Correlation

Spearman's Rank Correlation

Spearman's Rank Correlation Coefficient

- When we need to estimate the correlation between the qualitative variables which can not be quantified in numerical terms but can be ranked or ordered, the Karl Person's method fails. In such cases, Spearman Rank correlation method is applied.
- Formula
- $R_k = 1 - \frac{6 \sum D^2}{N(N^2 - 1)}$
- R_k = Rank correlation coefficient
- D = Difference of rank between paired item in two series.
- N = Total number of observation.

Interpretation of Rank Correlation Coefficient (R_k)

- The value of rank correlation coefficient, R ranges from -1 to +1
- If R_k = +1, then there is complete agreement in the order of the ranks and the ranks are in the same direction
- If R_k = -1, then there is complete agreement in the order of the ranks and the ranks are in the opposite direction
- If R_k = 0, then there is no correlation

Rank Correlation Coefficient (R_k)

a) Steps to Calculate R_k where actual rank are given.

1) Calculate the difference 'D' of corresponding ranks of two series i.e. $(R_1 - R_2)$.

2) Square the difference & calculate the sum of the difference i.e. $\sum D^2$

3) Substitute the values obtained in the formula.

Rank Correlation Coefficient

b) Problems where Ranks are not given: If the ranks are not given, then we need to assign ranks to the data series in ascending or descending order. For example, the lowest value in the series can be assigned rank 1 or the highest value in the series can be assigned rank 1. We need to follow the same pattern of ranking for both the series.

Then we follow the all the steps as we do when the ranks are given.

Rank Correlation Coefficient (R_k)

- **Equal Ranks or tie in Ranks:** In such cases average ranks should be assigned to each individual.
- $$R_k = 1 - \frac{6 \sum D^2 \left[\frac{1}{12}(m_1^3 - m_1) + \frac{1}{12}(m_2^3 - m_2) + \ldots\ldots + \frac{1}{12}(m_n^3 - m_n)\right]}{N(N^2 - 1)}$$
- **Where,**
- m is number of times a particular item in the series is repeated.
- **The component $\frac{1}{12}\left(m_i^3 - m_i\right)$ is repeated as many times are the number of items are repeated in both the series.**

Limitations of Spearman's Rank Correlation

- Cannot be used for finding out correlation in a grouped frequency distribution.
- This method should be applied where N exceeds 30.