F-Test [1]

Any statistical test that uses F-distribution [3] 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 [4] 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 [5] that the population variances [6] 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 [6]. 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 [7].

   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 [8] 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 <u>multiple regression</u> [9] 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 <u>variance</u> [6], 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 <u>null hypothesis</u> [10] against a complementary hypothesis called the <u>alternative hypothesis</u> [11]. 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://staging.explorable.com/en/f-test
[2] https://staging.explorable.com/en
[3] https://staging.explorable.com/f-distribution
[4] https://staging.explorable.com/students-t-test-2
[5] https://staging.explorable.com/hypothesis-testing
[6] https://staging.explorable.com/statistical-variance
[7] https://staging.explorable.com/anova
[8] https://staging.explorable.com/significance-test
[9] https://staging.explorable.com/multiple-regression-analysis
[10] https://staging.explorable.com/null-hypothesis
[11] https://staging.explorable.com/research-hypothesis