

# DATA DESCRIPTION

Population: The information collected about each and every item comprising the whole is called a population.

A statistical population is said to be finite or infinite depending on its size.

Sample: The information collected about a small number of items which are representing the whole is said to be a sample.

Frequency: The number of times each value occurs is called a frequency.

- i) Present the following data in the form of a frequency table:

41	17	83	63	54	92	60	58
70	6	67	82	33	92	36	52
36	60	33	88	35	28	10	23
0	41	60	72	53	57		

	FREQUENCY (f)	RELATIVE FREQUENCY ( $f/m$ )
0 - 10	3	0.1
11 - 20	1	0.03
21 - 30	2	0.06
31 - 40	5	0.16
41 - 50	2	0.06
51 - 60	8	0.26
61 - 70	3	0.1
71 - 80	1	0.03
81 - 90	3	0.1
91 - 100	2	0.06
	<u>30</u>	

PIE CHART

The Table given information about the number of fish in a class.

Fish	Frequency
Perch	10
Bream	23
Carp	39

Draw a Pie Chart  
to show this  
information

$$\text{Relative frequency} = \frac{0.138}{72}, 0.319, 0.54$$

$$f/m \times 360^\circ = 47.48^\circ, 49.68^\circ, 114.48^\circ, 194.4^\circ$$



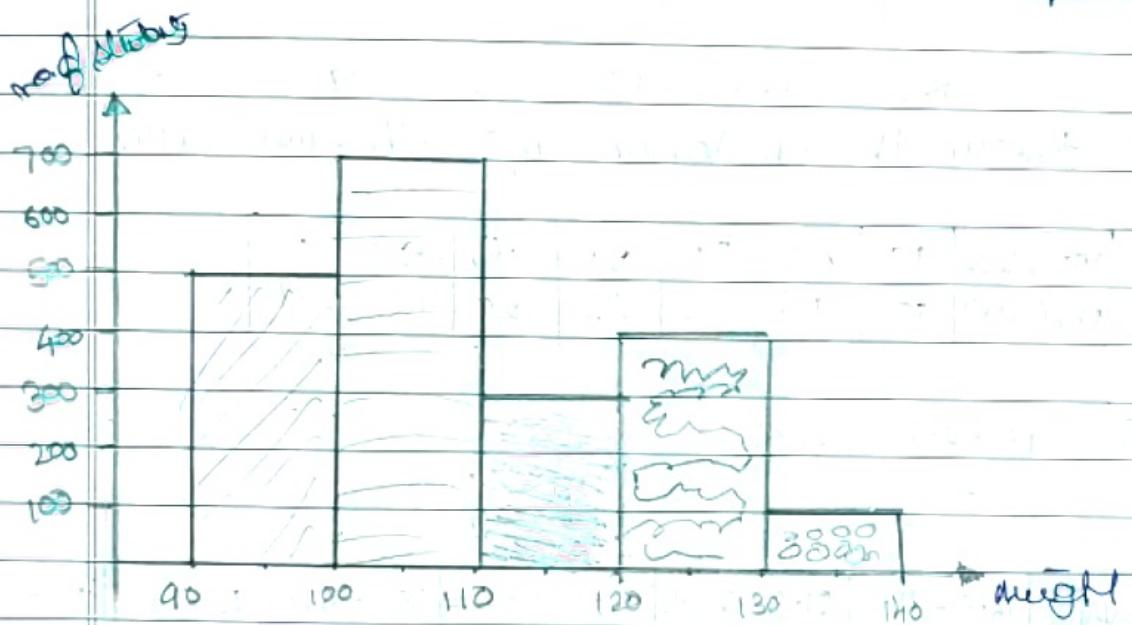
# HISTOGRAM

(*it should have class interval & must be continuous*)

- 1) Draw the histogram for the following frequency distribution.

*(continuous)*

WEIGHT	90-100	100-110	110-120	120-130	130-140
NO. OF STUDENTS	500	700	300	400	100



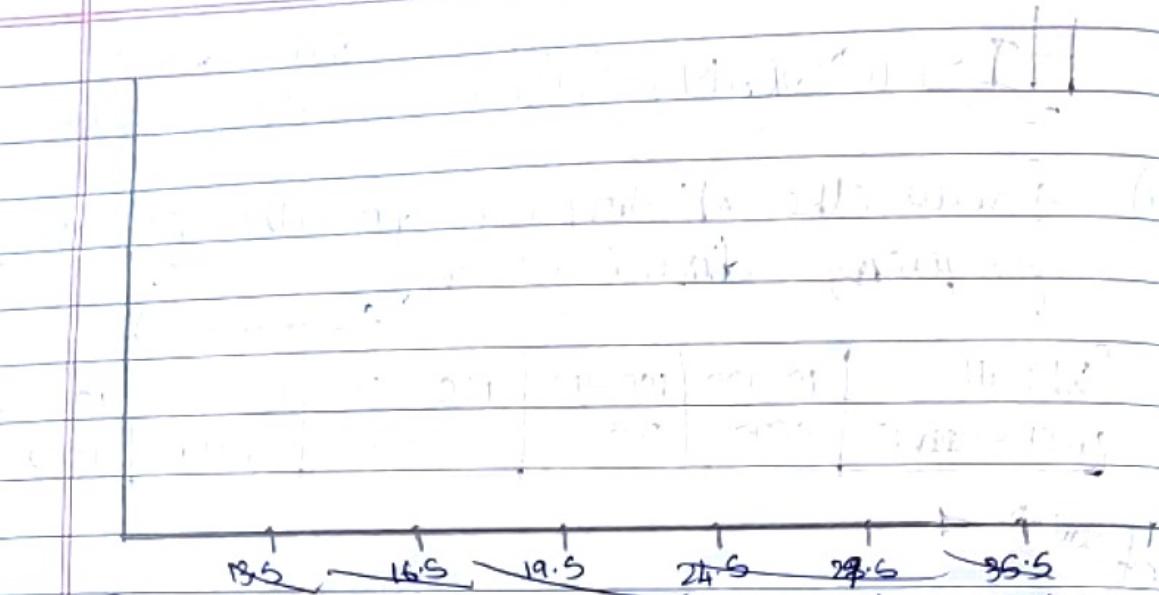
- 2) Draw the histogram for following data.

*(discontinuous)*

AGE	14-16	17-19	20-24	25-29	30-35	36-40	41-44
NO. OF WORKER	15	20	28	20	15	10	5

Converting discontinuous interval into continuous interval. (-0.5, +0.5)

AGE	15.5-16.5	16.5-19.5	19.5-24.5	24.5-29.5	29.5-35.5	35.5-40.5	40.5-45.5
NO. OF WORKER	15	20	28	20	15	10	5



3) Draw the histogram for the given data.

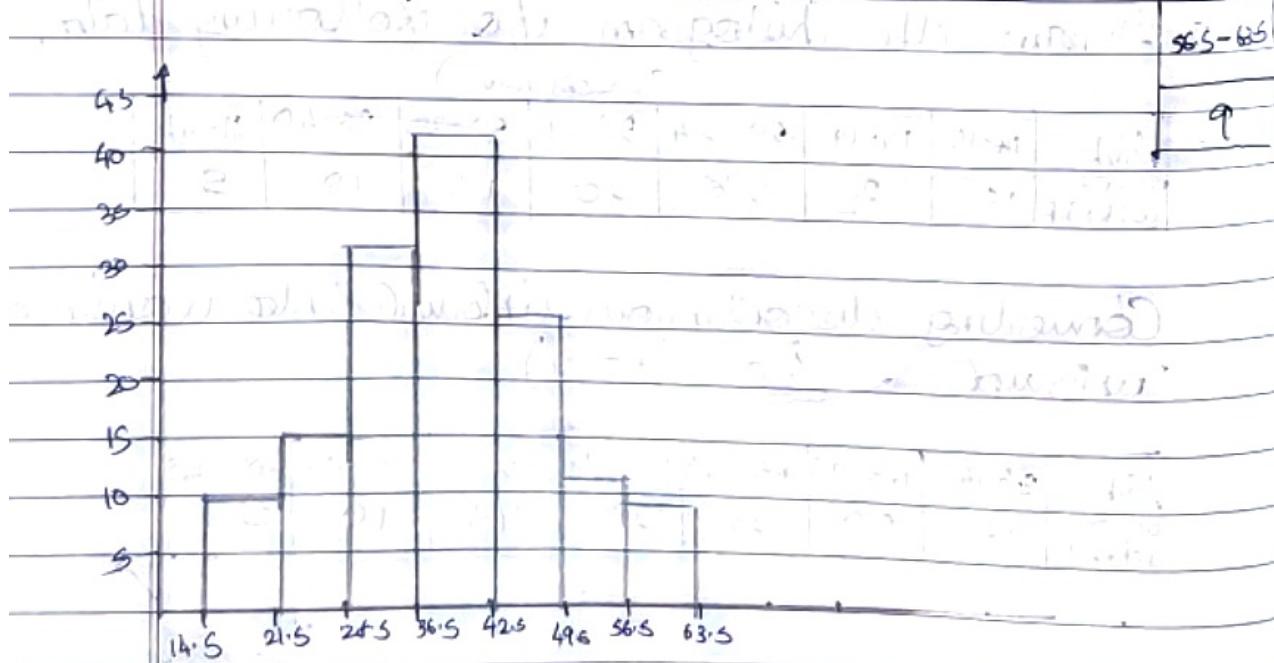
MID VALUE	18	21	24	27	30	33	36
FREQUENCY	10	15	32	42	26	12	9

SOLUTION

$$\frac{18+21}{2} = 19.5$$

2

MID VALUE	14.5 - 21.5	21.5 - 28.5	28.5 - 36.5	36.5 - 42.5	42.5 - 49.5	49.5 - 56.5
FREQUENCY	10	15	32	42	26	12



## MEASURES OF CENTRAL TENDENCY

- 1) Mean
- 2) Median
- 3) Mode.

### Mean

- 1) Find the mean of 24, 12, 6, 8, 10.

$$\text{Mean} = \frac{\sum x}{\sum n} = \frac{24+12+6+8+10}{5} = \frac{60}{5} = 12$$

- 2) Find the mean of

x	1	2	5	6
f	10	15	5	3

$$\text{Mean} = \frac{\sum f x}{\sum f}$$

X	f	fx	Mean = $\frac{83}{33} = 2.51$
1	10	10	
2	15	30	
5	5	25	
6	3	18	
		83	2.51

- 3) Find the mean of

Age	15-19	20-24	25-29	30-34	35-39	40-44
No.	4	20	38	24	10	9

$$\text{Mean} = \frac{\sum f_x}{\sum f}$$

Age	f	X	<u>fX</u>
15-19	4	17	68
20-24	20	22	440
25-29	38	27	1026
30-34	24	32	768
35-39	10	37	370
40-44	9	42	378
	105		<u>2542</u> 3050

$$\text{mean} = \frac{3050}{105} = 29.04$$

## MEDIAN

- 1) Find the median of 12, 16, 24, 3, 18, 5.

AUS

3, 5, 12, 16, 18, 24

$$\frac{12+16}{2} = 14 \quad \text{MEDIAN} = 14$$

- 2) Find the median of 95, 103, 83, 76, 99

83, 76, 95, 99, 103

$$\text{Median} = 95$$

3) Find the median of

$x$	18	19	20	21	22	23	24
$f$	25	37	45	21	14	7	1

$x$	$f$	Cumulative frequency
18	25	25
19	37	62
20	45	107
21	21	128
22	14	142
23	7	149
24	1	150

Cumulative frequency is 150

$$\Sigma F = 150$$

$$\frac{\Sigma F}{2} = \frac{150}{2} = 75$$

75 lies in the between 20, 19

$$\therefore \text{Median} = 20$$

4) Find the median of

MARKS	below 10	10-20	20-30	30-40	40-50
NO. OF STUDENTS	3	5	9	3	2

$$\text{MEDIAN} = l + \left( \frac{\frac{N}{2} - m}{f} \right) \times C$$

MARKS	FREQUENCY	C.F
10-20	3	3
20-30	8	8
30-40	9	17
40-50	3	20
50-60	2	22

$$\frac{\sum f}{2} = \frac{22}{2} = 11$$

U=20, m=8, f=9, C=10 *class interval*

$$\text{Median} = 20 + \left( \frac{11-8}{9} \right) \times 10$$

$$= 20 + \frac{30}{9}$$

$$= 23.33$$

## MODE

- 1) Find the mode of the following distribution

11.3, 14.6, 12.3, 7.4, 11.3, 11.5, 14.4

AoS *closed* = 11.3

Find the mode of the following data.

wages	3	15	25	35	45	55	65	75
worker	12	18	35	42	50	45	20	8

maximum frequency = 5

∴ mode = 45

Find the mode of the following data.

AGE	15-19	20-24	25-29	30-34	35-39	40-44
NO	4	20	38	24	10	9

$$\text{Mode} = l + \left( \frac{f_m - f_1}{2f_m - f_1 - f_2} \right) \times C$$

$$f_m = 38$$

$$f_1 = 20 \\ (\text{previous})$$

$$f_2 = 24 \\ (\text{next})$$

$$l = 25 \\ (\text{lower limit})$$

$$C = 5$$

$$\text{Mode} = 25 + \left( \frac{38 - 20}{76 - 20 - 24} \right) \times 5$$

$$= 25 + \left( \frac{\frac{18}{42}}{\frac{21}{7}} \right) \times 5$$

$$= 25 + 2.14$$

$$= 27.8124$$

- 1) Find the mean, median & mode for the following data.

~~203, 205, 200, 203, 200, 198, 199~~  
~~200, 203, 201, 204, 198~~

ANS Mode = 200, 203.

Median  
198, 199, 200, 201, 203, 204, 205

median = 201.

~~Median~~

$$\text{Mean} = \frac{1410}{7} = 201.42$$

- 2) Find the mean, median, mode for the following data.

SIZE	11	12	13	14	15	16	17	20	22
FREQUENCY	3	8	13	20	25	22	15	12	7

$$\begin{aligned} \text{MEAN} &= \frac{\sum f}{\sum f} = \frac{85 + 96 + 169 + 280 + 375 + 352}{127} \\ &= \frac{1266}{127} \\ &= 19.5 \end{aligned}$$

Mode = 15

Median

D	b	CF
11	5	55
12	8	13
13	13	26
14	20	46
15	26	77
16	22	93
17	15	108
20	12	120
22	7	(127)

$$\text{MEDIAN} \rightarrow \frac{127}{2} = 63.5$$

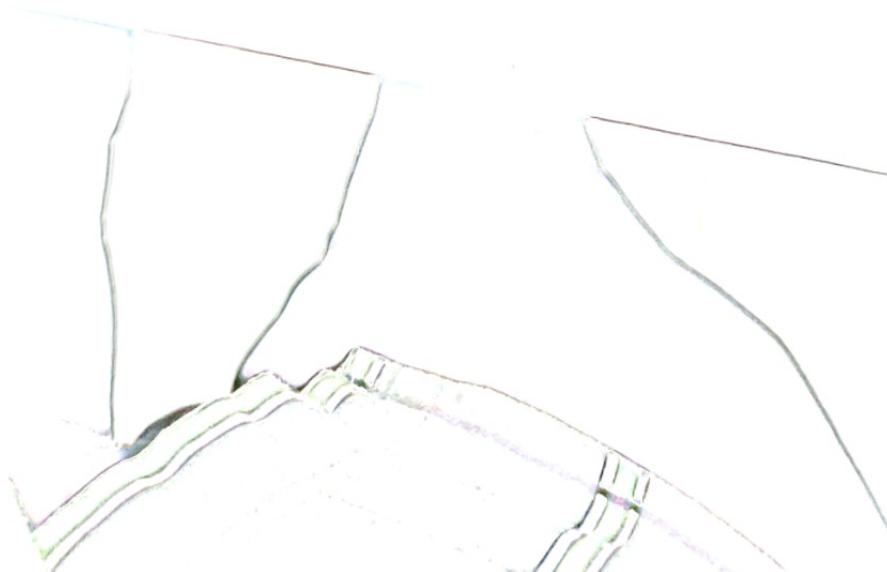
$$[\text{MEDIA} = 15]$$

- 3) Find the mean, median, mode from the following.

AGE	0-5	5-10	10-15	15-20	20-25	25-30/30-35
FREQUENCY	1	2	5	14	10	9/2

INS	$\bar{x}$	$x$	$\bar{x} f$
0-5	1	2.5	2.5
5-10	2	7.5	15
10-15	5	12.5	62.5
15-20	14	17.5	245
20-25	10	22.5	225
25-30	9	27.5	247.5
30-35	2	32.5	65
	43		862.5

$$\text{mean} = \frac{\sum fx}{\sum f} = \frac{862.5}{43} = 20.05$$



HOPE

$$d + \left( \frac{f_{m+1}}{2f_m - f_1 - f_2} \right) \times C$$

$$f_m = 14$$

$$f_1 = 5, f_2 = 10$$

$$C = 5$$

$$15 + 15$$

$$\text{mode} = 15 + \left( \frac{14 - 5}{28 - 5 - 10} \right) \times 5$$

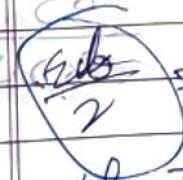
$$21 = 15 + \left( \frac{9}{13} \right) \times 5$$

~~15 min = 18.46 minutes (within 0.01 bits)~~

$$\text{median} = d + \left( \frac{\frac{m}{2} - m}{f} \right) \times C$$

<u>X</u>	<u>f</u>	<u>CF</u>	<u>f</u> =
0-5	1	1	1
5-10	2	3	2
10-15	5	8	2
(15)-20	4	22	2
20-25	10	32	1
25-30	9	41	0
30-35	12	43	0
35-40	8	51	0
40-45	2	53	0
45-50	1	54	0
50-55	0	54	0

$$21.5$$



$$\frac{m}{2} = \frac{43}{2} = 21.5 \quad m = 8$$

$$\approx 15 + \left( \frac{21.5 - 8}{14} \right) \times 5$$

median = 19.82

4) Find mean, median & mode.

<u>Class</u>	<u>Frequency</u>
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11 - 15

16 - 20

21 - 25

26 - 30

31 - 35

36 - 40

41 - 45

46 - 50

51 - 55

39

47

52

41

28

16

4

$$\text{mean} = 15 + \left( \frac{(14.5 + 18.5 + 22.5 + 26.5)}{4} \right) + 5 = 19.82$$

## MISSING FREQUENCY

- i) Given the following frequency distribution with some missing frequencies.

Class	10-20	20-30	30-40	40-50	50-60	60-70	70-80
f	185	-	34	180	136	102	50

If total frequency is 686 and median is 42.5, find out the missing frequency

Q5

All chrome

$$\text{median} = l + \left( \frac{\frac{N}{2} - m}{f} \right) \times c$$

Class	<u>f</u>	<u>CF</u>	<u>CF</u>
10-20	185	185	185
20-30	<u>f<sub>1</sub></u>	185 + <u>f<sub>1</sub></u>	219 + <u>f<sub>1</sub></u>
30-40	34	219 + <u>f<sub>1</sub></u>	253 + <u>f<sub>1</sub></u>
40-50	180	253 + <u>f<sub>1</sub></u>	399 + <u>f<sub>1</sub></u>
50-60	136	399 + <u>f<sub>1</sub></u>	535 + <u>f<sub>1</sub></u>
60-70	<u>f<sub>2</sub></u>	535 + <u>f<sub>1</sub></u> + <u>f<sub>2</sub></u>	535 + <u>f<sub>1</sub></u> + <u>f<sub>2</sub></u>
70-80	50	535 + <u>f<sub>1</sub></u> + <u>f<sub>2</sub></u>	585 + <u>f<sub>1</sub></u> + <u>f<sub>2</sub></u>

$$\frac{N}{2} = \frac{686}{2} = 343.5 \quad f = 40$$

$$l = 40, \quad \frac{N}{2} = 343.5, \quad m = 219 + f_1, \quad f = 40$$

$$\text{median} = 40 + \left( \frac{343.5 - (219 + f_1)}{40} \right) \times 10 = 42.5$$

$$40 + \left[ \frac{123.5 - f_1}{18} \right] = 42.6$$

$$123.5 - f_1 = 46.8$$

$$f_1 = 76.7$$

now

$$585 + f_1 + f_2 = 685$$

$$76.7 + f_2 = 100$$

$$f_2 = 23.3$$

2) Given -  $\sum (f_i \cdot m_i) = 111$  &  $f_1 = 4$

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
$f_i$	4	16	—	—	—	6	4	23.3

Find the missing frequencies if median is 33.5 and mode is 34.

ANS

Class

f

CF

0-10

4

4

10-20

16

20

20-30

$f_1$

$20 + f_1$

$30 - 40$

$f_2$

$20 + f_1 + f_2$

40-50

$f_3$

$20 + f_1 + f_2 + f_3$

50-60

6

$20 + f_1 + f_2 + f_3$

60-70

4

$30 + f_1 + f_2 + f_3$

~~$$\text{Mode} = l + \frac{(f_m - f_1)}{2f_m - f_1 - f_2} \times c$$~~
~~$$= 30 + \frac{(f_2 - f_1)}{2f_2 - f_1 - f_3} \times c$$~~

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

$$l = 30 \quad \frac{n}{2} = \frac{230}{2} = 115 \quad m = 20 + f_1$$

$$f = f_2 \quad C = 10$$

$$30 + \left( \frac{115 - 20 - f_1}{f_2} \right) \times 10 = 33.5$$

$$30 + \left( \frac{95 - f_1}{f_2} \right) \times 10 = 33.5$$

$$\left( \frac{95 - f_1}{f_2} \right) \times 10 = 3.5$$

$$\boxed{95 - f_1 = 0.35 \quad f_2 = 0} \quad \text{--- (1)}$$

$$\text{Mode} = l + \frac{(f_m - f_1)}{2f_m - f_1 - f_2} \times c$$

## MODULE-2 MEASURES OF DISPERSION

### Types of measures of dispersion

- 1) Range
- 2) Quartile deviation
- 3) Mean deviation
- 4) Standard deviation
- 5)

1) Range: It is defined as the difference between largest & smallest of the observation.

$$\text{Range} = L - S$$

where

L = largest of the observation

S = smallest of the observation

$$\text{Coefficient of Range} = \frac{L - S}{L + S}$$

- 2) Find the range and the coefficient of range for the following.
- 35, 40, 52, 29, 51, 54, 46, 27, 30, 30, 23.

ANS

$$L = 52, S = 23$$

$$\text{Range} = L - S = 52 - 23 = 29$$

$$\text{Coefficient of range} = \frac{L - S}{L + S} = \frac{29}{75} = 0.386$$

- ② Find the coefficient of range of the following data.

AGES	45-45	45-55	55-65	65-75	75-85
Frequency	18	25	30	6	4

mid value of largest class = 80 = L

mid value of smallest class = 40 = S

$$\text{Range} = L - S = 80 - 40 = 40$$

$$\text{Coefficient of range} = \frac{L - S}{L + S} = \frac{40}{120} = \frac{1}{3} = 0.333$$

QUARTILE DEVIATION : It is defined as

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

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

- ③ If  $(Q_3 - Q_1)$  is 100, then  
 ④ Find the quartile deviation and coefficient of quartile deviation for the following data.

Class	0-10	10-20	20-30	30-40	40-50	50-60	60-70
f	8	20	34	46	28	14	10

$$M_{\text{MEDIAN}} = l + \left( \frac{\frac{N}{2} - m}{f} \right) \times c$$

$$Q_1 = l_1 + \left( \frac{\frac{N}{4} - m_1}{f_1} \right) \times c$$

$$Q_3 = l_2 + \left( \frac{\frac{3N}{4} - m_2}{f_2} \right) \times c$$

Class frequency c.f. total f Q.F q1 median q3

0-10	8	8	16	20
10-20	20	28	48	52
20-30	34	62	82	91
30-40	46	108	154	median
40-50	28	136	164	$\rightarrow Q_3$
50-60	14	150	164	
60-70	10	160	170	

### MEDIAN

$$l = 30, c = 10, N = \frac{160}{2} = 80, m = 62, f = 46$$

$$\text{median} = 30 + \left( \frac{80 - 62}{46} \right) \times 10$$

$$= 33.91$$

Q1  $d_1 = 20, C = 10, \frac{N}{4} = \frac{160}{4} = 40, m_1 = 28$   
 $f_1 = 34$  - True frequency

$$Q_1 = 20 + \left( \frac{40-28}{34} \right) \times 10$$

$$= 23.52$$

Q3  $d_3 = 40, C = 10, \frac{3N}{4} = \frac{120}{4} = 30, m_3 = 108$   
 $f_3 = 28$

$$Q_3 = 40 + \left( \frac{120-108}{28} \right) \times 10$$

$$= 44.28$$

$$\text{Quartile deviation} = Q_3 - Q_1 = 10.38$$

$$\text{Coefficient of quartile deviation} = \frac{Q_3 - Q_1}{Q_3 + Q_1} = \frac{0.306}{0.306}$$

### MEAN DEVIATION

Let  $x_1, x_2, \dots, x_m$  be the values. Then  
mean deviation about mean is given  
by

26

$$\text{MEAN DEVIATION} = \frac{\sum |x_i - \bar{x}|}{n} \quad \left[ \bar{x} = \frac{\sum x_i}{n} \right]$$

In a frequency distribution with  
frequency  $F_1, F_2, \dots, F_m$  the mean

~~STANDARD DEVIATION~~

$$\text{Deviation about mean} = \frac{\sum F_i |x_i - \bar{x}|}{\sum F}$$

$$\text{Mean deviation about median} = \frac{\sum F_i |x_i - m|}{\sum F}$$

Coefficient of mean deviation about mean =  $\frac{\text{MEAN DEVIATION}}{\text{MEAN}}$

Coefficient of mean deviation about median =  $\frac{\text{MEAN DEVIATION}}{\text{MEDIAN}}$

- ① Find the mean deviation about mean for the following data.

18, 20, 12, 14, 19, 22, 26, 16, 19, 24.

ANS

12, 14, 16, 18, 19, 20, 22, 24, 26

$$\text{mean} = \frac{\sum x}{n} = \frac{190}{10} = 19$$

X	X - $\bar{x}$	$ x - \bar{x} $	MEAN DEVIATION ABOUT MEAN
18	$18 - 19 = -1$	1	$= \frac{\sum  x - \bar{x} }{n}$
20	$20 - 19 = 1$	1	
12	$12 - 19 = -7$	7	
14	$14 - 19 = -5$	5	
22	$22 - 19 = 3$	3	
19	$19 - 19 = 0$	0	
26	$26 - 19 = 7$	7	
16	$16 - 19 = -3$	3	
19	$19 - 19 = 0$	0	
24	$24 - 19 = 5$	5	
			$= \frac{32}{10} = 3.2$
			$\frac{32}{32}$

2) Find the mean deviation about mean from the following data.

VALUE	10	11	12	13	14	
FREQUENCY	3	12	19	12	12	0

VALUE	$x_i$	$ x_i - \bar{x} $	$f_i  x_i - \bar{x} $
10	3	2	6
11	12	1	12
12	18	0	0
13	12	1	12
14	23	2	6
60	48	6	36

$$\bar{x} = \frac{\sum f x_i}{\sum f} = \frac{60}{5} = 12 \quad \text{MEAN DEVIATION ABOUT MEAN} = \frac{\sum f |x_i - \bar{x}|}{\sum f}$$

$$= \frac{36}{48} = 0.75$$

# STANDARD DEVIATION

1) Standard deviation  $\sigma = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$

2) Standard deviation  $\sigma = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n}\right)^2}$

where  $d = x - \text{assumed mean}$

3) Standard deviation  $\sigma = \sqrt{\frac{\sum fd^2}{\sum f} - \left(\frac{\sum fd}{\sum f}\right)^2}$

only in CI

Coefficient of Variation =  $\frac{\text{Standard deviation}}{\text{mean}} \times 100$

Q1) Find the standard deviation of the following data

3, 8, 6, 12, 9, 11, 10, 12, 7

SOL

$$\begin{array}{c|c} X & x^2 \\ \hline 3 & 9 \end{array}$$

$$\sigma = \sqrt{\frac{\sum x^2}{n} - \left(\frac{\sum x}{n}\right)^2}$$

$$\begin{array}{c|c} 8 & 64 \end{array}$$

$$\begin{array}{c|c} 6 & 36 \end{array}$$

$$\begin{array}{c|c} 12 & 144 \end{array}$$

$$\begin{array}{c|c} 9 & 81 \end{array}$$

$$\begin{array}{c|c} 11 & 121 \end{array}$$

$$\begin{array}{c|c} 10 & 100 \end{array}$$

$$\begin{array}{c|c} 12 & 144 \end{array}$$

$$\begin{array}{c|c} 7 & 49 \end{array}$$

$$\begin{array}{c|c} 88 & 848 \end{array}$$

$$= \sqrt{\frac{848}{10} - \left(\frac{88}{10}\right)^2}$$

$$\sigma = \sqrt{84.8 - 77.44} = 2.712$$

2

Q Find the standard deviation of 45, 36, 40, 37, 39, 42, 45, 35, 40, 39.

(2nd form)

SOL

X	$d = X - 39$	$d^2$
40	1	1
37	-2	4
39	0	0
42	3	9
45	6	36
35	-4	16
40	1	1
39	0	0
45	6	36
36	-3	9
	<u>8</u>	<u>112</u>

We can also  
use 1st formula

$$\bar{a} = 39$$

$$\sigma = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n}\right)^2}$$

$$= \sqrt{\frac{112}{10} - \left(\frac{8}{10}\right)^2}$$

$$= \sqrt{11.2 - 0.64} = 3.24$$

- 3) The weekly wages of a group of employees are given below. Find the standard deviation of the wages.

WAGES	75	80	85	90	95	100
NO. of EMPLOYS	3	7	18	12	6	4

X	f	$d = x - 85$	$fd$	$fd^2$
75	3	-10	-30	300
80	7	-5	-35	175
85	18	0	0	0
90	12	5	60	300
95	6	10	60	300
100	4	15	225	1125
<b>50</b>		<b>15</b>	<b>475</b>	<b>2275</b>

$$\sigma = \sqrt{\frac{\sum fd^2}{\sum f} - \left( \frac{\sum fd}{\sum f} \right)^2}$$

$$= \sqrt{\frac{2275}{50} - \left( \frac{115}{50} \right)^2}$$

$$= \sqrt{45.5 - 5.29} = \sqrt{40.21} = 6.34$$

- 4) In a small town a survey was conducted in respect of profit made by ~~the~~ retail shop which is given in the following table.

PEOPLE OR HOUSES IN THOUSANDS	1 to 3	3 to 5	5 to 7	7 to 9	9 to 11	11 to 13
No. of shops						

PROFIT IN RS.	1 to 3	3 to 5	5 to 7	7 to 9	9 to 11	11 to 13
No. of shops	4	10	22	28	38	50
A.C.P.	4	10	22	28	38	50

Calculate

- Average profit made by a retail shop.
- Total profit by all shops.
- The coefficient of variation.  $(a=0.5)$

<u>f</u>	<u>x</u>	<u>fx</u>	<u><math>\sum fx</math></u>	<u><math>d=x-a</math></u>
-4 to -3	4	-3.5	-14	-4
-3 to -2	10	-2.5	-25	-3
-2 to -1	22	-1.5	-33	-2
-1 to 0	28	-0.5	-14	-1
0 to 1	38	0.5	19	0
1 to 2	56	1.5	84	1
2 to 3	40	2.5	100	2
3 to 4	24	3.5	84	3
4 to 5	18	4.5	81	4
5 to 6	10	5.5	55	5
<u><math>\Sigma f = 250</math></u>		<u><math>\Sigma fx = 337</math></u>		<u><math>\Sigma d = 5</math></u>

$$\text{mean} = \frac{\sum fx}{\sum f} = \frac{337}{250} = 1.348$$

$$\text{i) average profit} = 1.348 \times 1000 \\ \text{for a single shop} = 1348$$

$$\text{ii) average profit} \times \text{all shops} = 1348 \times 250 \\ = 337000$$

$$\text{iii) Coefficient of variation} = \frac{\text{Standard deviation}}{\text{mean}}$$

~~$$\text{Standard deviation } \sigma = \sqrt{\frac{\sum fd^2}{n} - \left(\frac{\sum f d}{n}\right)^2}$$~~

~~$$= \sqrt{\frac{85}{10} - \left(\frac{5}{10}\right)^2}$$~~

~~$$\sigma = \sqrt{8.5 - 0.25} = 2.87$$~~

~~$$\text{Coefficient of variation} = \frac{2.87}{5} \times 100 = 57.4\%$$~~

~~$$\text{Standard deviation} = \sigma = \sqrt{\frac{\sum fd^2}{n} - \left(\frac{\sum f d}{n}\right)^2}$$~~

~~$$\sum fd^2$$~~

~~$$\sum fd^2 = 85$$~~

~~$$\left(\frac{\sum f d}{n}\right)^2 = (5)^2$$~~

~~$$\text{Standard deviation} = \sqrt{85 - 25} = 8.7$$~~

## MEASURES OF SKEWNESS

Pearson's coefficient of skewness =  $\frac{\text{Mean} - \text{Mode}}{\text{Standard deviation}}$

If mode is unknown,

Pearson's coefficient of skewness =  $\frac{3(\text{Mean} - \text{Median})}{\text{Standard deviation}}$

Bowley's coefficient of skewness =  $\frac{Q_3 + Q_1 - 2M}{Q_3 - Q_1}$

- Find the Pearson's coefficient of skewness for the following distribution

Annual sales	0-20	20-40	40-60	60-80	80-100	100-120
No. of firms	20	50	59	30	25	18

Ans

Pearson's coefficient of skewness =  $\frac{\text{Mean} - \text{Mode}}{\text{Standard deviation}}$

X	Mid value	f	$f^2$	$xf^2$	$cf^2$
0-20	10	20	400	100	2000
20-40	30	50	900	900	45000
40-60	50	59	2500	2950	147500
60-80	70	30	4900	2100	147000
80-100	90	25	8100	2250	202500
100-120	110	16	129600	1760	193600
		200	40000	10760	756000
					737600

$$\text{Mean} = \frac{\sum Fx}{\sum F} = \frac{10760}{200} = 53.8$$

$$\text{Mode} = l + \left( \frac{f_m - f_1}{2f_m - f_1 - f_2} \right) \times C$$

$$f_m = 69, f_1 = 50, f_2 = 30$$

$$l = 40, C = 20$$

$$\text{Mode} = 40 + \left( \frac{69 - 50}{2(69) - 50 - 30} \right) \times 20$$

$$= 40 + \frac{19}{88} \times 20 = 44.74$$

$$\text{Mode} = 44.74$$

$$\text{Standard deviation } \sigma = \sqrt{\frac{\sum Fx^2 - (\sum Fx)^2}{\sum F}}$$

$$\text{Mean} = \frac{\sum Fx}{\sum F} = \frac{10760}{200}$$

$$\text{S.D.} = \sqrt{3688 - 2894.64}$$

$$\text{Standard deviation} = 28.17$$

$$\text{Pearson's Coefficient of skewness} = \frac{53.8 - 44.74}{28.17} = 0.32$$

2) Find Bowley's coefficient of skewness for the following distribution

Payment	No. of Collection (f)	C.F.	
100-120	4	4	0.00
120-140	10	14	
140-160	16	30	10. PES
160-180	29	59	
180-200	52	111	→ Q1
200-220	80	191	Median (140 lies between)
220-240	42	233	→ Q3
240-260	23	256	
260-280	17	273	
280-300	7	280	

$$\text{Median} = l + \left( \frac{\frac{N}{2} - m}{f} \right) \times C$$

$$\frac{N}{2} = \frac{280}{2} = 140 \quad f = 80, \quad C = 20$$

$$M = 111 \quad l = 200$$

$$= 200 + \left( \frac{140 - 111}{80} \right) \times 20$$

$$\boxed{\text{Median} = 207.25}$$

$$Q_1 = l_1 + \left( \frac{\frac{N}{4} - m}{f_1} \right) \times C$$

$$\frac{N}{4} = \frac{70}{4} = 17.5 \quad m = 59 \quad f_1 = 52 \quad l_1 = 180$$

$$Q_1 = 180 + \left( \frac{17.5 - 59}{52} \right) \times 20 = 184.23$$

$Q_3 = d + \left( \frac{B_P - m}{h} \right) \times c$  (followed by text)

$$\therefore d_2 = 220, \quad \frac{B_P}{h} = 210, \quad m_2 = 191$$

$$d = 20$$

$$Q_3 = 229.04$$

$$\text{Bouley's coefficient of scatter} = \frac{Q_3 + Q_1 - 2m}{Q_3 - Q_1 - m}$$

$$= 229.04 + 184.23 - 2(207.25)$$

$$= 229.04 - 184.23$$

$$= -0.0274$$

$$2x\left(\frac{m_2 - q}{h}\right) + d_1 = \text{middle}$$

$$0.2 = 2.08 = 0' \quad 0.11 = \frac{0.2}{2} = 0.1$$

$$0.02 = 0.1 \quad 0.11 = H$$

$$62.3(111 - 0.21) + 60.2 =$$

$$[20.502 = \text{middle}]$$

$$2x\left(\frac{m_2 - q}{h}\right) + d_1 = 0$$

$$2x\left(\frac{m_2 - q}{h}\right) + d_1 = 0$$

$$2x\left(\frac{m_2 - q}{h}\right) + d_1 = 0$$