

Physics 305
Introduction to Computational Physics
Fall 2009

The graph program

Unfortunately, graphics programs are not as universal as we would like. These notes discuss one simple graphics program, unimaginatively called “**graph**”. While it is not a part of the standard Linux setup, it is universally available (and free) from the GNU software project. In fact, it is written and maintained by Robert Maier in the UA Math department. More importantly for you, it is already installed on faraday.

Before you try out “**graph**”, make a couple of data files to practice on. These should be just two columns of number, where each line is an (x, y) pair. For example, file “**data1**” might look like:

```
0.0  0.123
0.5  0.2245
0.7  0.3145
1.1  0.224
```

Note that the x values don’t have to be evenly spaced.

graph can make several kinds of output. The two that are important to us are X-windows output, which makes plots appear on the screen in front of you, and PostScript output, which you can email as part of your homework assignment. (You can, and should, also view the PostScript on your screen by using the “**gv**” (short for “**ghostview**”) command.

Now try it out. Suppose “**data1**” is the name of one our your practice data files. Type `graph -T X data1`
WATCH OUT. Upper and lower case matters. Spacing and punctuation matter. “-T” and “X” must be upper case, and there must be a space between them. This should produce a graph of your data file on your screen. Here the “-T X” means “output type is X-windows”. When you are tired of admiring the graph, type “q” into the graph window to make it go away.

To store your result in a file, use `graph -T ps data1 > somefile.ps`
This will create a file called “somefile.ps” (“.ps” is the conventional name extension for PostScript files.) You can check this file by `gv somefile.ps`
and you can attach it as part of a homework submission.

Now, here are a few examples of more complicated things you can do. Some of these are almost always needed, like putting labels on the x and y axes. These are all “options” to the graph command, and you can string as many of them together as you like. Here is a table of a few simple ones:

Option	purpose
-T X	plot on X windows
-T ps	make PostScript output
-X "time (minutes)"	label the x axis “time (minutes)”
-Y "temperature (C)"	label the y axis “temperature (C)”
-x 0 20	x axis runs from 0 to 20
-y 10 15	y axis runs from 10 to 15
-L "HW 01 problem 2"	put a label at the top
-l x	use log scale on x axis
-l y	use log scale on y axis
-C	use colors
-m 0	use line style zero, which is no connection
-m 1	use line style one (or another small integer)
-S 4	plots points with symbol number 4 (a circle), (or another small integer)
-I e	subsequent data file is data with errors (three columns)
-help	“graph --help” reminds you of the options (tersely)

Some examples may make this clearer.

```
graph -T ps -X "time(sec)" -Y "height (cm)" -x 0 10 -y -5 5 datafile1
```

puts labels on the x and y axes, and chooses the range. (You don’t have to choose the range; if you don’t the program will try to do something sensible.)

Use the color and line style options together to plot several files:

```
graph -T X -C -m 1 datafile1 -m 2 datafile2 -m e datafile3
```

Plots three data lines, one from each file, in different colors. If you leave out the -C, you get solid, dotted, etc. lines instead of colors.

Make a log-log plot of error versus integration bin size, for example.

```
graph -T X -X "bin size" -Y "error" -l x -l y err_vs_bin_file
```

Make a plot of your fitted function versus data with error bars. (This may be useful in the least squares fitting assignment)

```
graph -T X fitfile -I e -m 0 -S 4 datafile
```

Here “fitfile” is a two column file of (x, y) pairs, and “datafile” is a three column file with columns x , y and *error on y*.

There is a full manual for **graph** available online at <http://www.gnu.org/software/plotutils/>

You may want to do this while logged in to faraday from your home computer. To do this, you will need to have an X-server installed. **Xming**, which we use in PAS 272, is free. I've never installed it, so I don't know how hard it might be.