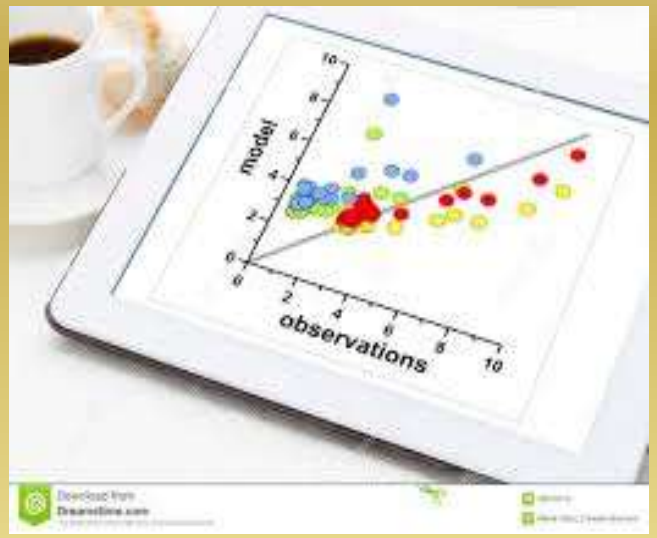
CORRELATION



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- **CLASS: M.SC. – SEM (III)**
- **SUBJECT: FORENSIC SCIENCE**

CORRELATION

- Correlation is an analysis used to determine the relationship between two or more variables.
- The measure of correlation is called coefficient of correlation and is denoted by the symbol ‘r’.
- It helps us in finding the degree or extent of quantitative relationship between two variables.
- It does not say anything about the cause and effect relationship between the two variables.

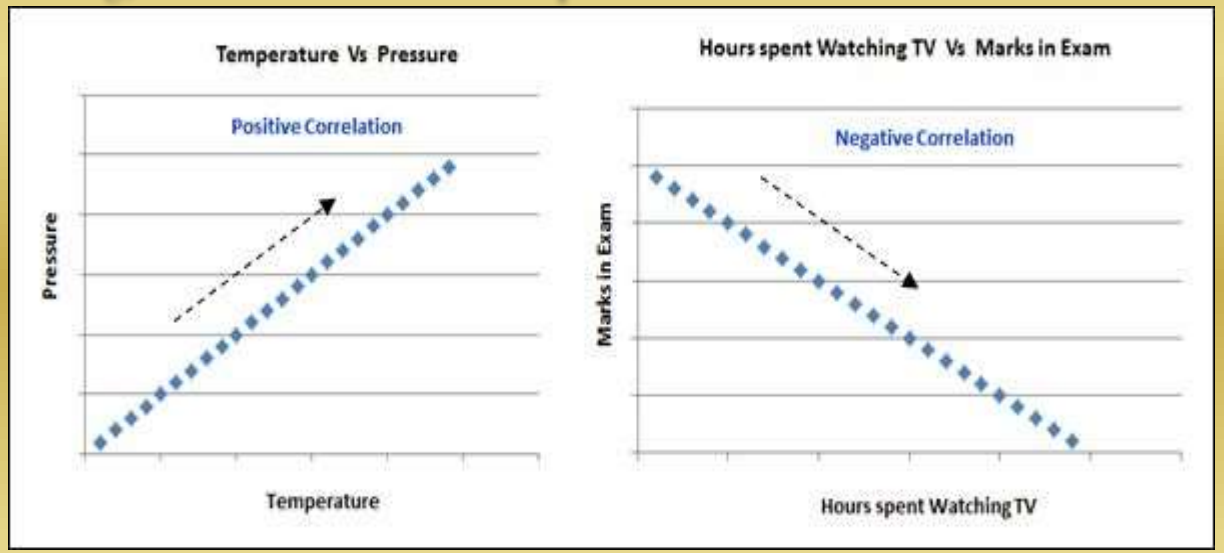
SIGNIFICANCE OF CORRELATION

- It is used to determine the relationship between two variables.
- It reduces the range of uncertainty. The predictions based on correlation analysis are more precise and reliable.
- It helps us to estimate the value of dependent variable for the given value of independent variable.

TYPES OF CORRELATION

- Correlation is described or classified in several different ways such as:

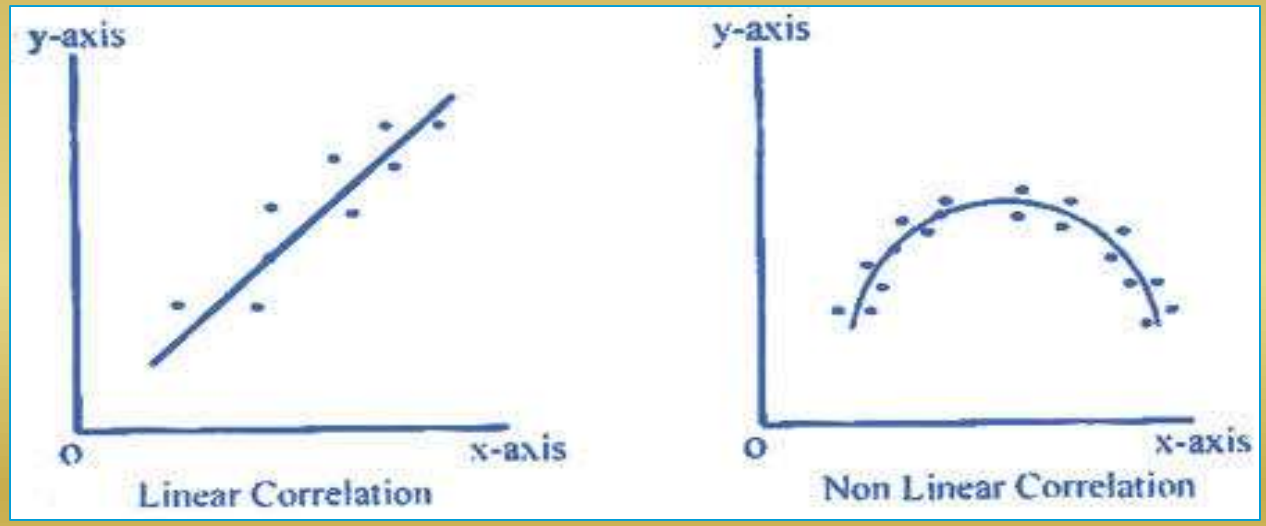
1. **Positive and Negative Correlation:** Whether correlation is positive (direct) or negative (inverse) would depend upon the direction of change of the variables. If both the variables are varying in the same direction i.e., if as one variable is increasing the other, on an average is also increasing or, if as one variable is decreasing the other, on an average, is also decreasing, correlation is said to be **positive.**



If on the other hand, the variable are varying in positive direction, i.e. as one variable is increasing the other is decreasing or vise versa, and correlation is said to be **negative.**

2. Liner and Curvilinear (Non-Linear) Correlation.

- **Linear Correlation:** Correlation is said to be linear when the amount of change in one variable tends to bear a constant ratio to the amount of change in the other.



- **Non-Linear Correlation:** The correlation would be non-linear if the amount of change in one variable does not bear a constant ratio to the amount of change in the other variable.

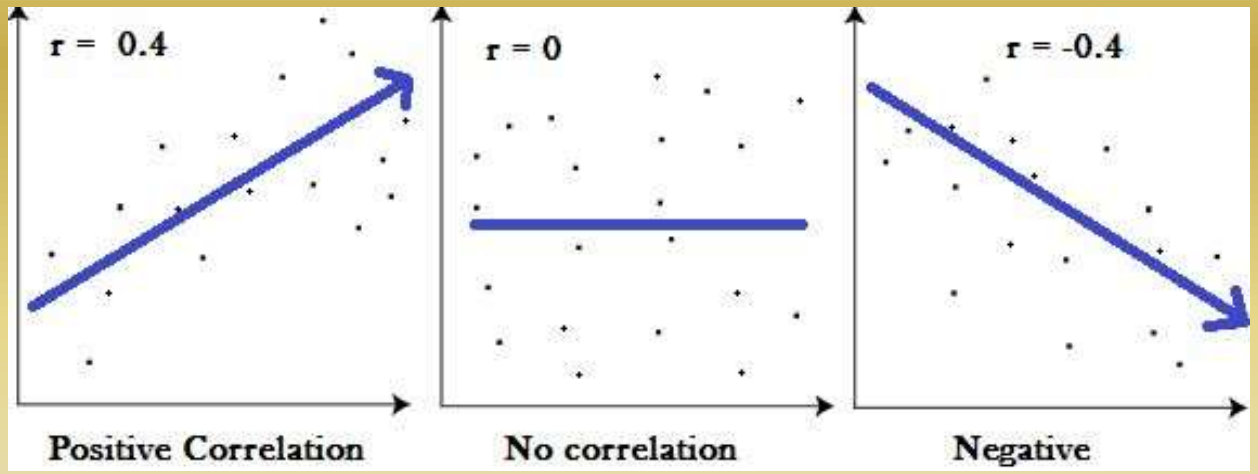
METHODS OF STUDYING CORRELATION

- Correlation can be studied by any of the following method.

1. **Scatter diagram method.**
2. **Karl Pearson's coefficient of correlation.**
3. **Spearman's coefficient of rank correlation and**
4. **Concurrent deviation method.**

Scatter diagram method

- Scatter diagram or dot diagram is the simplest graphical device of showing the correlation between the two variables (x and y). Such diagrammatic representation of bivariate data is known as scatter diagram.
- **Observations:**
  - **Positive Correlation:** When the x and y values increases together there will be a positive correlation. (r= +1)
  - **Negative Correlation**: When the x value gets bigger and the y value gets smaller there will be a negative correlation. (r= -1)
  - **No Correlation:** When the points do not show a pattern there is no correlation. (r= 0)



Merit of Scatter Diagram Method

- It is simple and non-mathematical method of studying correlation
- It is easy to understand

Demerit of Scatter Diagram Method

- It gives only a rough idea of how the two variable are related.
- Exact degree of correlation between the two variables can not be established by applying this method.

Karl Pearson's Coefficient of Correlation

- It is used universally for describing the degree of correlation between two series .

  Formula of computing Pearson's r is:

$$r = \frac{\sum xy}{NS_X S_Y}$$

Here, $x = (X - \bar{X})$; $y = (Y - \bar{Y})$

S_x = Standard deviation of x series

S_y = Standard deviation of y series

N = Number of pairs of observation

- Modified version:

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \sum y^2}}$$

Where, $x = (X - \bar{X})$; $y = (Y - \bar{Y})$

Procedure for computing the correlation coefficient

- Calculate the mean of the two series ‘x’ &’y’
- Calculate the deviations ‘x’ &’y’ in two series from their respective mean.
- Square each deviation of ‘x’ &’y’ then obtain the sum of the squared deviation
  i.e. $\sum x^2$ & $\sum y^2$
- Multiply each deviation under x with each deviation under y & obtain the product of ‘xy’. Then obtain the sum of the product of x , y i.e. Σxy
- Substitute the value in the formula.

Example:

- :

ACTUAL MEAN METHOD

- Illustration 1:- Calculate Karl Pearson's coefficient of correlation

X	50	54	56	58	59	60	61	62	65	75
Y	20	22	24	30	32	36	38	40	44	54

- Solution:-

X	$x = X-\bar{X}$	x^2	Y	$y = Y-\bar{Y}$	y^2	xy
50	-10	100	20	-14	196	140
54	-6	36	22	-12	144	72
56	-4	16	24	-10	100	40
58	-2	4	30	-4	16	8
59	-1	1	32	-2	4	2
60	0	0	36	2	4	0
61	1	1	38	4	16	4
62	2	4	40	6	36	12
65	5	25	44	10	100	50
75	15	225	54	20	400	300
$\Sigma X=600$		$\Sigma x^2=412$	$\Sigma Y=340$		$\Sigma y^2=1016$	$\Sigma xy=628$

$$\bar{X} = \frac{\Sigma X}{N} = \frac{600}{10} = 60$$

$$\bar{Y} = \frac{\Sigma Y}{N} = \frac{340}{10} = 34$$

Coefficient of Correlation

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

$$= \frac{628}{\sqrt{412 \times 1016}}$$

$$= \frac{628}{646.99}$$

$$= 0.97$$

Merit of Karl Pearson's Method

It is most important and precise method of measuring the relationship of two variables.

It measures the direction as well as the relationship between the two variables.

Demerit of Karl Pearson's Method

The computational procedure of this method is difficult as compared to other method.

The value of the coefficient is affected by extreme items.