BED104
TOPIC: STATISTICS

SPEARMAN'S COEFFICIENT OF CORRELATION
(ρ)

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Co-efficient of correlation by Spearman's Rank – Rule Method

- For expressing the degree of relationship quantitatively between two variable, we usually take the help of an index that is known as co-efficient of correlation.

- It is a kind of ratio which express the extent to which changes in one variable are accompanied by changes in the other variable.

Types of Correlation:

- **a) Positive correlation:** When **increase or decrease** in one variable promotes to **increase or decrease** in another variable. *(Change in same direction)*

- **b) Negative correlation:** When increase and decrease in one variable results **inverse** proportion in other variable *(Change in opposite direction)*

- **c) Zero correlation:** When rise and fall in either of the variable **does not depend** on the another *(no appropriate change)*

Range of correlation

- Co-efficient of correlation varies from **+1 to -1.**

- These values can be interpreted as follows:

- **0   to + 0.2** =   Correlation between two variable is negligible.
- **+0.2 to + 0.4** =   Less correlation between two variables.
- **+0.4 to + 0.7** =   Medium correlation between two variables.
- **+0.7 to + 0.9** =   High correlation between two variables.
- **+0.9 to + 0.99**=   Very High correlation between two variables.
- **+1**   =   Perfect correlation between two variables.
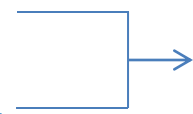
Ranking Method:

Normal ranking

A - 58 Marks - 1

B - 49 marks - 2

C -   38 marks- 3

D – 38 marks- 3

E -   35 marks - 4

Spearman's ranking

- Spearman Suggested **average** ranking

A - 58 Marks - 1

B - 49 marks -   2

C -   38 marks- 3

D – 38 marks-   4

E – 35 marks -   5

3.5 *(merged rank/ Spearman's rank*)

Formula for computing ρ

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

ρ = (rho) = Co efficient of correlation.

D^2 =   Square of difference of Ranks of the scores.

N =   No. of measures /students in a group.

Steps for computing ρ

- Rank the scores of both the variable.

- Give the average rank to the scores which are equal in each variable

- Give the next rank to the next score, after the average (merged) rank.

- Consider Rank 1 (R1) and Rank 2 (R2) for the respective variables.

- Calculate the difference of the ranks obtained (D=R1-R2)

- Do the summation of all the D^2 values.

- Put all the values in the given formula and compute ρ (rho) and interpret the value.

Find out Coefficient of Correlation by Spearman's Rank Difference Method between Science and Mathematics

Student	Science Marks	Maths Marks
A	48	42
B	37	40
C	40	38
D	52	50
E	67	60
F	48	40
G	42	40
H	35	37
I	48	45
J	52	48

Coefficient of Correlation

Student	Science Marks	Maths Marks	Science Rank R1	Maths Rank R2	D= (R1-R2)	D²
A	48	42				
B	37	40				
C	40	38				
D	52	50				
E	67	60				
F	48	40				
G	42	40				
H	35	37				
I	48	45				
J	52	48				

Rank the scores of Science score= R1 (variable 1)

Student	Science Marks	Maths Marks	Science Rank R1	Maths Rank R2	D= (R1-R2)	D²
A	48	42	5			
B	37	40	9			
C	40	38	8			
D	52	50	2.5			
E	67	60	1			
F	48	40	5			
G	42	40	7			
H	35	37	10			
I	48	45	5			
J	52	48	2.5			
TOTAL STUDENTS: 10						

Rank the scores of Maths score= R2 (variable 2)

Student	Science Marks	Maths Marks	Science Rank R1	Maths Rank R2	D= (R1-R2)	D^2
A	48	42	5	5		
B	37	40	9	7		
C	40	38	8	9		
D	52	50	2.5	2		
E	67	60	1	1		
F	48	40	5	7		
G	42	40	7	7		
H	35	37	10	10		
I	48	45	5	4		
J	52	48	2.5	3		
TOTAL STUDENTS: 10						

Calculate the difference of the ranks obtained (D=R1-R2)

Student	Science Marks	Maths Marks	Science Rank R1	Maths Rank R2	D= (R1-R2)	D²
A	48	42	5	5	0	
B	37	40	9	7	2	
C	40	38	8	9	-1	
D	52	50	2.5	2	0.5	
E	67	60	1	1	0	
F	48	40	5	7	-2	
G	42	40	7	7	0	
H	35	37	10	10	0	
I	48	45	5	4	1	
J	52	48	2.5	3	-0.5	
TOTAL STUDENTS: 10						

Do the square value of 'D'

Student	Science Marks	Maths Marks	Science Rank R1	Maths Rank R2	D= (R1-R2)	D²
A	48	42	5	5	0	0
B	37	40	9	7	2	4
C	40	38	8	9	-1	1
D	52	50	2.5	2	0.5	0.25
E	67	60	1	1	0	0
F	48	40	5	7	-2	4
G	42	40	7	7	0	0
H	35	37	10	10	0	0
I	48	45	5	4	1	1
J	52	48	2.5	3	-0.5	0.25
TOTAL STUDENTS: 10						

Do summation of all the D² values

Student	Science Marks	Maths Marks	Science Rank R1	Maths Rank R2	D= (R1-R2)	D²
A	48	42	5	5	0	0
B	37	40	9	7	2	4
C	40	38	8	9	-1	1
D	52	50	2.5	2	0.5	0.25
E	67	60	1	1	0	0
F	48	40	5	7	-2	4
G	42	40	7	7	0	0
H	35	37	10	10	0	0
I	48	45	5	4	1	1
J	52	48	2.5	3	-0.5	0.25
TOTAL STUDENTS: 10						$\Sigma D^2 = 10.5$

Put all the values in the given formula and compute ρ (rho) and interpret the value.

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

$$\Sigma D^2 = 10.5, \quad N = 10$$

$$\rho = 1 - \frac{6 \times 10.5}{10(10^2 - 1)}$$

$$\rho = 1 - \frac{63}{990}$$

$$\rho = 1 - 0.063$$

$$\rho = 0.93$$

Interpretation : *(refer the range of correlation)*

The correlation between mathematics and science subject of the above group is positive and very high.

Uses of Co-efficient of correlation:

- It is used in determining the validity of a test.
- It is used in determining the reliability of a test.
- Used to test objectivity of a test.
- It is useful to predict about the performance of the student.
- To find out the correlation between any two variable, groups, tests or any two subjects.
- It is used to find out the interest of the students.
- It is used in educational research.

Limitations of co efficient of correlation:

- By this method (rank) only location of scores is identified not the difference value of the scores.

- Co efficient is not able to define the cause behind the variation of the scores.

- For the better correlation, the distribution is essential to be a normal.

ASSIGNMENT

Find out the co efficient of correlation by Spearman's Rank Rule method and interpret the value.

Student	A	B	C	D	E	F	G	H	I	J
Maths Competency	45	30	60	62	60	70	60	75	55	60
Science Competency	52	45	70	64	63	64	35	70	60	64

THANKS