STATISTICS AND MATHEMATICS FOR MANAGEMENT

SUB. CODE : 18K2BBA31

UNIT : I

Statistics - Definition

"Statistics are numerical statement of facts in any department of enquiry placed in relation to each other"

- Bowley

"By statistics we mean quantitative data affected to a marked extent by multiplicity of cause"

- Yule and Kendall.

Limitations of Statistics :-

1. **Statistics does not deal with individual items :-**

Statistics deals with groups or aggregates only. The scope of statistics lies outside the study of

2. **Statistics deals with quantitative data only :-**

Statistics is numerical statement of facts. statistics deals with only the quantitative data.

For example:- Per capita income, Population growth, etc. can be studied by statistics, but qualitative aspects such as honestry intelligence, poverty, efficiency, blindness, deafness, etc. cannot be studied directly.

3. statistics may Mislead to wrong conclusion in the absence of details:-

If o figures are given without details, we may arrive at wrong and misleading conclusions.

4. statistical laws are true only on averages:-

Laws of physical chances are perfect. But statistical Laws are not so perfect as the Laws of physics or chemistry. statistical results are true only on the average.

5. Statistics doest not reveal the entire story:-

statistics simplifies complicated data. Before using the data, the Background of the data may be studied.

6. statistical data should be uniform and homogeneous:

comparison is one of the important characters of statistical data. Uniform and homogeneous data can be compared.

7. statistics is liable to be misused:- It is the most important limitation of statistics.

According to Bowley "statistics only furnishes a tool though imperfect, which is dangerous in the hands of those who do not know its use and deficiencies.

Collection of Data :-

Primary data - Definition :-

Primary data are those which are collected for the first time and they are original in character.

Secondary data - Definition :-

The secondary data are those which are already collected by someone for some purpose and there are available for the present study.

Methods of collecting the primary data :-

(i): Direct personal observation :-

Under this Method, the data are collected by the investigator personally. The investigator must be a keen observer, tactful and courteous in behaviour.

(ii) Indirect oral Interview :-

The informant is reluctant to supply information, the method of indirect oral investigation can be followed. Under this Method the investigator approaches the witnesses or third parties, who are in touch with the informant.

(iii) Information through agencies :-

Under this Method, local agents or correspondents will be appointed. They collect the information and transmit it to the office or person. They do this according to their own ways and tastes. This system is adopted by Newspapers, Periodicals, agencies, etc.

(iv) Mailed Quastionnaires :-

In this Method, a questionnaire consisting of a list of a liz questioning to the enquiry is prepared. There are blank spaces for answers. This questionnaire is sent to the respondents. Who are expected to write the answers in the blank spaces. A covering letter is also sent along with the questionnaire, requesting the rapondents to extend their full co-operation by giving the corsect replies and returning the questionnaire duly filled in time.

(v) Schedules Sent through enumerators :-

It is the most widely used method of collection of primary data. A number of enumerators and are selected and trained. They are provided with standardised filling up Schedules.

Sources of Secondary data :-

The Various Sources of Secondary data can be divided into two broad categories.

1. published sources.
2. Unpublished souraes.

(1) Published Sources :-

Various governmental, International and local agencies publish statistical data and chief among them are :

(a) International Publications :-

International agencies and International bodies publish regular occasional reports on economic and statistical matters. They are the I.M.F, the I.B.R.D., the I.C.A.F.E and UNO etc.

(b). official Publications of Central and State Governments

Departments of the Union and State Governments regularly publish reports on a number of subjects. They gather additional information. Some of the important publications are : the Reserve Bank of India Bulletin, Census of India, statistical Abstracts of states, Agricultural statistics of india, indian Trade Journal, etc.

(c) Semi-official Publications :

Semi- Government institutions, like Municipal corporation, District Board, panchayat, etc. publish reports.

(d). Publications of Research institutions.

Indian statistical Institution (I.S.I) Indian Council of agricultural Research (I.C.A.R) Indian agricultural statistics Research institute (I.A.S.R.I) etc. publish the findings of their research programmes.

(e) Publications of commercial and Financial Institutions.

(f) Reports of various committee and commissions appointed by the Government :-

for example :- Wanchoo commission Report on Taxation, Pay Cominission Reports, Land Reforms committee reports etc, are sources of secondary data.

(g) Journals and Newspapers :-

Current and important meterials on statistics and socio-economic problem can be obtained from journals and newspapers like Economic Times, Commerce, capital Indian Finance monthly statistics of Trade, etc.

2. Unpublished Sources :-

There are various sources of unpublished data, They are the records maintained by various government and private offices, the researches carried out by individual research scholars in the universities

Classification

Definition :-

classification is the process of arranging things in groups or classes according to their resemblances and affinities, and giving expression to the unity of attributes that may subsist among a diversity of individuals - R.L. Connor.

Objects of classification :-

The chief objectives of classification are

1. To condense the mass of data.
2. To present the facts in a simple form
3. To bring out clearly the points of similarity and dissimilarity
4. To facilitate comparison.
5. To bring out the relationship.
6. To prepare data for tabulation.
7. To facilitate the statistical treatment of the data.
8. To facilitate easy interpretation.
9. To eliminate unnecessary details.

Types of classification :-

1. Geographical ie., areawise or regionwise or districtwise.
2. Chronological or historical ie, on the basis of the time.
3. Qualitative by character or by attributes.
4. Quantitative or Numerical or by magnitudes.

Tabulation of Data :-

Definition :-

A statistcal table is a Systematic organisation of data in columns and rows. Tabulation is the process of presenting data in tables.

The main objectives of tabulation :-

1. To clearly clasify the object of investigation.
2. To simplify complex data.
3. To clasify the characteristic of data.
4. To present facts in the minimum of data
5. To facilitate comparison.
6. To detect errors and omission in the data.
7. To depict trend and tendencies of the problem under consideration.
8. To facilitate Statistical processing
9. To help reference.

Types of Tabulation :-

1. One-way Table 2. Two-way Table 3. Three way table.

Diagrammatic presentation :-

Definition :-

A diagram is a visual form for presentation of statistical data. Diagram refers to the various types of devices such as bars, circles maps, Pictorials, cartograms, etc. These devices can like take many attrative forms.

Types of Diagram

The following are the common types of diagram.

1. One-dimensional diagram (line and Bar)
2. Two dimensional diagram (rectangle, square, circle, etc)
3. Three dimensional diagram (cube, sphere, cylinder etc)
4. pictogram
5. cartogram.

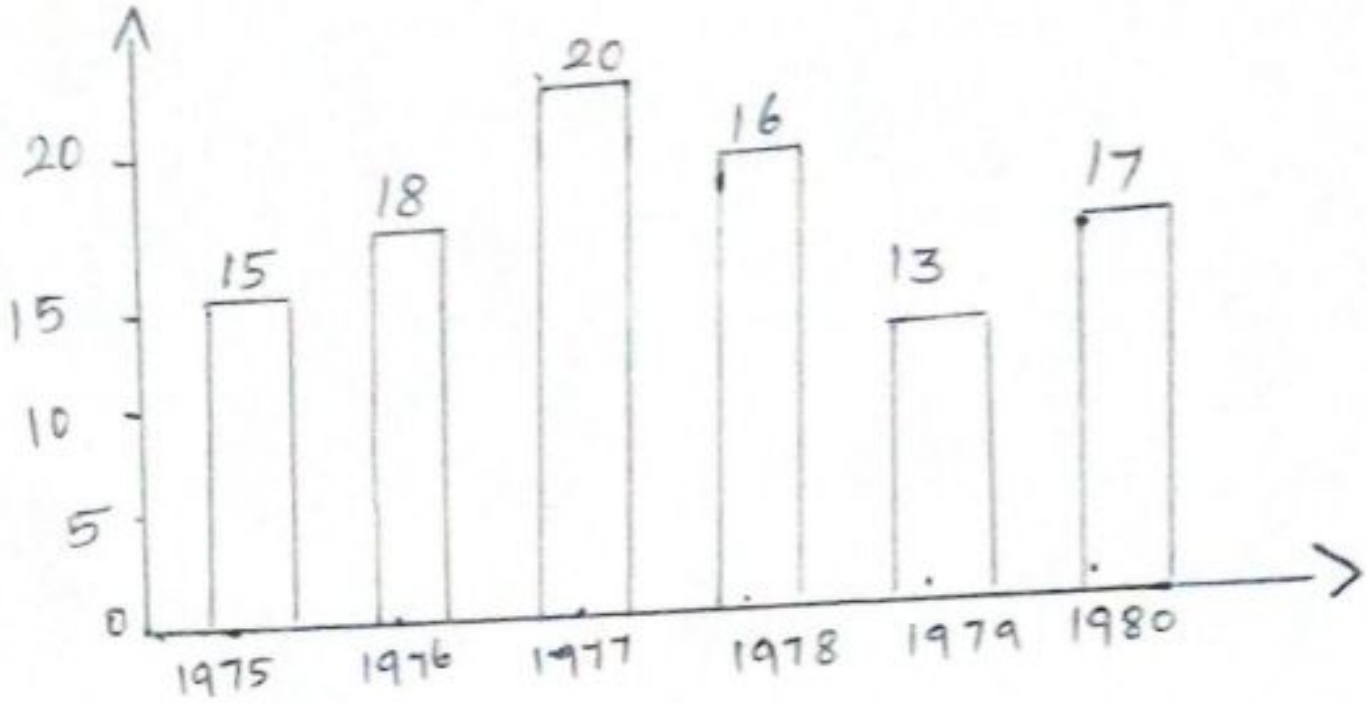
(1) One dimensional Diagram :-

(a) Line diagram (b) Simple Bar diagram (c) Multiple bar diagram (d) Sub-divided bar diagram (e) Percentage Subdivided bar diagram (f) Pie-diagram.

(a) Simple Bar diagram

1. Draw a suitable bar diagram showing the following data

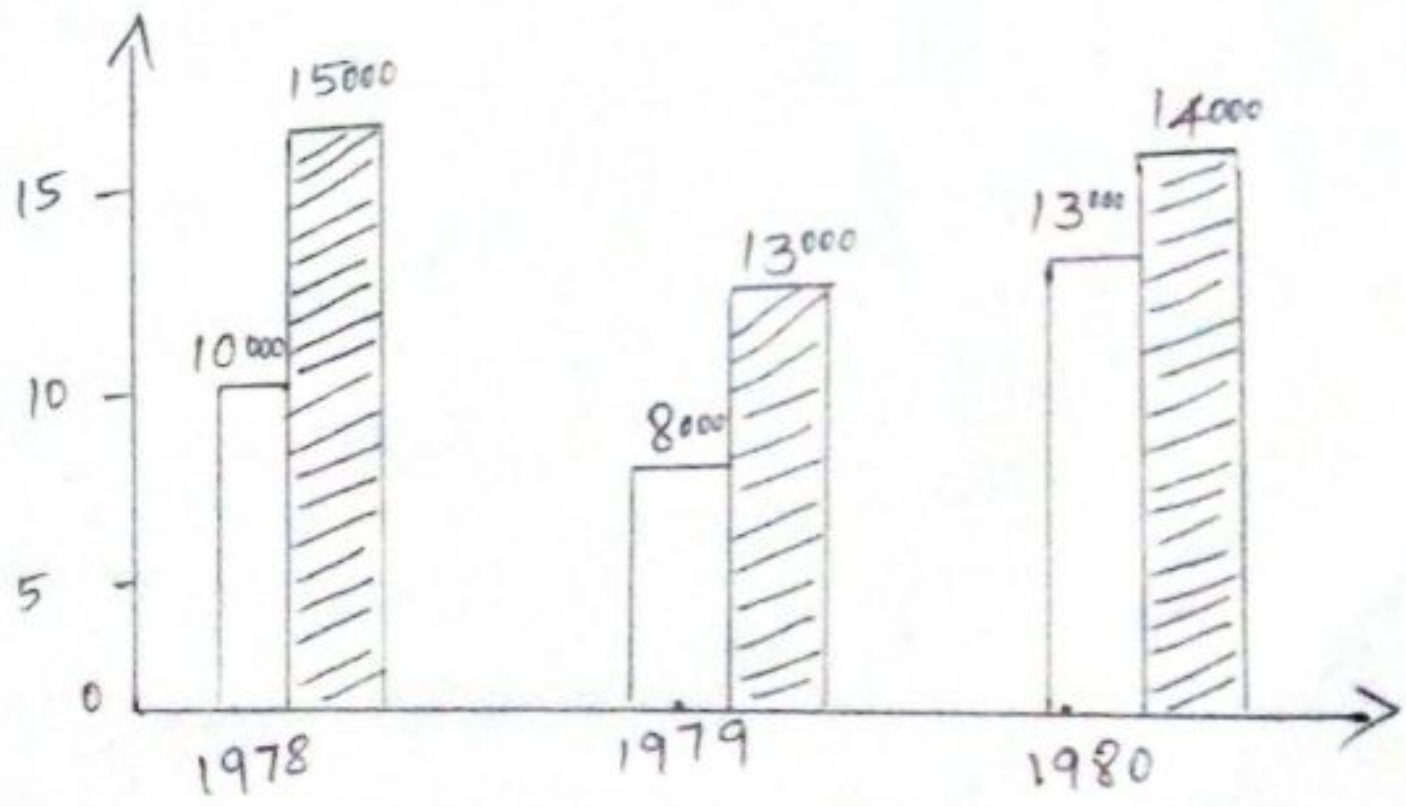
years :	1975	1976	1977	1978	1979	1980
profits :	15000	18000	20000	16000	13000	17000



(c) Multiple Bar diagram :-

The data below gives the yearly profits of two companies A and B. To draw a multiple Bar diagram.

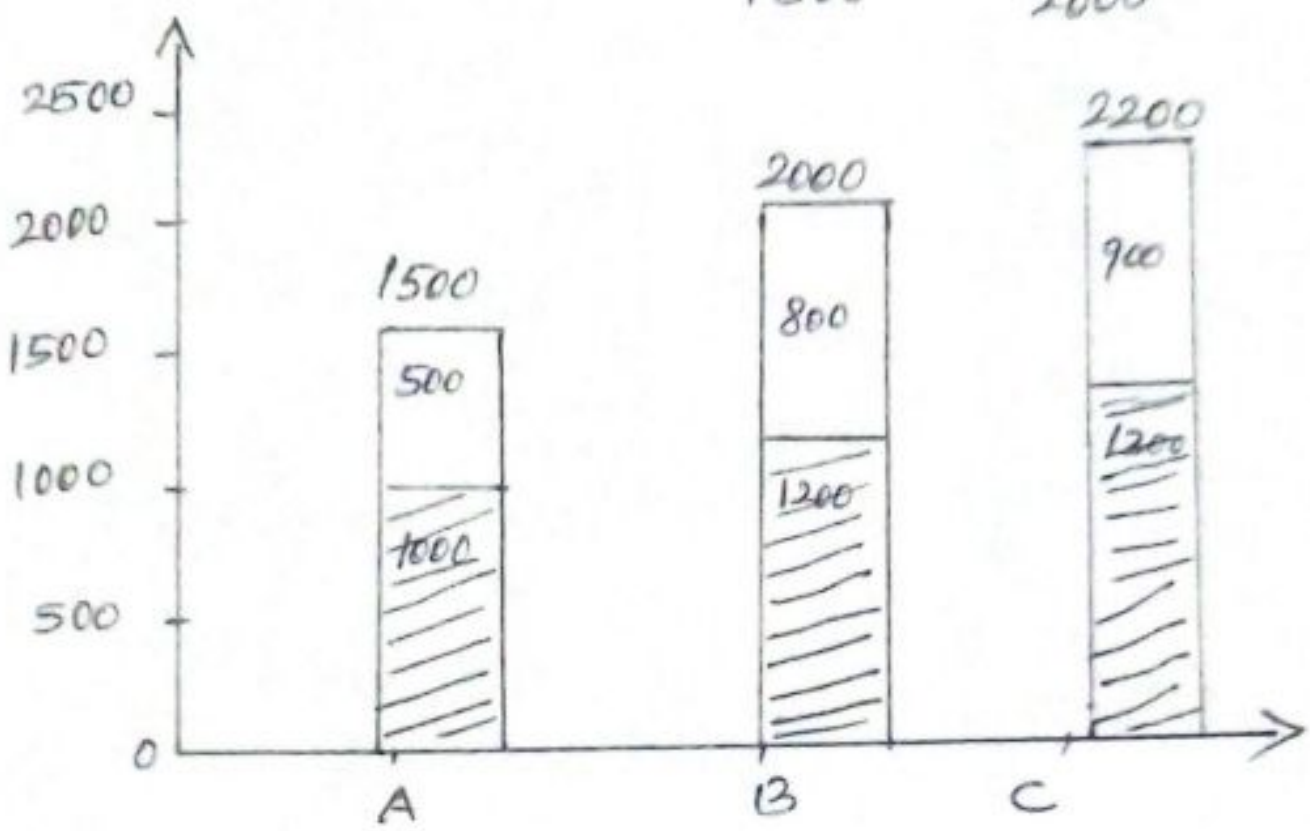
Year	:	1978	1979	1980
Profits	A :	10,000	8000	14000
	B :	15000	13000	



(D) Sub-divided Bar diagram

Represent the following data. Draw a sub-divided bar diagram.

Districts		A	B	C
Population	Male	1000	1200	1300
	Female	500	800	900
		1500	2000	2200



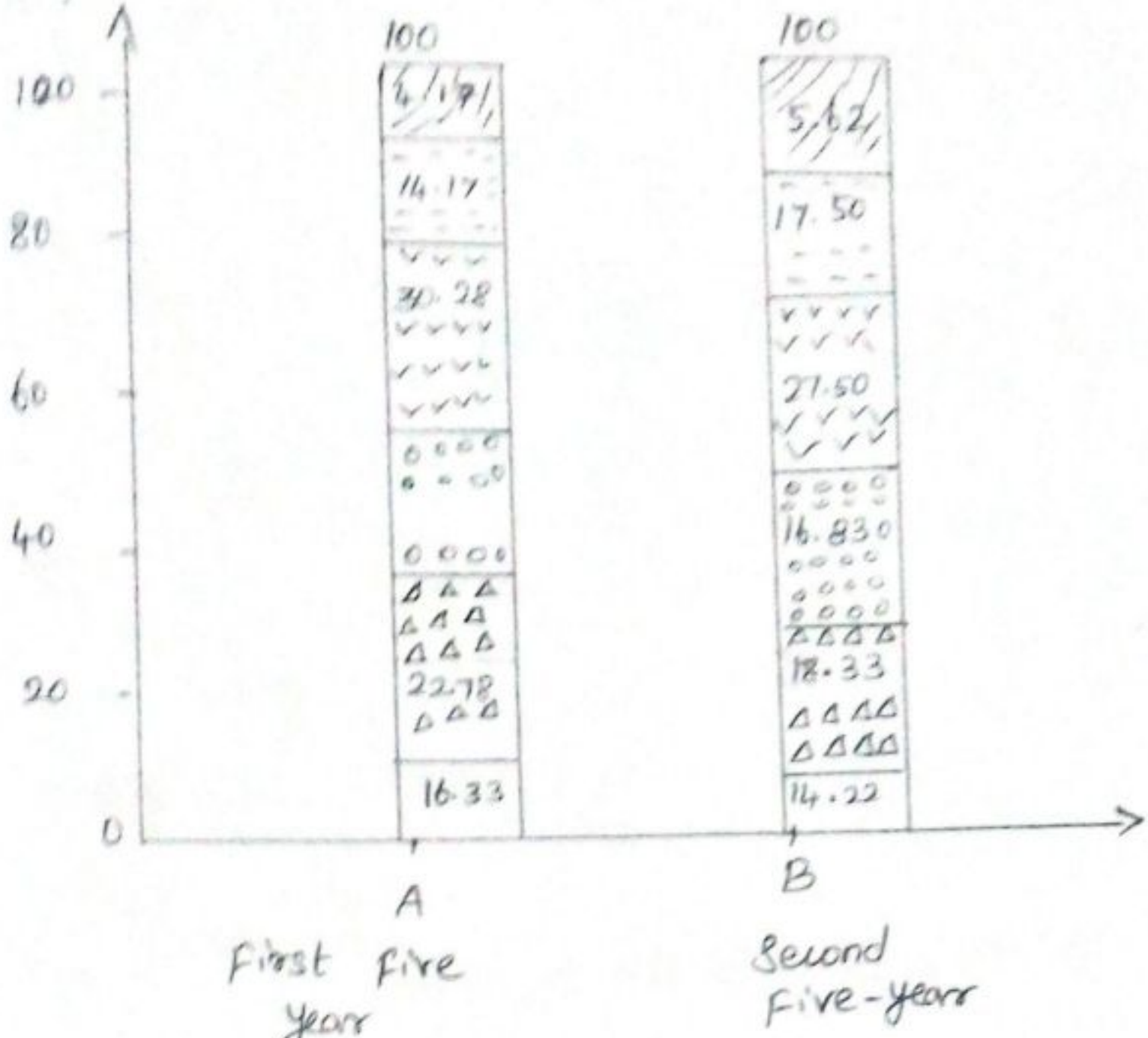
(E) percentage sub divided Bar diagram

Draw a Sub-divided Bar diagram for the following data

Items	Agri	Irri	Industry	Trans	social	Miscellaneous
First Five year	357	492	261	654	36	90
Second Five year	768	990	909	1485	945	300

calculation :-

Item	First-Five year	%	second Five year	%
Agriculture	357	16.33	768	14.22
Irrigation	492	22.78	990	18.33
Industry	261	12.08	909	16.83
Trans	254	30.28	1485	27.50
social	306	14.16	945	17.50
Miscellaneous	90	4.17	300	5.62
Total	2160	100	5400	100



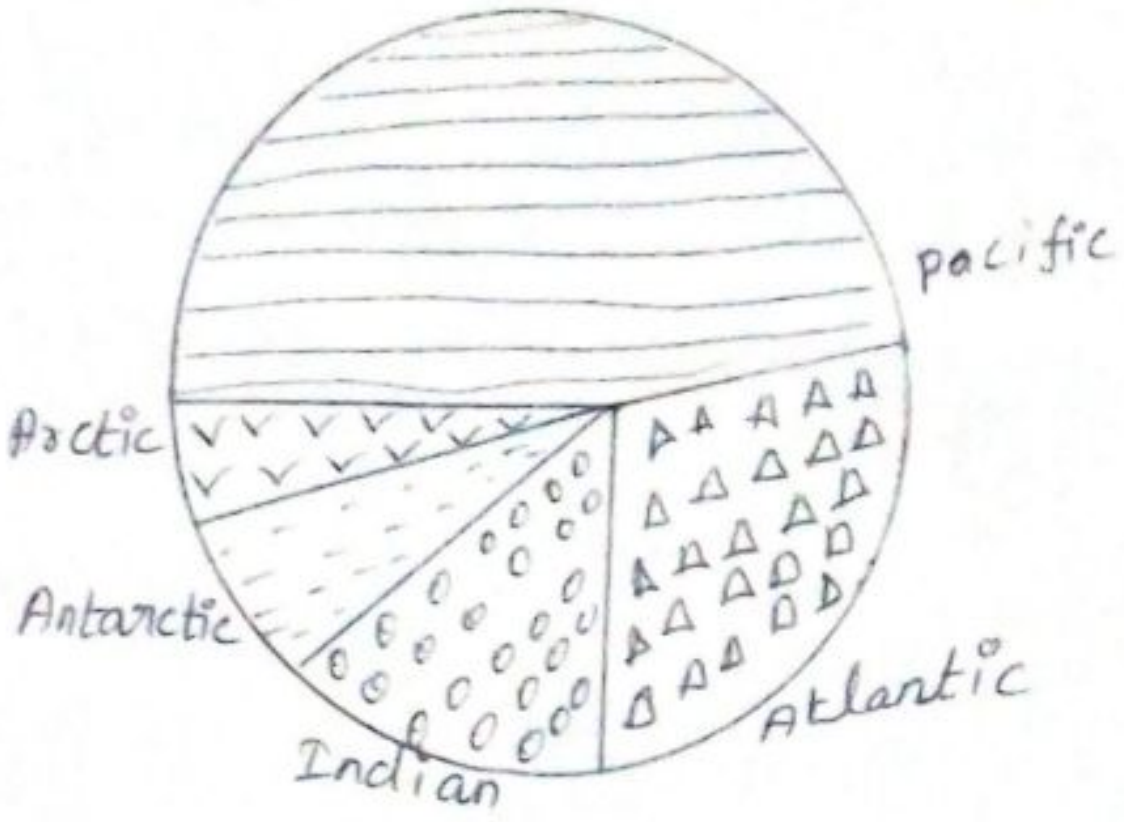
(f) Pie-Diagram :-

Draw a pie-diagram from the following data.

Ocean :	Pacific	Atlantic	Indian	Antaretic	Aretic
Area :	70.8	41.2	28.5	7.6	4.8

Calculation :-

Ocean	Area	Degrees
pacific	70.8	$167 \Rightarrow \frac{70.8}{152.9} \times 360$
Atlantic	41.2	$97 \Rightarrow \frac{41.2}{152.9} \times 360$
Indian	28.5	$67 \rightarrow \frac{28.5}{152.9} \times 360$
Antarctic	7.6	$18 \rightarrow \frac{7.6}{152.9} \times 360$
Arctic	4.8	$11 \rightarrow \frac{4.8}{152.9} \times 360$

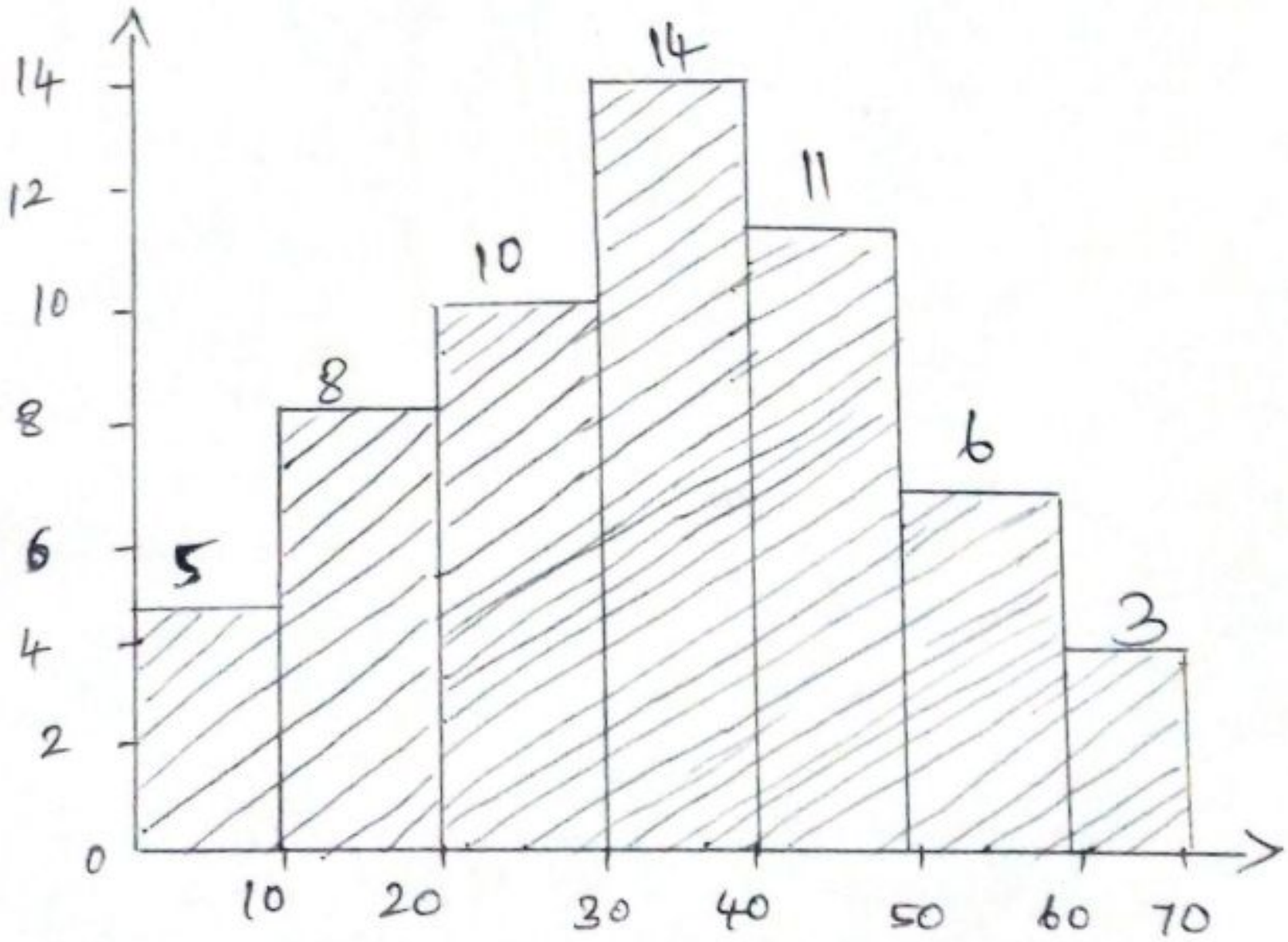


Graphical representation :-

Histogram :-

① To Draw a Histogram from the following data.

Wages in Rs :	0-10	10-20	20-30	30-40	40-50	50-60	60-70
No. of Works :	5	8	10	14	11	6	3



UNIT : II

Measures of Central Tendency (Averages)

Definition :-

An average is typical value in the sense that it is sometimes employed to represent all the individual values in a series or of a variable.

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The following are the important types of averages:

1. Arithmetic Mean 2. Median and 3. Mode.

1. Arithmetic Mean - Definition :-

Arithmetic mean is also called as Mean. It is the most common types and widely used measure of central tendency. Arithmetic average of a series is the figure obtained by dividing the total value of the various item.

Example :-

Calculate the mean from the following data.

Roll. No:	1	2	3	4	5	6	7	8	9	10
Marks:	40	50	55	78	58	60	73	35	43	48

Calculation :-

Roll. No	Marks
1	40
2	50
3	55
4	78
5	58
6	60
7	73
8	35
9	43
10	48
	$\Sigma x = 540$

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

$$\bar{x} = \frac{540}{10} = 54$$

Discrete Method :-

Example :-

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

Calculation :-

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
	300	1716

$$\bar{x} = \frac{\Sigma fx}{N} = \frac{1716}{300}$$

$$\bar{x} = 5.72$$

Continuous Method :-

Example :-

From the following data find out the mean profits.

Profits :	100-200	200-300	300-400	400-500	500-600	600-700	700-800
No. of shops :	10	18	20	26	30	28	18

Calculation :-

Arithmetic Mean.

Profits	Mid Point	No. of shops	fm
100-200	150	10	1500
200-300	250	18	4500
300-400	350	20	7000
400-500	450	26	11,700
500-600	550	30	16,500
600-700	650	28	18,200
700-800	750	18	13,500
		150	72,900

$$\bar{X} = \frac{\Sigma fm}{N} = \frac{72,900}{150}$$

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

Median - Definition

"The Median is that value which divides a series so that one half or more of the item are equal to or less than it and one of half or more of the items are equal to or greater than it"

— croxton and cowden.

Example :-

Find out the Median for the following data.

Size (x): 10 15 9 25 19.

Calculation :-

S.NO	Size of item
1	10
2	15
3	9
4	25
5	19

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

= Size of $\left(\frac{5+1}{2}\right)^{th}$ item

= 3.5^{th} item

= Size of $\frac{(3rd + 4th \text{ item})}{2}$

= $\left(\frac{9+10}{2}\right) = 9.5$

Median - Discrete Series :-

Example :-

Locate Median from the following data.

Size of shoes:	5	5.5	6	6.5	7	7.5	8
frequency :	10	16	28	15	30	40	34

Calculation.

Size of shoes	frequency	C.f
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 $\left(\frac{N+1}{2}\right)^{th}$ item

= size of $\left(\frac{173+1}{2}\right)^{th}$ item

= size of 87^{th} item

Median = 7

Continuous Method - Median

Example :-

calculate the Median from the following data.

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

Calculation :-

Marks	frequency	c.f
10-25	6	6
25-40	20	26
40-55	44	70
55-70	26	96
70-85	3	99
85-100	1	100

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

Median is estimated as

$$\text{Median} = L + \left[\frac{\frac{N}{2} - c.f}{f}\right] \times C$$

$$= 40 + \left[\frac{50-26}{44}\right] \times 15$$

Med = 27 years

Mode - Definition.

Mode is the value which occurs the greatest number of frequency in a series.

"The mode of a distribution is the value at the at mode is defined as the value of the variable which occures most frequency in a distribution.

Example :-

10 persons have the following income.

850, 750, 600, 825, 850, 725, 600, 850, 640, 530

850 repeats three times, therefore the mode is Rs 850.

In certain cases that there may not be a mode or there may be more than one mode,

(a) 40, 44, 57, 78, 48 (No mode)

(b) 45, 55, 50, 45, 40, 55, 45, 45 (Bimodel)

Mode (a) = 45

(b) = 55.

MODE - Discrete Method :-

Calculate the mode from the following data.

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

Calculation :-

Grouping Table

Size	1	2	3	4	5	6
10	10	22				
11	12		27	37	(46)	
12	15	(34)				(54)
13	19		(39)	(47)		
14	20	28	12		32	
15	8					15
16	4	7	5	9		
17	3					
18	2					

Analysis Table

Column No	Size of item					
	10	11	12	13	14	15
1						
2			1	1		
3				1	1	
4				1	1	1
5		1	1	1		
6			1	1	1	
Total		1	3	5	3	1

Mode – Continuous Method :-

Example:-

Compute the mode from the following data

Size of item	0-5	5-10	10-15	15-20	20-25	25-30	30-35	35-40	40-45
frequency	20	24	32	28	20	16	34	10	8

Calculation:-

Size of item	Frequency 1	2	3	4	5	6
0-5	20	44				
5-10	24		56	76		
10-15	32	60			84	
15-20	28		48	64		80
20-25	20	36			70	
25-30	16		50			
30-35	34	44		52		60
35-40	10		18			
40-45	8					

$$z = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times c$$

Column	Grouping frequency. 0-5	5-10	10-15	15-20	20-25	25-30
1						
2			1	1		
3		1	1			
4	1	1	1	1		
5			1	1	1	
6						

$$z = L + \left[\frac{f_1 - f_0}{2f_1 - f_0 - f_2}\right] \times c$$

$\Rightarrow L = 10,\ f_1 = 32,\ f_0 = 24,\ f_2 = 28 \quad i = 5.$

$$z = 10 + \left[\frac{32-24}{2\times 32 - 24 - 28}\right] \times 5$$

$$z = 13.33$$

Measures of Dispersion

(i) Range - Definition :-

The range is the simplest measures of dispersion. It is a rough measure of disperson. Its measure depends upon the extreme items and not on all the items.

Quartile deviation - Raw data Method :-

Example :-

Calculate Q.D and its coefficient for the following data.

Months	1	2	3	4	5	6	7	8	9	10	11	12
Monthly earnings	239	250	251	251	257	258	260	261	262	262	273	275

Calculation :-

$Q_1 = \text{Size of } \left(\frac{N+1}{4}\right)^{th} \text{ item} \Rightarrow = \text{Size of } \left(\frac{12+1}{4}\right)^{th} \text{ item}$

$Q_1 = 251$

$Q_3 = \text{Size of } 3\left(\frac{N+1}{4}\right)^{th} \text{ item} \Rightarrow = \text{Size of } 3\left(\frac{12+1}{4}\right)^{th} \text{ item}$

$Q_3 = 262$

$$Q.D = \left[\frac{Q_3 - Q_1}{2}\right] = \left[\frac{262 - 251}{2}\right] = 5.5$$

$$C.Q.D = \left[\frac{Q_3 - Q_1}{Q_3 + Q_1}\right] = \left[\frac{262 - 251}{262 + 251}\right] = 0.0214.$$

Example :-

Calculate the quartile deviation and coefficient for the following data.

Age	20	30	40	50	60	70	80
No. of persons	3	61	132	153	140	51	3

Calculation :-

Age in yrs	No. of Workers	c.f
20	3	3
30	61	64
40	132	196
50	153	349
60	140	489
70	51	540
80	3	543

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

= Size of $\left(\frac{543+1}{4}\right)^{th}$ item

Q_1 = 40 years

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

= Size of $3\left(\frac{543+1}{4}\right)^{th}$ item

Q_3 = 60 years.

$Q.D = \left[\frac{Q_3 - Q_1}{2}\right] = \left[\frac{60-40}{2}\right]$

Q.D = 10 years.

$$C.Q.D = \left[\frac{Q_3 - Q_1}{Q_3 + Q_1}\right] = \left[\frac{60-40}{60+40}\right] = 0.2.$$

Example :-

Calculate the Quartile deviation and coefficient for the following data.

x :	30-32	32-34	34-36	36-38	38-40	40-42	42-44
f :	12	18	16	14	12	8	6

Calculation :-

x	f	c.f
30-32	12	12
32-34	18	30
34-36	16	46
36-38	14	60
38-40	12	72
40-42	8	80
42-44	6	86
	86	

Q_1 = Size of $\left(\frac{N}{4}\right)^{th}$ item.

= Size of $\left(\frac{86}{4}\right)^{th}$ item.

Q_1 = 21.5

$Q_1 = L + \left[\frac{\frac{N}{4} - c.f}{f}\right] \times c$

$= 32 + \left[\frac{21.5 - 12}{18}\right] \times 2$

$= 32 + \frac{19}{18}$

= 33.06

Q_3 = Size of $3\left(\frac{N}{4}\right)^{th}$ item.

= Size of $3\times\left(\frac{86}{4}\right)^{th}$ item $= 64.5^{th}$ item.

$$Q_3 = L + \left[\frac{\frac{3N}{4} - c.f}{f}\right] \times c = 38 + \left[\frac{64.5 - 60}{12}\right] \times 2$$

$Q_3 = 38.75$

$$Q.D = \left[\frac{Q_3 - Q_1}{2}\right] = \left[\frac{38.75 - 33.06}{2}\right] = 2.85$$

$$C.Q.D = \left[\frac{Q_3 - Q_1}{Q_3 + Q_1}\right] = \left[\frac{38.75 - 33.06}{38.75 + 33.06}\right] = 0.08.$$

Mean deviation - Continuous Method :-

Example :-

Age in years. :	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80
No. of persons :	20	25	32	40	42	35	10	8

Calculation :-

x	f	mid Value	d = x-A, A=35	fd	|D|	f|D|
0-10	20	5	-30	-600	31.5	630
10-20	25	15	-20	-500	21.5	537.5
20-30	32	25	-10	320	11.5	368
30-40	40	35	0	0	1.5	60
40-50	42	45	10	420	8.5	357
50-60	35	55	20	700	18.5	647.5
60-70	10	65	30	300	28.5	285
70-80	8	75	40	320	38.5	308
				320		3193.0

$$Mean = A + \left(\frac{\Sigma fd}{N}\right) = 35 + \left[\frac{320}{212}\right] = 36.5$$

$$M.D = \left[\frac{\Sigma f|D|}{N}\right] = \frac{3193}{212} = 15.1 \text{ year}, \quad C.M.D = \frac{M.D}{Mean} = \frac{15.1}{36.5} = 0.41.$$

Standard Deviation :-

Continuous Method :-

Example :-

Calculate the S.D for the following data.

class	0-10	10-20	20-30	30-40	40-50	50-60	60-70
frequency	8	12	17	14	9	7	4

Calculation.

x	f	m	$dx = \left[\frac{x-A}{c}\right]$ A = 35	fd	fd^2
0-10	8	5	-3	-24	72
10-20	12	15	-2	-24	48
20-30	17	25	-1	-17	17
30-40	14	35	0	0	0
40-50	9	45	1	9	9
50-60	7	55	2	14	28
60-70	4	65	3	12	36

$$\bar{x} = A + \left[\frac{\Sigma fd}{N}\right] \times C$$

$$= 35 + \left[\frac{-30}{71}\right] \times C$$

$$= 30.775$$

$$M.D = \frac{\Sigma f|D|}{N}$$

$$= 13.906$$

$$S.D = \sqrt{\frac{\Sigma fd^2}{N} - \left(\frac{\Sigma fd}{N}\right)^2} \times C$$

$$= \sqrt{\frac{210}{71} - \left(\frac{-30}{71}\right)^2} \times 10$$

$$S.D = 16.67.$$

UNIT - 3

Karl Pearson's coefficient of correlation:-

Example:-

Calculate the Karl Pearsons coefficient of correlation for the following data.

x :	100	101	102	102	100	99	97	98	96	95
y :	98	99	99	97	95	92	95	94	90	91

Calculation:-

x	$dx = x - \bar{x}$	dx^2	y	$dy = y - \bar{y}$	dy^2	dxdy
100	1	1	98	3	9	3
101	2	4	99	4	16	8
102	3	9	99	4	16	12
102	3	9	97	2	4	6
102	1	1	95	0	0	0
100	0	0	92	-3	9	0
99	-2	4	95	0	0	0
97	-1	1	94	-1	1	1
98	-3	9	90	-5	25	15
96	-4	16	91	-4	16	16
95	0	54	950	0	96	6
990						

$$r = \frac{\Sigma dxy}{\sqrt{\Sigma dx^2 \times dy^2}} = \frac{61}{\sqrt{54 \times 96}} = 0.847$$

Rank correlation coefficient

Example:-

Calculate the rank correlation coefficient for the following data.

x :	85	60	73	40	90
y :	93	75	65	50	80

Calculation:-

x	R_1	y	R_2	$R_1 - R_2$	d^2
85	2	93	1	1	1
60	4	75	3	-1	1
73	3	65	4	0	0
40	5	50	5	-1	1
90	1	80	2		4

$$\rho = 1 - \left[\frac{6 \times \Sigma d^2}{N(N^2-1)}\right]$$

$N = 5, \quad D^2 = 4.$

$$\rho = 1 - \left[6 \times \frac{4}{5(5^2-1)}\right] = 0.8$$

$$\rho = 0.8$$

Example:-

Calculate the rank correlation coefficient for the following data.

x :	48	33	40	9	16	16	65	24	16	57
y :	13	13	24	6	15	4	20	9	6	19

calculation:-

x	R_1	Y	R_2	$d = R_1 - R_2$	d^2
48	8	13	5.5	2.5	6.25
33	6	13	5.5	5	0.25
40	7	24	10	-3	9.00
9	1	6	2.5	-1.5	2.25
16	3	15	7	4	16.00
16	3	4	1	2	4.00
65	10	20	9	1	1.00
24	5	9	4	1	1.00
16	3	6	2.5	5	0.25
57	9	19	8	1	1.00
					41

$$\rho = 1 - \left[\frac{6\Sigma d^2 + \frac{1}{12}(m^3-m) + \frac{1}{12}(m^3-m) + \frac{1}{12}(m^3-m)}{N^3 - N}\right]$$

$$= 1 - \left[\frac{6\ 41 + \frac{1}{12}(3^3-3) + \frac{1}{12}(2^2-2) + \frac{1}{12}(2^3-2)}{10^3-10}\right]$$

$$= 0.738$$

Two Regression Lines x on y and y on x.

Example:-

Calculate the two regression lines for the following data.

x :	1	2	3	4	5	6	7
y :	9	8	10	12	11	13	14

Calculation :-

x	$(x-\bar{x})=x$	x^2	y	$(y-\bar{y})=y$	y^2	xy
1	-3	9	9	-2	4	6
2	-2	4	8	-3	9	6
3	-1	1	10	-1	1	1
4	0	0	12	1	1	0
5	1	1	11	0	0	0
6	2	4	13	2	4	4
7	3	9	14	3	9	9
28	0	28	77	0	28	26

$$\bar{x} = \frac{\Sigma x}{n} = \frac{28}{7} = 4 \quad ; \quad \bar{y} = \frac{\Sigma y}{n} = \frac{77}{7} = 11$$

Regression equation y on x

$$(y-\bar{y}) = r\frac{\sigma y}{\sigma x}(x-\bar{x})$$

$$\Rightarrow r\frac{\sigma y}{\sigma x} = \frac{\Sigma xy}{\Sigma x^2}$$

$$(y-11) = \frac{26}{28}(x-4)$$

$$\Rightarrow (y-11) = .929(x-4)$$

$$y = .929x + 7.284$$

Regression x on y

$$(x-\bar{x})\, r\frac{\sigma x}{\sigma y}(y-\bar{y}) \quad \Rightarrow r\frac{\sigma x}{\sigma y} = \frac{\Sigma xy}{\Sigma y^2}$$

$$x-4 = \frac{26}{28}(y-11) \Rightarrow x = .929y - 10.219 + 4$$

$$x = .929y - 6.219.$$

Index Numbers :-

Example :-

calculate price index number for 1995 and 1985 as base by (i) Laspeyres Method (ii) Paasche's Method (iii) Fisher's ideal Method

Commodity	1985		1995	
	Price	Quantity	Price	Quantity
A	20	8	40	6
B	50	10	60	5
C	40	15	50	15
D	20	20	20	25

Calculation

commodity	1985		1995		P_1q_0	P_0q_0	P_1q_1	P_0q_1
	P_0	q_0	P_1	q_1				
A	20	8	40	6	320	160	240	120
B	50	10	60	5	600	500	300	250
C	40	15	50	15	750	600	750	600
D	20	20	20	25	400	400	500	500
Total					2070	1660	1790	1470

(i) Laspayre's index $= P_{01} = \frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times 100$

$= \frac{2070}{1660} \times 100 = 124.70$

(2) Paasches Index $= P_{01} = \frac{\Sigma P_1 q_1}{\Sigma P_0 q_1} \times 100$ (30)

$= \frac{1790}{1470} \times 100 = 121.77$

(3) Fisher index.

$$P_{01} = \sqrt{\frac{\Sigma P_1 q_0}{\Sigma P_0 q_0} \times \frac{\Sigma P_1 q_1}{\Sigma P_0 q_1} \times 100} = \sqrt{\frac{2070}{1660} \times \frac{1790}{1470} \times 100}$$

$P_{01} = 123.22$
