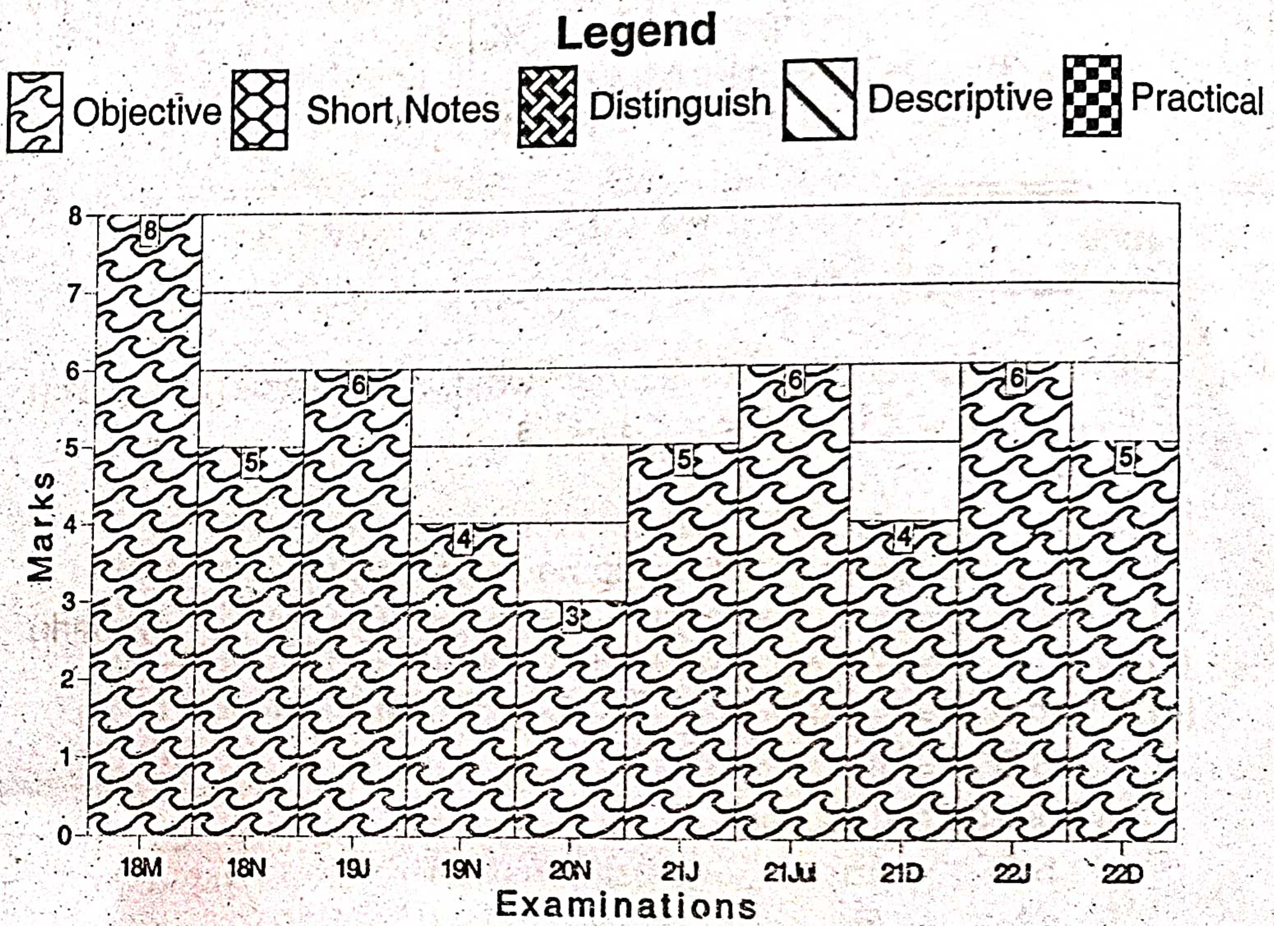
CHAPTER	
17	**CORRELATION AND REGRESSION**

Marks of Objective, Short Notes, Distinguish Between, Descriptive & Practical Questions



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PAST YEAR QUESTIONS AND ANSWERS

2009 - JUNE

[1] The two regression equations are :

$2x + 3y + 18 = 0$

$x + 2y - 25 = 0$

find the value of y if $x = 9$

(a) -8

(b) 8

(c) -12

(d) 0 (1 mark)

Answer:

(b) To find the value of y when x's value is given, regression equation of Y on X should be known.

Let us assume that $2x + 3y + 18 = 0$ represents the regression line of Y on X and $x + 2y - 25 = 0$ represents the regression line of X on Y.

Now, $2x + 3y + 18 = 0$

$$Y = -18 + \frac{(-2)x}{3}$$

$$\therefore b_{yx} = \frac{-2}{3}$$

Again $x + 2y - 25 = 0$

$x = 25 - 2y$

$\therefore b_{xy} = -2$

Thus, $r^2 = b_{yx} \times b_{xy}$

$= \frac{-2}{3} \times -2$

$= \frac{4}{3} > 1$

Since $|r| \leq 1 = r^2 \leq 1$, our assumption is wrong. Thus, $2x + 3y + 18 = 0$ truly represents the regression line of X on Y and $x + 2y - 25 = 0$ truly represents the regression line of Y on X.

$\therefore \quad x + 2y - 25 = 0$ ....(1)

Substituting $x = 9$ in (1)

$9 + 2y - 25 = 0$

$2y = 25 - 9$

$y = \frac{16}{2}$

$y = 8$

$\therefore$ When $x = 9$ then $y = 8$

[2] The correlation coefficient between x and y is – 1/2. The value of b_{xy} –1/8. Find b_{yx}.

(a) – 2

(b) – 4

(c) 0

(d) 2 (1 mark)

Answer:

(a) Since $r^2 = b_{xy} \times b_{yx}$

$\left(\frac{-1}{2}\right)^2 = \frac{-1}{8} \times b_{yx}$

$\frac{1}{4} = \frac{-1}{8} \times b_{yx}$

$b_{yx} = \frac{1}{4} \times (-8)$

$b_{yx} = -2$

[3] Ranks of two________.characteristics by two judges are in reverse order then find the value of Spearman rank correlation co-efficient.

(a) – 1
(b) 0
(c) 1
(d) 0.75

(1 mark)

Answer:

(a) Lets solve this question by taking an example. Suppose the hypothetical value of n be 5.

Then,

Rank by I Judge (R_x)	Rank by II Judge ($-R_y$)	$d = R_x - R_y$	d^2
1	5	– 4	16
2	4	– 2	4
3	3	0	0
4	2	+ 2	4
5	1	+ 4	16
			40

Spearman's Rank Correlation Coefficient

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

$$= 1 - \frac{6 \times 40}{5(5^2-1)}$$

$= 1 - \frac{240}{5 \times 24}$

$= 1 - 2$

$= -1$

$\therefore r_{xy} = -1$

NOTE :

Students may, however, solve this question by taking any value of n. But, they should remember that the ranks given by two judges are in reverse order.

2009 - DECEMBER

[4] Which of the following regression equations represent regression line of Y on X :

7x + 2y + 15 = 0, 2 x + 5y + 10 = 0

(a) 7x + 2y + 15 = 0

(b) 2x + 5y + 10 = 0

(c) Both (a) and (b)

(d) None of these

(1 mark)

Answer:

(b) $7x + 2y + 15 = 0$ ....(1)

$2x + 5y + 10 = 0$ ....(2)

Assume that $7x + 2y + 15 = 0$ is the regression line of X on Y and $2x + 5y + 10 = 0$ is the regression line of Y on X.

$7x + 2y + 15 = 0$

$x = \frac{-2y}{7} \; \frac{-15}{7}$

$b_{xy} = -\frac{2}{7}$

$2x + 5y + 10 = 0$

$y = -\frac{2x}{5} - \frac{10}{5}$

$b_{yx} = -\frac{2}{5}$

$r^2 = b_{xy} \times b_{yx}$

$= -\frac{2}{7} \times -\frac{2}{5}$

$r = \sqrt{\frac{4}{35}}$

$r = -0.33$

Since $-1 \leq r \leq 1$ ∴ our assumption is correct So, $2x + 5y + 10 = 0$ is the regression line of Y on X.

[5] If the rank correlation co-efficient between marks in Management and Mathematics for a group of students is 0.6 and the sum of the squares of the difference in ranks is 66. Then what is the number of students in the group?

(a) 9

(b) 10

(c) 11 (1 mark)

(d) 12

Answer:

(b) $r = 0.6$

$d^2 = 66$

$r = 1 - \frac{6\sum d^2}{n(n^2-1)}$

$0.6 = 1 - \frac{6 \times 66}{n(n^2-1)}$

$1 - 0.6 = \frac{396}{n(n^2-1)}$

$0.4 = \frac{396}{n(n^2-1)}$

$$n(n^2 - 1) = \frac{396}{0.4}$$

$$n(n^2 - 1) = 990$$

$$n = 10$$

Therefore, the number of students = 10

[6] Correlation coefficient between X and Y will be negative when:-

(a) X and Y are decreasing

(b) X is increasing, Y is decreasing

(c) X and Y are increasing

(d) None of these (1 mark)

Answer:

(b) When X and Y move in opposite direction, then correlation coefficient is negative. Therefore, if X is increasing, and Y is decreasing the correlation coefficient will be negative.

[7] The two regression lines are $7x - 3y - 18 = 0$ and $4x - y - 11 = 0$.Find the values of b_{yx} and b_{xy}

(a) 7/3, 1/4 (b) – 7/3, – 1/4

(c) – 3/7, – 1/4 (d) None of these. (1 mark)

Answer:

(a) Assume that $7x - 3y - 18 = 0$ is the line $7x - 3y - 18 = 0$ of Y on X and $4x - y - 11 = 0$ is of X on Y.

$$3y = 7x - 18$$

$$y = \frac{7x}{3} - \frac{18}{3}$$

$$b_{yx} = \frac{7}{3}$$

$$4x - y - 11 = 0$$

$$4x = y + 11$$

$$x = \frac{y}{4} + \frac{11}{4}$$

$$b_{xy} = \frac{1}{4}$$

$$r^2 = b_{xy} \times b_{yx}$$

$$r = \sqrt{\frac{1}{4} \times \frac{7}{3}}$$

$$r = \sqrt{\frac{7}{12}} = 0.764$$

since value of r is lying between – 1 and 1 therefore our assumption was correct.

So, $b_{yx} = \frac{7}{3}$ and $b_{xy} = \frac{1}{4}$.

2010 - JUNE

[8] If 'P' is the simple correlation coefficient, the quantity P^2 is known as:
(a) Coefficient of determination
(b) Coefficient of Non-determination
(c) Coefficient of alienation
(d) None of the above. (1 mark)

Answer:

(a) Better measure for measuring correlation is provided by the square of correlation coefficient, known as 'coefficient of determination' which is expressed as–

$$r^2 = \frac{\text{Explained Variance}}{\text{Total Variance}}$$

[9] ________ of the regression Coefficients is greater than the correlation coefficient
(a) Combined mean
(b) Harmonic mean
(c) Geometric mean
(d) Arithmetic mean (1 mark)

Answer:

(d) Correlation Coefficient (r) is the Geometric Mean (G.M.) between two co regression coefficients.

$$r = \pm\sqrt{b_{xy} \cdot b_{yx}}$$

Since, AM > GM > HM

Therefore, AM of regression coefficients is greater than correlation coefficient.

[10] If the correlation coefficient between x and y is r, then between $U = \frac{x-5}{10}$ and $V = \frac{y-7}{2}$ is

(a) r
(b) – r
(c) (r-5)/2
(d) (r – 7)/10 (1 mark)

Answer:

(a) $x - 10u = 5 \rightarrow$ (1) eq.

$y - 2v = 7 \rightarrow$ (2) eq.

Since correlation coefficient (Karl Pearson's) is independent of both scale and origin, therefore,

$P(u, v) = p(x, y) = r$

It may be noted that if

$u_1 = ax_1 + b$ and $v_i = cy_i + d$, then

$r(u, v) = p(x, y)$ if a and c are of same signs

$r(u, v) = - p(x, y)$ if a and c are of opposite signs.

[11] If the two lines of regression are

$x + 2y - 5 = 0$ and $2x + 3y - 8 = 0$

The regression line of y on x is:

(a) $x + 2y - 5 = 0$
(b) $2x + 3y - 8 = 0$
(c) Any of the two line
(d) None of the two lines. (1 mark)

Answer:

(c) Let us take equation (1) as

$x + 2y - 5 = 0$

$$byx = \frac{\text{coeff. of } x}{\text{coeff. of } y} = \frac{-1}{2} = -0.5$$

Now, let us take equation (2) as

$2x + 3y - 8 = 0$

$$byx = -\frac{2}{3} = -0.66$$

In both the cases r < 1

Hence, any of the two lines can be regression line of y on x.

2010 - DECEMBER

[12] If the sum of the product of deviations of x and y series from their means is zero, then the coefficient of correlation will be.

(a) 1 (b) -1

(c) 0 (d) None of these (1 mark)

Answer:

(c) Coefficient of correlation = $\frac{Cov(x,y)}{Sx \times Sy} = \frac{\sum(x-\bar{x})(y-\bar{y})}{n \times \sigma_x \times \sigma_y}$

Cov (x, y) = $\frac{\sum xy}{x} - \bar{x}\bar{y} = 0$

It is given that the above value

$\Rightarrow \Sigma(x-\bar{x})(y-\bar{y}) = 0$ (Numerator)

Hence, Coefficient of correlation = $\frac{0}{Sx \times Sy} = 0$

[13] The ranks of five participants given by two judges are

		Participants				
		A	B	C	D	E
Judge	1	1	2	3	4	5
Judge	2	5	4	3	2	1

Rank correlation coefficient between ranks will be

(a) 1 (b) 0

(c) -1 (d) 1/2 (1 mark)

Answer:

(c)

	Judge 1 (r_1)	Judge 2 (r_2)	d	d^2
A	1	5	– 4	16
B	2	4	– 2	4
C	3	3	0	0

D	4	2	2	4
E	5	1	2	16
				40

$$\text{Rank correlation coefficient} = 1 - \frac{6\sum d^2}{n(n^2-1)}$$

$$= 1 - \frac{6 \times 40}{5 \times 24}$$

$$= 1 - 2 = -1$$

[14] Regression coefficient are ________

(a) dependent of change of origin and of scale.
(b) independent of both change of origin and of scale.
(c) dependent of change of origin but not of scale.
(d) independent of change of origin but not of scale (1 mark)

Answer:

(d) Regression coefficient are independent of change of origin but not of scale (As per Fundamental Principle)

[15] Given : $\bar{x} = 16$, $\sigma x = 4.8$

$\bar{y} = 20$, $\sigma y = 9.6$

The coefficient of correlation between x and y is 0.6. What will be the regression coefficient of 'x' on 'y'?

(a) 0.03 (b) 0.3
(c) 0.2 (d) 0.05 (1 mark)

Answer:

(b) $bxy = r \times \frac{SDx}{SDy}$

$r = 0.6$

$SDx = 4.8$

$SDy = 9.6$

$bxy = 0.6 \times \frac{4.8}{9.6} = 0.3$

[16] If the two lines of regression are
$x + 2y - 5 = 0$ and $2x + 3y - 8 = 0$
The regression line of y on x is

(a) $x+2y-5 = 0$ (b) $2x+3y-8 = 0$
(c) Any of the two line (d) None of the two lines. (1 mark)

Answer:

(c) Let us take equation (1) as
$x + 2y - 5 = 0$

$$byx = \frac{\text{coeff. of } x}{\text{coeff. of } y} = \frac{-1}{2} = -0.5$$

Now, let us take equation (2) as
$2x + 3y - 8 = 0$

$$byx = -\frac{2}{3} = -0.66$$

In both the cases $r < 1$
Hence, any of the two lines can be regression line of y on x

2011 - June

[17] The covariance between two variables X and Y is 8.4 and their variances are 25 and 36 respectively. Calculate Karl Pearson's coefficient of correlation between them.

(a) 0.82 (b) 0.28
(c) 0.01 (d) 0.09 (1 mark)

Answer:

(b) Given : Cov (x, y) = 8.4

$\because$ Variance of $x = 25$

$\therefore$ S.D of x $(\sigma_x) = \sqrt{25} = 5$

and

$\because$ Variance of $y = 36$

$\therefore$ S.D of $y = \sqrt{36} = 6$

∴ Karl Pearson's Coefficient of Correlation = $\frac{Cov(x,y)}{\sigma x, \sigma y}$

$= \frac{8.4}{5 \times 6}$

$= \frac{8.4}{30}$

$= 0.28$

[18] For a bivariate data, two lines of regression are 40x - 18y = 214 and 8x - 10y + 66 = 0, then find the values of $\bar{x}$ and $\bar{y}$

(a) 17 and 13
(b) 13 and 17
(c) 13 and -17
(d) -13 and 17 (1 mark)

Answer:

(b) Given : $40x - 18y = 214$ ______(1)

$8x - 10y = -66$ ______(2)

On solving (1) and (2) we get

x = 13 and y = 17

∴ $\bar{x} = 13$ and $\bar{y} = 17$.

[19] Three competitors in a contest are ranked by two judges in the order 1,2,3 and 2,3,1 respectively. Calculate the Spearman's rank correlation coefficient.

(a) -0.5
(b) -0.8
(c) 0.5
(d) 0.8 (1 mark)

Answer:

(a)

Rank by I[st] Judge R_1	Rank by II[nd] Judge R_2	Diff $D = R_1 - R_2$	D^2
1	2	− 1	1
2	3	− 1	1
here 3 n = 3	1	+2	4 $\sum D^2 = 6$

Spearman's Rank Correlation coefficient $= 1 - \dfrac{6\sum D^2}{n(n^2-1)}$

$$= 1 - \frac{6 \times 6}{3(3^2-1)}$$

$$= -0.5$$

2011 - DECEMBER

[20] Out of the following which one affects the regression co-efficient.

(a) Change of Origin Only
(b) Change of scale Only
(c) Change of scale & origin both
(d) Neither Change of origin nor change of scale (1 mark)

Answer:

(b) The regression coefficients remain unchange due to a shift of origin but change due to a shift of scale.

[21] For a bivariate data, the lines of regression of Y on X, and of X on Y are respectively 2.5Y – X = 35 and 10X – Y = 70, then the Correlation coefficient r is equal to:

(a) 0.2 (b) – 0.2
(c) 0.5 (d) – 0.5 (1 mark)

Answer:

(a) The equation of regression line y on x is given by

$$2.5y - x = 35$$

$$2.5y = x + 35$$

$$y = \frac{x+35}{2.5}$$

$$y = \frac{x}{2.5} + \frac{350}{25}$$

$$y = 14 + \frac{2}{5}x$$

On comparing

$y = a + bx$

we get $b = \frac{2}{5} \Rightarrow b_{yx}$

Now the equation of Regression line x on y in given by

$10x - y = 70$

$10x = 70 + y$

$x = \frac{70}{10} + \frac{y}{10}$

$x = 7 + \frac{1}{10}y$

Comparing from $x = a + by$

we get $b = \frac{1}{10} \Rightarrow bxy$

coefficient of correlation (r) $= \sqrt{bxy \times byx}$

$= \sqrt{\frac{2}{5} \times \frac{1}{10}}$

$= \sqrt{\frac{1}{25}}$

$= \frac{1}{5}$

$= 0.2$

[22] If one of regression coefficient is ________ unity, the other must be ________ unity.

(a) more than, more then
(b) Less than, Less then
(c) more than, less than
(d) Positive, Negative (1 mark)

Answer:

(c) If one of regression Co-efficient is **more than** unity, the other must be **less than** unity.

[23] If Y is dependent variable and X is Independent variable and the S.D of X and Y are 5 and 8 respectively and Co-efficient of co-relation between X and Y is 0.8. Find the Regression coefficient of Y on X.

(a) 0.78 (b) 1.28
(c) 6.8 (d) 0.32 (1 mark)

Answer:

(b) Given

S. D of x $(\sigma_x) = 5$

S. D of y $(\sigma_y) = 8$

Co-eff. of Correlation $(r) = 0.8$

Regression Co-eff of y on x

$$b_{yx} = r.\frac{\sigma_y}{\sigma_x} = \frac{0.8 \times 8}{5} = \frac{6.4}{5} = 1.28$$

2012 - JUNE

[24] If the regression lines are $8x - 10y + 66 = 0$ and $40x - 18y = 214$, the correlation coefficient between 'x' and 'y' is :

(a) 1 (b) 0.6
(c) -0.6 (d) -1 (1 mark)

Answer:

(b) Given I[st] Regression line

$8x - 10y + 66 = 0$

$10y = 66 + 8x$

$y = \frac{66}{10} + \frac{8x}{10}$

$y = 6.6 + 0.8x$

on comparing $y = a + bx$

we get $b = byx = 0.8$

and II[nd] Regression line

$40x - 18y = 214$

$40x = 214 + 18y$

$x = \frac{214}{40} + \frac{18y}{40}$

$x = 5.35 + 0.45y$

on comparing x = a + by

we get b = bxy = 0.45

coefficient of correlation between x & y

$r = \pm\sqrt{byx \times bxy}$

$= \pm\sqrt{0.8 \times 0.45}$

$= \pm\sqrt{.36}$

$= \pm 0.6$

[25] The coefficient of correlation between two variables x and y is the simple ________ of the two regression coefficients.

(a) Arithmetic Mean (b) Geometric Mean

(c) Harmonic Mean (d) None of the above. (1 mark)

Answer:

(b) The coefficient of correlation between two variables x and y is the simple **geometric mean** of the two regression coefficient.

[26] If 2 variables are uncorrelated, their regression lines are:

(a) Parallel (b) Perpendicular

(c) Coincident (d) Inclined at 45 degrees. (1 mark)

Answer:

(b) If two variables are uncorrelated (i.e. r = 0) then regression lines are **perpendicular.**

[27] If the covariance between variables X and Y is 25 and variance of X and Y are respectively 36 and 25, then the coefficient of correlation is

(a) 0.409 (b) 0.416

(c) 0.833 (d) 0.0277 (1 mark)

Answer:

(c) Given (Covariance) Cov (x, y) = 25

Variance of x = 36

S.D of x (σ_x) $= \sqrt{36} = 6$

Variance of y = 25

S.D of (σ_y) $= \sqrt{25} = 5$

Coefficient of correlation

$$r = \frac{Cov(x_1, y)}{\sigma_x . \sigma_y}$$

$$= \frac{25}{6 \times 5}$$

$$= \frac{5}{6}$$

$$= 0.833$$

[28] If $\bar{x}$, $\bar{y}$ denote the arithmetic means, σ_x, σ_y denotes the standard deviations. b_{xy}, b_{yx} denote the regression coefficients of the variables 'x' and 'y' respectively, then the point of intersection of regression lines x on y & y on x is ________.

(a) $(\bar{x}, \bar{y})$
(b) (σ_x, σ_y)
(c) (b_{xy}, b_{yx})
(d) (σ_x^2, σ_y^2) (1 mark)

Answer:

(a) Since the two lines of regression pass through the point $(\bar{x}, \bar{y})$, the mean values $(\bar{x}, \bar{y})$ can be obtained as the point of intersection of the two regression lines.

2012 - DECEMBER

[29] In Spearman's Correlation Coefficient, the sum of the differences of ranks between two variables shall be ______.

(a) 0
(b) 1
(c) – 1
(d) None of the above. (1 mark)

Answer:

(a) In spearman's correlation coefficient, the sum of the differences of ranks between two variable shall be **any number.**

[30] For certain x and y series which are correlated, the two lines of regression are

$5x - 6y + 9 = 0$

$15x - 8y - 130 = 0$

The correlation coefficient is

(a) 4/5 (b) 3/4

(c) 2/3 (d) 1/2 (1 mark)

Answer:

(c) The lines of regression are

$5x - 6y + 9 = 0$ and $15x - 8y - 130 = 0$

$6y = 5x + 9$ $15x = 8y + 130$

$y = \frac{5}{6}x + \frac{9}{6}$ $x = \frac{8}{15}y + \frac{130}{15}$

$y = \frac{9}{6} + \frac{5}{6}x$ $x = \frac{130}{15} + \frac{8}{15}y$

$y = a + bx$ $x = a + by$

We get We get

$b = \frac{5}{6} = b_{yx}$ $b = \frac{8}{15} = b_{xy}$

Coefficient of correlation $r = \pm\sqrt{b_{yx} \times b_{xy}}$

$= \pm\sqrt{\frac{5}{6} \times \frac{8}{15}}$

$= \pm\sqrt{\frac{4}{9}}$

$= \pm 2/3$

[31] The Coefficient of correlation between x and y series is – 0.38. The linear relation between x & u and y & v are 3x + 5u = 3 and – 8y – 7v = 44, what is the coefficient of correlation between u & v?

(a) 0.38 (b) – 0.38

(c) 0.40 (d) None of the above. (1 mark)

Answer:

(b) Given $r_{xy} = -0.38$

Given linear relation between x & u and y & v are

$3x + 5u = 3$ and $-8y - 7v = 44$

$5u = 3 - 3x$ $7v = -44 - 8y$

$u = \frac{3}{5} - \frac{3}{5}x$ $v = -\frac{44}{7} - \frac{8}{7}y$

$u = a + bx$ $v = c + dy$

We get

$b = -\frac{3}{5}$

We get

$d = -\frac{8}{7}$

$r_{xy} = \frac{bd}{|b|\,|d|} r_{uv}$

$-0.38 = \frac{\left(\frac{-3}{5}\right)\left(\frac{-8}{7}\right)}{\left[\left(\frac{-3}{5}\right)\right]\left[\left(\frac{-8}{7}\right)\right]} \times r_{uv}$

$-0.38 = \frac{24}{35} \times \frac{35}{24} r_{uv}$

$r_{uv} = -0.38$

[32] If y = 18x + 5 is the regression line of y on x value of b_{xy} is

(a) 5/18

(b) 18

(c) 5

(d) 1/18

(1 mark)

Answer:

(d) If $y = 18x + 5$

$18x = -5 + y$

$x = \frac{-5 + y}{18}$

$x = \frac{-5}{18} + \frac{1}{18} y$

$x = a + by$

We get $b = b_{xy} = 1/18$

2013 - JUNE

[33] If 'r' be the Karl's Pearson's coefficient of correlation in a bivariate distribution then the two regression lines are at right angle if:

(a) $r = \pm 1$

(b) $r = 0$

(c) r = ± any finite value whose numerical value is less than 1
(d) None of these (1 mark)

Answer:

(b) If r = 0 the two regression lines are at right angle.

[34] If the regression equations are 8x – 3y + 50 = 0 and 14x – 7y – 60 = 0 and standard deviation of y is 1. The coefficient of correlation is = __________

(a) 2
(b) 1
(c) 0.87
(d) – 0.87 (1 mark)

Answer:

(c) Regression Equation are

$8x - 3y + 50 = 0$ and $14x - 7y - 60 = 0$

$8x = -50 + 3y$ | $7y = -60 + 14x$

$x = \frac{-50}{8} + \frac{3}{8}y$ | $y = \frac{-60}{7} + \frac{14}{7}x$

$x = a + 3y$ | $y = a + bx$

We get | We get

$b = \frac{3}{8} \rightarrow bxy$ | $b = \frac{14}{7} = 2 \rightarrow byx$

$r = \pm\sqrt{bxy \times byx}$

$= \pm\sqrt{\frac{3}{8} x 2}$

$= \pm\frac{\sqrt{3}}{2}$

$= +\frac{1.732}{2} = +0.866$

$= +0.87$

[35] The coefficient of correlation between two variables x and y is 0.28. Their covariance is 7.6. If the variance of x is 9, then the standard deviation of y is:

(a) 8.048
(b) 9.048
(c) 10.048
(d) 11.048 (1 mark)

Answer:

(b) Coeff of correlation (r) = 0.28

Cov (x, y)= 7.6

Var (x) = 9

S.D. (σx) = $\sqrt{9} = 3$

S.D. of y (σy)= ?

We know that

$$r = \frac{Cov(x, y)}{\sigma x . \sigma y}$$

$$0.28 = \frac{7.6}{3 \times \sigma y}$$

$$\sigma y = \frac{760^{190}}{3 \times 0.28_7}$$

σy = 9.048

[36] Two variables x and y are related according to 4x + 3y = 7. Then x and y are:

(a) Positively correlated.

(b) Negatively correlated.

(c) Correlation is zero.

(d) None of these. (1 mark)

Answer:

(b) Given Regression Equation

4x + 3y = 7 and	4x + 3y = 7
3y = 7 – 4x	4x = 7 – 3y
$y = \frac{7}{3} \frac{-4x}{3}$	$x = \frac{7}{4} \frac{-3y}{4}$
y = a + bx	x = a + by
We get	We get
b = -4/3 = byx	b = -3/4 = bxy

$$r = \pm\sqrt{byx \times bxy}$$

$$= \pm\sqrt{\left(\frac{-4}{3}\right)\left(\frac{-3}{4}\right)}$$

$= -\sqrt{1}$ [∵ both bxy & byx are negative]

r = – 1 (Negative correlated)

2013 - DECEMBER

[37] Determine the coefficient of correlation between x and y series:

	x Series	y Series
No. of items	15	15
Arithmetic Mean	25	18
Sum of Squares of Deviations from Mean	136	138

Sum of products of Deviations of x and y series from Mean = 122

(a) - 0.89 (b) 0.89
(c) 0.69 (d) - 0.69 (1 mark)

Answer:

(b) Given N = 15, $\bar{x} = 25$, $\bar{y} = 18$, $\Sigma dx^2 = 136$, $\Sigma dy^2 = 138$ $\Sigma dx\, dy = 122$

Coeff of correlation

$$r = \frac{\sum dx\,dy}{\sqrt{\sum dx^2 \sum dy^2}}$$

$$= \frac{122}{\sqrt{136 \times 138}} = \frac{122}{136.99} = 0.89$$

[38] Price and Demand is the example for

(a) No correlation (b) Positive correlation
(c) Negative (d) None of the above (1 mark)

Answer:

(c) Price and Demand is the example for negative correlation.

[39] If mean of x and y variables is 20 and 40 respectively and the regression coefficient of y on x is 1.608, then the regression line of y on x is

(a) y = 1.608x + 7.84 (b) y = 1.5x + 4.84
(c) y = 1.608x + 4.84 (d) y = 1.56x + 7.84 (1 mark)

Answer:

(a) $\bar{x} = 20, \bar{y} = 40$, byx = 1.608

The Regression equation of line y on x

$$y - \bar{y} = byx\,(x - \bar{x})$$
$$y - 40 = 1.608\,(x - 20)$$
$$y - 40 = 1.608x - 32.16$$
$$y = 1.608x - 32.16 + 40$$
$$y = 1.608x + 7.84$$

[40] When the value of correlation coefficient is +1 or -1, then the two regression lines will ______________.

(a) have 30° angle between them.

(b) have 45° angle between them.

(c) coincide.

(d) be perpendicular to each other (1 mark)

Answer:

(c) When the value of correlation coefficient is + 1 or - 1 then the two regression line will **coincide**

2014 - JUNE

[41] Two regression lines for a bivariate data are: 2x - 5y + 6 = 0 and 5x-4y + 3 = 0. Then the coefficient of correlation should be:

(a) $\frac{-2\sqrt{2}}{5}$ (b) $\frac{2}{5}$

(c) $\frac{+2\sqrt{2}}{5}$ (d) $\frac{\sqrt{2}}{5}$ (1 mark)

Answer:

(c) Two Regression lines

$2x - 5y + 6 = 0$ and $5x - 4y + 3 = 0$

$byx = \frac{-\text{Coeff. of } x}{\text{Coeff. of } y}$, $bxy = \frac{-\text{Coeff. of } y}{\text{Coeff. of } x}$

$= \frac{-(2)}{-5}$ $= \frac{-(-4)}{5}$

$= \frac{2}{5}$ $= \frac{4}{5}$

$r = \pm\sqrt{byx \times bxy}$

$= \pm\sqrt{\frac{2}{5} \times \frac{4}{5}}$

$= +\sqrt{\frac{8}{25}}$

$= +\frac{2\sqrt{2}}{5}$

[42] When each individual gets the exactly opposite rank by the two Judges, then the rank correlation will be ______.

(a) 0 (b) -1

(c) +1 (d) $\frac{1}{2}$ (1 mark)

Answer:

(b) When each individual gets the exactly opposite rank by the two Judges, then the rank correlation will be – 1.

[43] If the mean of the two variables 'x' and 'y' are 3 and 1 respectively. Then the equation of two regression lines are______.

(a) 5x+7y-22=0, 6x+2y-20 = 0 (b) 5x+7y-22=0, 6x+2y+20=0

(c) 5x+7y+22=0, 6x+2y-20 = 0 (d) 5x+7y+22=0, 6x+2y+20=0

(1 mark)

Answer:

(a) The equation of two Regression lines are

$5x + 7y - 22 = 0, 6x + 2y - 20 = 0$

by solving these equations we get.

$x = 3$ & $y = 1$

So $\bar{x} = 3$, & $\bar{y} = 1$

(The Intersection of two regression lines are $\bar{x}$, $\bar{y}$).

[44] The equation of two lines of regression for 'x' and 'y' are 5x = 22 + y and 64x = 24 + 45y then the value of regression coefficient of 'y' on 'x' will be ______.

(a) 5
(b) $\frac{1}{5}$
(c) $\frac{64}{45}$
(d) $\frac{45}{64}$ (1 mark)

Answer:

(c) Given Regression Equation

5x = 22 + y and 64x = 24 + 45y

5x – y – 22 = 0 and 64x – 45y – 24 = 0

$bxy = \frac{1}{5}$ and $byx = \frac{+64}{45}$

So, bxy × byx ≤ 1 then byx = 64/45

2014 - DECEMBER

[45] If the correlation coefficient between two variables is zero, then the lines of regression are:

(a) Parallel
(b) Perpendicular
(c) Coincide
(d) None of these (1 mark)

Answer:

(b) If the correlation coefficient b/w two variables is zero, then the lines of regression are **perpendicular.**

[46] If the value of correlation coefficient between x & y is 1, then the value of correlation coefficient between x - 2 and $\frac{-y}{2}+1$ is:

(a) 1
(b) -1
(c) -1/2
(d) 1/2 (1 mark)

Answer:

(b) Given $r_{xy} = 1$

Let $x - 2 = u$ and $\frac{-y}{2} + 1 = v$

$x = 2 + u$ $\qquad \frac{-y+2}{2} = v$

Comparing from

$x = a + bu$ $\qquad -y + 2 = 2v$

we get $b = 1$ $\qquad y = 2 - 2v$

on comparing

$y = c + dv$

we get

$d = -2$

$$r_{xy} = \frac{b.d}{|b|\,|d|} r_{uv}$$

$$1 = \frac{1 \times (-2)}{|1|\,|-2|} . r_{uv}$$

$$1 = \frac{-2}{2} r_{uv}$$

$$r_{uv} = -1$$

[47] The equations of two regression lines are $x + y = 6$ and $x + 2y = 10$, then the value of correlation coefficient between x and y is:

(a) -1/2 (b) +1/2

(c) $-1/\sqrt{2}$ (d) $+1/\sqrt{2}$ (1 mark)

Answer:

(c) Given two Regression lines:

$x + y = 6$ and $x + 2y = 10$

$x + y - 6 = 0$ $\qquad x + 2y - 10 = 0$

$b_{xy} = \frac{-\text{Coeff. of } y}{\text{Coeff. of } x}$ $\qquad b_{yx} = \frac{-\text{Coeff. of } x}{\text{Coeff. of } y}$

$= \frac{-1}{1} = -1$ $\qquad = \frac{-1}{2}$

$$r = \pm\sqrt{b_{xy} \times b_{yx}} = \pm\sqrt{(-1)\left(\frac{-1}{2}\right)} = -\frac{1}{\sqrt{2}}$$

2015 - JUNE

[48] Two regression lines are

$16x - 20y + 132 = 0$

$80x - 36y - 428 = 0$

The value of the correlation coefficient is

(a) 0.6 (b) - 0.6

(c) 0.54 (d) 0.45 (1 mark)

Answer:

(a) Given: Regression line

$$16x - 20y + 132 = 0$$

$$byx = -\frac{\text{coefficient of x}}{\text{coefficient of y}} = \frac{-16}{-20} = \frac{4}{5}$$

and other Regression line

$$80x - 36\,y - 428 = 0$$

$$bxy = -\frac{\text{coefficient of y}}{\text{coefficient of x}} = -\left(\frac{-36}{80}\right)$$

$$= \frac{36}{80} = \frac{9}{20}$$

$$byx \times bxy = \frac{4}{5} \times \frac{9}{20} = 0.36$$

$byx \times bxy \leq 1$ so it is satisfies

Then,

$$r = \pm\sqrt{byx \times bxy}$$

$$= \pm\sqrt{\frac{4}{5} \times \frac{9}{20}}$$

$$= +\sqrt{\frac{36}{100}}$$

$$= +0.6$$

[49] When the correlation coefficient r is equal to + 1, all the points in a scatter diagram would be

(a) On a straight line directed from upper left to lower right
(b) On a straight line directed from lower left to upper right
(c) On a straight line
(d) Both (a) and (b) (1 mark)

Answer:

(b) When the correlation coefficient r is equal to '+1', all the points in a scatter diagram on a straight line directed from lower left to upper Right.

2015 - DECEMBER

[50] Out of following which is correct?

(a) $b_{yx} = r\,\dfrac{\sigma_x}{\sigma_y}$
(b) $b_{yx} = r\,\dfrac{\sigma_y}{\sigma_x}$
(c) $b_{yx} = \dfrac{\pi.\Sigma xy}{\sigma_x}$
(d) $b_{yx} = \dfrac{\pi.\Sigma xy}{\sigma_y}$ (1 mark)

Answer:

(b) $byx = \dfrac{r.\sigma_y}{\sigma_x}$

Where σ_y = S.D. of y, σ_x = S.D. of x
r = Coeff. of Correlation

[51] In case of "Insurance Companies" profits and the number of claims they have to pay there is _______ correlation.

(a) Positive
(b) Negative
(c) No correlation
(d) None of the above (1 mark)

Answer:

(b) In case of Insurance Companies Profits and the Number of claims they have to pay there is **Negative** Correlation.

2016 - JUNE

[52] Two regression equations are as follows:
Regression equation of x on y : $5x - y = 22$
Regression equation of y on x : $64x - 45y = 24$
What will be the mean of x and y?

(a) $\bar{x} = 8$, $\bar{y} = 6$
(b) $\bar{x} = 6$, $\bar{y} = 6$
(c) $\bar{x} = 6$, $\bar{y} = 8$
(d) $\bar{x} = 8$, $\bar{y} = 8$ (1 mark)

Answer:

(c) Given Regression Equations

$$5x - y = 22 \quad \text{———— (1)}$$
$$64x - 45y = 24 \quad \text{———— (2)}$$

Multiply by 45 in equation (1) we get

$$225x - 45y = 990 \quad \text{———— (3)}$$

equation (3) – equation (2)

$$\begin{array}{r} 225x - 45y = 990 \\ 64x - 45y = 24 \\ - \quad + \quad - \\ \hline 161x = 966 \end{array}$$

$$\boxed{x = 6}$$

Putting x = 6 in equation (1)

$$5 \times 6 - y = 22$$
$$30 - y = 22$$
$$\boxed{y = 8}$$

$$\bar{x} = x = 6$$
$$\bar{y} = y = 8$$

[53] If the coefficient of correlation between X and Y variables is +0.90 then what will be the coefficient of determination?

(a) 0.30
(b) 0.81
(c) 0.94
(d) None of these (1 mark)

Answer:

(b) If Coeff. of Correlation (r) $= 0.90$

Coeff. of Determination $= r^2$

$= (0.90)^2$

$= 0.81$

[54] The two lines of regression become identical when

(a) $r = 1$

(b) $r = -1$

(c) $r = 0$

(d) (a) or (b) (1 mark)

Answer:

(d) If $r = -1$ or $+1$ then two lines of Regression become Identical.

[55] If $r = 0.6$, then the coefficient of determination is.

(a) 0.4 (b) – 0.6

(c) 0.36 (d) 0.64 (1 mark)

Answer:

(c) If $r = 0.6$

Then Coeff. of determination $= r^2$

$= (0.6)^2$

$= 0.36$

2016 - DECEMBER

[56] The two regression lines passing through

(a) Represent means

(b) Represent S.Ds

(c) (a) and (b)

(d) None of these. (1 mark)

Answer:

(a) The two Regression lines passing through or (Intersect) at their means.

[57] Out of the following the one which effects the regression coefficient is
(a) Change of origin only
(b) Change of scale only
(c) Change of scale and origin both
(d) Neither change in origin nor change of scale (1 mark)

Answer:

(b) By shifting the scale, coefficient of regression is changed.

[58] The regression equation of x on y is 3x + 2y = 100. The value of b_{xy} is:
(a) $-\frac{2}{3}$ (b) $\frac{100}{3}$
(c) $\frac{3}{2}$ (d) $\frac{2}{3}$ (1 mark)

Answer:

(a) The regression equation of x on y is 3x + 2y = 100.
The standard equation of x on y is of the form $x = a + b_{xy}y$

We have $3x = 100 - 2y \Rightarrow x = \frac{100}{3} - \frac{2}{3}y$

Comparing this with the standard form, we have $b_{xy} = -\frac{2}{3}$

[59] In a beauty contest there were 10 competitors. Rank of these candidates are assigned by two judges A and B. The sum of squares of differences of ranks is 44. The value of rank correlation is:
(a) 0.70 (b) 0.73
(c) 0.80 (d) 0.60 (1 mark)

Answer:

(b) Sum of squares of differences of ranks(Σd^2) = 44
No. of candidates n = 10
$r_R = ?$

Formula:

Rank correlation

$$r_R = 1 - \frac{6\sum d^2}{n(n^2-1)}$$

$$= 1 - \frac{6 \times 44}{10(10^2 - 1)}$$
$$= 1 - \frac{6 \times 44}{10 \times 99}$$
$$= 1 - 0.267$$
$$= 0.733$$
$$= 0.73$$

2017 - JUNE

[60] The coefficient of correlation between the temperature of environment and power consumption is always:

(a) Positive (b) Negative

(c) Zero (d) Equal to 1 (1 mark)

Answer:

(a) The coefficient of correlation between the temperature of environment and power consumption is always positive.

[61] If two regression lines are $x + y = 1$ and $x - y = 1$ then mean values of x and y will be:

(a) 0 and 1

(b) 1 and 1

(c) 1 and 0

(d) -1 and -1 (1 mark)

Answer:

(c) Given Regression line

$x + y = 1$ ———————— (1)

Adding $x - y = 1$ ———————— (2)

$2x = 2$

$x = \frac{2}{2} = 1$

x = 1 in equation (1) we get

$1 + y = 1$

$y = 0$

Mean of x = x = 1

Mean of y = y = 0

[62] The coefficient of correlation between x and y is 0.6. If x and y values are multiplied by -1, then the coefficient of correlation will be:

(a) 0.6 (b) – 0.6

(c) $\frac{1}{0.6}$ (d) 1 – 0.6 (1 mark)

Answer:

(a) The coefficient of correlation between X and Y is 0.6. If X and Y values are multiplied by -1 then coefficient of correlation remains unchanged. Then are coefficient of correlation will be 0.6.

2017 - DECEMBER

[63] If two regression lines are 5y = 9x – 22 and 20x = 9y + 350, then the value of correlation coefficient (r) will be:

(a) 0.10 (b) – 0.10

(c) – 0.90 (d) 0.90 (1 mark)

Answer:

(d) Given two regression lines are

$5y = 9x - 22$ ——— (1) and $20x = 9y + 350$ ——— (2)

$9x - 5y - 22 = 0$ and $20x - 9y - 350 = 0$

$byx = \frac{-\text{coeff. of } x}{\text{coeff. of } y} = \frac{-9}{-5}$ and $bxy = \frac{-\text{coeff. of } y}{\text{coeff. of } x}$

$byx = \frac{9}{5}$ $bxy = \frac{-(-9)}{20} = \frac{9}{20}$

$r = \pm\sqrt{byx \times bxy}$

$$= \pm\sqrt{\frac{9}{5} \times \frac{9}{20}}$$

$$= \pm\sqrt{\frac{81}{100}}$$

$$= + \left(\frac{9}{10}\right) = + 0.90$$

[64] The regression coefficient is independent of the change of:

(a) Origin (b) Scale

(c) Both (a) and (b) (d) Neither (a) nor (b). (1 mark)

Answer:

(a) The regression coefficient is independent of the change of 'origin'.

or

By shifting the origin, coefficient of regression is not changed.

[65] If r = 0.6 then the coefficient of non-determination will be:

(a) 0.40 (b) -0.60

(c) 0.36 (d) 0.64 (1 mark)

Answer:

(d) Given r = 0.6

Coefficient of non determination $= 1 - r^2$

$= 1 - (0.6)^2$

$= 1 - 0.36$

$= 0.64$

[66] The correlation coefficient (r) is the ______ of the two regression coefficients (b_{yx} and b_{xy})

(a) AM (b) GM

(c) HM (d) Median (1 mark)

Answer:

(b) The coefficient of correlation (r) is the G.M. of the two regression coefficient (byx × bxy)

$r = \pm\sqrt{byx \times bxy}$

[67] If there is a constant increase in a series, then the corresponding graph will be
(a) Convex curve
(b) Concave curve
(c) Parabola
(d) Straight line from the left to the right (1 mark)

Answer:

(d) If there is a constant increase in a series, then the corresponding graph will be straight line from the left to the right.

2018 - MAY

[68] If the plotted points is a scatter diagram are evenly distributed, then the correlation is
(a) Zero
(b) Negative
(c) Positive
(d) (a) Or (b) (1 mark)

Answer:

(a) If the plotted points in a scatter diagram are evenly distributed, then the correlation is **Zero**

[69] The covariance between two variables is
(a) Strictly positive
(b) Strictly negative
(c) Always Zero
(d) Either positive or negative or zero (1 mark)

Answer:

(d) The Co-variance between two variables is either positive or negative or zero.

[70] The coefficient of determination is defined by the formula

(a) $r^2 = \frac{1 - \text{unexplained variance}}{\text{total variance}}$

(b) $r^2 = \frac{\text{explained variance}}{\text{total variance}}$

(c) both (a) and (b)

(d) none (1 mark)

Answer:

(c) The coefficient of determination $= 1 - \frac{\textit{unexplained variance}}{\textit{total variance}}$

$= \frac{\text{explained variance}}{\text{total variance}}$

[71] In the method of Concurrent Deviations, only the directions of change (Positive direction/Negative direction) in the variables are taken into account for calculation of

(a) Coefficient of SD.

(b) Coefficient of regression

(c) Coefficient of correlation

(d) none (1 mark)

Answer:

(c) The Method of concurrent Deviation, only the directions of change (Positive direction/Negative direction) in the variables are taken into account for calculation of Coefficient of correlation.

[72] Correlation coefficient is ________ of the units of measurement.

(a) dependent

(b) independent

(c) both

(d) none (1 mark)

Answer:

(b) Correlation coefficient is **Independent** of the units of measurement.

[73] In case speed of an automobile and the distance required to stop the car after applying brakes correlation is

(a) Positive
(b) Negative
(c) Zero
(d) None (1 mark)

Answer:

(a) In case 'speed of on automobile and the distance required to stop the car often applying brakes' correlation is positive

[74] A relationship $r^2 = 1 - \frac{500}{300}$ is not possible

(a) True
(b) False
(c) Both
(d) None (1 mark)

Answer:

(a) $r^2 = 1 - \frac{500}{300}$ $r = \sqrt{1 - \frac{500}{300}} = \sqrt{-0.67}$

Since square root of a negative number is not possible, the given statement in the question is true.

[75] Rank correlation coefficient lies between

(a) 0 to 1
(b) – 1 to +1 inclusive of these value
(c) – 1 to 0
(d) both (1 mark)

Answer:

(b) Rank correlation coefficient lies between – 1 to +1 inclusive of both value

2018 - NOVEMBER

[76] The two line of regression intersect at the point

(a) Mean
(b) Mode
(c) Median
(d) None of these (1 mark)

Answer:

(a) The two line of regression Intersect at the point is Mean.

[77] If the two lines of regression are $x + 2y - 5 = 0$ and $2x + 3y - 8 = 0$, then the regression line of y on x is:

(a) $x + 2y - 5 = 0$ (b) $2x + 3y - 8 = 0$

(c) $x + 2y = 0$ (d) $2x + 3y = 0$ (1 mark)

Answer:

(a) Given two Regression lines are

$x + 2y - 5 = 0$ and $2x + 3y - 8 = 0$

$$byx = \frac{-\text{Coeff. of x}}{\text{Coeff. of y}} = \frac{-1}{2} \text{ and } bxy = \frac{-\text{Coeff. of y}}{\text{Coeff. of x}} = \frac{-3}{2}$$

Here, $byx \times bxy \leq 1$ which is satisfied.

So 1st equation $x + 2y - 5 = 0$ is the Regression Equation y on x.

[78] If the two regression lines are $3X = Y$ and $8Y = 6X$, then the value of correlation coefficient is

(a) 0.5 (b) – 0.5

(c) 0.75 (d) – 0.80 (1 mark)

Answer:

(a) Let $8y = 6x$ be the equation of y on x

The standard equation of y on x is of the form $y = a+b_{yx}x$.

We have $8y = 6x \quad y = \frac{6}{8}x \quad y = 0 + \frac{6}{8}x$

Comparing this with the standard form, we have $b_{yx} = \frac{6}{8}$

Also, let $3x = y$ be the equation of x on y.

The standard equation of x on y is of the form $x= a + b_{xy}y$

We have $3x = y \quad x = \frac{1}{3}y \quad x = 0 + \frac{1}{3}y$

Comparing this with the standard form, we have $b_{xy} = \frac{1}{3}$

Since both the regression coefficients are positive, $r = \sqrt{b_{yx} \times b_{xy}}$

$$r = \sqrt{b_{yx} \times b_{xy}} = \sqrt{\frac{6}{8} \times \frac{1}{3}} = 0.5$$

Since r lies between -1 and 1, our assumption is correct and therefore, $8y = 6x$ is the equation of y on x.

[79] The regression coefficient is independent of the change of:
(a) Scale (b) Origin
(c) Scale and origin both (d) None of these (1 mark)

Answer:

(b) The Regression coefficient is independent of the change of 'Origin'.

[80] If the correlation coefficient between the variables X and Y is 0.5, then the correlation coefficient between the variables $2x-4$ and $3-2y$ is
(a) 1 (b) 0.5
(c) −0.5 (d) 0 (1 mark)

Answer:

(c) If coefficient of correlation $r_{xy} = 0.5$

Given $u = 2x - 4$ and $v = 3 - 2y$

$2x - u - 4 = 0$ and $2y + v - 3 = 0$

$b = \frac{-\text{Coeff. of } u}{\text{Coeff. of } x}$ and $d = \frac{-\text{Coeff. of } v}{\text{Coeff. of } y}$

$= \frac{-(-1)}{2}$ $d = \frac{-1}{2}$

$b = \frac{1}{2}$ $d = \frac{-1}{2}$

Here, b and d both have different sign so $r_{uv} = -r_{xy}$

$= -0.5$

2019 - JUNE

[81] A.M. of regression coefficients is
(a) Equal to r
(b) Greater than or equal to r
(c) Half of r
(d) None (1 mark)

Answer:

(b) A.M of Regression Coefficient is greater than or equal to r.

[82] Given that

X	−3	−3/2	0	3/2	3
Y	9	9/4	0	9/4	9

Then Karlpearson's coefficient of correlation is

(a) Positive
(b) Zero
(c) Negative
(d) None (1 mark)

Answer:

(b) Given that

x	-3	-3/2	0	3/2	3
y	9	9/4	0	9/4	9

then Karlpearson's Coefficient of Correlation is "Zero" because it is equally distribute.

[83] Find the probable error if $r = \frac{2}{\sqrt{10}}$ and $n = 36$

(a) 0.6745
(b) 0.067
(c) 0.5287
(d) None (1 mark)

Answer:

(b) $r = \frac{2}{\sqrt{10}}$, $n = 36$, P.E = ?

Probable Error $P.E = \frac{2}{3}$ S.E

$$= \frac{2}{3} \frac{1-r^2}{\sqrt{n}}$$

$$= \frac{2}{3}\left[\frac{1-\left(\frac{2}{\sqrt{10}}\right)^2}{\sqrt{36}}\right]$$

$$= \frac{2}{3}\,\frac{\left(1-\frac{4}{10}\right)}{6}$$

$$= \frac{2}{3} \times \frac{\cancel{8}}{10\times\cancel{8}}$$

$$= \frac{1}{15}$$

$$= 0.067$$

[84] Given the following series:

X	10	13	12	15	8	15
Y	12	16	18	16	7	18

The rank correlation coefficient r =

(a) $1 - \dfrac{6\sum d^2 + \sum\limits_{i=1}^{2} \dfrac{m_i(m_i^2-1)}{12}}{n(n^2-1)}$

(b) $1 - \dfrac{6\left[\sum d^2 + \sum\limits_{i=i}^{2} \dfrac{m_i(m_i^2-1)}{12}\right]}{n(n^2-1)}$

(c) $1 - 6\sum d^2 + \sum\limits_{i=1}^{2} \dfrac{\dfrac{m_i(m_i^2-1)}{12}}{n(n^2-1)}$

(d) $1 - 6\sum d^2 + \sum\limits_{i=1}^{3} \dfrac{\dfrac{m_i(m_i^2-1)}{12}}{n(n^2-1)}$ (1 mark)

Answer:

(b) Given the following series:

x	10	13	12	15	8	15
y	12	16	18	16	7	18

In this question we use the formula of the Rank Correlation Coefficient.

$$r = 1 - \frac{6\left[\sum d^2 + \sum_{i=1}^{2} \frac{m_i(m_i^2 - 1)}{12}\right]}{n(n^2-1)}$$

[85] Determine Spearman's rank correlation coefficient from the given data $\sum d^2 = 30$, $n = 10$:

(a) $r = 0.82$

(b) $r = 0.32$

(c) $r = 0.40$

(d) None of the above (1 mark)

Answer:

(a) Here, $\sum d^2 = 30$, $n = 10$

Spearman's rank correlation

$$r_R = 1 - \frac{6\sum d^2}{n(n^2-1)}$$

$$= 1 - \frac{6 \times 30}{10(10^2-1)} = 1 - \frac{180}{990} = 1 - \frac{2}{11} = \frac{9}{11}$$

$= 0.82$

[86] If the regression line of y on x is given by $y = x + 2$ and Karl Pearson's coefficient of correlation is 0.5 then $\frac{\sigma y^2}{\sigma x^2} =$ ____________.

(a) 3

(b) 2

(c) 4

(d) None (1 mark)

Answer:

(c) The regression line of y on x is given by y = x + 2

$x - y + 2 = 0$

$$b_{yx} = -\frac{\text{coefficient of } x}{\text{coefficient of } y}$$

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

$$b_{yx} = 1$$

coeff. of correlation (r) = 0.5

then Regression coefficient y or x

$$b_{yx} = r\frac{\sigma y}{\sigma x}$$

$$1 = 0.5\frac{\sigma y}{\sigma x}$$

$$\frac{\sigma y}{\sigma x} = \frac{\not{10}\,2}{\not{5}}$$

$$\left(\frac{\sigma y}{\sigma x}\right)^2 = (2)^2$$

$$\frac{\sigma y^2}{\sigma x^2} = 4$$

2019 - NOVEMBER

[87] If two line of regression are x + 2y – 5 = 0 and 2x + 3y – 8 = 0. So x + 2y – 5 = 0 is

(a) y on x

(b) x on y

(c) both

(d) None

(1 mark)

Answer:

(a) $x + 2y - 5 = 0$ — Eq 1 $2x + 3y - 8 = 0$ — Eq 2

Let Eq 1 be y on x from Eq 2

$b_{yx} = \frac{-\text{coeff of } x}{\text{coeff of } y}$ $b_{xy} = \frac{-\text{coeff of } y}{\text{coeff of } x}$

$b_{yx} = \frac{-1}{2}$ $b_{xy} = \frac{-3}{2}$

$b_{yx} \times b_{xy} = \left(\frac{-1}{2}\right) \times \left(\frac{-3}{2}\right) = \frac{3}{4}$

So, $b_{yx} \times b_{xy} < 1$

So, $x + 2y - 5 = 0$ is y on x

and $2x + 3y - 8 = 0$ is x on y.

[88] Find the coefficient of correlation.

$2x + 3y = 2$

$4x + 3y = 4$

(a) -0.71

(b) 0.71

(c) -0.5

(d) 0.5

(1 mark)

Answer:

(b) Let $2x + 3y = 2$ be the equation of y on x.

The standard equation of y on x is of the form $y = a+b_{yx}x$.

We have $2x + 3y = 2 \Rightarrow 3y = 2 - 2x \Rightarrow y = \frac{2}{3} - \frac{2}{3}x$

Comparing this with the standard form, we have $b_{yx} = -\frac{2}{3}$.

Also, let $4x + 3y = 4$ be the equation of x on y.

The standard equation of x on y is of the form $x = a + b_{xy}y$.

We have $4x + 3y = 4 \Rightarrow 4x = 4 - 3y \Rightarrow x = \frac{4}{4} - \frac{3}{4}y \Rightarrow x = 1 - \frac{3}{4}y$

Comparing this with the standard form, we have $b_{xy} = -\frac{3}{4}$.

Since both the regression coefficients are negative, $r = -\sqrt{b_{yx} \times b_{xy}}$

$$r = -\sqrt{b_{yx} \times b_{xy}} = -\sqrt{\left(-\frac{2}{3}\right)\left(-\frac{3}{4}\right)} = -0.71$$

[89] What is the coefficient of correlation from the following data?

x :	1	2	3	4	5
y :	5	4	3	2	6

(a) 0

(b) – 0.75

(c) – 0.85

(d) 0.82

(1 mark)

Answer:

(a)

x	y	xy
1	5	5
2	4	8
3	3	9
4	2	8
5	6	30
$\Sigma x = 15$	$\Sigma y = 20$	$\Sigma xy = 60$

$$\text{cov}(x, y) = \frac{\Sigma xy}{n} - \bar{x}, \bar{y}$$

$$= \frac{60}{5} - \left(\frac{15}{5}\right) \times \left(\frac{20}{5}\right)$$

$$= 12 - 12$$

$$\text{cov}(x, y) = 0$$

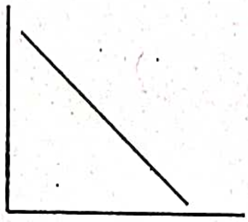
$$r = \frac{\text{Cov}(x, y)}{\sigma_x \cdot \sigma_y} = \frac{0}{\sigma_x \cdot \sigma_y}$$

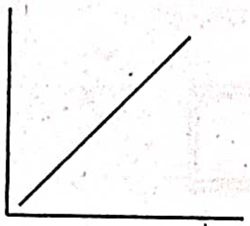
$$r = 0$$

[90] If the plotted points in a scatter diagram lie from upper left to lower right, then correlation is
(a) Positive
(b) Negative
(c) Zero
(d) None of these (1 mark)

Answer:

(b) If the plotted points in a scatter diagram lie from upper left to lower right them correlation us negative.


Negative correlation


Positive correlation

2020 - NOVEMBER

[91] Which of the following is spurious correlation?
(a) Correlation between two variables having no casual relationship
(b) Negative correlation
(c) Bad relation between two variables
(d) Very low correlation between two variables. (1 mark)

Answer:

(a) Correlation between two variables having no casual relationship is known as spurious correlation.

[92] Scatter diagram does not help us to?
(a) Find the type of correlation
(b) Identify whether variables correlated or not
(c) Determine the linear or non-linear correlation
(d) Find the numerical value of correlation coefficient (1 mark)

Answer:

(d) Scatter diagram does not help us to find the Numerical Value of correlation co-efficient.

[93] The covariance between two variables is

(a) Strictly positive

(b) Strictly negative

(c) Always Zero

(d) Either positive or negative or zero. (1 mark)

Answer:

(d) The covariance between two variables is either positive or negative or zero.

2021 - JANUARY

[94] For the set of observations {(1,2), (2, 5), (3,7), (4,8), (5,10)} the value of karl-person's coefficient of correlation is approximately given by

(a) 0.755

(b) 0.655

(c) 0.525

(d) 0.985 (1 mark)

Answer:

(d)

x	dx = x-A = x-3	dx^2	y	dy = y – B = y – 7	dy^2	dx. dy
1	1 - 3 = – 2	4	2	2 – 7 = – 5	25	10
2	2 - 3 = – 1	1	5	5 – 7 = – 2	4	2
A (3)	3 - 3 = 0	0	7	7 – 7 = 0	0	0

4	4 - 3 = 1	1	8	8 − 7 = 1	1	1
5	5 - 3 = 2	4	10	10 − 7 = 3	9	6
$\Sigma x = 15$	$\Sigma dx = 0$	$\Sigma dx^2 = 10$	$\Sigma y = 32$	$\Sigma dy = -3$	$\Sigma dy^2 = 39$	$\Sigma dxdy = 19$

Coff. of correlation $r = \dfrac{N\Sigma d_x d_y - \Sigma d_x . \Sigma d_y}{\sqrt{N\Sigma d_x^2 - (\Sigma d_x)^2}\sqrt{N\Sigma d_y^2 - (\Sigma d_y)^2}}$

$$r = \frac{5 \times 19 - 0 \times (-3)}{\sqrt{5 \times 10 - (0)^2}\sqrt{5 \times 39 - (-3)^2}}$$

$$= \frac{95 - 0}{\sqrt{50 - 0}\sqrt{195 - 9}}$$

$$r = \frac{95}{\sqrt{50}\sqrt{186}}$$

$$= \frac{95}{\sqrt{9300}}$$

$$r = \frac{95}{96.44} = 0.985$$

[95] The coefficient of correlation between x and y is 0.5 the covariance, is 16, and the standard deviation of y is

(a) 4
(b) 8
(c) 16
(d) 64 (1 mark)

Answer:

(b) Given Coeff. of correlation (r) = 0.5
(Covariance) Cov.(x, y) = 16
S.D. of x (σ x) = 4
S.D. of y (σ y) = ?
Coeff. of Correlation

$$r = \frac{Cov(x, y)}{\sigma x . \sigma y}$$

$$0.5 = \frac{16}{4 \times \sigma y}$$

$$\sigma y = \frac{16}{4 \times 0.5}$$

$$\sigma y = \frac{16}{2}$$

$$\boxed{\sigma y = 8}$$

[96] The interesting point of the two regression lines: y on x and x on y is

(a) (0, 0)

(b) ($\bar{x}$, $\bar{y}$)

(c) (b_{yx}, b_{xy})

(d) (1, 1)

(1 mark)

Answer:

(b) The Intersection point of two regression lines y on x and x on y is ($\bar{x}$,$\bar{y}$)

[97] Given that the variance of x is equal to the square of standard deviation by and the regression line of y on x is y = 40 + 0.5 (x-30). Then regression line of x on y is

(a) y = 40 + 4 (x - 30)

(b) y = 40 + (x - 30)

(c) y = 40 + 2 (x - 30)

(d) x = 30 + 2 (x - 40)

(1 mark)

Answer: (d)

(d) Here Regression Equation of line y on x

y = 40 + 0.5 (x - 30)

(y - 40) = 0.5 (x -30)

Comparing from $(y-\bar{y}) = b_{yx}\ (x-\bar{x})$

we get $\bar{x} = 30$, $\bar{y} = 40$, $b_{yx} = 0.5$

we know that

$$b_{yx} \times b_{xy} = 1$$

$$b_{xy} = \frac{1}{b_{yx}} = \frac{10}{0.5} = 2$$

$$\boxed{b_{xy} = 2}$$

Equation of Regression line x on y

$x - \bar{x} = b_{xy} (y - \bar{y})$

$x - 30 = 2 (y - 40)$

[98] The regression coefficients remain unchanged due to

(a) A shift of scale

(b) A shift of origin

(c) Replacing x - values by $\frac{1}{x}$

(d) Replacing y values by $\frac{1}{y}$ (1 mark)

Answer:

(b) The Regression coefficients remain unchanged due to **a shift of origin.**

2021 - JULY

[99] If y = 9x and x = 0.01y then r is equal to:

(a) -0.1

(b) 0.1

(c) +0.3

(d) -0.3 (1 mark)

Answer:

(c) Given

$y = 9x$

$y = a + bx$ (comparing from)

We get

$\boxed{b = 9} \Rightarrow b_{yx} = 9$

and $x = 0.01y$

$x = a + b_y$ (comparing from)

We get

$\boxed{b = 0.01} \Rightarrow b_{xy} = 0.01$

$r = \pm\sqrt{b_{yx} \times b_{xy}}$

$= \pm\sqrt{9 \times 0.01}$

$= +\sqrt{0.09}$

$= +0.3$

[100] The straight -line graph of the linear equation y = a + b x, slope is horizontal if:

(a) $b = 1$

(b) $b \neq 0$

(c) $b = 0$

(d) $a = b \neq 0$ (1 mark)

Answer:

(c) Given line $y - a + bx$

slope of horizontal if $b = 0$

[101] If byx = -1.6 and bxy = -0.4, then r_{xy} will be:

(a) 0.4

(b) -0.8

(c) 0.64

(d) 0.8 (1 mark)

Answer:

(b) $r_{xy} = \pm\sqrt{b_{yx} \times b_{xy}}$

$= \pm\sqrt{(-1.6) \times (-0.4)}$

$= -\sqrt{0.64}$

$= -0.8$

[102] If the sum of the product of the deviations of X and Y from their means is zero the correlation coefficient between X and Y is:

(a) Zero

(b) Positive

(c) Negative

(d) 10 (1 mark)

Answer:

(a) If Σ dx dy = 0 then

Correlation coefficient (r) = 0

[103] If the slope of the regression line is calculated to be 5.5 and the intercept 15 then the value of Y and X is 6 is:
(a) 88
(b) 48
(c) 18
(d) 78 (1 mark)

Answer:

(b) Here b = 5.5, a = 15

Then regression equation of line

$y = a + bx$

$y = 15 + 5.5x$

but x = 6

$y = 15 + 5.5 \times 6$

$= 15 + 33$

$y = 48$

[104] The sum of square of any real positive quantities and its reciprocal is never less than:
(a) 4
(b) 2
(c) 3
(d) 4. (1 mark)

Answer:

(b) The sum of square of any real positive quantities and its reciprocal is never less then '2'.

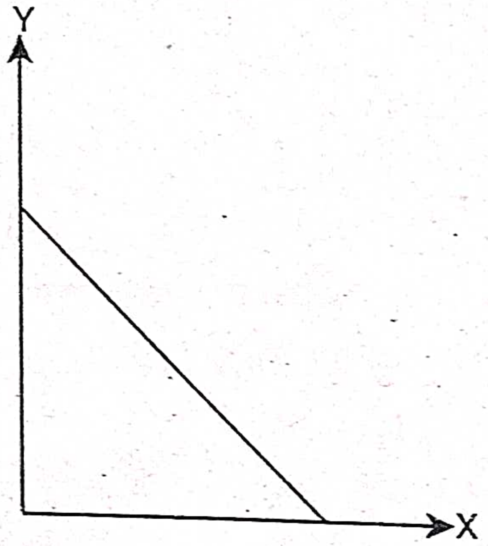
2021 - DECEMBER

[105] If the data points of (X,Y) series on a scatter diagram lie along a straight line that goes downwards as X-values move from left to right, then the data exhibit ------------------correlation.
(a) Direct
(b) Imperfect indirect

(c) Indirect
(d) Imperfect direct

Answer: (1 mark)

(c)



This is a Perfect Negative correlation, or indirect correlation.

[106] For any two variables x and y the regression equations are given as $2x + 5y - 9 = 0$ and $3x - y - 5 = 0$. What are the A.M. of x and y?
(a) 2, 1
(b) 1, 2
(c) 4, 2
(d) 2, 4 (1 mark)

Answer:

(a) The regression lines intersect at the means of x and y. Therefore, the common point of intersection of these two lines will give the means of x and y. This means that the means of x and y will satisfy these two equations simultaneously.

We can either solve these two equations simultaneously and find out the values of x and y, which will give us our means; or, we can simply try the options.

Option (a) → 2, 1

Putting the value of x = 2, and y = 1 in the equation

$2x + 5y - 9 = 0$, we get

LHS = 2(2) + 5(1) – 9 = 0 = RHS
Putting the value of x = 2, and y = 1 in the equation
3x – y – 5 = 0, we get
LHS = 3(2) – 1 – 5 = 0 = RHS
Therefore, option (a) is the answer.

[107] The intersecting point of two regression lines falls at X-axis. If the mean of X-values is 16, the standard deviations of X and Y are respectively, 3 and 4, then the mean of Y-values is
(a) 16/3
(b) 4
(c) 0
(d) 1 (1 mark)

Answer:

(c) The intersecting point of two regression lines gives the means of x and y. Since the point of intersection falls on the x-axis, the value of y is 0. Therefore, the mean of y-values is zero.

[108] The regression coefficients remain unchanged due to
(a) Shift of origin
(b) Shift of scale
(c) Always
(d) Never (1 mark)

Answer:

(a) The regression coefficient remain uncharged due to shift of origin.

2022 - June

[109] If Coefficient of correlation for 3x+ 4y = 6 is 0.5. Find the coefficient of correlation for of 3u+ 9v = 7 for u and v.
(a) - (0.5)
(b) + (0.5)
(c) ± 0.5
(d) 0.25 (1 mark)

Answer:

(b) We know that shift of scale coefficient of correlation is change (under consideration) then $r_{xy} = r_{uv} = 0.5$

[110] Karl Pearson Correlation Coefficient method is used for -
(a) Any data
(b) Scattered data
(c) Grouped data
(d) Ungrouped data (1 mark)

Answer:

(d) Karl Pearson Correlation Coefficient method is used for ungrouped data.

[111] If the plotted point in a scatter diagram lie from lower left to upper right then correction is:
(a) Positive
(b) Negative
(c) Perfectively negative
(d) Zero (1 mark)

Answer:

(a) If the plotted point in a scatter diagram lie from lower left to upper right then it is said to be positive correlation.

[112] If concurrent coefficient is $\frac{1}{\sqrt{3}}$. If sum of deviation is 6 for n pairs of data?
(a) 9
(b) 8
(c) 10
(d) 11 (1 mark)

Answer:

(c) Given $r_c = \frac{1}{\sqrt{3}}$, n = ?

$c = 6$

Coeff of concurrent deviation

$$r_c = \pm\sqrt{\frac{2c-m}{m}}$$

$$\frac{1}{\sqrt{3}} = \pm\sqrt{\frac{2\times6-m}{m}}$$

On squaring Both side

$$\left(\frac{1}{\sqrt{3}}\right)^2 = \left(\mp\sqrt{\frac{12-m}{m}}\right)^2$$

$$\frac{1}{3} = \frac{12-m}{m}$$

$$m = 36 - 3m$$

$$m + 3m = 36$$

$$4m = 36$$

$$m = \frac{36}{4} = 9$$

$$n = m + 1 = 9 + 1 = 10$$

[113] Which of the following is used he find correlation between two qualitative characteristics

(a) Karl Pearson
(b) Spearman rank correlation
(c) Concurrent deviation
(d) Scatter diagram (1 mark)

Answer:

(b) Spearman's rank correlation coefficient is used to find correlation between two qualititative characteristics.

[114] Scattered diagram is used the plot

(a) Quantitative data (b) Qualitative data
(c) Discrete data (d) Continuous data (1 mark)

Answer:

(a) Scattered diagram is used to plot quantitative data.

2022 - DECEMBER

[115] The equations of the two lines of regression are $4x + 3y + 7 = 0$ and $3x + 4y + 8 = 0$. Find the correlation coefficient between x and y?

(a) –0.75
(b) 0.25
(c) –0.92
(d) 1.25 (1 mark)

Answer:

(a) Given two Equations of Regression lines are:

$$4x + 3y + 7 = 0 \quad \text{and} \quad 3x + 4y + 8 = 0$$

$$bxy = \frac{-\text{coeff. of } y}{\text{coeff. of } x} \quad \text{and} \quad byx = \frac{-\text{coeff. of } x}{\text{coeff. of } y}$$

$$bxy = \frac{-3}{4} \qquad byx = \frac{-3}{4}$$

Coeff. of correlation is given by:

$$r = \pm\sqrt{byx \times bxy}$$

$$= \pm\sqrt{(-3/4) \times (-3/4)}$$

$$= -\sqrt{\frac{3}{16}}$$

$$= \frac{-3}{4}$$

$$r = -0.75$$

[116] The regression equations are $2x + 3y + 1 = 0$ and $5x + 6y + 1 = 0$, then Mean of x and y respectively are:

(a) –1,–1
(b) –1,1
(c) 1, –1
(d) 2,3 (1 mark)

Answer:

(c) Given Regression Equations are:

$2x + 3y + 1 = 0 \rightarrow 2x + 3y = -1$ ______(1)

and $5x + 6y + 1 = 0 \rightarrow 5x + 6y = -1$ ______ (2)

multiply by (2) in eq. (1) we get

$4x + 6y = -2$ _______ (3)

eq. (2) - eq. (3)

$5x + 6y = -1$

$4x + 6y = -2$

$-\quad -\quad +$

$\boxed{x = 1}$

Putting x = 1 in equation (1)

$2 \times 1 + 3y = -1$

$2 + 3y = -1$

$3y = -1-2$

$3y = -3$

$\boxed{y = -1}$

Ans. x = 1, y = -1

[117] If $b_{yx} = 0.5$, $b_{xy} = 0.46$ then the value of correlation coefficient r is:

(a) 0.23

(b) 0.25

(c) 0.39

(d) 0.48 (1 mark)

Answer:

(d) Given byx = 0.5, bxy = 0.46 find r = ?

Coeff. of correlation

$r = \pm \sqrt{byx \times bxy}$

$= \pm \sqrt{0.5 \times 0.46}$

$= + \sqrt{0.23}$

$= + 0.48$

[118] The coefficient of rank correlation between the ranking of following 6 students in two subjects Mathematics and Statistics is:

Mathematics	3	5	8	4	7	10
Statistics	6	4	9	8	1	2

(a) 0.25 (b) 0.35
(c) 0.38 (d) 0.20 (1 mark)

Answer:

(a) MATHEMATICS → X, STATISTICS → Y

Table

Marks of Maths (x)	Rank of 'x' R_x	Marks of Stats (y)	Rank of y (R_y)	d = Rx - Ry	d^2
3	6	6	3	3	9
5	4	4	4	0	0
8	2	9	1	1	1
4	5	8	2	3	9
7	3	1	6	-3	9
10	1	2	5	-4	16
n = 6					$d^2 = 44$

Coeff. of rank correlation

$$r_R = 1 - \frac{6\sum d^2}{n(n^2-1)}$$

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

$$= 1 - \frac{\cancel{6} \times 44}{\cancel{6} \times 35}$$

$$= 1 - \frac{44}{35}$$

$$= \frac{-9}{35}$$

$$r_R = -0.257$$

$$r_R = -0.25$$

[119] Pearson's Correlation coefficient between x and y is:-

(a) $\frac{cov(x,y)}{S_x S_y}$

(b) $\frac{cov^2(x,y)}{S_x S_y}$

(c) $\frac{(S_x S_y)^2}{cov(x,y)}$

(d) $\frac{S_x S_y}{cov(x,y)}$ (1 mark)

Answer:

(a) Kal Pearson's correlation coefficient

$$r = \frac{Cov(x, y)}{S_x . S_y}$$

Where Cov (x, y) → Covariance of (x, y)

S_x → S.D of x

S_y → S.D of y