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ICCPP-STATISTICS

- F-test

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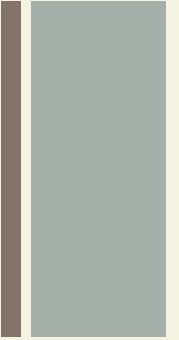


George W. Snedecor
(1881-1974)

F-test

+ Definition

- An F-test is any statistical test in which the test statistic has an F-distribution under the null hypothesis.



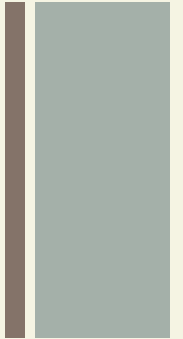
+ Formula for F-Test to Compare Two Variances

- A Statistical F Test uses an F Statistic to compare two variances, σ_1 and σ_2 , by dividing them. The result will always be a positive number because variances are always positive. Thus, the equation for comparing two variances with the F-test is

$$F - value = \frac{\text{variance 1}}{\text{variance 2}}$$

$$\text{i.e. } F - value = \frac{\sigma_1^2}{\sigma_2^2}$$

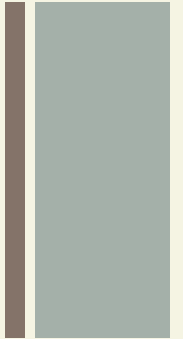
+ Use



- It is most often used when comparing statistical models that have been fitted to a data set, in order to identify the model that best fits the population from which the data were sampled.



Assumptions

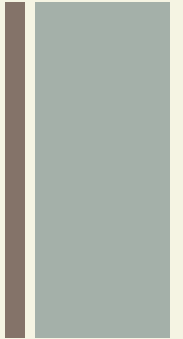


Several assumptions are made for the test. Your population must be approximately normally distributed (i.e. fit the shape of a bell curve) in order to use the test.

Plus, the samples must be independent events. In addition, you'll want to bear in mind a few important points:



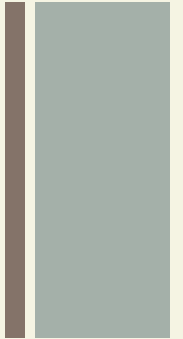
Assumptions



- The larger variance should always go in the numerator (the top number) to force the test into a right-tailed test.
- Right-tailed tests are easier to calculate.



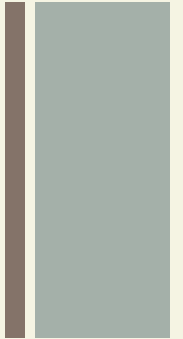
Assumptions



- For two-tailed tests, divide alpha by 2 before finding the right critical value.
- If you are given standard deviations, they must be squared to get the variances.

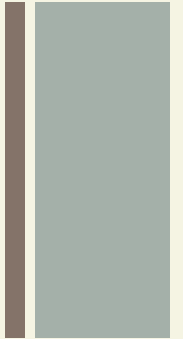


Assumptions



- If your degrees of freedom aren't listed in the F Table, use the larger critical value.
- This helps to avoid the possibility of Type I errors.

+ Example



- Conduct an F-Test on the following samples:

Sample-1 having variance = 109.63,
sample size = 41.

Sample-2 having Variance = 65.99,
sample size = 21.

+ Solution Steps wise

Step 1

First write the hypothesis statements as:

H₀: No difference in variances.

H_a: Difference in variances.

+ Solution Steps wise

Step 2

Calculate the F-critical value. Here take the highest variance as the numerator and the lowest variance as the denominator:

$$F \text{ Value} = \frac{\sigma_1^2}{\sigma_2^2}$$

$$F \text{ Value} = \frac{109.63}{65.99}$$

$$F \text{ Value} = 1.66$$

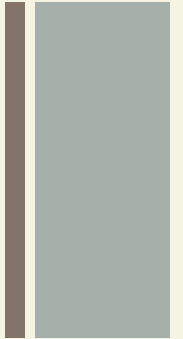
+ Solution Steps wise

Step 3

Calculate the degrees of freedom as:

The degrees of freedom in the table will be the sample size - 1,
so for sample-1 it is 40
and for sample-2 it is 20.

+ Solution Steps wise

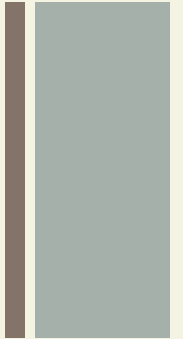


Step 4

Choose the alpha level. As, no alpha level was given in the question, so we may use the standard level of 0.05.

This needs to be halved for the test, so use 0.025.

+ Solution Steps wise



Step 5

We will find the critical F-Value using the F-Table.

We will use the table with 0.025.

Critical-F for (40,20) at alpha (0.025) is 2.287.

+ Solution Steps wise

Step 6

Compare the calculated value to the standard table value.

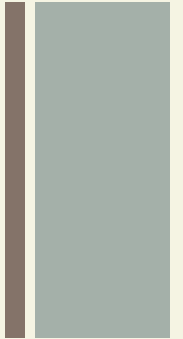
If our calculated value is higher than the table value, then we may reject the null hypothesis.

Here, $1.66 < 2.287$.

So, we cannot reject the null hypothesis.



References



Archdeacon, T. (1994). *Correlation and Regression Analysis: A Historian's Guide*. Univ of Wisconsin Press.

Lomax, Richard G. (2007). *Statistical Concepts: A Second Course*. p. 10. ISBN 0-8058-5850-4.

Box, G. E. P. (1953). "Non-Normality and Tests on Variances". *Biometrika*. 40 (3/4): 318–335. doi:10.1093/biomet/40.3-4.318. JSTOR 2333350.

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