The feasibility of coleus blumei cv. essay sample

In working to digest what is all contained in an ANOVA table, let's start with the column headings: (1) Source means " the source of the variation in the data." As we'll soon see, the possible choices for a one-factor study, such as the learning study, are Factor, Error, andTotal. The factor is the characteristic that defines the populations being compared. In the tire study, the factor is the brand of tire. In the learning study, the factor is the learning method. (2) DF means " the degrees of freedom in the source."

(3) SS means " the sum of squares due to the source."

(4) MS means " the mean sum of squares due to the source." (5) F means " the F-statistic."

(6) P means " the P-value."

Now, let's consider the row headings:

(1) Factor means " the variability due to the factor of interest." In the tire example on the previous page, the factor was the brand of the tire. In the learning example on the previous page, the factor was the method of learning. Sometimes, the factor is a treatment, and therefore the row heading is instead labeled as Treatment. And, sometimes the row heading is labeled as Between to make it clear that the row concerns the variation between the groups. (2) Error means " the variability within the groups" or " unexplained random error." Sometimes, the row heading is labeled as Within to make it clear that the row concerns the variation within the groups. (3) Total means " the total variation in the data from the grand mean" (that is, ignoring the factor of interest). With the column headings and row headings now defined, let's take a look at the individual entries inside a general one-factor ANOVA table:

Yikes, that looks overwhelming! Let's work our way through it entry by entry to see if we can make it all clear. Let's start with the degrees of freedom (DF) column: (1) If there are n total data points collected, then there are n−1 total degrees of freedom. (2) If there are m groups being compared, then there are m−1 degrees of freedom associated with the factor of interest. (3) If there are n total data points collected and m groups being compared, then there are n−m error degrees of freedom. Now, the sums of squares (SS) column:

(1) As we'll soon formalize below, SS(Between) is the sum of squares between the group means and the grand mean. As the name suggests, it quantifies the variability between the groups of interest. (2) Again, as we'll formalize below, SS(Error) is the sum of squares between the data and the group means. It quantifies the variability within the groups of interest. (3) SS(Total) is the sum of squares between the n data points and the grand mean. As the name suggests, it quantifies the total variabilty in the observed data. We'll soon see that the total sum of squares, SS(Total), can be obtained by adding the between sum of squares, SS(Between), to the error sum of squares, SS(Error). That is: SS(Total) = SS(Between) + SS(Error)

The mean squares (MS) column, as the name suggests, contains the " average" sum of squares for the Factor and the Error: (1) The Mean Sum of Squares between the groups, denoted MSB, is calculated by dividing the Sum of Squares between the groups by the between group degrees of freedom. That is, MSB = SS(Between)/(m−1). (2) The Error Mean Sum of Squares, denoted MSE, is calculated by dividing the Sum of Squares within the groups by the error degrees of freedom. That is, MSE = SS(Error)/(n−m). The F

column, not surprisingly, contains the F-statistic. Because we want to compare the " average" variability between the groups to the " average" variability within the groups, we take the ratio of the Between Mean Sum of Squares to the Error Mean Sum of Squares. That is, the F-statistic is calculated as F = MSB/MSE.

When, on the next page, we delve into the theory behind the analysis of variance method, we'll see that the F-statistic follows an F-distribution with $m-1$ numerator degrees of freedom and $n-m$ denominator degrees of freedom. Therefore, we'll calculate the P-value, as it appears in the column labeled P, by comparing the F-statistic to an F-distribution with $m-1$ numerator degrees of freedom and $n-m$ denominator degrees of freedom. Now, having defined the individual entries of a general ANOVA table, let's revisit and, in the process, dissect the ANOVA table for the first learning study on the previous page, in which n = 15 students were subjected to one of m = 3 methods of learning:

(1) Because n = 15, there are $n-1 = 15-1 = 14$ total degrees of freedom. (2) Because m = 3, there are $m-1 = 3-1 = 2$ degrees of freedom associated with the factor. (3) The degrees of freedom add up, so we can get the error degrees of freedom by subtracting the degrees of freedom associated with the factor from the total degrees of freedom. That is, the error degrees of freedom is $14-2 = 12$. Alternatively, we can calculate the error degrees of freedom directly from $n-m = 15-3 = 12$. (4) We'll learn how to calculate the sum of squares in a minute. For now, take note that the total sum of squares, SS(Total), can be obtained by adding the between sum of squares,

SS(Between), to the error sum of squares, SS(Error). That is: 2671. 7 = 2510. 5 + 161. 2

(5) MSB is SS(Between) divided by the between group degrees of freedom. That is, 1255. 3 = 2510. 5 ÷ 2. (6) MSE is SS(Error) divided by the error degrees of freedom. That is, 13. 4 = 161. 2 ÷ 12. (7) The F-statistic is the ratio of MSB to MSE. That is, F = 1255. 3 ÷ 13. 4 = 93. 44. (8) The P-value is P(F(2, 12) ≥ 93. 44) < 0. 001.

Okay, we slowly, but surely, keep on adding bit by bit to our knowledge of an analysis of variance table. Let's now work a bit on the sums of squares. The Sums of Squares