

The lesson documents provide information about using the calculator provided with the lessons. The purpose of this supplement is to supply information about another possible technology, namely the StatCrunch computer software product.

CAUTION: You should note that the interface for StatCrunch has changed in the past and may well change in the future – accordingly, some of the information given here may prove to be out of date.

Starting StatCrunch – see Lesson 2 document

Lesson 12

It is not trivial to calculate the F test statistic by hand, so we will use technology to assist in the calculations. Here are the instructions, based on the example in Exercise 1, for which we have the following data:

Brand A	251	244	248	251	261	251	253	246	254	249
Brand B	263	263	266	254	264	258	263	264	261	256
Brand C	269	263	278	267	271	267	271	272	276	266
Brand D	252	249	249	242	247	251	262	249	247	246

1. First, put the data into StatCrunch, with each group in a different column. The remainder of the instructions assume you have called the columns Brand A, Brand B, Brand C, and Brand D.
2. Run the test, as follows:
 - a. Use the **Stat > ANOVA > One Way** menu option, choose “Compare selected columns,” and choose the columns that have the data, as shown here:

The screenshot shows the 'One Way ANOVA' dialog box in StatCrunch. The 'Compare' section is selected, and the 'Selected columns:' option is chosen. A list of columns is shown, with Brand A, Brand B, Brand C, and Brand D selected. The 'Where' section is set to '--optional--'. The 'Options' section has 'Compute Tukey HSD' unchecked and 'Level' set to 0.95.

b. Choosing **Compute!** gives the results:

Options				
Analysis of Variance results: Data stored in separate columns.				
Column statistics				
Column	n	Mean	Std. Dev.	Std. Error
Brand A	10	250.8	4.7093288	1.4892205
Brand B	10	261.2	3.9101009	1.2364825
Brand C	10	270	4.5946829	1.4529663
Brand D	10	249.4	5.2323778	1.6546232

ANOVA table					
Source	DF	SS	MS	F-Stat	P-value
Columns	3	2799.5	933.16667	43.425543	<0.0001
Error	36	773.6	21.488889		
Total	39	3573.1			

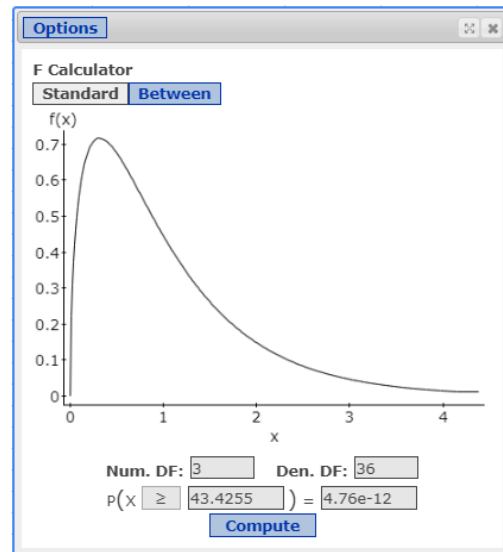
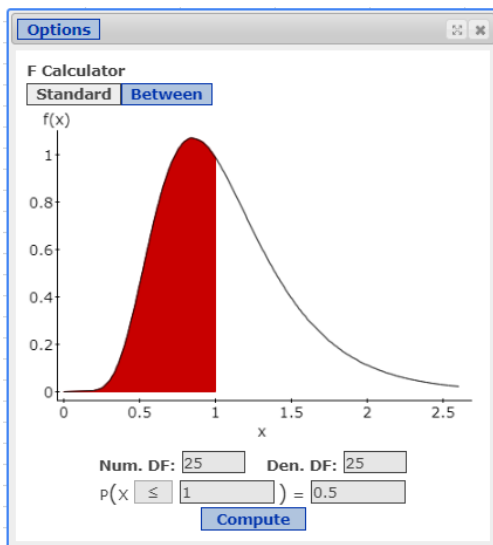
F is 43.4255, and the p -value is less than 0.0001. We will reject the null hypothesis.

Note: In addition to the F -score and the p -value, StatCrunch gives the complete ANOVA table. This table contains some of the intermediate calculations involved in the ultimate calculation of the F -score. These intermediate calculations are further explained in Section 12.4.

Additional information for the “by hand” section

Calculating the p -value

Use menu option **Stat > Calculators > F** to obtain the screen shown on the left. Enter the numerator and denominator degrees of freedom, change the \leq to \geq , enter the F value, and press the Compute button. This gives the result shown in the screen on the right (0.00048044).



So F is 43.4255, and the p -value is extremely small

Verifying condition for the standard distributions

When you do the ANOVA test, StatCrunch automatically reports statistics for the groups, along with the ANOVA table. For the golf ball example, the “**Std. Dev.**” column contains the four results we need:

Brand A: standard deviation 4.7093
Brand B: standard deviation 3.9101
Brand C: standard deviation 4.5947
Brand D: standard deviation 5.2324