**Linear Regression Assignment**

**Purpose:**

1. Learn statistics for linear regression, including definitions and use of confidence intervals and confidence bands.
2. Learn software to plot confidence intervals and confidence bands.

**Assignment:**

1. Fit the practice data (one with a linear fit and one with a quadratic fit) and get (a) the confidence intervals for the coefficients, (b) the confidence intervals for the line, and (c) the prediction bands for the data. Igor is a simple way to do this.
2. Use the regression package in the Analysis Toolpak in Excel to fit a line to the first set of data and get the confidence intervals on the slope and intercept.

**Steps:**

1. Open the Igor program
2. Open the Excel data file and copy the two data columns including the headers (CTRL C)
3. In Igor, paste the data into the first two columns in the table (CTRL V)
4. Now plot the data in Igor
   1. Under “Windows”, select “New Graph”
   2. Select which array will be the x-axis and which will be the y-axis. Note that the y-axis selection is on the left, which seems backwards. Click “Do It”. A plot should appear.
   3. You can tidy up the axes by clicking on them and selecting appropriate actions.
5. Now fit the data with a linear regression
   1. Under “Analysis, click “Curve Fitting”
   2. The default should be a “line”. Select the array name that you want to be the “x” variable and then the array name to be the “y” variable. Don’t select “Do It” yet.
   3. Select the tab labeled “output options”, and select the checkbox for “Error Analysis”
   4. Click the checkboxes for (1) “Confidence Intervals for Fit Coefficients”, (2) “Confidence Bands”, and (3) “Prediction Bands”. Also, select which confidence interval you would like (95%, 90%, etc.). Click “Do It”. The linear regression line will appear along with lines for the confidence interval and prediction bands will appear. The confidence interval on the slope and intercept will also appear. You can click on them to make them the right color, etc.
6. Now fit the second set of data (heat capacity versus temperature) with a cubic equation and show the confidence intervals on the coefficients and plot the confidence intervals and prediction bands for the cubic curve fit.

**Turn in the following:**

* Igor plots of both sets of data with curve fits, coefficients, confidence intervals on coefficients, and plotted confidence intervals and prediction bands for the curves. You can past both plots into a powerpoint slide.
* Excel plots showing similar curve fits with values of the coefficients and r2 values, and the table with the confidence intervals on the coefficients.
* Your name

**Hints:**

To get a legend:

* Click on graph,
* Under “Graph” menu, click “Add Annotation”
* At the top of the window, change “Text Box” to “Legend”
* You can edit the legend in the top box, and the changes show up in the bottom box
* Click “Do It” to finish

To get superscripts or subscripts:

* Click on the axis label or legend
* Place cursor where you want to start the super or subscript
* Under the “Special” menu, click the super or subscript button
* To return the next variable to normal size, under the “Special” menu click “Normal”

To get symbols, change the font to symbol

To get special characters:

* Click on the axis label or legend
* Click on “Special” then “Characters”

The default in Igor is to have an axis standoff distance. This means that the tick mark for x=0 is not where the vertical axis lies. Click on the axis, and under the “axis” tab, unclick the “axis standoff” box.