrical application

Quartiles

The values which divides an array into four equal parts are called as Quartiles

Q_1 = Value of $\left(\frac{N+1}{4}\right)^{th}$ item

Q_2 = Value of $\left(2\left(\frac{N+1}{4}\right)\right)^{th}$ item

Q_3 = Value of $\left(3\left(\frac{N+1}{4}\right)\right)^{th}$ item

Calculate mode for the following data

dw

Size	0-5	5-10	10-15	15-20	20-25	25-30
frequency	20	24	32	28	20	16

30-35	35-40	40-45
31	10	8

mode $= l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times i$ i-class interval

Continuous

l = lower limit of the model class

f_1 = frequency of model class

f_0 = frequency of class preceding the modal class.

f_2 = frequency of the class succeeding the modal class.

Grouped Table

C_1	C_1	C_2	C_3	C_4	C_5	C_6
0-5	20		44	76		
5-10	24	60	56		84	80
10-15	32					
15-20	28		48	64		
20-25	20	36			70	
25-30	16		50	52		60
30-35	34					
35-40	10	44	18			
40-45	8					

Analysis table

Size	C_1	C_2	C_3	C_4	C_5	C_6	Total
0-5				1			1
5-10			1	1	1		3
10-15		1	1	1	1	1	5
15-20		1			1	1	3
20-25						1	1
25-30							—
30-35	1						1
35-40							—
40-45							—

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

$f_1 = 32$

$f_0 = 24$

$f_2 = 28$

$l = 10$

$i = 5$

$$\text{mode} = 10 + \frac{32 - 24}{64 - 24 - 28} \times 5$$

$$= 10 + \frac{8}{12} \times 5$$

$$= 10 + \frac{40}{12}$$

$$= 10 + 3.33$$

$$\text{mode} = 13.33$$

Quartiles

find Q_1, Q_2, Q_3 from the following data.

Values	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-20
f	2	5	4	11	11	11	13	10

20-22	22-24	24-26	26-28	28-30
7	6	4	3	1

$$Q_1 = l + \frac{\frac{N}{4} - cf}{f} \times i$$

$$Q_2 = l + \frac{\frac{N}{2} - cf}{f} \times i$$

$$Q_3 \quad \frac{l + \frac{3N}{4} - cf}{f} \times i$$

x	f	cf
4-6	2	2
6-8	5	7
8-10	4	11
10-12	11	22
12-14	11	33
14-16	11	44
16-18	13	57
18-20	10	67
20-22	7	74
22-24	6	80
24-26	4	84
26-28	3	87
28-30	1	88

Percentiles

The values which divides an array into one hundred equal parts are called as percentiles

P_1 = Value of $\left(\frac{N+1}{100}\right)^{th}$ item

P_2 = Value of $\left(2\left(\frac{N+1}{100}\right)\right)^{th}$ item

P_{99} = Value of $\left(99\left(\frac{N+1}{100}\right)\right)^{th}$ item.

Q_1

$$Q_1 = l + \frac{\frac{N}{4} - cf}{f} \times i$$

$l = 10 \quad cf = 11, \quad f = 11, \quad i = 2$

$$= 10 + \frac{22 - 11}{11} \times 2$$

$$= 10 + 2$$

$$Q_1 = 12$$

$$Q_2 = l + \frac{\frac{N}{2} - cf}{f} \times i$$

$l = 14, \quad cf = 33, \quad f = 11 \quad , i = 2$

$$Q_2 = 14 + \frac{44 - 33}{11} \times 2$$

$$= 14 + 2$$

$$Q_2 = 16$$

$$Q_3 = \frac{l + \frac{3N}{4} - cf}{f} \times i$$

$l = 16, \quad \frac{3N}{4} = 66$

$cf = 57$

$f = 13$

$i = 2$

$$Q_3 = \frac{16 + 66.57}{13} \times 2$$

$Q_3 = 17.38$