UNIT - 2 DESIGN OF EXPERIMENTS
Applications of ANOVA

What is an ANOVA (Analysis of Variance)

ANOVA stands for **Analysis of Variance** and is a statistical analysis that is used to determine whether the means of two or more groups are equal. It is based on the concept that if the means of two groups differ, the variation within the groups should be smaller than the variance between them.

The two most common types of ANOVAs are,

- One-Way ANOVA
- Two-Way ANOVA

Applications of ANOVA Test

ANOVA is widely used in many fields, including:

- In Agriculture
- In Medicine
- In Education
- In Manufacturing
- In Social Sciences
- In Business
- In Psychology, etc

Let's learn about them in detail using various examples.

In Agriculture

- **Example 1:** A farmer wants to compare the yields of three different maize kinds. He grows each kind in a separate area and measures the yield at harvest. ANOVA may be used to analyze if there is a significant difference in mean yield between the three kinds.
- **Example 2:** A researcher wants to know the impact of various fertilizers on the development of tomatoes. He assists different fertilizers to different groups of plants and then measures the plant's height after a set period. ANOVA may be used to see if there are any differences in the mean height of the plants among fertilizer groups. ANOVA may be used to see if there is a significant difference in mean plant height among fertilizer groups.

In Medicine

- **Example 1:** A doctor wants to check the efficacy of two medicines for a certain condition. He randomly assigns patients to one of the two treatment approaches and keep tracks of their recovery time. ANOVA may be used to see if there is a significant difference in the mean recovery time between the two treatment groups or not.
- **Example 2:** A researcher wnats to look into the effects of various lifestyle factors on the risk of heart disease. He collects data on a huge population and measures their nutrition, exercise habits, and smoking status. ANOVA can be used to see if there are any difference in the average risk of heart disease across persons with various lifestyles.

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In Education

- **Example 1:** A teacher wants to compare the performance of the students from two totally different courses. He conducts the exact same test to all of his students and scores them accordingly. ANOVA may be used to see if there are any difference in the mean score between the two classes.
- **Example 2:** A researcher wants to evaluate the efficency of a new teaching approach. He randomly assigns students to either the new or standard approach and evaluates their learning results. ANOVA may be used to see if there are any difference in the students' mean learning outcomes between the two teaching technique groups.

In Manufacturing

- **Example 1:** A manufacturing organization wants to compare the quality of items from two separate production lines. They randomly choose goods from each line and examine their failure rates. ANOVA may be used to see if there are any difference in average defect rate between the two manufacturing lines.
- **Example 2:** A researcher is looking for those components that cause product problems. They collect data on a wide number of items and examine failure rates. They also capture information about the manufacturing process, such as the temperature and humidity levels. ANOVA may be used to identify which factors have a significant effect on the product's mean defect rate.

In Social Sciences

- **Example 1:** A sociologist wants to compare the views of individuals from various socioeconomic backgrounds. They interview people of various economic levels to evaluate their opinions regarding issues related to society. ANOVA may be used to see if there are any difference in average opinions of persons from different socioeconomic groups.
- **Example 2:** A political scientist would like to determine the efficiency of various campaign techniques. They randomly assign people to receive various campaign messages and keep track their voting behavior. ANOVA can be used to find out if there are any variation in their mean voting behavior among voters who received different campaign messages.

In Business

- **Example 1:** A marketing manager want to compare sales of two totally different items. They launch a sales campaign for each product and keep track sales volume. ANOVA may be used to figure out if there is a significant difference in the mean sales volume between both items.
- **Example 2:** A financial analyst wants to examine the performance of several investment portfolios. They track the performance of various portfolios over time. ANOVA may be used to see if there is a significant difference in the average return of the various portfolios.

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In Psychology

- **Example 1:** A psychologist measures cognitive ability of children across age groups. They perform a variety of cognitive tests to children of various ages and then record their results also. ANOVA may be used to see if there is a significant difference in mean cognitive capacity across children of different ages.
- **Example 2:** A researcher wants to compare the effects of various psychological therapies on anxiety levels. They randomly assign people to different therapies and examine their anxiety levels before and after the sessions. ANOVA can be used to figure out if there are any difference in mean anxiety levels throughout the people who received various therapies.