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Practice: Using the One-Way ANOVA Task to Perform a One-Way ANOVA

Montana Gourmet Garlic is a company that uses organic methods to grow garlic. It specializes in hardneck varieties. Knowing a little about experimental methods, the owners design an experiment to test whether growth of the garlic is affected by the type of fertilizer. They limit the experimentation to a Rocambole variety named Spanish Roja, and test three organic fertilizers and one chemical fertilizer (as a control). They "blind" themselves to the fertilizer by using containers with numbers 1 through 4. (In other words, they design the experiment in such a way that they do not know which fertilizer is in which container.) One acre of farmland is set aside for the experiment. The land is divided into 32 beds, and they randomly assign fertilizers to the beds. At harvest, they calculate the average weight of garlic bulbs in each of the beds. The data are in the **garlic** data set.

Consider an experiment to study four types of fertilizer, labeled 1, 2, 3, and 4. One fertilizer is chemical and the rest are organic. You want to see whether the average weights of the garlic bulbs are significantly different for plants in beds that use different fertilizers.

1. Test the hypothesis that the means are equal. Use the Summary Statistics task to generate descriptive statistics for the four groups.

    1. In the Navigation pane, select **Tasks and Utilities**.
    2. Expand **Tasks**.
    3. Expand **Statistics** and open the **Summary Statistics** task.
    4. Select the **stat1.garlic** table.
    5. Assign **BulbWt** to the Analysis variables role and assign **Fertilizer** to the Classification variables role.
    6. Run the task to produce summary statistics for the four groups.

    Here are the results.

2. Use the Box Plot task to produce box plots of bulb weight for the four groups.

    1. Expand **Graph** and open the **Box Plot** task.
    2. Assign **BulbWt** to the Analysis variable role and assign **Fertilizer** to the Category role.
    3. Run the task to produce box plots of bulb weight for the four groups.

    Here are the results.

3. Which fertilizer has the highest mean?

    Fertilizer 3 has the highest mean, 0.2424075, although its mean is quite close to fertilizers 1 and 2.

4. Perform a one-way ANOVA using the One-Way ANOVA task. Be sure to check that the assumptions of the analysis method that you choose are met.

    ANOVA
    1. Expand **Statistics** and open the **One-Way ANOVA** task.
    2. Assign **BulbWt** to the Dependent variable role and assign **Fertilizer** to the Categorical variable role.
    3. On the OPTIONS tab, under HOMOGENEITY OF VARIANCE, clear the checkbox for **Welch's variance-weighted ANOVA**.

4. Under COMPARISONS, use the Comparisons method drop-down list to select **None**.
5. Under PLOTS, use the Display plots drop-down list to select **Selected plots**, and then select **Diagnostics plot**. Clear all the other check boxes.
6. Run the task.

Here are the results.

5. What conclusions can you reach at this point in your analysis?

The overall *F* value from the analysis of variance table is associated with a *p*-value of 0.0013. Presuming that all assumptions of the model are valid, you know that at least one treatment mean is different from one other treatment mean. At this point, you don't know which means are significantly different from one another.

Both the histogram and Q-Q plot show that the residuals seem relatively normally distributed (one assumption for ANOVA).

The Levene's Test for Homogeneity of Variance table shows a *p*-value greater than alpha. Therefore, do not reject the hypothesis of homogeneity of variances (equal variances across fertilizer types). This assumption for ANOVA is met.

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