Lab #1 - Mathematics 140
Introduction to MINITAB

In this lab, we will learn how to manipulate Minitab's windows; enter and edit data; get Help on MINITAB commands; do some basic arithmetic and statistics; and plot data. It is important to enter each of the Minitab commands and pay attention to the results (this is called "heads-up" typing).

Clones are genetically identical cells descended from the same individual. Researchers have identified a single poplar clone, which yields fast-growing, hardy trees. These trees may one day serve as an alternative to conventional fuel as an energy resource. Researchers planted Poplar Clone 252 on two different sites: one, a rich site by a creek; the other, a dry site on a ridge. They measured the diameter in centimeters, height in meters, and dry weight of wood in kilograms of a sample of three-year-old trees. They want to see if they can predict how much a tree weighs from its diameter and height measurements.

Congratulations! You have been hired as data analyst for the project, and you will be performing the statistical analysis.

- **Starting MINITAB.** Locate and open the MINITAB program group and then double-click on the icon labeled "MINITAB for Windows."
- **Retrieving Data from a File.** To retrieve the MINITAB saved worksheet named *POPLAR1.MTW* from the *DATA* directory choose **File > Open Worksheet...** (careful do not choose Open Project). This it a shorthand notation meaning, click **File** on the Minitab menu bar, then click the menu command **Open Worksheet**. **Select the file** *POPLAR1.MTW* by scrolling through the files until you see poplar1.mtw then click on the file: poplar1.mtw. Finally, click **OK**.
- **Viewing Your Data**. If it is not already visible, choose **Window > Poplar1.MTW** to open the Data window and view your worksheet. This worksheet contains three variables, labeled *Diameter*, *Height*, and *Weight*. Each variable contains 15 observations.
- **Entering Data from the Keyboard**. To add 5 new observations just received from the field, just type the data into the appropriate cells in the worksheet. Use the scroll bars to locate the first blank cell in row 16 of column 1 (Diameter), with your mouse select this cell (that is, move the mouse cursor into the cell and click the left mouse button). Type the value 1.52 into the cell. If you enter an incorrect value, simply select that cell, type the correct value, and press enter. You can also use the arrow keys to move to the correct cell. Enter the following data:

Diameter	Height	Weight
1.52	2.9	0.07
4.51	5.27	.79
1.18	2.2	0.03
3.17	4.93	.44
3.33	4.89	.52

- **Entering Patterned Data**. The first ten data values are from a site with rich, well-drained soil and the second ten data values are from a site with dry, sandy soil. Now we will create a variable to identify the site. We can always enter data by typing in the Data

Window. However, MINITAB provides a way to enter patterned data. Let's create a new variable, which we will call Site, consisting of ten 1's followed by ten 2's to indicate whether an observation was taken from the site with rich, well-drained soil (1) or from the site with dry, sandy soil (2). Choose **Calc > Make Patterned Data > Simple Set of Numbers...** First, we will name the column where we want MINITAB to store the new data: In the box labeled "*Store patterned data in*," type **Site**. MINITAB will automatically assign the first empty column to this new variable. Next, click in the "*From first value*" text box to indicate the beginning of the sequence: Type **1**. Press Tab or click to move into the "*To last value*" box to indicate the end of the sequence: Type **2**. Press Tab twice or click to move into the "*List each value*" text box. Since we want ten 1's and ten 2's: Type **10**. Choose **OK**.

- **Computing Descriptive Statistics**. Minitab offers a wide array of basic statistics to help us analyze our data. For example, we can do t-tests, z-tests, correlation, and more. To begin, we choose to produce a summary table describing the three variables: Diameter, Height, and Weight. Choose **Stat > Basic Statistics > Display Descriptive Statistics...** Now we select the three variables we want to describe: Click **Diameter** and drag the mouse so that you highlight **Diameter, Height**, and **Weight** (we could just double-click on Diameter, then double click on Height, and so on). Then Click **Select**. Note that when we select a series of columns, Minitab uses a dash to abbreviate the series. In this example, Diameter-Weight means all three variables. Click **OK** and MINITAB will display the Descriptive Statistics for the three variables. We see the average diameter is 2.813 and that the median diameter is 2.820.

- For this data, it makes sense that we want to compare the descriptive statistics for the two sites. Having descriptive statistics for each site, will all us to determine if the trees are growing bigger at one of the sites. To obtain descriptive statistics for each site, choose **Stat > Basic Statistics > Display Descriptive Statistics...** and select the variables for which you want the descriptive statistics: **Diameter, Height**, and **Weight** (do this as we did above). Choosing the By variable option tells Minitab to generate separate statistics for Diameter, Height, and Weight for each level of the variable **Site**. Choose this option by clicking in the **By variables (Optional)** box, then click the variable **Site**, and then click **Select**. Click **OK** and MINITAB will display the Descriptive Statistics for the three variables by **Site** in the **Session Window**.

  Let's examine the output. Looking at the means, you notice that Site 2 seems to be producing larger trees than Site 1. Recall that Site 1 was the site with the rich, well-drained soil. The mean and median of all three variables (diameter, height, and weight) are greater for site 2 than site 1, respectively. In addition, you might notice that the standard deviation of Weight is very large (it is almost as large as the mean). At site 2, the minimum weight is only 0.03kg while the maximum is 1.11kg. It appears that at this site some of the poplars are doing very, while others are barely alive. Record the mean and standard deviation of the variables.

- **Arithmetic Operations on Columns**. Next, we will try to predict the weights of a tree. The weight of the tree is proportional to the volume of wood in the tree. The volume of a cylinder can approximate the volume; therefore, it follows that the weight should be proportional to the square of the diameter multiplied by the height. Since we have diameter and height, we can calculate this new variable. Choose **Calc > Calculator...** to

display the Calculator dialog box. This command performs the calculation entered and saves the result into the column specified in the box after Store result in variable. Name the new variable **D2H** for diameter squared times height: Type **D2H** in the box beside Store result in variable. Type **(C1**2)*C2** in the Expression: text box. This tells Minitab to square the variable Diameter (C1), multiply by the variable Height (C2), and put the result into a new variable called D2H. Alternately, you could have typed **(Diameter**2)*Height**. Choose **OK**. Now look in the Data window to see the new variable D2H that we just created. The first value in the column for D2H should be *18.698*. Record the mean and standard deviation of the variable D2H.

- **Graphics: The Scatter Plot**. The researchers told us there is a relationship between weight and this variable called D2H. Let's check if this data follow a linear relationship by plotting Weight versus D2H. Choose **Graph > Scatterplot...** then choose the icon for **Simple** and click **OK**. Select Weight for the Y-variables box (the vertical axis) by double-clicking **Weight**, or click Weight then click **Select**. Now select D2H for the X-variables box (the horizontal axis). To get the graph Click **OK**. The graph will appear in its own window in a few seconds. You should see a positive linear relationship between Weight and D2H. That is, as D2H increases, so does Weight. You notice an unusual data point-a tree that has a very low weight for a relatively large D2H value. For now you decide to ignore it, but it is something you may want to check on later.

- **Stem-and-Leaf Display**. Minitab can create many types of graphs and plots. For example, to make a stem-and-leaf display of the variable **D2H** by **Site**, choose **Graph > Stem-and-Leaf…** The dialog box that appears is very similar to the dialog box for Descriptive Statistics. Select **D2H** as the variable, click the **By variable** checkbox, and select **Site** as the by variable. Click **OK** and MINITAB produces two stem-and-leaf displays, one for site 1 and the other for site 2. Comparing these two stem-and-leaf displays we can see that the values of **D2H** tend to be a little larger in site 2 than site 1.

- **Histograms**. To make a histogram (a bar chart) of the Weights, choose **Graph > Histogram…**, select the icon for **Simple** and click OK. Select the variable **Weight** into the Graph Variables text box and click **OK** and MINITAB will display the histogram. We can see that the weights are mostly less than 1.0.

Turn in the following

1. Do problem 1.36b on page 34 of the textbook.
2. Do problems 2.15 and 2.16 on pages 58-59 of the textbook.
3. Write a paragraph describing your experience with this lab. Discuss any problems or successes you had with Minitab.