ANALYSIS OF VARIANCE (ANOVA)

SUBJECT: QUANTITATIVE BIOLOGY
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(ANOVA)

- Variance is defined as the expectation of the squared deviation of a random variable from its mean i.e. S^2 or σ^2
- Analysis of Variance (ANOVA) is a method for testing the hypothesis that there is no difference between two or more population means.
- The ANOVA technique enables us to perform the simultaneous test and as such is considered to be an important tool of analysis in the hands of a researcher.
- The significance of the difference of means of the two samples can be judged through either z-test or t-test.

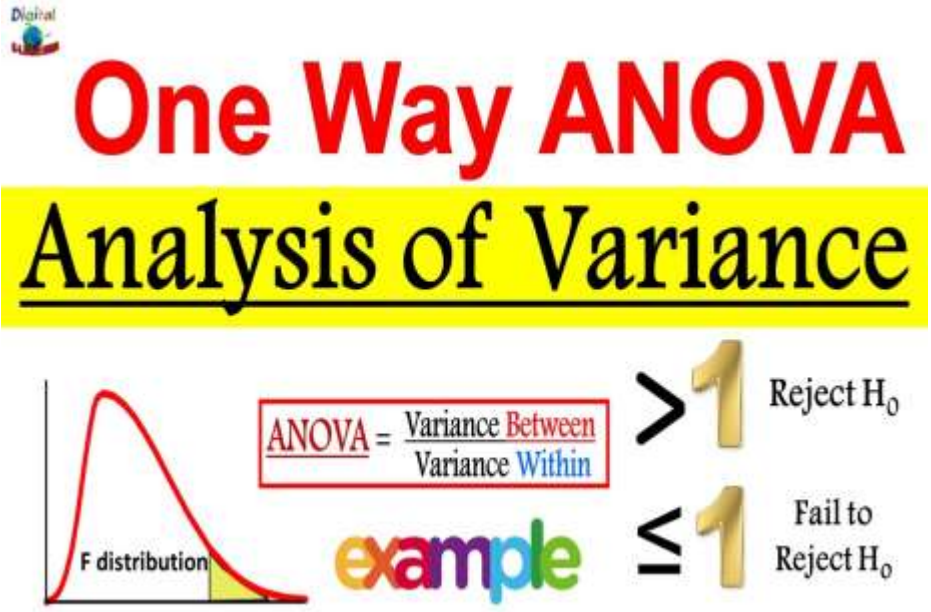
- The technique of the analysis of variance was extremely useful in all types of researches.
- The variance of analysis studies the significance of the difference in means by analyzing variance.
- The variance would differ only when the means are significantly different.
- H0: Variability within group= Variability b/t group.
- Ha: Variability within groups Variability b/t groups.

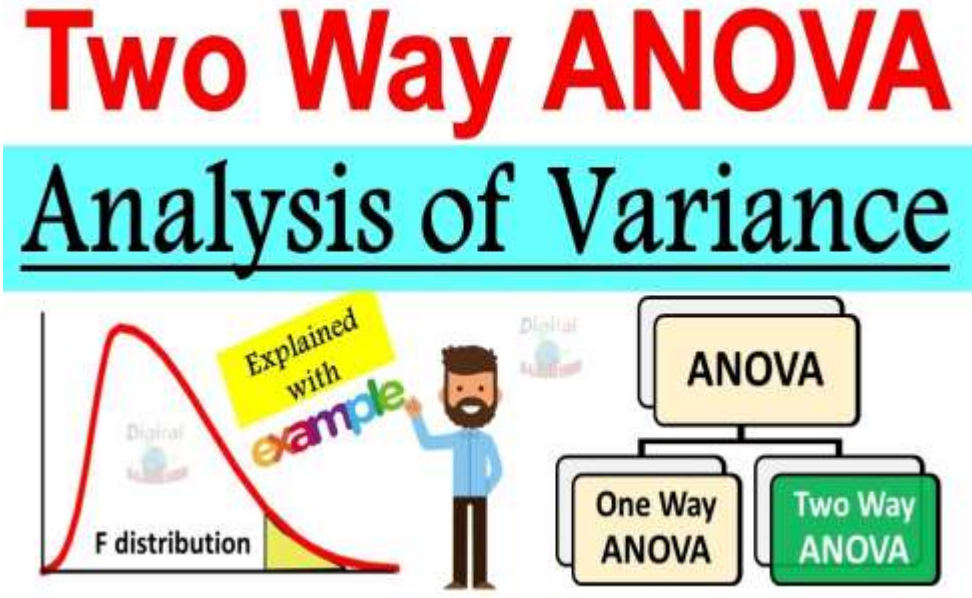
- For this technique **Fisher is called the Father of Modern Statistics.**
- It the most powerful techniques available in the field of statistical teaching.
- It is widely used in the experiments of behavioral and social sciences to test the significance of differences of means in different groups of a varied populations.
- Through this technique, it is possible to determine the significance of difference of different means in a single test rather than many.
- It minimizes the Type I error unlike in case of t-test.

Basic principle of ANOVA

To test for differences among the means of the populations by examining the amount of variation within each of these samples, relative to the amount of variation between samples.

CLASSIFICATION





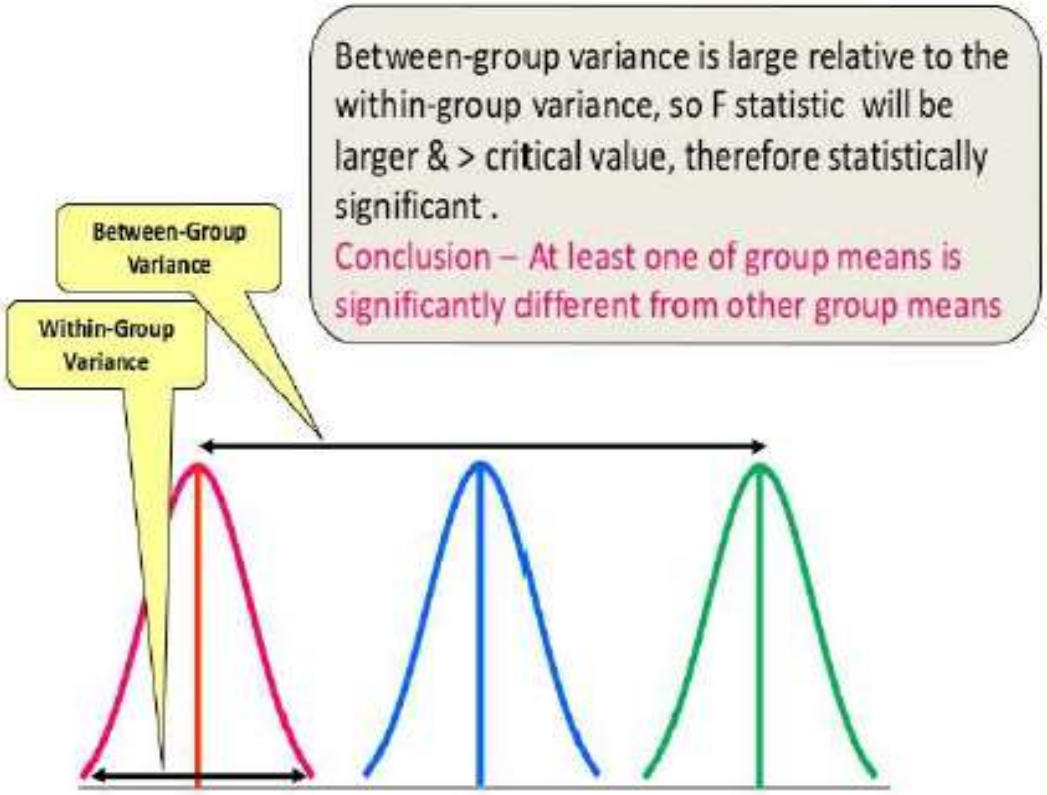
ONE WAY

TWO WAY

- In a **one-way classification** we take into account the effect of **only one variable**.
- If there is **a two-way classification** the effect of **two variables or two factors** can be studied.
- The procedure of analysis in a two-way technique is total both the columns and rows.
- The effect of one factor is studied through the column wise figures and totals and of the other through the row wise figures and totals.
- The variances are compared with the residual variance or error.

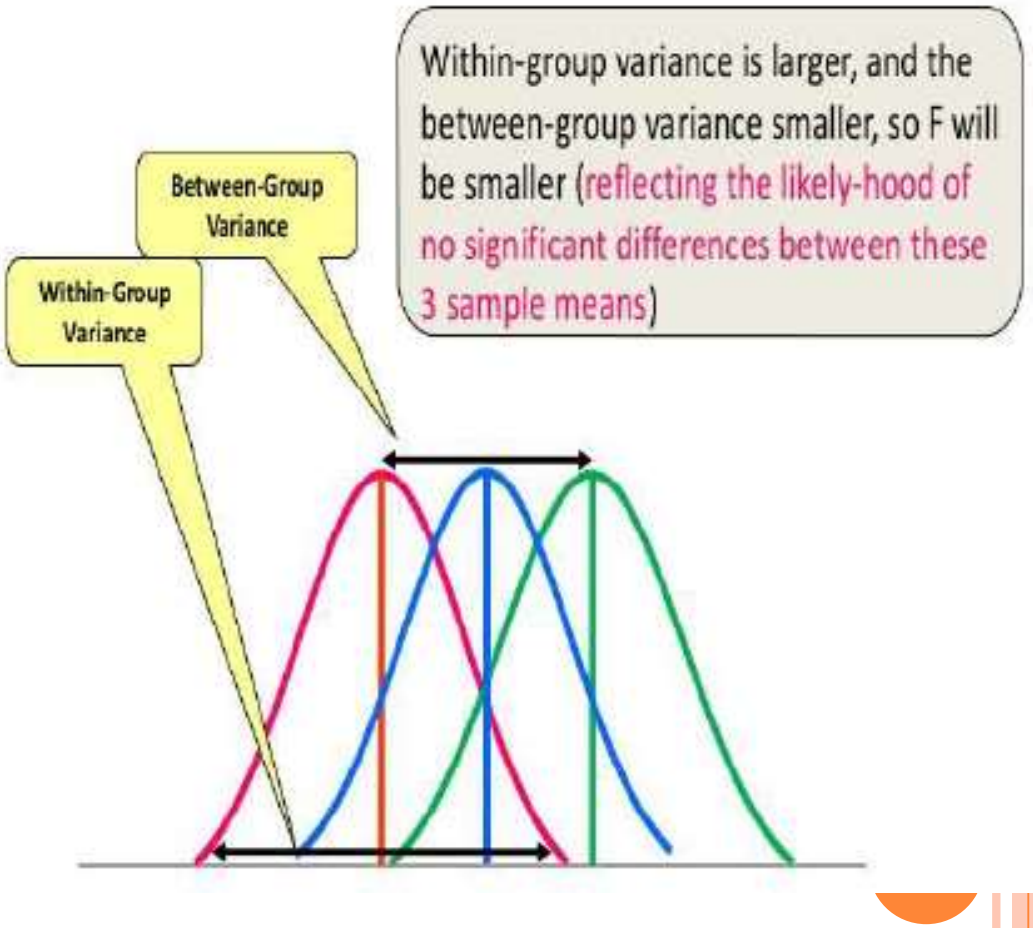
ANOVA TECHNIQUE

- Obtain the mean of each sample.
- Work out the mean of the sample means.
- Calculate sum of squares for variance between the samples **(or SS between)**
- Obtain variance or mean squares **(MS) between samples**



ANOVA TECHNIQUE

- Calculate sum of squares for variance within the samples **(or SS within).**
- Obtain the variance or mean square **(MS) within samples.**
- Find sum of squares of deviations for total variance.
- Finally, find F-ratio



ANOVA PROCEDURE

This is the ten step procedure for analysis of variance:

1. Description of data
2. Assumption: Along with the assumptions, we represent the model for each design we discuss.
3. Hypothesis
4. Test statistics
5. Distribution of test statistics
6. Description rule
7. Calculation of test statistics: the results of the arithmetic calculations will be summarized in a table called the ANOVA table. The entries in the table make it easy to evaluate the results of the analysis.
8. Statistical decision
9. Conclusion
10. Determination of p value

ADVANTAGES OF ANOVA

- It is improved technique over t-test & z-test.
- Suitable for multi-dimensional variables.
- Analysis various factors at a time.
- Can be used in three and more than three groups.
- Economical and good method of Parametric testing.
- It involve more than independent variables in studying the main impact & interaction effect.
- The experimental design (simpler and random design & level treatment design) are based on one way ANOVA technique.

LIMITATIONS OF ANOVA

- It is difficult to analyze ANOVA under strict assumptions regarding the nature of data.
- It is not so helpful in comparison with t-test that there is no special interpretation of the significance level.
- It has a fixed and difficult set for designing experiments for the researcher.
- Requirement of post-ANOVA t-test for further testing.
- Sometimes, time consuming & also time requires knowledge & skills for solving numerical problems.
- It provides no additional information as compared to t-test.


Thank you!