**F-Test**

Any statistical test that uses **F-distribution** can be called an F-test. It is used when the sample size is small i.e. n < 30.

For example, suppose one is interested to test if there is any significant difference between the mean height of male and female students in a particular college. In such a situation, a **t-test** for difference of means can be used.

However one assumption of the t-test is that the variance of the two populations is equal; in this case the two populations are the populations of heights for male and female students. Unless this assumption is true, the t-test for difference of means cannot be carried out.

The F-test can be used to **test the hypothesis** that the **population variances** are equal.

## F-tests for Different Purposes

There are different types of t-tests for different purposes. Some of the more common types are outlined below.

1. F-test for testing equality of variance is used to test the hypothesis of the equality of two **population variances**. The height example above requires the use of this test.
2. F-test for testing equality of several means. The test for equality of several means is carried out by the technique called **ANOVA**.

For example, suppose that an experimenter wishes to test the efficacy of a drug at three levels: 100 mg, 250 mg and 500 mg. A test is conducted among fifteen human subjects taken at random, with five subjects being administered each level of the drug.

To test if there are **significant** differences among the three levels of the drug in terms of efficacy, the ANOVA technique has to be applied. The test used for this purpose is the F-test.

1. F-test for testing significance of regression is used to test the significance of the regression model. The appropriateness of the **multiple regression** model as a whole can be tested by this test. A significant F value indicates a linear relationship between Y and at least one of the Xs.

## Assumptions

Irrespective of the type of F-test used, one assumption has to be met: the populations from which the samples are drawn have to be normal. In the case of the F-test for equality of variance, a second requirement has to be satisfied in that the larger of the sample variances has to be placed in the numerator of the test statistic.

Like t-test, F-test is also a small sample test and may be considered for use if sample size is < 30.

## Deciding

In attempting to reach decisions, we always begin by specifying the **null hypothesis** against a complementary hypothesis called the **alternative hypothesis**. The calculated value of the F-test with its associated p-value is used to infer whether one has to accept or reject the null hypothesis.

All statistics software packages provide these p-values. If the associated p-value is small i.e. (< 0.05) we say that the test is significant at 5% and we may reject the null hypothesis and accept the alternative one.

On the other hand if the associated p-value of the test is > 0.05, we should accept the null hypothesis and reject the alternative. Evidence against the null hypothesis will be considered very strong if the p-value is less than 0.01. In that case, we say that the test is significant at 1%.