Chapter 7: CORRELATION

Important terms and concepts

Correlation studies the relationship between tow variables in which change in the value of one variable causes change in the other variable. It is denoted by letter 'r'.

Kinds of correlation:-

1. Positive and Negative correlation.
2. Linear and non – linear correlation.
3. Simple and multiple correlations.

Positive correlation: When both variables move in the same direction. If one increases, other also increases and vice-versa.

Negative correlation: - When two variables move in the opposite direction, they are negatively correlated.

Linear Correlation: - When two variables change in a constant proportion.

Non- linear correlation: - When two variables do not change in the same proportion.

Simple correlation – Relationship between two variables are studied.

Multiple Correction – Relationship between three or more than three variables are studied.

Degrees of Correlation:

1. **Perfect Correlation -** When values of both variables changes at a constant rate Types – (a) Perfect positive correlation – when values of both variables changes at a constant ratio in the same direction correlation coefficient value (r) is + 1

   (b) Perfect negative correlation – When values of both the variables change at a constant ratio in opposite direction. Value of coefficient of correlation is -1
2. **Absence of correlation :** When there is no relation between the variables r = 0
3. **Limited degree correlation :** The value of r varies between more than O and less than 1

Types - a) High : r his between ± 0.7 & 0.999

b) Moderate = r lies between ± 0.5 and + 0.699

c) Low: r < ± 0.5

Different methods of finding correlation

a) Karl Pearson's coefficient method

b) Rank method / Spearman's coefficient method

c) Scatter Diagram

(A) **Karl Pearson's Method**

$$r = \frac{\Sigma xy}{N\sigma \times \sigma y}$$

Where X = X – X, Y = Y – Y

N = number of observations

σ X = Standard deviation of series X

σ Y = Standard deviation of series Y

OR

Actual Mean Method

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

Where x = X – X, y = Y – Y

Assumed Mean Method

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

Where dx = X – A

dy = Y – A

A = assumed mean

Merits of Karl Pearson's Method

1. Helps to find direction of correlation
2. Most widely used method

Demerits of Karl Pearson's method

1. Based on large number of assumptions
2. Affected by extreme values

(B) Spearmans's Rank Correlation Method

Formula

In case of non repeated ranks :-

$$r_s = 1 - \frac{6\Sigma D^2}{N^3 - N}$$

r_s = Spearman's rank correlation

ΣD^2 = Sum of squares of difference of ranks

N = Number of observation

In case of repeated ranks:-

$$r_s = 1 - \frac{6\Sigma D^2 + \frac{1}{12}(m^3 - m) + \frac{1}{12}(m^3 - m)}{N^3 - N}$$

M = number of items with repeated ranks.

Merits of Spearman's Rank Correlation

1. Simple and easy to calculate
2. Not affected by extreme values

Demerits of Spearman's Rank Correlation

1. Not Suitable for grouped data
2. Not based on original values of observations.

(C) Scatter Diagram – Given data are plotted on a graph paper. By looking at the scatter of points on the graph, degree and direction of two variables can be found.

Merits of Scatter Diagram

1. Most simplest method.
2. Not affected by size of extreme values.

Demerits

1. Exact degree of correlation cannot be found.

1 Mark questions

1. Give the meaning of correlation.
2. What is absence of correlation?
3. What is scatter diagram?
4. What does it mean if the correlation between two variables is + 1?
5. What is positive correlation?

4 Mark questions

1. Calculate Karl Pearson's coefficient of correlation from the following:-

X:	12 9	8	10	11	13	7
Y:	14 8	6	9	11	12	3

2. Calculate Karl Pearson's coefficient of correlation from the following :-

Marks in Accountancy:	48	35	17	23	47
Marks in stratified:	45	20	40	25	45

3. Calculate Karl Pearson's coefficient by actual mean method

X :	8	4	10	2	6
Y:	9	11	5	8	7

4. Obtain rank correlation from the following

X:	88	70	75	60	95	81	50	80
Y:	134	115	120	110	150	142	100	140

5. Calculate rank correlation

Price of tea:	55	50	75	55	60	65	50	65	70	50
Price of Coffee:	140	110	160	110	115	115	125	120	115	130