KARPAGAM ACADEMY OF HIGHER EDUCATION
(Deemed to be University)
(Established under Section 3 of UGC Act, 1956)
Pollachi Main Road, Coimbatore – 641 021, Tamil Nadu

Department of Mathematics

Subject : Mathematical Statistics **Semester III**
Subject Code : 18MMP311 **Class :II M.Sc Mathematics**

Instruction Hours / week: L: 0 T: 0 P: 4 **Marks:** Internal: **40** External: **60** Total: **100**
End Semester Exam: 3 Hours

List of Practical

1. Introduction to SPSS Package
2. Working with windows in SPSS
3. Defining variables in variable view window in SPSS
4. Drawing of graphs and diagrams in SPSS Package
5. Standard deviation for individual and discrete series using SPSS Package.
6. Standard deviation continuous series using SPSS Package.
7. Coefficient of variation for individual and discrete series using SPSS Package.
8. Calculation of Mean and variance for binomial distribution using SPSS Package.
9. Calculation of Mean and variance for Poisson distribution using SPSS Package.
10. Karl Pearson's Correlation using SPSS Package.
11. Rank Correlation Coefficient using SPSS Package.
12. Testing Hypothesis using t - test in SPSS Package.
13. Testing Hypothesis using Z - test in SPSS Package.
14. Testing Hypothesis using chi-square - test in SPSS Package.
15. Interpretation of results in the SPSS output viewer.

Ex. No: 01

INTRODUCTION TO SPSS PACKAGE

Objective

To understand how SPSS package is useful for the purpose of data analysis.

Introduction

Originally it is an acronym of "Statistical Package for the Social Science" but now it stands for "Statistical Product of Service Solution".

One of the most popular statistical packages which can perform highly complex data manipulated and analysis with simple instruction.

The Four Windows

- Data Editor
- Output Viewer
- Syntax Editor
- Script Window

The Basic Analysis of SPSS Frequencies

The Analysis produces frequency table showing frequency counts and percentage of the values of individual variable.

Descriptive

This analysis shows the maximum, minimum, mean and standard deviation of the variables.

Correlation and Linear Regression Analysis

Association between correlation and linear regression estimates the co-efficient of the linear equation.

Chi-Square, ANOVA, T-Test

Independence (cross table), Frequency (Goodness of fit) one way and two way ANOVA and test.

Ex No: 02

WORKING WITH WINDOWS IN SPSS

Objectives

To understand how the windows in SPSS work.

The Four Windows

Data Editor

Output Viewer

Syntax Editor

Script Window

Data Editor

Spread sheet like system for defining entering, editing and displaying data, extension of the saved file will be ‘save’.

Output Viewer

Displaying output and errors, extension of the saved file will be ‘SPV’.

Syntax Editor

Text editor for syntax composition extension of saved file will be ‘SPS’.

Script Window

To provides the opportunity to write full-blown programs in a basic like language. Tex editor for syntax composition extension of saved file will be ‘SBS’.

Ex. No: 03

WORKING WITH VARBIALE VIEW WINDOW IN SPSS

Objective

To know how to define variables in the variable view in data editor view.

Opening SPSS

Start→ All programs→SPSS Inc→ SPSS.

There are two sheets in the window.

1. Data View and 2. Variable View

Data View Window

This sheet is visible when you first open the data editor and this sheet contains the data.

Click on the tab labeled variable view.

Variable View Window

This sheet contains information about the data set that is stored with the data set.

Name

The first character of the variable name must be alphabetic. Variable names must be unique, and have to be less than 64 characters. Spaces are NOT allowed.

Type

Click on the “type” box .The two basic types of variables that you will use are numeric and string. This column enables you to specify the type of variable.

Width

Width allows you to determine the number of character SPSS will allow to be entered for the variable.

Decimals

Number of decimals. It has to be less than or equal to 16.

Label

You can specify the details of the variable.

You can write characters with spaces upto 256 characters.

Values

This is used and to suggest which numbers represent which categories when the variable represents a category.

Defining the Value Label

Click the cell in the value column. For the value, and the label, you can put upto 60 characters. After defining the values click add and then click OK.

Ex. No: 04

DRAWING OF GRAPHS AND DIAGRAMS IN SPSS PACKAGE

Objective

To know how to draw graphs and diagrams in SPSS package.

Algorithm

Step 1: Start → All program → SPSS Inc → SPSS

Step 2: Enter the given data in the variable view.

Step 3: Click Analysis → Descriptive statistics → Frequency

Step 4: Click gender and put it into the variable box.

Step 5: Click chart →Bar / Pie chart and continue.

Step 6: Finally click ok in the frequency box.

Problem

How would you put the following information into SPSS?

NAME	GENDER	HEIGHT
Juanita	2	5.4
Sally	2	5.3
Donna	2	5.6
Sabrina	2	5.7
John	1	5.7
Mark	1	6
Eric	1	6.4
Bruce	1	5.9

Value 1: Represents Male

Value 2: Represents Female

Ex. No: 05

CALCULATION OF STANDARD DEVIATION FORINDIVIDUAL AND DISCRETE SERIESUSING SPSS PACKAGE

Objective

To calculate the standards deviation for individual and discrete series using SPSS package.

Algorithm

Step 1: Start→ all programs → SPSS Inc→ SPSS

Step 2: Enter the given data in the variable view.

Step 3: Click analysis→ descriptive statistics→ frequency.

Step 4: click statistic option to choose the standard deviation →continue and click ok.

Step 5: Finally we get the output.

Individual Series

Problem

1. Calculate the standard deviation for the data given below using SPSS package.

x	25	18	27	10	30	42	20	53	20

Formula:

Standard deviation= $\sqrt{\frac{\sum(x-\bar{x})^2}{n}}$

Discrete Series

2. Calculate the standard deviation for the following data using SPSS package.

No of Members	1	2	3	4	5	6	7	8	9	10	11	12
Frequency	1	3	5	6	10	13	9	5	3	2	2	1

Formula:

Standard deviation= $\sqrt{\frac{\sum fx2}{\sum f} - [\frac{\sum fx}{\sum f}]^2}$

Inference

Standard deviation for the given data for individual series using SPSS is 13.141.

Standard deviation for the given data for discrete series using SPSS is 2.350.

Ex. No: 06

STANDARD DEVIATION CONTINUOUS SERIES

Objective:

To know how to calculate the standard deviation for continuous seriesusing SPSS Package.

Algorithm

STEP 1: Start → All programs → SPSS inc → SPSS.

STEP 2: Enter the given data in the variable view.

STEP 3: Click analysis → Descriptive statistics → Frequencies.

STEP 4: Click statistic option to choose the mean and standard

Deviation → Continue and Click OK.

STEP 5: Finally we get the output.

Problem

Calculate the standard deviation for the following data using SPSS package

Income	0-10	10-20	20-30	30-40	40-50	50-60	60-70
Rs(100)	6	8	10	12	7	4	3

Solution

x	0-10	10-20	20-30	30-40	40-50	50-60	60-70
f	6	8	10	12	7	4	3

Formula:

Standard deviation= $\sqrt{\frac{\sum fm^2}{\sum f} - \left[\frac{\sum fm}{\sum f}\right]^2}$

Calculation:

x	f	m	m²	fm	fm²
0-10	6	5	25	30	150
10-20	8	15	225	120	1800
20-30	10	25	625	250	62500
30-40	12	35	1225	420	14700
40-50	7	45	2025	315	14175
50-60	4	55	3025	220	12100
60-70	3	65	4225	195	12675

$\sum f=50$ $\sum fm=1550$ $\sum fm^2=61850$

Standard deviation = $\sqrt{\frac{\sum fm^2}{\sum f} - \left[\frac{\sum fm}{\sum f}\right]^2}$

$= \sqrt{\frac{61850}{50} - \frac{(1550)^2}{(50)^2}}$

$=\sqrt{1237 - 961}$ $=\sqrt{276}$ $= 16.613$

Inference

The standard deviation for the given data for continuous series using SPSS is 16.782.

Ex. No: 07

CALCULATION OF COEFFICIENT OF VARIATION FOR INDIVIDUAL SERIES

Objective

To know how to calculate the coefficient of variation individual and discrete series using SPSS package.

Algorithm

Step1: Start →All programs→ SPPS in C→ SPPS.

Step2: Enter the given data in the variable view.

Step3: Click Analyze→ Descriptive Statistics→ Frequencies.

Step4: Click statistics option to choose the mean and standard deviation →continue and click ok.

Step5: Collect the mean and standard deviation values.

Step6: Click Transforms→ Compute variables.

Step7: Enter the target values.

Step8: Finally find the coefficient of variation.

Step9: The result will be appeared in data view.

Individual Series

Calculate the Mean and Standard Deviation and Coefficient Variance for the given data below:

x	25	18	27	10	30	42	20	53	20

Formula

Formula for individual value for mean

$$\text{Mean} = \sum X/N,$$

Where N=number of items.

Calculation

$\sum X = 245$ Mean $= 245/9$ $= 27.22$

Formula

$$\text{Standard deviation} = \sqrt{(\sum X-\bar{X})^2/n}$$

$= \sqrt{1381.5556/9}$ $= \sqrt{153.5061778}$ $= 12.38976101$

Standard deviation $= 12.39$

Coefficient of variation of individual series value =std dev /mean

$= 12.39/27.22$

$= 0.45518$

Coefficient of variation is = 0.48

Discrete Series

Calculate the coefficient of variation for the data given below using SPSS

No. of. Members	1	2	3	4	5	6	7	8	9	10	11	12
Frequency	1	3	5	6	10	13	9	5	3	2	2	1

Formula Mean = $\sum f_x / \sum f$ Standard deviation $= \sqrt{\sum f_x^2 / \sum f - [\sum f_x / \sum f]^2}$

Calculation

X	**F**	**f_x**
1	1	1
2	3	6
3	5	15
4	6	24
5	10	50
6	13	78
7	9	63
8	5	40
9	3	27
10	2	20
11	2	22
12	1	12
	$\sum f = 60$	$\sum f_x = 358$

Mean = $\sum f_x / \sum f$ = 358 / 60 = 5.96667 = 5.9 (or) 6.0

Calculation

X	**x^2**	**F**	**f_x**	**f_x^2**
1	1	1	1	1
2	4	3	6	12
3	9	5	15	45
4	16	6	24	96
5	25	10	50	250
6	36	13	78	468
7	49	9	63	441
8	64	5	40	320
9	81	3	27	243
10	100	2	20	200
11	121	2	22	242
12	144	1	12	144
		$\sum f = 60$	$\sum f_x = 358$	$\sum f_x^2 = 2462$

Standard deviation $= \sqrt{2462 / 60 - [358 / 60]^2}$

$= \sqrt{41.03 - [5.96]^2}$ $= \sqrt{41.03 - 35.52}$ $= \sqrt{5.5}$ = 2.347

Coefficient of variation of discrete series value = std. dev /mean

= 2.347 / 5.967 = 0.3933

Coefficient of variation is = 0.39

Inference

The coefficient of variation for the given data for individual series is 0.48

The coefficient of variation for the given data for discrete series is 0.39

Ex. No: 08

CALCULATING MEAN AND VARIANCE FOR BINOMIALDISTRIBUTION

Binomial Distribution

A Random Variable X is said to follow binomial distribution ,if its probability mass function is given by

$P(X=x) = P(x) = \{ nC_x p^x q^{n-x}$;x=0,1,2,…….n}

= { 0 ;otherwise}

Hence the two independent constant n and p are known as the 'Parameters' of the distribution .The distribution is completely determined if n and p are known X refer the number of successes.

Problem

Assuming that one in 80 births in a case of twins, calculate the probability of 2 (or) more sets of twins on a day when 30 births occurs obtained by using the binomial distribution.

Solution

Probability of twins birth = p =1/80

=0.0125

q =1-p

=1-0.0125

q =0.9875

n=30,

Mean = np

=30*0.0125

=0.375

Variance= npq

= 30*0.0125*0.9875

=0.3703125

Binomial distribution is given by,

$P(x) = nc_x p^x q^{n-x}$

$P(x \geq 2) = 1-p(x<2)$

$=1-\{p(x=0)+p(x=1)\}$

$=1-\{30C_0(0.0125)^0(0.9875)^{30}+30C_1(0.0125)^1(0.9875)^{29}\}$

$=1-\{1*1(0.9875)^{30}+30(0.9875)^{29}(0.0125)\}$

=1-(0.6839+0.2597}

=1-0.9436

$P(x \geq 2) = 0.0564$

Ex. No: 09

CALCULATION OF MEAN AND VARIANCE FOR POISSONDISTRIBUTION

Poisson Distribution

Poisson distribution was discovered by a French Mathematician-Cum-Physicist Simeon Denis Poisson in 1837. Poisson distribution is also a discrete distribution. He derived it as a limiting case of binomial distribution for n-trials. The binomial distribution is $(q+p)^n$. The probability of X successes is given by $P(X=x) = nC_x p^x q^{n-x}$. If the number of trials n is very large and the probability of success 'p' is very small so that the product np=m is non-negative and finite. The probability of x success is given by,

$$P(X=x) = \begin{cases} e^{-m}m^x/x! & \text{for } x=0,1,2,\ldots\ldots \\ 1 & \text{Otherwise} \end{cases}$$

Here 'm' is known as parameter of the distribution so that m>0.

Problem

Find the mean and variance to the following data which gives the frequency of the number of deaths due to horse kick in 10 corps per army per annum over twenty years.

X	0	1	2	3	4	Total
F	109	65	22	3	1	200

Obtain by using Poisson distribution.

Solution

Let us calculate the mean and variance of the given data

x_i	f_i	f_ix_i	$f_ix_i^2$
0	109	0	0
1	65	65	65
2	22	44	88
3	3	9	27
4	1	4	16
Total	200	122	196

Mean, $\bar{X} = \sum \frac{fix}{N}$

= 122/200 = 0.61

Variance, $\sigma^2 = \sum \frac{fi^2x}{N} - (\bar{X})^2$

= 196/200 –$(0.61)^2$ = 0.61 Hence, **Mean = Variance =0.61**

Ex No: 10

CALCULATION OF KARL PEARSON CORRELATION

Objective

To find the correlation coefficient by Karl Pearson Correlation Coefficient for the given variables using SPSS package.

Algorithm

STEP 1: Start → All Program → SPSS Inc → SPSS.
STEP 2: Enter the given data in the variable view.
STEP 3: Click analysis → Correlate → Bivariate click the variable X and Y
And put it into the variable box.
STEP 4: Select the check box Karl Pearson Correlation and continue
Then click OK in the frequency box.
STEP 5: Finally we get the Output.

Problem

Calculate the Karl Pearson coefficient of correlation between two variables X and Y from the following data.

Height of Father	64	65	66	67	68	69	70
Height of Sons	66	67	65	68	70	68	72

Formula

$$r = \frac{n\,[\sum dxdy\,]}{\sqrt{[\,\sum(dx)^2 * \sum(dy)^2}}$$

x	dx	dx²	y	dy	dy²	dxdy
64	-3	9	66	-2	4	6
65	-2	4	67	-1	1	2
66	-1	1	65	-3	9	3
67	0	0	68	0	0	0
68	1	1	70	2	4	2
69	2	4	68	0	0	0
70	3	9	72	4	16	12

$\sum dx^2 = 28$ $\sum dy^2 = 34$ $\sum dxdy = 25$

$$r = \frac{n\,[\sum dxdy\,]}{\sqrt{[\,\sum(dx)^2 * \sum(dy)^2}} \qquad = \frac{25}{\sqrt{(28 * 34)}} \qquad r = 0.81$$

Inference

$0.75 \leq 0.8 < 1$ strong positive relationship existing between the height of father and the height of son.

Ex.No:11

CALCULATION OF RANK CORRELATION

Aim:

To calculate the given value by Rank correlation coefficient in the package.

Algorithm

STEP 1: Start →All program →SPSS in c → SPSS.
STEP 2: Enter the given data in the variable view.
STEP 3: Click analyze → Correlation → Bivariate.
STEP 4: Click the variable X and Y, Put it into the variable box.
STEP 5: Select Spearman check box and continues, then click ok in the Bivariate box.
STEP 6: Finally we get the output.

Calculation

Calculate rank correlation coefficient for the following data using SPSS package.

First exam Score(X)	88	95	70	60	50	80	75	85
Second exam Score (Y)	84	90	88	55	48	85	82	72

Formula

$$r = 1-\left(\frac{6\sum(D^2)}{(N^3-N)}\right)$$ Where D = Different between X and Y

N = Number of observation

Calculation

X	**Y**	**RX**	**RY**	**D=(RX-RY)**	**D=$(RX-RY)^2$**
88	84	2	4	-2	4
95	90	1	1	0	0
70	88	6	2	4	16
60	55	7	7	0	0
50	48	8	8	0	0
80	85	4	3	1	1
75	82	5	5	0	0
85	72	3	6	-3	9
					$\sum D^2 = 30$

$$r = 1-\left(\frac{6\sum(D^2)}{(N^3-N)}\right) = 1-\left(\frac{6(30)}{(8^3-8)}\right)$$

$$= 1-\left(\frac{180}{8(64-1)}\right) = 1-\left(\frac{180}{504}\right) = 1- 0.3571 = 0.6429$$

Inference

$0.25 \leq 0.6429 < 0.75$, moderate degree positive relationship existing between the first exam score and second exam score.

Ex No: 12

TESTING HYPOTHESIS USING T-TEST IN SPSSPACKAGE

Aim

Testing Hypothesis using t-test in SPSS package.

Algorithm

STEP 1: Start All Programs SPSS in C SPSS

STEP 2: Enter the given data in the variable view

STEP 3: Click Analyze Compare means One Sample T-test

STEP 4: Click the Variable X and put it into the variable box

STEP 5: Click options Confidence integral percentage at 95% continue

STEP 6: Put test value 10 ok

STEP 7: Finally we get the out put

Problem

Certain pesticide is packed in to bags be a machine a random sample of 10 days is drawn and their contents are found to weight (in kg) as follows

50	49	52	44	45	48	46	45	49	45

Test if the average packing can be taken to be 50 kg.

Solution

Null Hypothesis

H_o:µ=50 kgs in the average packing in 50 kgs

Alternative Hypothesis

H_1:≠50 Kgs [Two Tailed]

Level Of Significance

Let α=0.05

Calculation

$\bar{X}=\frac{473}{10}$=47.3

$s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}} = \sqrt{\frac{64.1}{9}}$s =**2.668**

X	$\mathbf{X-\bar{X}}$	$\mathbf{(X-\bar{X})^2}$
50	2.7	7.29
49	1.7	2.89
52	4.7	22.09

44	-3.3	10.89
45	-2.3	5.29
48	0.7	0.49
46	-1.3	1.69
45	-2.3	5.29
49	1.7	2.89
45	-2.3	5.29
		64.1

$$t_0 = \left|\frac{47.3-50}{\frac{2.668}{\sqrt{10}}}\right| = \left|\frac{-2.7}{0.343695}\right|$$

$\boldsymbol{t_0}$ **= 3.2**

Expected Value

$t_e = \left|\frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}}\right|$ follows t-distribution with (10-1) degrees of freedom is 2.262.

Inference

Since $t_0 > t_e$. H_0 is rejected at 5% level of significance and we conclude that the average packing cannot be taken to be 50 kgs.

Ex No: 13

TESTING HYPOTHESIS USING Z TEST IN SPSS PACKAGE

Aim

Testing hypothesis using z test in SPSS package.

Algorithm

STEP 1: Start →All Program→ SPPS in C →SPPS.

STEP 2: Enter the given data in the variable view.

STEP 3: Click Analyze →Compare mean →One sample t test.

STEP 4: Click the variable x and put it into the variable box.

STEP 5: Click Option →Confidence interval percentage at 95%→ Continue.

STEP 6: Put test value 100 Ok.

STEP 7: Finally we get the output.

Testing Hypothesis Using Z Test in SPSS Package

Problem

The life time fluorescent bulbs of 100 samples are given below. Test the samples for the expected mean life time of 1600 for 5% level of significance.

1450	1640	1615	1638	1672
1455	1650	1625	1639	1632
1460	1660	1635	1659	1653
1470	1670	1645	1679	1671
1480	1680	1655	1689	1673
1490	1690	1665	1673	1534
`1500	1465	1675	1556	1644
1510	1475	1685	1458	1486
1520	1487	1453	1468	1476
1530	1495	1468	1567	1566
1540	1515	1497	1648	1498
1550	1525	1488	1623	1493
1560	1535	1526	1674	1463
1570	1545	1539	1684	1532
1580	1555	1499	1673	1573
1590	1565	1577	1494	1593

1600	1575	1469	1591	1461
1610	1585	1569	1593	1582
1620	1595	1589	1573	1536
1630	1605	1599	1582	1476

Solution

Given n=100, μ=1600.

Null hypothesis

H_0:μ=1600.

(i.e) there is no significant difference between the sample mean and population mean.

Alternative hypothesis

H_1 :μ≠1600.(two tailed)

Level of significance:

Let α=0.05

Calculation of statistics

$$Z_0 = \left|\frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}}\right|$$

$$= \left|\frac{1570.73-1600}{\frac{73.496}{\sqrt{100}}}\right|$$

$$= \left|\frac{-29.27}{7.3496}\right|$$

=3.982

Z_0=3.98

Expected value

$$Z_e = Z_0 = \left|\frac{\bar{x}-\mu}{\frac{s}{\sqrt{n}}}\right| \sim N(0,1)$$

=1.96 for α=0.05

Inference

Since $Z_0 > Z_e$. We reject the null hypothesis at 5% level of significance and we conclude that there is a significant difference between the sample mean and the population mean.

Ex: No: 14

TESTING HYPOTHESIS USING CHI-SQUARE TEST IN SPSS PACKAG

Objective

To test a hypothesis using chi -square test in SPSS package.

Algorithm

Step1: start →all programs →SPSS in c →SPSS

Step2: Enter the given data in the variable view.

Step3: Click the data →weight cases and select the frequency variable.

Step4: Click analysis →nonparametric test →one sample test →select automatically compare Observed data to hypothesized and click run.

Step5: Finally we get the output.

Problem

For goodness of fit the following information is derived from the record of an employee payroll the absenteeism of the employees during the weekdays is given below

DAYS	ABSENCE
Monday	12
Tuesday	10
Wednesday	7
Thursday	8
Friday	13

Test the distribution of absenteeism is uniform across the week days.

Solution

Null hypothesis

$H_{\circ}:\mu=\overline{x}$

There is no significance difference between during the absenteeism of weekdays.

Alternative hypothesis

$H1:\mu\neq\overline{x}$

There is a significance difference between the absenteeism of weekdays.

Level of significance

Let α=0.05

Calculation of χ^2 statistics

$$\chi^2 = \sum_{i=1}^{n} \frac{(O-E)^2}{E}$$

O	E	O-E	$(O-E)^2$	$(O-E)^2/E$
12	10	2	4	0.4
10	10	0	0	0
7	10	-3	9	0.9
8	10	-2	4	0.4
13	10	3	9	0.9

Degrees of freedom

df = (r-1) (c-1)

= (5-1) (2-1) df = 4

Expected value:

$\chi^2_e = 9.488$

$\chi^2_o < \chi^2_e$

2.6<9.488

Inference

Since $\chi^2_o < \chi^2_e$ we accept the null hypothesis at 5% level of significance and we conclude that there is no significance difference between during the absenteeism of weekdays.

Ex. No: 15

INTERPERTATION OF RESULT IN THESPSS OUTPUT VIEWER

Aim

To know how to interpret the results in the SPSS output viewer

Representation of data in the form of graphs and diagrams are used for better decision making through graphs and diagrams. One can easily understand the pattern of data over a period of time and one can easily identify the ups and downs of the data points by which the decision making is easy.

Standard deviation is a Measure of Dispersion which is mostly used. It shows the amount of variation in a particular variable. In the comparison of two differentt variables, coefficient of variation is used with the help of standard deviation. Coefficient of variation in decision making is easy.

When we calculate the measure of central value which is closed to each other for difference variables decision can be made by comparing central measures of different variables and the deviation from the centre values of each value in different variables also can be understood by the output. If the standard deviation values are consistent in nature then the scores are better performing.

If the standard deviation values are having greater variation then the deviation among the scores are more scattered from the centre value and the variables are having greater deviation and less efficiency.

Binomial and Poisson are discrete are discrete probability distribution which gives an idea about how values are distributed among the variables. The maximum possible outcome of binomial distribution is only two.

The Poisson distribution is similar to binomial and it is discussed about rare events. The mean of the Binomial distribution is calculated by $\mu = n\ p$ and variance = n pq. But in Poisson distribution, the mean and variance $\lambda = n\ p$.

To measure the relationship between two or more variables, correlation coefficient is used. There are different methods but two are most popularly used. They are,

1. Karl Pearson correlation coefficient
2. Spearman (rank) correlation coefficient

Karl Pearson is used for measuring the relationship between quantitative data and spearman Rank correlation is used for measuring relationship between qualitative data. By The result of correlation coefficient, we can understand the strength of the relationship between the variables and it is denoted by 'r' and the r-value ranges between -1 to +1.

The relationship between r-value is shown in the following table.

r value	**Relationship**
1	Perfect positive relationship
≥0.75 and<1	Strong positive
≥0.25 and <0.75	Moderate degree positive
>0 and < 0.25	Low degree positive
0	No correlation
≥ - 0.25 and < 0	Low degree negative
≥ - 0.75 and < - 0.25	Moderate degree negative
≥ - 0.75 and < -1	Strong negative
-1	Perfect negative relationship

In Hypothesis test if the asymptotic significance value is less than the level of significance value (α) then we accept the null hypothesis otherwise we reject the null hypothesis.