

F-test

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F-test

- The name for the test is given in honour of Sir. Ronald A Fisher by George W Snedecor.
- To perform an F Test using technology, the following aspects are to be taken care of.
 - State the null hypothesis along with the alternative hypothesis.
 - Compute the value of 'F' with the help of the standard Formula.
 - Determine the value of the F Statistic. The ratio of the variance of the group of means to the mean of the within-group variances.
 - As the last step, support or reject the Null hypothesis.

F-Test Equation to Compare Two Variances

- In Statistics, the F-test Formula is used to compare two variances, say σ^2_1 and σ^2_2 , by dividing them.
- As the variances are always positive, the result will also always be positive.
- Hence, the F Test equation used to compare two variances is given as:

$$F_value = \frac{\textit{variance1}}{\textit{variance2}}$$

$$\text{i.e. } F_value = \frac{\sigma^2_1}{\sigma^2_2}$$

- F Test Formula helps us to compare the variances of two different sets of values.
- To use F distribution under the null hypothesis, it is important to determine the mean of the two given observations at first and then calculate the variance.

$$\sigma^2 = \frac{\sum(x - \bar{x})^2}{n - 1}$$

In the above formula,

σ^2 is the variance

x is the values given in a set of data

\bar{x} is the mean of the given Data set

n is the total number of values in the Data set

- While running an F Test, it is very important to note that the population variances are equal. In more simple words, it is always assumed that the variances are equal to unity or 1. Therefore, the variances are always equal in the case of the null hypothesis.

F Test Statistic Formula Assumptions

- F Test equation involves several assumptions. In order to use the F - test Formula, the population should be distributed normally. The samples considered for the test should be independent events. In addition to these, it is also important to consider the following points.
- Calculation of right-tailed tests is easier. To force the test into a right-tailed test, the larger variance is pushed in the numerator.
- In the case of two-tailed tests, alpha is divided by two prior to the determination of critical value.
- Variances are the squares of the standard deviations.
- If the obtained degree of freedom is not listed in the F table, it is always better to use a larger critical value to decrease the probability of type 1 errors.
- The difference between running a one or two tailed F test is that the alpha level needs to be halved for two tailed F tests. For example, instead of working at $\alpha = 0.05$, you use $\alpha = 0.025$; Instead of working at $\alpha = 0.01$, you use $\alpha = 0.005$.

Is the number above the line and how many pieces there are.

$$\frac{\text{Numerator}}{\text{Denominator}} = \frac{3}{4}$$

Is the number below the line and how many equal pieces the whole is divided into.

For example, to determine the .05 critical value for an F distribution with 10 and 12 degrees of freedom, look in the 10 column (numerator) and 12 row (denominator) of the F Table for $\alpha = .05$. $F_{(.05, 10, 12)} = 2.7534$.

F-Value Definition: Example Problems

Example 1:

Perform an F Test for the following samples.

1. Sample 1 with variance equal to 109.63 and sample size equal to 41.
2. Sample 2 with variance equal to 65.99 and sample size equal to 21.

Solution:

Step 1:

The hypothesis Statements are written as:

H₀: No difference in variances

H_a: Difference invariances

Step 2:

Calculate the value of F critical. In this case, the highest variance is taken as the numerator and the lowest variance in the denominator.

$$F_value = \frac{\sigma_1^2}{\sigma_2^2}$$

$$F_value = \frac{109.63}{65.99}$$

$$F_value = 1.66$$

Step 3:

The next step is the calculation of degrees of freedom.

The degrees of freedom is calculated as Sample size - 1

The degree of freedom for sample 1 is $41 - 1 = 40$.

The degree of freedom for sample 2 is $21 - 1 = 20$.

Step 4:

There is no alpha level described in the question, and hence a standard alpha level of 0.05 is chosen.

During the test, the alpha level should be reduced to half the initial value, and hence it becomes 0.025.

Step 5:

Using the F table, the critical F value is determined with alpha at 0.025. The critical value for (40, 20) at alpha equal to 0.025 is 2.287.

Step 6:

It is now the time for comparing the calculated value with the standard value in the table. Generally, the null hypothesis is rejected if the calculated value is greater than the table value. In this F value definition example, the calculated value is 1.66, and the table value is 2.287.

It is clear from the values that $1.66 < 2.287$. Hence, the null hypothesis cannot be rejected.

In case of a problem with two sample Data sets, the F value can be obtained by dividing the larger variance by the smaller one.