Two types of Error.

Type I error : Type I error is committed by rejecting the null hypothesis when it is true. It is denoted by α.

Type II error : It is committed by not rejecting (that is accepting) the null hypothesis when it is false. It is denoted by β.

PARAMETER : A number that describes the data from a population.

STATISTIC : A number that describes the data from a sample.

CORRELATION

correlation refers to a relationship or connection between 2 or more variables. It tells us whether and how strongly the variables move together.

KARL PEARSON'S COEFFICIENT OF CORRELATION

$$r = \frac{N\Sigma XY - (\Sigma X)(\Sigma Y)}{\sqrt{N\Sigma X^2 - (\Sigma X)^2}\sqrt{N\Sigma Y^2 - (\Sigma Y)^2}}$$

N: Number of pair of observations.

Calculate correlation coefficient between X and Y

X	X^2	Y	Y^2	XY
9	81	15	225	135
8	64	16	256	128
7	49	14	196	98
6	36	13	169	78
5	25	11	121	55
4	16	12	144	48
3	9	10	100	30
2	4	8	64	16
1	1	9	81	9
$\Sigma X = 45$	$\Sigma X^2 = 285$	$\Sigma Y = 108$	$\Sigma Y^2 = 1356$	$\Sigma XY = 597$

$$r = \frac{9 \times 597 - 45 \times 108}{\sqrt{9 \times 285 - (45)^2}\sqrt{9 \times 1356 - (108)^2}}$$

$$r = \frac{5373 - 4860}{\sqrt{2565 - 2025}\sqrt{12204 - 11664}}$$

$$r = \frac{513}{\sqrt{540 \times 540}} = \frac{513}{540} = +0.95$$

SPEARMAN'S RANK CORRELATION COEFFICIENT.

$$R = 1 - \frac{6 \Sigma D^2}{N(N^2-1)}$$

R denotes rank coefficient of correlation and D refers to the difference of rank between paired items in two series.

N = Number of pairs of observations.

Q1. Where Ranks are given.

1. The ranking of 10 students in two subjects A and B are as follows:

A	B
6	3
5	8
3	4
10	9
2	1
4	6
9	10
7	7
8	5
.	2

Sol:

R_1	R_2	$(R_1 - R_2)^2 [D^2]$
6	3	9
5	8	9
3	4	1
10	9	1
2	1	1
4	6	4
9	10	1
7	7	0
8	5	9
1	2	1
		$\Sigma D^2 = 36$

$$R = 1 - \frac{6\Sigma D^2}{N(N^2-1)}$$

$$R = 1 - \frac{6 \times 36}{10(10^2-1)}$$

$$R = 1 - \frac{216}{10(100-1)} = 1 - \frac{216}{990}$$

$$R = 0.782.$$

Q2. 2 ladies were asked to rank 7 different types of lipsticks. The ranks given by them as follows:

Lipsticks	A	B	C	D	E	F	G
Kate	2	1	4	3	5	7	6
Rose	1	3	2	4	5	6	7

Calculate Spearman's rank correlation coefficient.

Sol: $R = 0.786$

Where ranks are not given

When we are given the actual data and not the ranks, it will be necessary to assign the ranks. Ranks can be assigned by taking either highest value as 1 or the lowest value as 1. But whether we start with the lowest value or the highest value we must follow the same method in case of both the variables.

Q1. Calculate Spearman's coefficient of correlation between marks assigned to ten students by judges X and Y in a certain competitive test as shown below:

S.NO	: 1	2	3	4	5	6	7	8	9	10
Marks by Judge X	: 52	53	42	60	45	41	37	38	25	27
Marks by Judge Y	: 65	68	43	38	77	48	35	30	25	50

Sol: First Assign ranks and then calculate rank correlation coefficient.

Marks by Judge X	R_x	Marks by Judge Y	R_y	$(R_x - R_y)^2$ D^2
52	8	65	8	0
53	9	68	9	0
42	6	43	5	1
60	10	38	4	36
45	7	77	10	9
41	5	48	6	1
37	3	30	3	0
38	4	32	2	4
25	1	25	1	0
27	2	50	7	25
				$\Sigma D^2 = 76$

$$R = 1 - \frac{6\Sigma D^2}{N(N^2-1)}$$

$$= 1 - \frac{6 \times 76}{10(10^2-1)} = 1 - 0.461 = 0.539$$

Q2. Quotations of Index numbers of security prices of a certain stock company are given below:

Year	Debenture price	Share price
1	97.8	73.2
2	99.2	85.8
3	98.8	78.9
4	98.3	75.8
5	98.4	77.2
6	96.7	87.2
7	97.1	83.8

Using rank correlation method, determine the relationship between debenture prices and share prices.

Sol: $R = -0.107$