Biology 110 – Rules for Scientific Graphing
Penn State New Kensington

The rules described on this sheet should be followed throughout the semester, whenever you are required to construct a graph.

Graphs consist of a horizontal, or X axis and a vertical, or Y axis. Each axis represents the possible values of some variable. Thus, points on a graph show the relationship between 2 variables. A complete graph should include:

- A complete, descriptive title at the top. Your title should be a precise description of what your graph shows. It should not just be the names of the two variables or a vague phrase.

  Examples of Good Titles
  "The Relationship Between Daily Cigarette Consumption and Incidence of Lung Cancer"
  "The Distribution of Ages of Penn State New Kensington Students"

  Examples of Bad Titles
  "Cigarettes and Cancer"
  "Average Ages"

- The independent variable (the variable whose values you 'set' at the start of the experiment) plotted on the X axis. The dependent variable (the variable whose values you 'measure') plotted on the Y axis. A graph explores the effect that the independent variable has on the dependent variable. In other words, the graph illustrates whether the value of the dependent variable depends on the independent in some non-random way.

- Each axis labeled clearly with the variable name and units. Variable names might be 'Weight', 'Height', 'Length' or 'Time' while their corresponding units might be 'pounds', 'inches', 'meters', or 'minutes'.

- A uniform scale on each axis. This means that the units on each of your axes (be they inches, pounds, number of students etc) must be marked off uniformly (as on a ruler). One unit must occupy the same length throughout the length of the axis.

- Clearly plotted data points which are connected in an appropriate way (usually either a 'smooth curve' or a 'best-fit straight line' depending on the nature of the data).

- A 'key' or 'legend', if necessary. Complicated graphs which show several sets of data often require a legend to clearly indicate what each set of data represents. Do not include a legend if it does not add anything useful to your graph.
Hints for Clearer Graphs

You will be creating your graphs using Excel (or a similar program) – see instructions later in this handout. Your final graph should include all the elements described above and should be formatted to fill an entire page, unless otherwise instructed.

To properly determine which variable is dependent and which independent, keep in mind that you are examining the effect of one variable (the independent) on the other variable (the dependent).

Pay attention to the scale that the computer has set up on your axes. What are the minimum and maximum values? Has the scale been set up to spread your data points out rather than ‘squish’ them together in a small part of the graph? Try changing the scale, just to see how that affects your graph.

Use a legend only if it adds clarity. Excel adds a legend by default – delete this if it is not adding useful information to your graph.

Creating a Graph (Chart) with Excel 2007

The following brief instructions should help you get started. If you would like more help on graphing, refer to the link in Angel to an Excel tutorial.

1. Enter the data for the X (independent) variable in a column in an Excel worksheet.
2. Enter the data for the Y (dependent) variable in the column to the right of the column containing the independent variable.
3. Select both columns of data.
4. Click ‘Insert’ on the top toolbar. You will now see a number of different types of charts available along the top toolbar.
5. For most of the data we will generate in Biology 110 lab, a ‘Scatter’ chart will be the most appropriate.
6. Click the arrow under ‘Scatter’ and select an option. You may need to think about whether a smooth curve or a line is most appropriate for your data. You can also choose to just plot the points, with no line or curve (‘trendline’) added at this time.
7. Your chart will be created right inside the Excel worksheet that contains your data.
8. You will now see three sets of ‘Chart Tools’ on the top menu bar – ‘Design’, ‘Layout’, and ‘Format’. Click each and explore the tools each provides.
   a. Add and edit a title, axes labels, legend, trendline (best-fit straight line, smooth curve, etc) and adjust your axes’ scales under ‘Layout’
   b. Make changes to the appearance, size and style of your chart under ‘Design’ and ‘Format’
9. Remember - your finished chart should include all the elements described earlier for scientific graphs.
10. To print your finished chart, click on the outside border of the chart. This selects the entire ‘Chart Area’.
11. Once you have selected the entire chart, you can choose to print the chart (like shortcuts? Try Ctrl-P)
12. You can also choose to copy the entire chart (Ctrl-C) and then paste (Ctrl-V) it into a different program (like Word).

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