

F DISTRIBUTION AND ANOVA: PURPOSE AND BASIC ASSUMPTION OF ANOVA*

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Abstract

This module describes the assumptions needed for implementing an ANOVA and how to set up the hypothesis test for the ANOVA.

1 F Distribution and ANOVA: Purpose and Basic Assumption of ANOVA

The purpose of an **ANOVA** test is to determine the existence of a statistically significant difference among several group means. The test actually uses **variances** to help determine if the means are equal or not.

In order to perform an ANOVA test, there are three basic **assumptions** to be fulfilled:

- Each population from which a sample is taken is assumed to be normal.
- Each sample is randomly selected and independent.
- The populations are assumed to have **equal standard deviations (or variances)**.

2 The Null and Alternate Hypotheses

The null hypothesis is simply that all the group population means are the same. The alternate hypothesis is that at least one pair of means is different. For example, if there are k groups:

$$H_o : \mu_1 = \mu_2 = \mu_3 = \dots = \mu_k$$

H_a : At least two of the group means $\mu_1, \mu_2, \mu_3, \dots, \mu_k$ are not equal.

Glossary

Definition 1: Analysis of Variance

Also referred to as ANOVA. A method of testing whether or not the means of three or more populations are equal. The method is applicable if:

- All populations of interest are normally distributed.
- The populations have equal standard deviations.

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- Samples (not necessarily of the same size) are randomly and independently selected from each population.

The test statistic for analysis of variance is the F-ratio.

Definition 2: Variance

Mean of the squared deviations from the mean. Square of the standard deviation.