

For 274: Forest Measurements and Inventory

Lab 4: Measuring Variation of Tree Measurements

Objectives of this laboratory exercise:

- Measure DBH and tree heights for a range of tree sizes
- Analyze variability of the data in excel

Location: Meet at **CNR/GIS Teaching Lab**
We will walk to the Old Arboretum

Materials and Supplies:

- Clipboard
- Pencils

Provided Materials and Supplies:

- 100 feet tape for chain calibration
- DBH Tape
- Clinometers

Task #1: Collecting Data

10 different trees that will be marked with a flag or flagging in the old Arboretum. At each tree, measure the diameter at breast height, the maximum tree height, the crown base height, and the percentage live crown.

Record each of your measurements in the following field sheet:

Examiner:		
Location:		
	Slope: Slope Position:	Aspect:
Notes:		

Tree ID	DBH (in)	Max Height (feet)	Crown Base Height (feet)	Percentage Live Crown (%)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Question 1. What are your field measurement errors for?

DBH: _____

Maximum Tree Height: _____

Crown Base Height: _____

Percentage Live Crown: _____

Task #2: Data Analysis in Excel

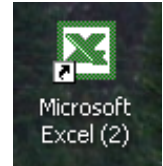
Step 1 – Starting the Software

In the **CNR GIS/RS Teaching Laboratory** logon to a machine using the following information:

User Id: class

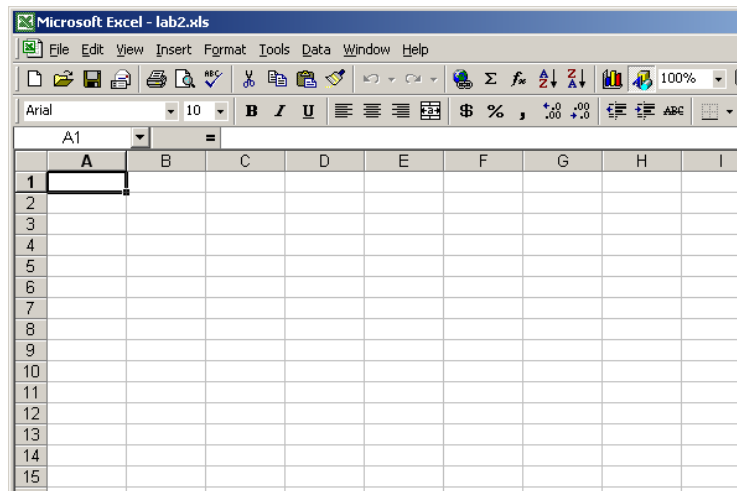
Password: GIS_Lab

Once the computer has started up, double click the left mouse button on the Excel icon (as shown on the right):



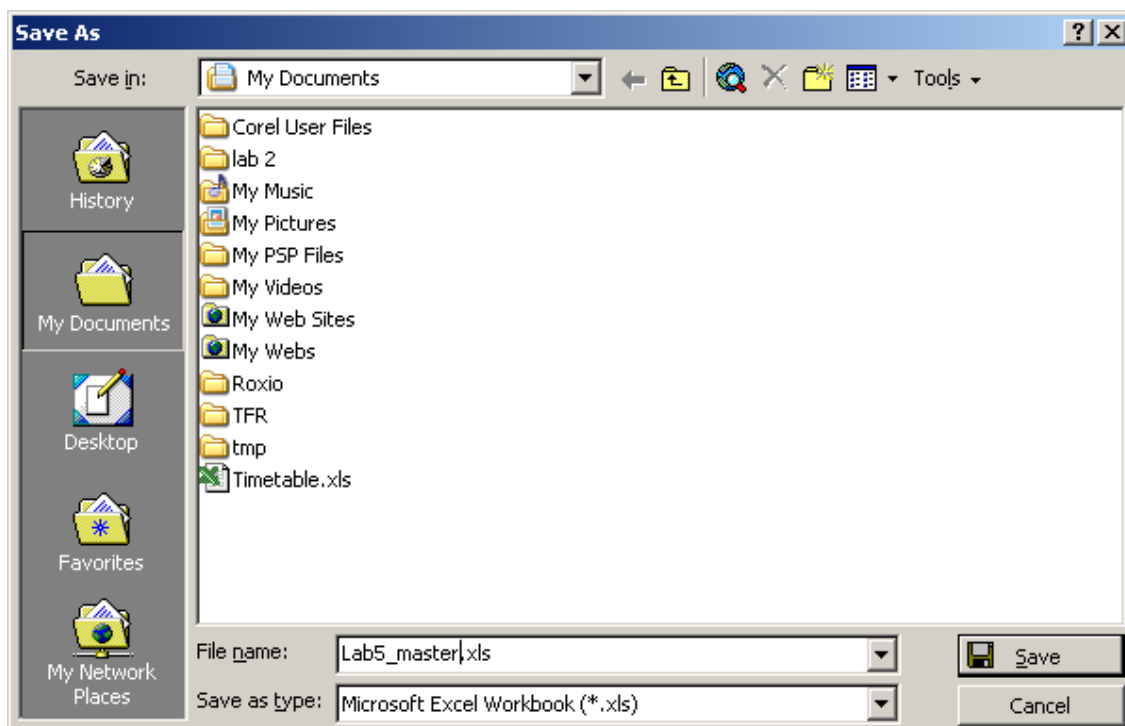
This will open the Excel program, which will look something like this:

You are now ready to start doing data analysis in excel.



Step 2 – Enter the Field Data and Creating a Master document

Click your left mouse button on the word **File** and then select the “**Save As**” button. This will open the **Save As** **dialogue box**. Left click your mouse when the cursor is over the File name box and type on the keyboard the name: Lab5_master.xls



You have not created your master document.

Using what you learned in Lab 2 to create a table in Excel based on the field sheet. Your final table should look like this:

You will notice that your titles do not all fit in a box.

To make your columns bigger we can use the auto-thickness feature of Excel.

Move your mouse pointer until it is exactly between the column headings C and D:

A cross will appear. Double left click when you see the cross to make the C column auto-adjust its thickness.

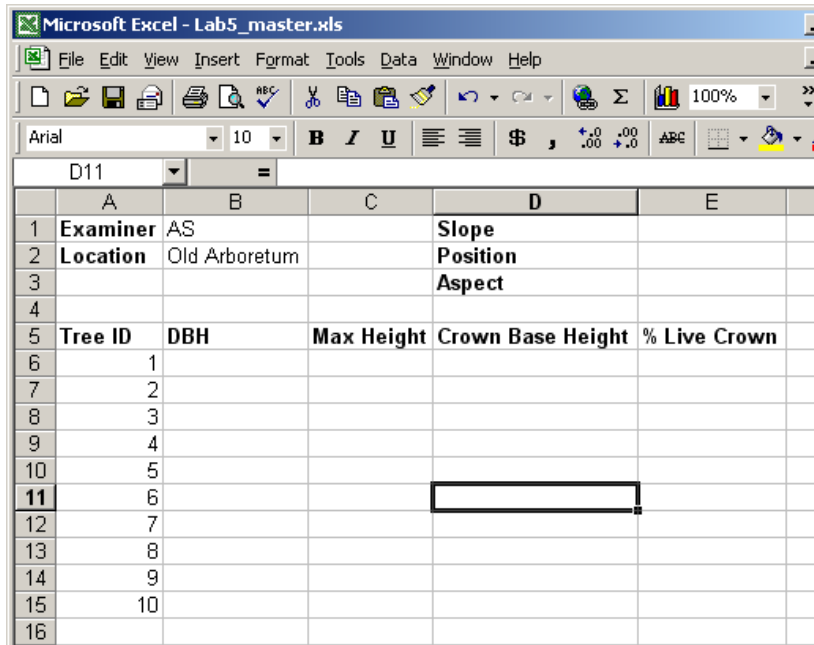
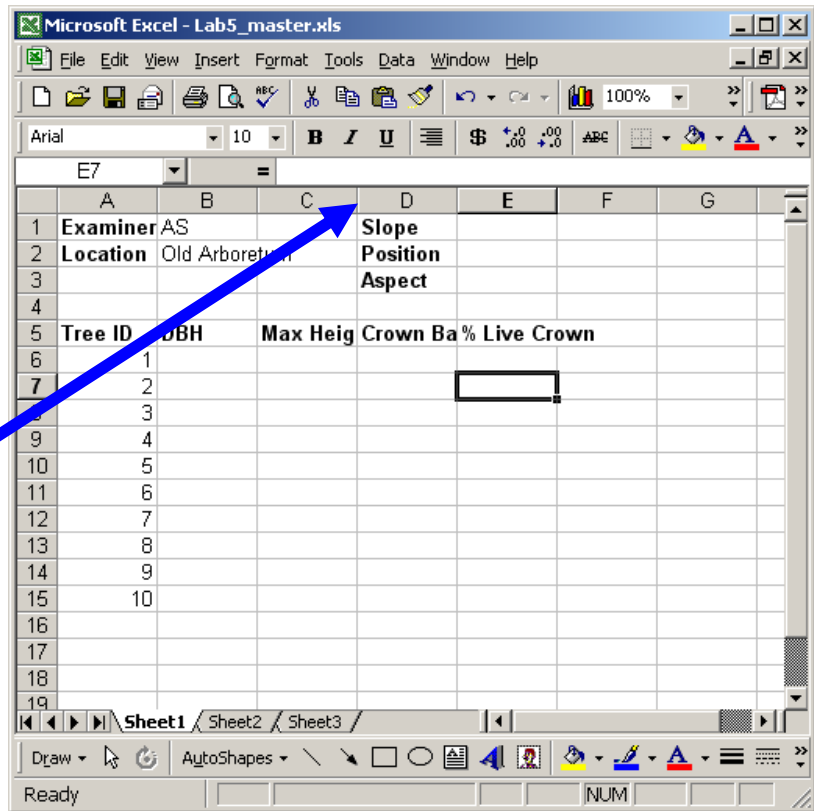
Repeat this process for all the other columns to produce your master table:

Next fill in your table with all your field measurements. Be careful to make sure you accurately type in the correct numbers.

Step 3 – Data Analysis

Repeat the [Save As](#) procedure but this time naming your file as [Lab5_analysis.xls](#)

This is a **GOOD measurement practice**. Once you have entered your figures from your field sheets and double-checked your numbers, you will create a new file BEFORE doing any analysis.



In this way, you can always re-visit your master document to look at and check your original data.

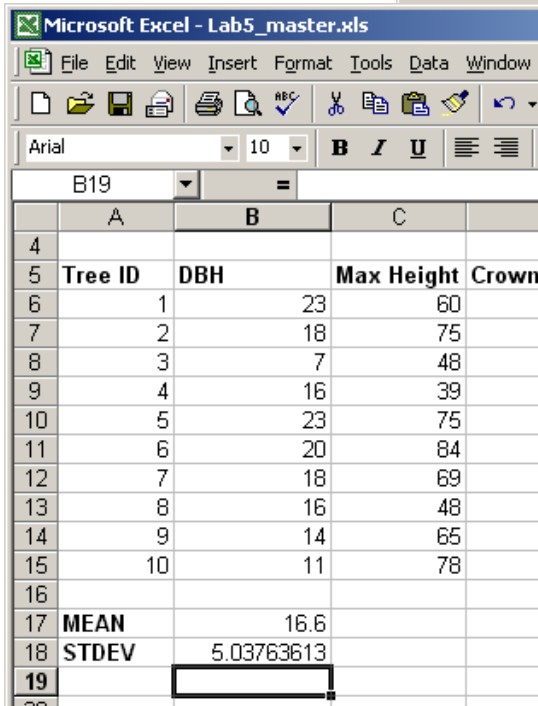
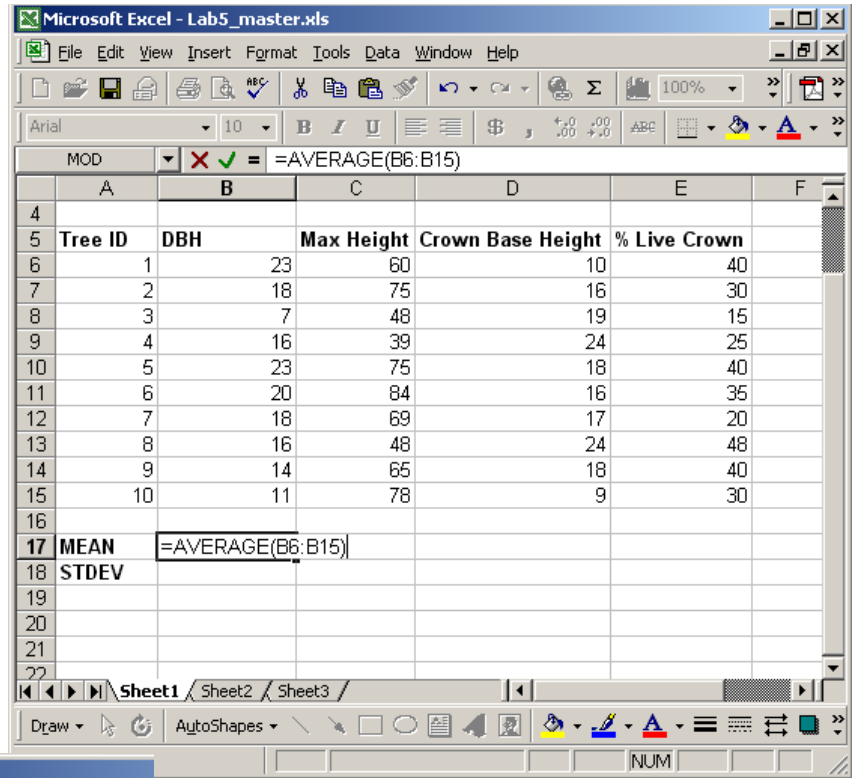
Next, add into the table Two new titles in Cells A17 and A18 called **MEAN** and **STDEV** respectively. As we did in Lab 2, we will calculate the mean and now also the standard deviation of your 4 sets of measurements (Example in figure below – numbers will be different).

To do this type in Cell B17:
`=AVERAGE(B6:B15)` and press **Enter**.

Clearly, if we had lots of measurements typing the formula in this way could take a long time.

We will now use another feature of excel to speed this up.

In Cell B18 type:
`=STDEV(`
 then move your mouse cursor over to B6 and left mouse click. This will cause B6 to appear in the equation.



Keep holding down on the left mouse button and slowly move the cursor down the column to B15.

You will notice that the equation is being filled out for you and that it will say `=STDEV(B6:B15)`

Once at B15, let go of your left mouse button and move your cursor to the upper equation bar and click your left mouse button to the right of the B15.

Once selected type in a `)` and press enter:

You have now successfully calculated the mean and standard deviation of your DBH measurements.

Rather than typing all the equations out again for each of the other 3 measurements, we will not use an auto-fill feature widely used in Excel.

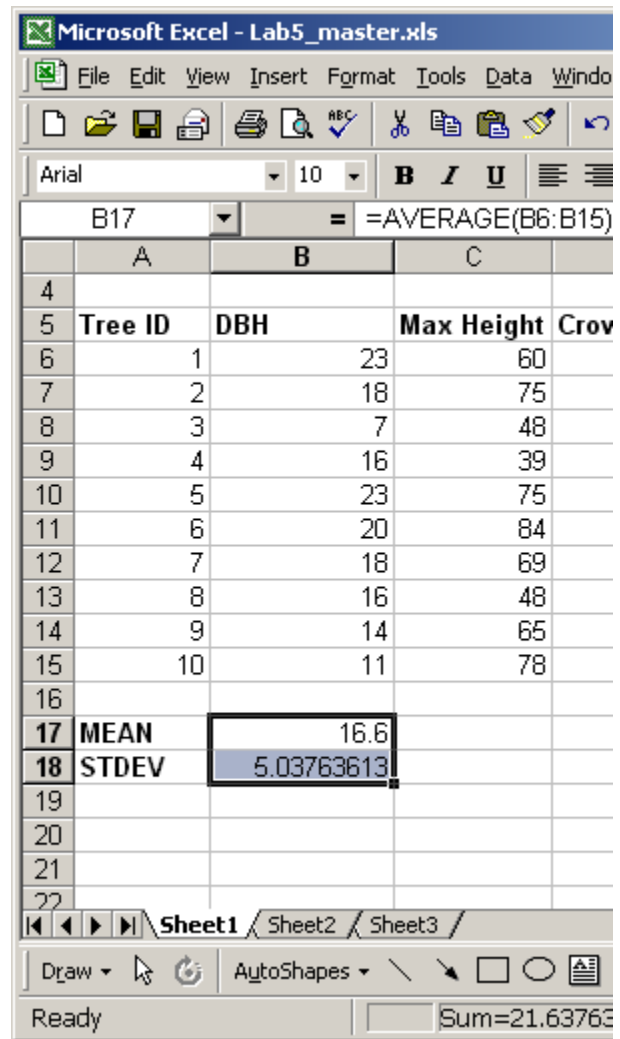
Holding down on your left mouse button, select the two cells were we just calculated the mean and standard deviation of our DBH measures:

Let go of the left mouse button and move the mouse cursor to the bottom right hand corner of the highlighted cells until a small black cross appears.

Click the left mouse button and while holding down on the left mouse button slowly drag your mouse cursor to the right. This will highlight a series of cell pairs. First C17 and C18, then D17 and D18, then E17 and E18.

Once all these are highlighted, let go of the mouse button and you will see that your equations have been copied to all these new cells.

Importantly, when you do this Excel adjusts the equations such that the formulas refers to the cells in the correct columns.



	A	B	C	D	E	F
4						
5	Tree ID	DBH	Max Height	Crown Base Height	% Live Crown	
6	1	23	60	10	40	
7	2	18	75	16	30	
8	3	7	48	19	15	
9	4	16	39	24	25	
10	5	23	75	18	40	
11	6	20	84	16	35	
12	7	18	69	17	20	
13	8	16	48	24	48	
14	9	14	65	18	40	
15	10	11	78	9	30	
16						
17	MEAN	16.6	64.1	17.1	32.3	
18	STDEV	5.03763613	14.9699699	4.931756505	10.25291287	
19						

Step 4 – Relating two measurements

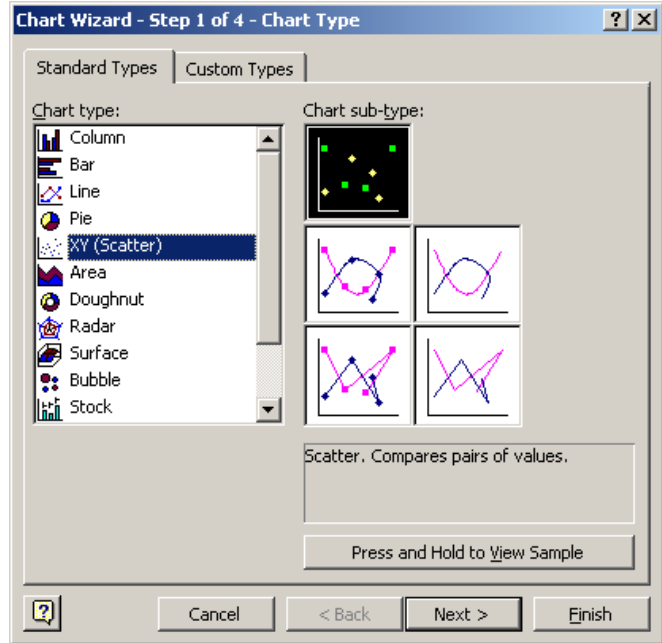
Next, click your left mouse button on B6 and by holding down and dragging your mouse over to column C and row 15 highlight all the DBH and maximum height measurements.

Next, let go of your mouse and move the cursor to the Chart Wizard icon and click your left mouse button on it:

When the Wizard appears, select XY (scatter) and then press Finish.

Question 2:

Describe the relationship (if there is one) that the measure of DBH with maximum tree height produced? Explain whether this is what you expected?



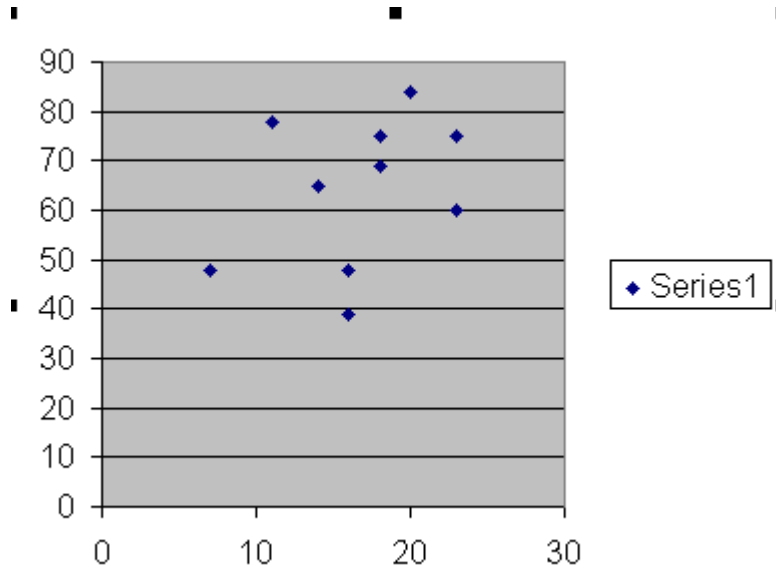
Step 5 – Adding Graph Information and Error Bars

Before presenting graphs in reports we have to make them look nice and make sure the present our data in open and meaningful ways.

Right click your left mouse button anywhere on the graph and select [Chart Options](#).

Under Value (X) axis type:
[DBH \(inches\)](#)
Under Value (Y) axis type:
[Max Height \(Feet\)](#)

As you will see the graph automatically updates its appearance.



Press [OK](#)

Next, click the [right](#) mouse button on one of the points and select [Format Data Series](#).

Select the tab [X Error Bars](#). Then Select the [Both icon](#) and under [Fixed Value](#) type your field measurement error for your DBH measure.

Repeat this for the [Y Error Bars](#) tab but with using the field measurement error for your maximum tree height measure. Press [OK](#).

Finally, click your right mouse button on the Series 1 box and press [Clear](#).

This will produce a report/memo ready graph.

