**Experiment No.4**

**Aim**: To implementation of Statistical Hypothesis Test using Scipy.

**Prerequisites**: Python3, numpy, pandas,seaborn.

**Objectives:** At the end of this experiment, students will be able to perform :

1. Student’s t-test

2. Paired Student’s t-test

3. Analysis of Variance Test (ANOVA)

**Theory:** -

**Student's t-test**

The Student's t-test is a statistical test used to determine whether there is a significant difference between the means of two independent groups. The formula for the two-sample t-test is:

t = (x̄1 - x̄2) / [s\_p \* sqrt(1/n1 + 1/n2)]

Where:

x̄1 and x̄2 are the sample means of the two groups being compared

s\_p is the pooled standard deviation, calculated as:

s\_p = sqrt(((n1-1)\*s1^2 + (n2-1)\*s2^2) / (n1+n2-2))

n1 and n2 are the sample sizes of the two groups being compared

s1 and s2 are the sample standard deviations of the two groups being compared

Example:

Suppose we are interested in comparing the average test scores of two groups of students. We randomly select 20 students from each group and find that the average test scores of Group A and Group B are 80 and 85, respectively. The sample standard deviations of the two groups are 5 and 6, respectively. We can use the two-sample t-test to determine whether there is a significant difference between the two groups.

t = (80 - 85) / [sqrt(((195^2) + (196^2)) / (20+20-2)) \* sqrt(1/20 + 1/20)]

t = -2.52

Using a t-distribution table with 38 degrees of freedom at a significance level of 0.05, we find that the critical value of t is ±2.024. Since our calculated t-value (-2.52) is greater than the critical value, we can conclude that there is a significant difference between the average test scores of the two groups.

**Conclusion**: - In conclusion, statistical tests such as the Student's t-test, paired t-test, and ANOVA test are powerful tools for analyzing data and drawing conclusions. The selection of a particular test depends on the research question, the type of data, and the number of groups being compared. The results of these tests can provide valuable insights and inform future research and decision-making.