# 6 CORRELATION

## KARL PEARSON'S COEFFICIENT OF CORRELATION, RANK CORRELATION, CONCURRENT DEVIATION

### FORMULAE

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|---|---|
| Karl Pearson' Coefficient of Correlation<br>1. When deviations are taken from actual mean<br>$r = \frac{\Sigma xy}{N\sigma_x\sigma_y}$ or<br>$= \frac{\Sigma xy}{\sqrt{\Sigma x^2 \times \Sigma y^2}}$ | r = Karl Pearson's Coefficient of Correlation<br>$x = (X - \overline{X})$<br>$y = (Y - \overline{Y})$<br>$N$ = Number of Pairs of observations<br>$\sigma_x$ = Standard deviation of $X$ series.<br>$\sigma_y$ = Standard deviation of $Y$ series. |
| 2. When deviations are taken from assumed mean<br>$r = \frac{\Sigma dxdy - \frac{(\Sigma dx)(\Sigma dy)}{N}}{\sqrt{\Sigma dx^2 - \frac{(\Sigma dx)^2}{N}}\sqrt{\Sigma dy^2 - \frac{(\Sigma dy)^2}{N}}}$ | $dx = (X - A)$<br>$dy = (Y - A)$ |
| 3. Bivariate frequency Distribution<br>$r = \frac{\Sigma fdxdy - \frac{(\Sigma fdx)(\Sigma fdy)}{N}}{\sqrt{\Sigma fdx^2 - \frac{(\Sigma fdx)^2}{N}}\sqrt{\Sigma fdy^2 - \frac{(\Sigma fdy)^2}{N}}}$ | |
| 4. When we take actual value of $X$ and $Y$<br>$r = \frac{N\Sigma XY - \Sigma X\Sigma Y}{\sqrt{N\Sigma X^2 - (\Sigma X)^2}\sqrt{N\Sigma Y^2 - (\Sigma Y)^2}}$ | PRODUCT METHOD |
| 5. Spearman's Rank Correlation Coefficient<br>$r = 1 - \frac{6\Sigma D^2}{N(N^2-1)}$ or $1 - \frac{6\Sigma D^2}{(N^3 - N)}$ | $r$ = Spearman's Rank Correlation<br>$D$ = Difference of Rank<br>$N$ = Number of pairs of observations |
| 6. When Ranks are repeated | $m$ = The number of times, the values are repeated or |

$$r = 1 - \frac{6\left[\Sigma D^2 + \frac{1}{12}(m^3 - m) + \frac{1}{12}(m^3 - m) \ldots\right]}{N^3 - N}$$

the ranks are common

7. Concurrent Deviation

$$r_c = \pm\sqrt{\pm\frac{2C - N}{N}}$$

$r_c$ = Coefficient of correlation by the concurrent deviation method

$C$ = Number of concurrent deviations or the number of positive signs

$N$ = Number of pairs of deviation compared *i.e.*$(N - 1)$

8. Probable Error

$$\text{P.E}_r. = 0.6745\,\frac{1 - r^2}{\sqrt{N}}$$

$$\text{S.E}_r. = \frac{1 - r^2}{\sqrt{N}}$$

P.E$_r$. = Probable Error

$r$ = Correlation

$N$ = Number of pairs of observation

S.E$_r$. = Standard Error

9. Coefficient of Determination $= r^2$

10. Coefficient of non-Determination $= 1 - r^2$

## CORRELATION

Problem 1. Calculate the coefficient of correlation