NCERT SOLUTIONS

CLASS - 11th



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Class : 11th
Subject : Statistics
Chapter : 7
Chapter Name : Correlation

Q1 The unit of correlation coefficient between height in feet and weight in kgs is
(i) kg/feet
(ii) percentage
(iii) non-existent

Answer. Option (iii) is correct. There is no relation between the two quantities.

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Q2 The range of simple correlation coefficient is
(i) 0 to infinity
(ii) minus one to plus one
(iii) minus infinity to infinity

Answer. Option (ii) is correct. The range of simple correlation coefficient is -1 to 1.

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Q3 If rxy is positive the relation between X and Y is of the type
(i) When Y increases X increases
(ii) When Y decreases X increases
(iii) When Y increases X does not change

Answer. Option (i) is correct. If r_{xy} is positive, then it indicates positive correlation and the two quantities move in same direction.

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Q4 If rxy = 0 the variable X and Y are
(i) linearly related
(ii) not linearly related
(iii) independent

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Answer. Option (ii) is correct. There is no linear relation between the two quantities if r_{xy} is zero.

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Q5 Of the following three measures which can measure any type of relationship
(i) Karl Pearson's coefficient of correlation
(ii) Spearman's rank correlation
(iii) Scatter diagram

Answer. Option (iii) is correct. The scatter diagram can be used to measure any type of relationship as it is the simplest form of representation which does not involve any values.

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Q6 If precisely measured data are available the simple correlation coefficient is
(i) more accurate than rank correlation coefficient
(ii) less accurate than rank correlation coefficient
(iii) as accurate as the rank correlation coefficient

Answer. Option (i) is correct. In case of simple correlation coefficient, it is the most accurate if precisely measured data is available.

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Q7 Why is preferred to covariance as a measure of association?

Answer. It is due to the following reasons,

1. It is a ratio, and has no unit.
2. It lies between 0 and 1.
3. It is unaffected by change of origin and selection of scale.

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Q8 Can r lie outside the –1 and 1 range depending on the type of data?

Answer. No, The value of r must lie between -1 and 1. If it goes beyond this range, it implies some error in the calculation.

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Q9 Does correlation imply causation?

Answer. No, correlation only defines the level of relationship two quantities have between them.

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Q10 When is rank correlation more precise than simple correlation coefficient?
Answer. The Rank correlation is more precise when the measurement of variables is not qualitative. Also, it is more precise when extreme values are present in the observations.

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Q11 Does zero correlation mean independence?

Answer. No, zero correlation only means that there is no linear relationship between the two quantities involved. There can be a non linear relationship between them.

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Q12 Can simple correlation coefficient measure any type of relationship?

Answer. No, simple correlation coefficient cannot measure any type of relationship. It can only measure linear relationship between the quantities.

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Q13 Collect the price of five vegetables from your local market every day for a week. Calculate their correlation coefficients. Interpret the result.

Answer. This question involves multivariate results, and is out of the scope of syllabus of CBSE.

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Q14 Measure the height of your classmates. Ask them the height of their benchmate. Calculate the correlation coefficient of these two variables. Interpret the result.

Answer. The values in the observation are:

X	Y	XY	X^2	Y^2
67	65	4355	4489	4225
56	66	3696	3136	4356
65	57	3705	4225	3249
68	67	4556	4624	4489
72	68	4896	5184	4624
72	69	4968	5184	4761
69	70	4830	4761	4900
71	72	5112	5041	5184
$\sum X$ = 540	$\sum Y$ = 534	$\sum XY$ = 36118	$\sum X^2$ = 36644	$\sum Y^2$ = 35788

Here, X is the height of the classmate and Y is the height of his benchmate.

$$r = \frac{\left[XY\left(\frac{XY}{N}\right)\right]}{\left[\left(\sum X^2\left(\frac{XX}{N}\right)\left(\sum Y^2\frac{YY}{N}\right)\right)\right]^{0.5}}$$

$$r = \frac{73}{(194 \times 143.5)^{0.5}}$$

$$r = \frac{73}{166.88}$$

r = 0.44

Therefore, there is a medium correlation between the heights.

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Q15 List some variables where accurate measurement is difficult.

Answer. Some of such variables are:

1. Temperature and number of frost bites
2. Rainfall and Yield of Crops
3. Honesty and Industrialisation
4. Overpopulation and Poverty

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Q16 Interpret the values of r as 1, –1 and 0.

Answer. If r is positive, it indicates a positive correlation between the variables. If r is negative, it indicates a negative correlation between variables. If r is zero, it means there is no linear relationship between the variables.

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Q17 Why does rank correlation coefficient differ from Pearsonian correlation Coefficient?

Answer. The following points will highlight the difference between the coefficients:

1. Pearson's method measures quantitative data whereas rank correlation coefficient measures qualitative data.
2. Pearsonian method calculates deviation from mean whereas rank correlation coefficient measures differences in rank.
3. Pearson's method gives high weightage to extreme values but rank correlation method gives no weightage to extreme values.

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Q18 Calculate the correlation coefficient between the heights of fathers in inches (X) and their sons (Y)

X	65	66	57	67	68	69	70	72
Y	67	56	65	68	72	72	69	71

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Answer. The calculation of parameters can be done as:

X-Series		Y-Series		XY
X	X^2	Y	Y^2	
65	4225	67	4489	4355
66	4356	56	3136	3696
57	3249	65	4225	3705
67	4489	68	4624	4556
68	4624	72	5184	4896
69	4761	72	5184	4968
70	4900	69	4761	4830
72	5184	71	5041	5112
$\sum X$ = 534	$\sum X^2$ = 35788	$\sum Y$ = 540	$\sum Y^2$ = 36644	$\sum XY$ = 36118

Now,

$$r = \frac{\left[\sum XY\left(\frac{XY}{N}\right)\right]}{\left[\left(\sum X^2\left(\frac{X\sum X}{N}\right)\right)\left(\sum Y^2\left(\frac{\sum Y\sum Y}{N}\right)\right)\right]^{0.5}}$$

$$r = \frac{73}{(194 \times 143.5)^{0.5}}$$

$$r = \frac{73}{166.88}$$

r = 0.44

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Q19 Calculate the correlation coefficient between X and Y and comment on their relationship :

X	-3	-2	-1	1	2	3
Y	9	4	1	1	4	9

Answer. The tabulation of values:

X-Series		Y-Series		XY
X	X^2	Y	Y^2	
-3	9	9	81	-27
-2	4	4	16	-8
-1	1	1	1	-1
1	1	1	1	1
2	4	4	16	8
3	9	9	81	27
$\sum X$ = 0	$\sum X^2$ = 28	$\sum Y$ = 28	$\sum Y^2$ = 196	$\sum XY$ = 0

Now,

$$r = \frac{\left[\sum XY - \left(\frac{\sum X \sum Y}{N}\right)\right]}{\left[\left(\sum X^2 - \left(\frac{X \sum X}{N}\right)\right)\left(\sum Y^2 - \left(\frac{\sum Y \sum Y}{N}\right)\right)\right]^{0.5}}$$

$$r = \frac{\left(0 - 0 \times \frac{28}{6}\right)}{(28 \times 165.33)^{0.5}}$$

$$r = E^d$$

r = 0

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Q20 Calculate the correlation coefficient between X and Y and comment on their relationship

X	1	3	4	5	7	8
Y	2	6	8	10	14	16

Answer. The tabulation of values is as under:

X-Series		Y-Series		XY
X	X^2	Y	Y^2	
1	1	2	4	2
3	9	6	36	18
4	16	8	64	32
5	25	10	100	50
7	49	14	196	98
8	64	16	256	128
$\in (-\infty, 0]$ = 28	$\sum X^2$ = 164	$\sum Y$ = 56	$\sum Y^2$ = 656	$\sum XY$ = 328

Now,

$$r = \frac{\left[\sum XY - \left(\frac{\sum X \sum Y}{N}\right)\right]}{\left[\left(\sum X^2 - \left(\frac{X \sum X}{N}\right)\right)\left(\sum Y^2 - \left(\frac{\sum Y \sum Y}{N}\right)\right)\right]^{0.5}}$$

$$r = \frac{66.67}{(33.33 \times 133.33)^{0.5}}$$

r = p

r = 1.00

Since the coefficient of correlation 1, it implies a perfect positive correlation.

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