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## F-Test

Explorable.com, Lyndsay T Wilson81.4K reads

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.

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## 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 [1]. 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 [2].

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 [3] 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.

3. *F-test for testing significance of regression* is used to test the significance of the regression model. The appropriateness of the multiple regression [4] 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 [1], 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 [5] against a complementary hypothesis called the alternative hypothesis [6]. 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%.

## Links

[1] <https://explorable.com/statistical-variance> [2] <https://explorable.com/anova> [3] <https://explorable.com/significance-test> [4] <https://explorable.com/multiple-regression-analysis> [5] <https://explorable.com/null-hypothesis> [6] <https://explorable.com/research-hypothesis>