

 Lagunita is retiring and will shut down at 12 noon Pacific Time on March 31, 2020. A few courses may be open for self-enrollment for a limited time. We will continue to offer courses on other online learning platforms; visit <http://online.stanford.edu>.

Course > Inference: Relationships C→Q > ANOVA > ANOVA: Finding the p-value

 Bookmark this page

ANOVA: Finding the p-value

Learning Objective: In a given context, carry out the inferential method for comparing groups and draw the appropriate conclusions.

Step 3: Finding the p-value

The p-value of the ANOVA F-test is the probability of getting an F statistic as large as we got (or even larger), had $H_0 : \mu_1 = \mu_2 = \dots = \mu_k$ been true. In other words, it tells us how surprising it is to find data like those observed, assuming that there is no difference among the population means $\mu_1, \mu_2, \dots, \mu_k$.

Example

As we already noticed before, the p-value in our example is very small (less than 0.0001) telling us that it would be next to impossible to get data like those observed had the mean frustration level of the four majors been the same (as the null hypothesis claims).

Analysis of Variance results:

Data stored in separate columns.

Column means

Column	n	Mean	Std. Error
Business	35	7.3142858	0.48984894
English	35	11.771428	0.35286513
Mathematics	35	13.2	0.3639189
Psychology	35	14.028571	0.52096504

ANOVA table

Source	df	SS	MS	F-Stat	P-value
Treatments	3	939.85	313.28333	46.600895	<0.0001
Error	136	914.2857	6.722689		
Total	139	1854.1357			

Step 4: Making Conclusions in Context

As usual, we base our conclusion on the p-value. A small p-value tells us that our data contain a lot of evidence against H_0 . More specifically, a small p-value tells us that the differences between the sample means are statistically significant (unlikely to have happened by chance), and therefore we reject H_0 . If the p-value is not small, the data do not provide enough evidence to reject H_0 , and so we continue to believe that it may be true. A significance level (cut-off probability) of .05 can help determine what is considered a small p-value.

Example

In our example, the p-value is extremely small—close to 0—indicating that our data provide extremely strong evidence to reject H_0 . We conclude that the frustration level means of the four majors are not all the same, or in other words, that majors do have an effect on students' academic frustration levels at the school where the test was conducted.

Open Learning Initiative [↗](#)



[↗](#) Unless otherwise noted this work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License [↗](#).

© All Rights Reserved