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Correlation

Meaning and Definition of Correlation:

Generally by correlation is meant relationship between two or more than two objects, groups or incidents; but in statistics, by correlation is meant by the relations found in the two or more variables of an object, group or incident. In the words of **Lathrop**: *Correlation indicates a joint relationship between two variables.* There can be several variables of an object, group or incident, but at one time the relationship of only any two of them can be studied, so Lathrop has talked about only two variables. Even in these two variables, any change in the first variable causes a particular type of change in the second variable, the similar change occurs in the first variable in case of change in the second variable, so Lathrop has talked about joint relationship. But in this definition the basis of variables (objects, group or incidents) have not taken. So this definition appears to be incomplete.

From our viewpoint, correlation should be defined in the following way: *By correlation is meant the change occurring in a variable due to change in another variable of an object, group or incident.*

Types of Correlation:

Correlation is of three types.

1. Positive Correlation:

When an increase in the value of one variable of an object, group or incident causes increase in the associate variable; or a decrease in one variable causes a decrease in the assciate variable; then this conformable relationship between these two variables is called positive correlation. For example, under same pressure, increase in temperature of a gas causes increase in its volume and decrease in its temperature causing decrease in its volume is the positive correlation between two variables of gas temperature and volume.
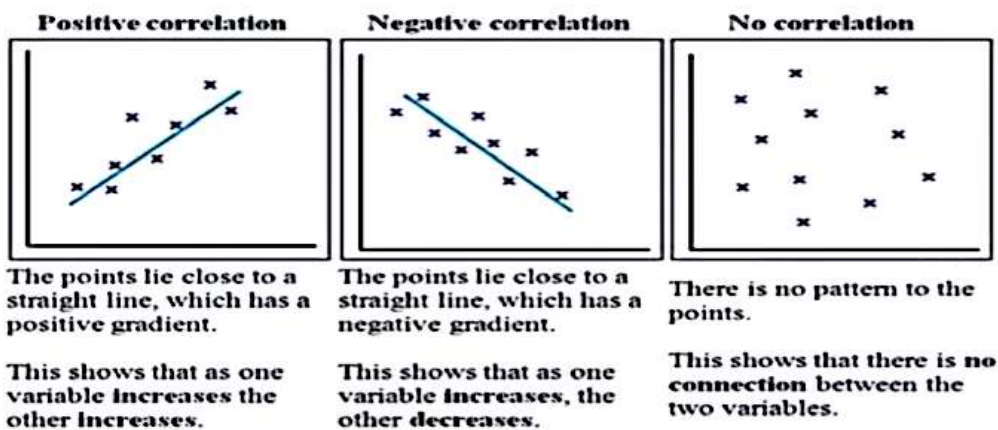
2. Negative Correlation:

When an increase in the value of a variable of an object, group or incident causes decrease in the value of another associate variable; or a decrease in the first variable causes an increase in the second associate variable; then this opposite relationship between these two variables is called negative correlation. For example, under same Temperature, the increase in pressure of a gas causing decrease in its volume tem and decrease in its pressure causing increase in its volume is the negative correlation between two variables of gaspressure and volume.

3. Zero Correlation:

When a change in a variable of an object, group or incident does not have any effect on the associate variable, this relationship between these two variables is called zero correlation.

For example, expansion or contraction in volume of a gas having no effect on its chemical formula, has zero correlation between two variables of gas volume and chemical formula.

Positive correlation	Negative correlation	No correlation
The points lie close to a straight line, which has a positive gradient.	The points lie close to a straight line, which has a negative gradient.	There is no pattern to the points.
This shows that as one variable **increases** the other **increases**.	This shows that as one variable **increases**, the other **decreases**.	This shows that there is **no connection** between the two variables.

Utility, Need and Importance of Correlation:

The fundamental basis of science is cause and effect relationship. On the basis of this knowledge, we can predict about the change in another field because of a change in one field. So, correlation is most needed and useful in science. In the modern times, psychologists have found out the factors of human behaviour to establish their cause and effect relationship. Today, to understand cause and effect relationship in human behaviour, correlation techniques are used. Thus, correlation is very useful in the field of psychology and education too. Utility, need and importance in the field of education.

1. With the help of correlation between two subjects, the ability of astudent in one subject can be estimated on the basis of his ability in other subject, a student's ability in one subject can be used to find out his ability in another subject.
2. If correlation does not help in the above prediction, then it becomes necessary to diagnose its causes.
3. After diagnosis, remedial teaching is arranged for. With the help of correlation among the subjects, the students are given educational and vocational guidance.
4. Correlation is especially used in action research.

Limitations of Correlation:

1. Correlation between any two subjects does not acquaint us about the fundamental causes of their correlation.
2. Correlation of any two subjects depends on the number of students; Corelation obtained from a larger group is more reliable as compared to correlation obtained from a small group.
3. Correlation between any two subjects depends on the nature of uojects besides nature of students (ability, interest and aptitude) . So, the correlation obtained from one sample cannot be applied on another sample in the same form.
4. The interpretation of Coefficient of Correlation depends an circumstances, so it is a little difficult to analyse it.

Measurement of Correlation:

In general, correlation between any two variables that they have positive correlation or negative correlation or zero correlation. Sometimes it is also possible to state whether it is highly positive or highly negative correlation or low positive or low negative correlation; but it cannot be said how much positive or how much negative is it. To measure the quantity of correlation, the scholars have developed Coefficient of Correlation.

Meaning and Definition of Coefficient of Correlation:

Coefficient of Correlation is such a ratio number which tells about the nature of correlation between two variables (positive, negative or zero) and tells about its quantity. In the words of **Guilford:** *A Coefficient of Correlation is a single number that tells us to what extent two things are related, to what extent variations in one go with variations in the other.*

Analysis of Coefficient of Correlation:

Coefficient of Correlation is a ratio number whose value is from -1 to +1. the -ve signs represents negative correlation and +ve sign represents the positive correlation, and numbers falling between -1 to +1 acquaints about the quantity of correlation. Analysis of Coefficient of Correlation is done on basis of the following table:

Analysis Table of Coefficient of Correlation:

Value of Coefficient of Correlation	Analysis of Coefficient of Correlation
+1.00	Perfect Positive Correlation
From +0.91 to + 0.99	Very High Positive Correlation
From +0.71 to + 0.90	High Positive Correlation
From +0.41 to + 0.70	Moderate Positive Correlation
From +0.21 to + 0.40	Low Positive Correlation
From +0.01 to + 0.20	Very Low Positive Correlation
00	Zero Correlation
From - 0.01 to - 0.20	Very Low Negative Correlation
From - 0.21 to - 0.40	Low Negative Correlation
From - 0.41 to - 0.70	Moderate Negative Correlation
From - 0.71 to - 0.90	High Negative Correlation
From - 0.91 to - 0.99	Very High Negative Correlation
- 1.00	Perfect Negative Correlation

Characteristics of Rank Difference Method:

1. This method can be used to calculate coefficient of correlation easily.
2. This method is also useful in case of heterogeneous data also.

Limitations of Rank Difference Method:

1. This method can be used only on small groups (less than 30).
2. The coefficient of correlation calculated from this method is comparatively less reliable.

Spearman's Rank Difference Method:

This method was developed by Charles Spearman, so it is named after hi name as Spearman's Rank Difference Method. This method is used when group (sample) is small (less than 30) and scores (data), are given in figures rank order.

The following formula is used in both situations: Rho $(\rho) = 1 - \{6\Sigma D^2 / N(N^2 - 1)\}$

In which,

ρ (Rho)- Coefficient of Correlation,

D^2- Total of Square of rank difference,

N- Number of members of group.

Example: 10 students have obtained the following scores in the mathematics and science examinations of 100 marks each. Find out coefficient of correlation between these scores with the help of rank difference method.

Students	Scores in Maths	Scores in Science	Rank of Maths R_M	Rank of Science R_S	$D = R_M \sim R_S$	D^2
A	50	48	5	6	1	1
B	35	50	7	5	2	4
C	55	60	3	1	2	4
D	47	55	6	3	3	9
E	28	35	9	9	0	0
F	70	53	1	4	3	9
G	52	58	4	2	2	4
H	30	40	8	8	0	0
I	20	25	10	10	0	0
J	60	45	2	7	5	25
N = 10						$\Sigma D^2 = 56$

Calculation:

Rho (ρ),

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

$\rho = 1 - \{6 \times 56 / 10(100 - 1)\}$

$\rho = 1 - \{336 / 990\}$

$\rho = 1 - 0.339 = 1 - 0.34$

$\rho = 0.66$

Now, we will analyse coefficient of correlation. $\rho = 0.66$ represents Moderate Positive Correlation between the scores in mathematics and science.

Note:

Rank Determination in case of Tied Scores: Sometimes a situationcomes while calculating coefiicient of correlation by rank difference method that the scores of two or more students are equal. In such a situation, we allot rank serially and when the question arises to allot ranks for the equal scores, we give them one rank before another, and their average is given the rank of all equal scores. We shall clarify it by an example.

Example: Heights and Weights of 8 children are given here. Find out correlation between their height and weight.

Children	Height (in cm.)	Weight (in Kg)	Rank of Hight R_H	Rank of Weight R_W	$D = R_H \sim R_W$	D^2
A	72	75	1	1	0	0
B	60	65	6	4	2	4
C	65	70	3	2	1	1
D	62	65	4	4	0	0
E	60	60	6	6	0	0
F	67	65	2	4	2	4
G	58	58	8	7	1	1
H	60	40	6	8	2	4
N = 8						$\Sigma D^2 = 14$

Calculation:

Rho (ρ),

$$\rho = 1 - \{6\Sigma D^2 / N(N^2 - 1)\}$$
$$\rho = 1 - \{6 \times 14 / 8(64 - 1)\}$$
$$\rho = 1 - \{84 / 504\}$$
$$\rho = 1 - 0.16 = 1 - 0.84$$
$$\rho = 0.84$$

Now, we will analyse coefficient of correlation. $\rho = 0.84$ represents High Positive Correlation between the hight and weight of children.

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