**BIO 162 Fertilizer Treatments**

**Homework**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

In class your TA showed you an applet that can be used to assess the statistical significance of differences in sample means. Use this applet to perform the following tasks and answer the questions on your data from the plants grown in **high vs medium** fertilizer concentrations.

**Introduction**

Make sure your hypotheses and predictions refer to high vs. medium fertilizer concentrations.

Alternative Hypothesis:

Null Hypothesis:

Prediction:

**Results**

On the applet, make sure that the “Unstacked” and “Boxplots” boxes are checked. Clear the existing data, then copy/paste your high vs. medium data into the box then click “Use Data.”

1. Click the “Show Shuffle Options” box and select the “Plot” radio button. Enter 1 as the Number of Shuffles and press “Shuffle Responses.” Describe what the applet is doing.
2. Press “Shuffle Responses” again. Describe what you now have in the graph on the right.
3. Now enter 998 as the Number of Shuffles and press “Shuffle Responses.” Include a screen grab or drawing of the distribution that forms in the graph on the right.
4. Based on where your observed difference in sample means fell in the distribution when shuffled 1000 times, do you think the observed difference in sample means reflects a real difference between your groups or is a result of random chance? Why?
5. On the left-hand side of the screen is a pull-down menu labeled “Statistic.” Use this pull-down menu to select “*t*-statistic.” What is your observed t-statistic? Click the box beneath the graph that says “Overlay *t* distribution.” Where on the distribution does your *t* value fall?
6. Enter your observed *t*-statistic in the “Count Samples” box and use the pull-down menu to select “Beyond.” Press Count. What is the decimal value now listed in orange next to “theory-based p-value”? This is your p-value.
7. If the p-value is smaller than 0.05, scientists often conclude that their observed difference in sample means reflect statistically significant differences between the experimental groups. Based on the p-values you found, do you consider the difference in the experiment groups to be statistically significant? Justify your answer below.