MARUDHAR KESARI JAIN COLLEGE FOR WOMEN, VANIYAMBADI

PG & RESEARCH DEPARTMENT OF MATHEMATICS

CLASS : I – B.A. ECONOMICS

SUBJECT CODE : 23UEC12

SUBJECT NAME : STATISTICS FOR ECONOMICS –I

SYLLABUS

UNIT- V

Correlation and Regression

Correlation – Types of Correlation – Methods -Karl Pearson's Coefficient of Correlation –- Spearman's Rank Correlation – Regression Equations – Distinction between Correlation and Regression Analysis.

Unit - V

Meaning:

correlation is an analysis of the covariation between two or more variable.

Uses: (Significance of correlation):

* correlation is useful in physical and Social Science.

* It is used in business and economics.

* To study the relationship between variable.

* It helps in measuring the degree of relationship between the variable like Supply & demand.

* The relation between variable can be verified and tested for Significance.

* Sampling error can be calculated.

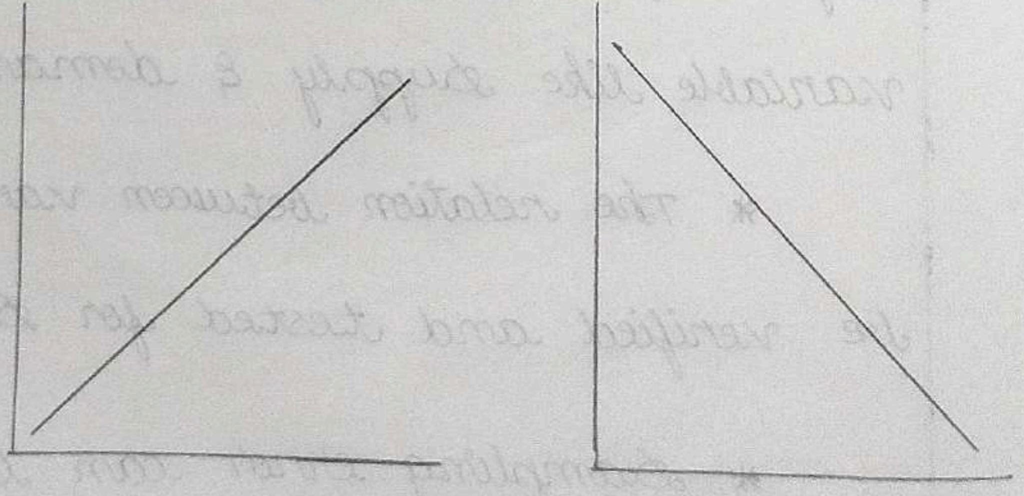
* It is basis for the concept of regression and ratio of variation.

Types of correlation :

1. Positive and Negative
2. Simple and Multiple
3. Partial and total
4. Linear and Non Linear

1. Positive and Negative correlation :

Positive and Negative correlation depends upon the direction of change of variables. If two variables increases or decreases in the same direction is called Positive or Negative correlation.



Positive correlation Negative correlation

2. Simple and Multiple correlation :-

The relationship between two variable is described as simple correlation.

The relationship between for more than two variables is described as multiple correlation.

3. Partial and Total correlation :-

The study of two variables excluding some other variables is called partial correlation.

All the facts are taken into account is called total correlation.

4. Linear and Non-Linear correlation :-

The study of the ratio of changes between two variables is uniform is called linear correlation.

Methods of correlation

→ Karl Pearson's co-efficient of correlation.

→ Spearman's Rank correlation co-efficient.

→ co-efficient of concurrent deviation.

→ Methods of last square

co-efficient of correlations:

The measure of correlation called co-efficient of correlation. The value of the co-efficient correlation shall always lie between +1 and -1.

Karl Pearson's co-efficient of correlation:

Karl Pearson's method is known as pearson's co-efficient of correlation. It is denoted by the symbol r.

1. $r = \dfrac{\text{covariation } (x, y)}{\sqrt{\text{variation } x} \sqrt{\text{variation } y}}$

2. $r = \dfrac{\text{co-variation of } xy}{\sigma x \, \sigma y}$

3. $r = \dfrac{\Sigma xy}{\Sigma N \, \sigma x \, \sigma y}$

4. $r = \dfrac{\Sigma xy}{\sqrt{\Sigma x^2 \Sigma y^2}}$ → Coeff of Correlation.

5. $r = \dfrac{N \Sigma xy - \Sigma x \Sigma y}{\sqrt{N \Sigma x^2 - (\Sigma x)^2} \times \sqrt{N \Sigma y^2 - (\Sigma y)^2}}$

6. $r = \dfrac{N \Sigma dx dy - \Sigma dx \Sigma dy}{\sqrt{N \Sigma dx^2 - (\Sigma dx)^2} \times \sqrt{N \Sigma dy^2 - (\Sigma dy)^2}}$ → karl pear → Actual mean method

Where,

$dx = x - \bar{x}$ (Actual mean)

$dx = x - A$ (Assumed mean)

$\therefore \sigma x$ - Standard deviation of x

σy - Standard deviation of y

1. calculate the co-efficient of correlation from the following data.

x	12	9	8	10	11	13	7
y	14	8	6	9	11	12	3

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

x	y	xy	x^2	y^2
12	14	168	144	196
9	8	72	81	64
8	6	~~64~~ 48	~~36~~ 64	36
10	9	90	100	81
11	11	121	121	121
13	12	156	169	144
7	3	21	49	9
		$\Sigma xy = 676$	$\Sigma x^2 = 728$	$\Sigma y^2 = 651$

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

$$= \frac{676}{\sqrt{728(651)}}$$

$$= \frac{676}{\sqrt{473928}}$$

$$= \frac{676}{688.42}$$

$$\therefore r = 0.981$$

2. Find the Karl Pearson's co-efficient of correlation in the following data.

Height of father (in inches)	65	66	67	67	68	69	71	73
Height of Son (in inches)	67	68	64	68	72	70	69	70

by assumed mean method.

x	y	$dx = x - A$ $= x - 67$	$dy = y - A$ $= y - 68$	dx^2	dy^2	$dxdy$
65	64	$65 - 67 = -2$	$64 - 68 = -4$	4	16	8
66	67	$66 - 67 = -1$	$67 - 68 = -1$	1	1	1
67	68	$67 - 67 = 0$	$68 - 68 = 0$	0	0	0
67 A	68 A	$67 - 67 = 0$	$68 - 68 = 0$	0	0	0
68	69	$68 - 67 = 1$	$69 - 68 = 1$	1	1	1
69	70	$69 - 67 = 2$	$70 - 68 = 2$	4	4	4
71	70	$71 - 67 = 4$	$70 - 68 = 2$	16	4	8
73	72	$73 - 67 = 6$	$72 - 68 = 4$	36	16	24
		$\Sigma dx = 10$	$\Sigma dy = 4$	$\Sigma dx^2 = 61$	$\Sigma dy^2 = 41$	$\Sigma dxdy = 46$

$$r = \frac{N \Sigma dxdy - \Sigma dx \Sigma dy}{\sqrt{N \Sigma dx^2 - (\Sigma dx)^2} \times \sqrt{N \Sigma dy^2 - (\Sigma dy)^2}}$$

$\therefore N = 8$

$$= \frac{8(46) - 10(4)}{\sqrt{8(61) - (10)^2} \times \sqrt{8(41) - (4)^2}}$$

$$= \frac{368 - 40}{\sqrt{488 - 100}\sqrt{328 - 16}}$$

$$= \frac{328}{\sqrt{388}\sqrt{312}}$$

$$= \frac{328}{(19.697)(17.668)}$$

$$= \frac{328}{347.908}$$

$\therefore r = 0.942$

3. Find out the co-efficient correlation in the following case by Actual mean method.

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

x	y	$dx = x - \bar{x}$ $= x - 99$	$dy = y - \bar{y}$ $= x - 95$	dx^2	dy^2	$dxdy$
100	98	$100 - 99 = 1$	$98 - 95 = 3$	1	9	3
101	99	$101 - 99 = 2$	$99 - 95 = 4$	4	16	8
102	99	$102 - 99 = 3$	$99 - 95 = 4$	9	16	12
102	97	$102 - 99 = 3$	$97 - 95 = 2$	9	4	6
100	95	$100 - 99 = 1$	$95 - 95 = 0$	1	0	0
99	92	$99 - 99 = 0$	$92 - 95 = -3$	0	9	0
97	95	$97 - 99 = -2$	$95 - 95 = 0$	4	0	0
98	94	$98 - 99 = -1$	$94 - 95 = -1$	1	1	1
96	90	$96 - 99 = -3$	$90 - 95 = -5$	9	25	15
95	91	$95 - 99 = -4$	$91 - 95 = -4$	16	16	16
$\Sigma x =$ 990	$\Sigma y =$ 950	$\Sigma dx = 0$	$\Sigma dy = 0$	$\Sigma dx^2 =$ 54	$\Sigma dy^2 =$ 96	$\Sigma dxdy =$ 61

$$\therefore \bar{x} = \frac{\Sigma x}{N} = \frac{990}{10} = 99$$

$$y^2 = \frac{\Sigma y}{N} = \frac{950}{10} = 95$$

$$r = \frac{N \Sigma dxdy - \Sigma dx \Sigma dy}{\sqrt{N \Sigma dx^2 (\Sigma dx)^2} \times \sqrt{N \Sigma dy^2 (\Sigma dy)^2}}$$

$$= \frac{10(61) - 0(0)}{\sqrt{10(54)-(0)^2} \times \sqrt{10(96)-(0)^2}}$$

$$r = \frac{610}{\sqrt{540}\sqrt{960}}$$

$$= \frac{610}{(23.23)(30.98)}$$

$$= \frac{610}{719.66}$$

$$= 0.847$$

4. Find if there is any significance correlation between the height and weight given below.

Height	57	59	62	64	65	65	58
Weight	113	117	126	130	129	~~130~~ 111	116

Assumed Mean

x	y	$dx = x - A$	$dy = y - A$	dx^2	dy^2	$dxdy$
57	111	$57-59=-2$	$111-116=-5$	4	25	10
58 ^{7}	112	$57-59=-2$	$112-116=-4$	4	16	8
58	113	$58-59=-1$	$113-116=-3$	1	9	3
59	116	$59-59=0$	$116-116=0$	0	0	0
62	117	$62-59=3$	$117-116=1$	9	1	3
64	126	$64-59=5$	$126-116=10$	25	100	50
65	129	$65-59=6$	$129-116=13$	36	169	78
65	130	$65-59=6$	$130-116=14$	36	196	84
		$\Sigma dx = 15$	$\Sigma dy = 26$	$\Sigma dx^2 = 115$	$\Sigma dy^2 = 516$	$\Sigma dxdy = 236$

$$r = \frac{N\Sigma dxdy - \Sigma dx \Sigma dy}{\sqrt{N\Sigma dx^2 - (\Sigma dx)^2} \times \sqrt{N\Sigma dy^2 - (\Sigma dy)^2}}$$

$$= \frac{8(236) - 115(26)}{\sqrt{8(115)-(15)^2} \times \sqrt{8(526)-(26)^2}}$$

$$= \frac{1888 - 390}{\sqrt{920-225} \times \sqrt{4128-676}}$$

$$= \frac{1498}{26.36\,(58.75)}$$

$$= \frac{1498}{1548.65}$$

5. Find out the co-efficient correlation between x & y from the following data.

$N = 10, \ \Sigma x = 60, \ \Sigma y = 60, \ \Sigma xy = 305,$

$\Sigma x^2 = 400, \ \Sigma y^2 = 580.$

$$r = \frac{N\Sigma xy - \Sigma x \Sigma y}{\sqrt{N\Sigma x^2 - (\Sigma x)^2} \times \sqrt{N\Sigma y^2 - (\Sigma y)^2}}$$

$$= \frac{10(305) - 60(60)}{\sqrt{10(400) - (60)^2} \times \sqrt{10(580) - (60)^2}}$$

$$= \frac{3050 - 3600}{\sqrt{4000 - 3600} \times \sqrt{5800 - 3600}}$$

$$= \frac{-550}{\sqrt{400}\sqrt{2200}}$$

$$= \frac{-550}{(20)(46.9}$$

$$= \frac{-550}{} \quad - \quad 0.586$$

6. Find out the co-efficient correlation between x & y from the following data. $N = 10$, $\Sigma dx = 50$, $\Sigma dy = 30$, $\Sigma dxdy = 115$, $\Sigma dx^2 = 290$, $\Sigma dy^2 = 300$.

$$r = \frac{N\Sigma dxdy - \Sigma dx\,\Sigma dy}{\sqrt{N\Sigma dx^2 (\Sigma dx)^2} \times \sqrt{N\Sigma dy^2 (\Sigma dy)^2}}$$

$$= \frac{10(115) - 50(30)}{\sqrt{10(290) - (50)^2} \times \sqrt{10(300) - (30)^2}}$$

$$= \frac{1150 - 1500}{\sqrt{2900 - 2500}\sqrt{3000 - 900}}$$

$$= \frac{-350}{\sqrt{400}\sqrt{2100}}$$

$$= \frac{-350}{20(45.82)}$$

$$= \frac{-350}{916.4}$$

$$= -0.381$$

7. Find out the co-efficient correlation between x & y from the following data.

$cov(x, y) = -16.5$, $var(x) = 2.89$, $var(y) = 100$.

$$r = \frac{\text{covariation }(x, y)}{\sqrt{\text{variation } x}\ \sqrt{\text{variation } y}}$$

$$= \frac{-16.5}{\sqrt{2.89}\sqrt{100}}$$

$$= \frac{-16.5}{(1.7)(10)}$$

$$= \frac{-16.5}{17}$$

$$r = -0.970$$

8. Find out the co-efficient correlation between x & y from the following data $N = 12$, $\Sigma(x-8)^2 = 150$, $\Sigma x = 120$, $\Sigma(y-10) = 200$, $\Sigma y = 130$, $\Sigma(x-8)(y-10) = 50$.

$$r = \frac{N\Sigma dxdy - \Sigma dx\,\Sigma dy}{\sqrt{N\Sigma dx^2 - (\Sigma dx)^2} \times \sqrt{N\Sigma dy^2 - (\Sigma dy)^2}}$$

$\therefore dx = y - A \qquad \Sigma dx^2 = 150$

$= x - A \qquad \Sigma dy^2 = 200$

$\Sigma dx\,dy = 50$

$\Sigma x = 120$

$\Sigma y = 130$

$N = 12$

$\Sigma dx = \Sigma(x - A)$

$= \Sigma x - \Sigma A$

$= 120 - 12(8)$

$= 120 - 96$

$= 24$

$\Sigma dy = \Sigma(y - A)$

$= \Sigma y - \Sigma A$

$= 130 - 12(10)$

$= 130 - 120$

$= 10$

$$= \frac{50(12) - 24(10)}{\sqrt{12(150)-(24)^2} \cdot \sqrt{12(200)-(10)^2}}$$

$$= \frac{600 - 240}{\sqrt{1800-576} \cdot \sqrt{2400-100}}$$

$$= \frac{600 - 240}{\sqrt{1224} \cdot \sqrt{2300}}$$

$$= \frac{360}{34.98\,(47.95)}$$

$$= \frac{360}{1677.29}$$

$$= 0.214$$

9. Find out the co-eff of correlation between x & y from the following data.

$N = 10$, $\Sigma x = 140$, $\Sigma y = 150$, $\Sigma(x-10)^2 = 180$, $\Sigma(y-15) = 215$, $\Sigma(x-10)(y-15) = 60$.

$$\Sigma(x-10)^2 = \Sigma dx^2 = 180$$

$$\Sigma(y-15)^2 = \Sigma dy^2 = 215$$

$$\Sigma dxdy = 60$$

$$\Sigma x = 140$$

$$\Sigma y = 150$$

$$N = 10$$

$$\Sigma dx = \Sigma (x - A)$$

$$= \Sigma x - \Sigma A$$

$$= 140 - 10(10)$$

$$= 140 - 100$$

$$= 40$$

$$\Sigma dy = \Sigma (y - A)$$

$$= \Sigma y - \Sigma A$$

$$= 150 - 10(15)$$

$$= 150 - 150$$

$$= 0$$

$$r = \frac{N \Sigma dx dy - \Sigma dx \Sigma dy}{\sqrt{N \Sigma dx^2 (\Sigma dx)^2} \times \sqrt{N \Sigma dy^2 (\Sigma dy)^2}}$$

$$= \frac{10(60) - 40(0)}{\sqrt{10(80) - (40)^2} \sqrt{10(215) - (0)^2}}$$

$$= \frac{600 - 0}{\sqrt{1800 - 1600} \sqrt{2150 - 0}}$$

$$= \frac{600}{\sqrt{200}\sqrt{2150}}$$

$$= \frac{600}{14.14(46.36)}$$

$$= \frac{600}{655.53}$$

$$= 0.915$$

Spearman's Rank correlation :

We Rank the observation in ascending or descending order using the number 1, 2, 3, 4 ... etc n and measure the degree of relationship between the rank instead actual numerical.

The Rank correlation co-efficient when there are n Ranks in each variable is given by the formula.

$$(\text{rho})\ \rho = 1 - \frac{6 \Sigma d^2}{N(N^2-1)}$$

Where,

$d = x - y$

N = Number of observation

10. The following are the ranks obtained by 10 students Statistics and mathematics.

Stat	1	2	3	4	5	6	7	8	9	10
Maths	1	4	2	5	3	9	7	10	6	8

x	y	$d = x - y$	d^2
1	1	0	0
2	4	-2	4
3	2	1	1
4	5	-1	1
5	3	2	4
6	9	-3	9
7	7	0	0
8	10	-2	4
9	6	3	9
10	8	2	4

$\Sigma d^2 = 36$

$$\rho = 1 - \frac{6\Sigma d^2}{N(N^2-1)}$$

$$= 1 - \frac{6(36)}{10(10^2-1)}$$

$$= 1 - \frac{216}{10(100-1)}$$

$$= \frac{1-216}{10(99)}$$

$$= \frac{1-216}{990}$$

$$= 1 - 0.218$$

$$\rho = 0.782$$

11. Ten competitors in a musical are ranked by a three judges A, B, C in the following data.

Rank A	1	6	5	10	3	2	4	9	7	8
Rank B	3	5	8	4	4	10	2	1	6	9
Rank C	6	4	9	8	1	2	3	10	5	7

using rank correlation method discuss with pair of judges has the nearest approaches to common linking the music.

x	y	z	$d_1 = x-y$	d_1^2	$d_2 = y-z$	d_2	$d_3 = z-x$	d_3^2
1	3	6	$1-3=-2$	4	-3	9	5	25
6	5	4	1	1	1	1	-2	4
5	8	9	-3	9	-1	1	4	16
10	4	8	6	36	-4	16	-2	4
3	4	1	-1	1	3	9	-2	4
2	10	2	-8	64	8	64	0	0
4	2	3	2	4	-1	1	-1	1
9	1	10	8	64	-9	81	1	1
7	6	5	1	1	1	1	-2	4
8	9	7	-1	1	2	4	-1	1
				$\Sigma d_1^2 = 185$		$\Sigma d_2^2 = 187$		$\Sigma d_3^2 = 60$

$$\rho = 1 - \frac{6 \Sigma d^2}{N(N^2-1)}$$

$$= 1 - \frac{6(185)}{10(10^2-1)}$$

$$= 1 - \frac{6(185)}{10(100-1)}$$

$$= 1 - \frac{6(185)}{10(99)}$$

$$= 1 - \frac{6(185)}{990}$$

$$= 1 - \frac{1110}{990}$$

$$= 1 - 1.1212$$

$$= 0.1212$$

$$\rho_2 = 1 - \frac{6\Sigma d^2}{N(N^2-1)}$$

$$= 1 - \frac{6(187)}{10(100-1)}$$

$$= 1 - \frac{6(187)}{10(99)}$$

$$= 1 - \frac{6(187)}{990}$$

$$= 1 - \frac{1122}{990}$$

$$= 1 - 1.133$$

$$= 0.133$$

$$\rho_3 = 1 - \frac{6\Sigma d^2}{N(N^2-1)}$$

$$= 1 - \frac{6(60)}{10(100^2-1)}$$

$$= 1 - \frac{6(60)}{}$$

$$= 1 - \frac{6(60)}{10(99)}$$

$$= 1 - \frac{360}{990}$$

$$= 1 - 0.363$$

$$= 0.637.$$

12. Ten competitors in a musical are rank by a three judge A, B, C in a the following data.

A	1	5	4	8	9	6	10	7	3	2
B	4	8	7	6	5	9	10	8	2	1
C	6	7	8	1	5	10	9	2	3	4

x	y	z	$d_1 = x - y$	d_1^2	$d_2 = y - z$	d_2^2	$d_3 = z - x$	d_3^2
1	4	6	-3	9	-2	4	5	25
5	8	7	-3	9	1	1	2	4
4	7	8	-3	9	-1	1	4	16
8	6	1	2	4	5	25	-7	49
9	5	5	4	16	0	0	-4	16
6	9	10	-3	9	-1	1	4	16
10	10	9	0	0	1	1	-1	1
7	3	2	4	16	1	1	-5	25
3	2	3	1	1	-1	1	0	0
2	1	4	1	1	-3	9	2	4
				$\Sigma d_1^2 = 74$		$\Sigma d_2^2 = 44$		$\Sigma d_3^2 = 156$

$$\rho = 1 - \frac{6 \Sigma d^2}{N(N^2-1)}$$

$$= 1 - \frac{6(74)}{10(10^2-1)}$$

$$= 1 - \frac{6(74)}{10(99)}$$

$$= 1 - \frac{444}{990}$$

$$= 1 - 0.448$$

$$= 0.552$$

$$\rho_2 = 1 - \frac{6 \Sigma d^2}{N(N^2-1)}$$

$$= 1 - \frac{6(44)}{10(10^2-1)}$$

$$= 1 - \frac{264}{990}$$

$$= 1 - 0.266$$

$$= 0.734$$

$$\rho_3 = 1 - \frac{6 \Sigma d^2}{N(N^2-1)}$$

$$= 1 - \frac{6(156)}{10(10^2-1)}$$

$= 1 - \frac{936}{990}$

$= 1 - 0.945$

$= 0.555$

13. Obtaining rank correlation co-efficient for the following data.

x	50	23	36	17	60
y	40	36	41	51	90

x	y	R_x	R_y	$d = R_x - R_y$	d^2
50	40	2	4	2	4
23	36	4	5	-1	1
36	41	3	3	0	0
17	51	5	2	3	9
60	90	1	1	0	0
					$d^2 = 14$

$$\rho = 1 - \frac{6 \Sigma d^2}{N(N^2-1)}$$

$$= 1 - \frac{6(14)}{5(5^2-1)}$$

$$= 1 - \frac{6(14)}{5(24)}$$

$$= 1 - \frac{84}{120}$$

$$= 1 - 0.7$$

$$= 0.3$$

14. From the following data calculate the rank correlation co-efficient.

x	48	33	40	9	16	65	24	16	57
y	13	13	24	6	15	20	9	6	14

x	y	R_x	R_y	$d = R_x - R_y$	d^2
48	13	3	5.5	-2.5	6.25
33	13	5	5.5	-0.5	0.25
40	24	4	1	3	9
9	6	9	8.5	0.5	0.25
16	15	7.5	4	3.5	12.25
65	20	1	2	-1	1
24	9	6	7	-1	1
16	6	7.5	8.5	-1	1
57	14	2	3	-1	1

$\Sigma d^2 = 32$

$16 \Rightarrow m_1 = 2 \quad \frac{7+8}{2} = 7.5$

$13 \Rightarrow m_2 = 2 \quad \frac{5+6}{2} = 5.5$

$6 \Rightarrow m_3 = 2 \quad \frac{8+9}{2} = 8.5$

$$\rho = 1 - \frac{6\left[\Sigma d^2 + \frac{1}{12}(m_1^3 - m_1) + \frac{1}{12}(m_2^3 - m_2) + \frac{1}{12}(m_3^3 - m_3)\right]}{N(N^2-1)}$$

$$= 1 - \frac{6\left[32 + \frac{1}{12}(2^3-2) + \frac{1}{12}(2^3-2) + \frac{1}{12}(2^3-2)\right]}{9(9^2-1)}$$

$$= 1 - \frac{6\left(32 + \frac{8-2}{12} + \frac{8-2}{12} + \frac{8-2}{12}\right)}{9(80)}$$

$$= 1 - \frac{6(32 + 0.5 + 0.5 + 0.5)}{9(80)}$$

$$= 1 - \frac{6(33.5)}{720}$$

$$= 1 - \frac{201}{720}$$

$$= 1 - 0.279$$

$$= 0.721$$

15. From the following data calculate the rank correlation co-efficient after making adjust of tied ranks.

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

x	y	Rx	Ry	$d = Rx - Ry$	d^2
48	13	3	5.5	-2.5	6.25
33	13	5	5.5	-0.5	0.25
40	24	4	1	3	9
9	6	10	8.5	1.5	2.25
16	15	8	4	4	16
16	4	8	10	-2	4
65	20	1	2	-1	1
24	9	6	7	-1	1
16	6	8	8.5	-0.5	0.25
57	19	2	3	-1	1
					$\Sigma d^2 = 41$

$\therefore 16 \Rightarrow m_1 = 3 = \frac{7+8+9}{3} = \frac{24}{3} = 8$

$\therefore 13 \Rightarrow m_2 = 2 = \frac{5+6}{2} = \frac{11}{2} = 5.5$

$\therefore 6 \Rightarrow m_3 = 2 = \frac{8+9}{2} = \frac{17}{2} = 8.5$

$$\rho = \frac{1-6\left[\Sigma d^2 + \frac{1}{12}(m_1^3 - m_1) + \frac{1}{12}(m_2^3 - m_2) + \frac{1}{12}(m_3^3 - m_3)\right]}{N(N^2-1)}$$

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

$$= \frac{1-6\left(41 + \frac{27-3}{12} + \frac{8-2}{12} + \frac{8-2}{12}\right)}{10(100-1)}$$

$$= \frac{1-6\left(41 + \frac{24}{12} + \frac{6}{12} + \frac{6}{12}\right)}{10(99)}$$

$$= \frac{1-6(41+2+0.5+0.5)}{990}$$

$$= 1 - \frac{6(44)}{990}$$

$$= 1 - \frac{264}{990}$$

$= 1 - 0.2666$

$= 0.733$

16. From the following data calculate the rank correlation co-efficient.

x	43	44	46	40	44	42	45	42	38	40	42	57
y	29	31	19	18	19	27	27	29	41	30	26	10

x	y	Rx	Ry	$d = Rx - Ry$	d^2
43	29	6	4.5	1.5	2.25
44	31	4.5	2	2.5	6.25
46	19	2	9.5	-7.5	56.25
40	18	10.5	11	-0.5	0.25
44	19	4.5	9.5	-5	25
42	27	8	6.5	-1.5	2.25
45	27	3	6.5	-3.5	12.25
42	29	8	4.5	-3.5	12.25
38	41	12	1	11	121
40	30	10.5	3	7.5	56.25
42	26	8	8	0	0
57	10	1	12	-11	121

$\Sigma d^2 = 415$

$\therefore 44 \Rightarrow m_1 = 2 = \frac{4+5}{2} = 4.5$

$\therefore 42 \Rightarrow m_2 = 3 = \frac{7+8+9}{3} = 8$

$\therefore 40 \Rightarrow m_3 = 2 = \frac{10+11}{2} = 10.5$

$\therefore 29 \Rightarrow m_4 = 2 = \frac{4+5}{2} = 4.5$

$\therefore 27 \Rightarrow m_5 = 2 = \frac{9+10}{2} = 9.5$

$$\rho = \frac{1-6\left[\Sigma d^2 + \frac{1}{12}(m_1^3 - m_1) + \frac{1}{12}(m_2^3 - m_2) + \frac{1}{12}(m_3^3 - m_3) + \frac{1}{12}(m_4^3 - m_4) + \frac{1}{12}(m_5^3 - m_5) + \frac{1}{12}(m_6^3 - m_6)\right]}{N(N^2-1)}$$

$$= \frac{1-6\left[415 + \frac{1}{12}(2^3-2) + \frac{1}{12}(3^3-3) + \frac{1}{12}(2^3-2) + \frac{1}{12}(2^3-2) + \frac{1}{12}(2^3-2) + \frac{1}{12}(2^3-2)\right]}{12(12^2-1)}$$

$$= \frac{1-6\left[415 + \frac{1}{12}(8-2) + \frac{1}{12}(9-3) + \frac{1}{12}(8-2) + \frac{1}{12}(8-2) + \frac{1}{12}(8-2) + \frac{1}{12}(8-2)\right]}{12(144-1)}$$

$$= \frac{1 - 6\left[415 + \frac{8-2}{12} + \frac{9-3}{12} + \frac{8-2}{12} + \frac{8-2}{12} + \frac{8-2}{12} + \frac{8-2}{12}\right]}{12(143)}$$

$$= \frac{1 - 6\left(415 + \frac{6}{12} + \frac{6}{12} + \frac{6}{12} + \frac{6}{12} + \frac{6}{12} + \frac{6}{12}\right)}{12(143)}$$

$$= \frac{1 - 6(415 + 0.5 + 0.5 + 0.5 + 0.5 + 0.5 + 0.5)}{1716}$$

$$= 1 - \frac{6(418)}{1716}$$

$$= 1 - \frac{2508}{1716}$$

$$= 1 - 1.461$$

$$= -0.461$$

17. calculate the co-efficient of concurrent deviations from the following data.

Month	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sep
Supply	160	164	172	182	166	170	178	192	186
Price	292	280	260	234	266	254	[illegible]	[illegible]	[illegible]

Karl Pearson's correlation co-efficient :-

Merits :-

* Karl Pearson's co-efficient of correlation is the most popular correlation co-efficient.

* It is used in regression quation also.

* It is Superior to other method.

* It is calculated directly from the numerical value of each and every pairs.

Demerits :-

correlations co-efficient compare it with other method Karl Pearson's correlation method is the most difficult one to calculate.

Spearman's Rank correlation co-efficient :-

Merits :-

* It is the only methed when the rank are given.

* It can also be calculated when the values of the variable are given.

* It is simple to understood.

* It is generally easy to calculate.

Demerits :-

If N is large it is very difficult to rank the items and to calculate & it cannot be calculated by bivariate frequency table.

Regression :-

The line which gives the average relationship between two variable is known as the regression line.

Note : The regression equation is also called estimating equation.

Simple Regression :-

The regression analysis is the study of only two variable at a time is termed as simple regression.

Multiple Regression :-

The regression analysis for studying more than two variables at a time is known as multiple regression.

Uses of Regression :-

Regression analysis is used in Statistics and other discipline.

The value of the dependent variable are estimated corresponding to any values of the independent variables using the appropriate regression equation.

We can calculate co-efficient of correlation (or) and co-efficient of determination (r^2) with the help of regression co-efficient.

Regression analysis is a practical use in determining demand a curve, Supply curve co from market survey.

In economics and business there are many group of inter-related variable.

Similarities and dissimilarities of correlation and Regression.

	Correlation	Regression
1.	correlation is the relationship between variables and it is express numerically.	Regression means going back the average relationship between two variables
2.	Between two variables names in identified as independent or dependent variable.	One of the variables is independent in any particular context.
3.	correlation co-efficient is a number between -1 and +1.	The two regression of co-efficient are the same sign (+) or (-)

		one of them can be greater than 1 but can't be greater than one numerically.
4.	correlation co-efficient is not in any unit of measurement.	Each regression co-efficient is the unit of measurement of the dependent variables.
5.	correlation co-efficient is independent & changes of origin and scale.	Regression co-efficient is independent of changes of origin but it is affected by change of scale.
6.	It is not very useful for further mathematical treatment.	It is rarely used for further mathematical treatment.

7.	Both the variables x and y are random variables	Here x is a random variable & y is a fixed variable. Sometimes both the variables may be random variables.