

What is gnuplot?

gnuplot is a command-driven interactive function plotting program. It can be used to plot functions and data points in both two- and three-dimensional plots in many different formats. It is designed primarily for the visual display of scientific data. gnuplot is copyrighted, but freely distributable; you don't have to pay for it.

Prescribed syllabus about gnuplot

Visualization: Introduction to graphical analysis and its limitations. Introduction to Gnuplot. importance of visualization of computational and computational data, basic Gnuplot commands: simple plots, plotting data from a file, saving and exporting, multiple data sets per file, physics with Gnuplot (equations, building functions, user defined variables and functions), Understanding data with Gnuplot

Hands on exercises:

How did it come about and why is it called gnuplot?

The authors of gnuplot are: Thomas Williams, Colin Kelley, Russell Lang, Dave Kotz, John Campbell, Gershon Elber, Alexander Woo and many others. The following quote comes from Thomas Williams: I was taking a differential equation class and Colin was taking Electromagnetics, we both thought it'd be helpful to visualize the mathematics behind them. We were both working as sys admin for an EE VLSI lab, so we had the graphics terminals and the time to do some coding. The posting was better received than we expected, and prompted us to add some, albeit lame, support for file data. Any reference to GNUplot is incorrect. The real name of the program is "gnuplot". You see people use "Gnuplot" quite a bit because many of us have an aversion to starting a sentence with a lower case letter, even in the case of proper nouns and titles. gnuplot is not related to the GNU project or the FSF in any but the most peripheral sense. Our software was designed completely independently and the name "gnuplot" was actually a compromise. I wanted to call it "llamaplot" and Colin wanted to call it "nplot." We agreed that "newplot" was acceptable but, we then discovered that there was an absolutely ghastly pascal program of that name that the Computer Science Dept. occasionally used. I decided that "gnuplot" would make a nice pun and after a fashion Colin agreed.

GNU PLOT

Gnuplot is a command-driven interactive function and data plotting program. If files are given, gnuplot loads each file with the load command, in the order specified. Gnuplot exits after the last file is processed.

Features of GNU PLOT

- 1) **Plots any number of functions, built up of C operators, C library functions, and some things C doesn't have like **, sgn(), etc. Also**
- 2) **support for plotting data files, to compare actual data to theoretical curves.**
- 3) **User-defined X and Y ranges (optional auto-ranging), smart axes scaling, smart tic marks.**
- 4) **Labelling of X and Y axes.**
- 5) **User-defined constants and functions.**
- 6) **Support for many output devices and file formats**
- 7) **Shell escapes and command line substitution.**
- 8) **Load and save capability.**
- 9) **Output redirection.**
- 10) **All computations performed in the complex domain. Just the real part is plotted by default, but functions like imag() and abs() and arg() are available to override this.**

- The art of discovering relationships in data & extracting information from it by visual means
- Gnuplot: the state-of-the-art tool for graphical analysis
- Graphs quality: Polished (publications) or simple (exploratory)
- Requires limited resources
- Highly scalable - Supports millions of data points
- However, gnuplot is neither a statistical program nor a drawing tool!

- **Starting and exiting gnuplot:**
 - >gnuplot**
 - >exit**
- **Choosing the terminal:**
 - >set terminal wxt enhanced**
- **Issue commands:**
 - 1. Directly at the command line or**
 - 2. Load a gnuplot script at the command line:**
 - >load "script.gp"**
- **Gnuplot scripts development:**
 - 1. Write at a text file and issue:**
 - >load "script.gp"**
 - 2. Write at the command line and issue:**
 - >save "script.gp"**
- **Accessing and plotting data:**
 - >plot "data.txt"**
- **Resetting all options to system defaults:**
 - >reset**
- **Clears the current output device:**
 - >clear**

- **Selecting columns:**
 - >plot "data.txt" using 1**
 - >plot "data.txt" using 1:3**
 - >plot "data.txt" using 1, "data.txt" using 3, ...**
 - **You can add comments directly in your data with '#'**
 - Gnuplot ignores these lines**
 - **You can choose the field separator:**
 - >set datafile separator ","**
 - **Mulptiple data blocks in one file:**
 - Seperation with two blank lines**
 - Accessing specific blocks:**
- >plot "data.txt" index 0:1 using 1**

Controlling the Appearance

Test plot styles: dots, points, lines, linespoints, impulses

>plot sin(x) with style

>set title "My cool plot"

>set style line 1 lt 2 lw 2 pt 3 ps 0.5

>set xlabel "My X axis"

>set ylabel "My Y axis"

>set xtics 1,20,100

>set xrange [1:100]

>set yrange [1:100]

>set key top right

>set size square

>replot

Operators, Constants & Functions

Performing on-the-fly operations on the data:

```
>plot "data.txt" using (sqrt($1))
```

```
>plot "data.txt" using (sqrt($1/100))
```

Plotting functions and defining variables:

```
>plot sin(x)
```

```
>set xrange [0:250]
```

```
>plot sin(x)*(x**2)
```

```
>a=10
```

```
>show variables
```

```
>plot sin(a*x)*(x**2)
```


Demos

Demos in gnuplot homepage:

http://gnuplot.sourceforge.net/demo_cv/

- **Simple plots:** http://gnuplot.sourceforge.net/demo_cv/simple.html
- **Error bars:** http://gnuplot.sourceforge.net/demo_cv/mgr.html
- **Histograms:** http://gnuplot.sourceforge.net/demo_cv/histograms.html
- **Multi-axis:** http://gnuplot.sourceforge.net/demo_cv/multiaxis.html
- **3-D palette-mapped:** http://gnuplot.sourceforge.net/demo_cv/pm3d.html
- **Cool "bars":** http://gnuplot.sourceforge.net/demo_cv/barchart_art.html
- **Gantt charts:** http://gnuplot.sourceforge.net/demo_cv/gantt.html
- **Heat maps:** http://gnuplot.sourceforge.net/demo_cv/heatmaps.html

Gnuplot and Latex I

You can output plots in LATEX in at least four different ways:

- Output EPS files and use in a LATEX document

```
>set terminal postscript eps enhanced
```

```
>set output "output.eps"
```

```
>replot
```

- Output PDF files and use in a LATEX document

```
>set terminal pdfcairo enhanced
```

```
>set output "output.pdf"
```

```
>replot
```

- Use of the epslatex terminal and the `\input{output.tex}`

LATEX command:

```
>set ylabel '$\sigma$'
```

```
>set terminal epslatex
```

```
>set output "output.tex"
```

```
>replot
```

- Use of the gnuplottex package

```
\usepackage{gnuplottex}
```

```
...
```

```
\begin{figure}[htbp]
```

```
\centering
```

```
\begin{gnuplot}[terminal=pdf]
```

```
load "myscript.gp"
```

```
\end{gnuplot}
```

```
\end{figure}
```

Interactive Terminals

- **wxt**
 - **In wxWidgets. Uses Cairo & Pango libs for graphics & text**
 - **Cross-platform**
 - **High-quality graphics (anti-aliasing)**
 - **Interactive menus**
 - **Exports to PDF and PNG**
- **x11 Unix terminal**
- **Aqua MacOS terminal**
- **windows Microsoft Windows terminal**
- **Many other, e.g. check dumb terminal :)**

Things to Remember

- **Plot size vs canvas size**
- **Terminals handle the fonts, not gnuplot! e.g.:**
 - >set terminal wxt font 'Verdana, 20'**
- **Enhanced option:**
 - >set terminal wxt enhanced**
 - **Provides more appearance options**
 - **E.g. use of Greek letters, subscripts and superscripts**
 - **http://gnuplot.sourceforge.net/demo_cvs/enhanced_utf8.html**

Output and Terminals

Gnuplot supports more than 70 terminals!

>set terminal

Terminals are classified into 3 categories based on their output:

- 1. Standard graphics file format, e.g. GIF, JPG, PNG, SVG**
- 2. Output for print, e.g. PostScript and PDF**
- 3. Terminals for interactive use**

knoppix@Microknoppix:~\$ gnuplot

GNUPLOT

Version 4.2 patchlevel 6
last modified Sep 2009
System: Linux 2.6.32.6

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Thomas Williams, Colin Kelley and many others

Type `help` to access the on-line reference manual.
The gnuplot FAQ is available from <http://www.gnuplot.info/faq/>

Send bug reports and suggestions to
<<http://sourceforge.net/projects/gnuplot>>

Terminal type set to 'wxt'

```
gnuplot> set contour  
gnuplot> set hidden3d  
gnuplot> plot x*x*exp(-x*x)*y*y*exp(-y*y)  
output shown in fig1
```

```
gnuplot> set isosamples 60,60  
gnuplot> set ticslevel 0  
gnuplot> replot  
Output shown in fig2
```

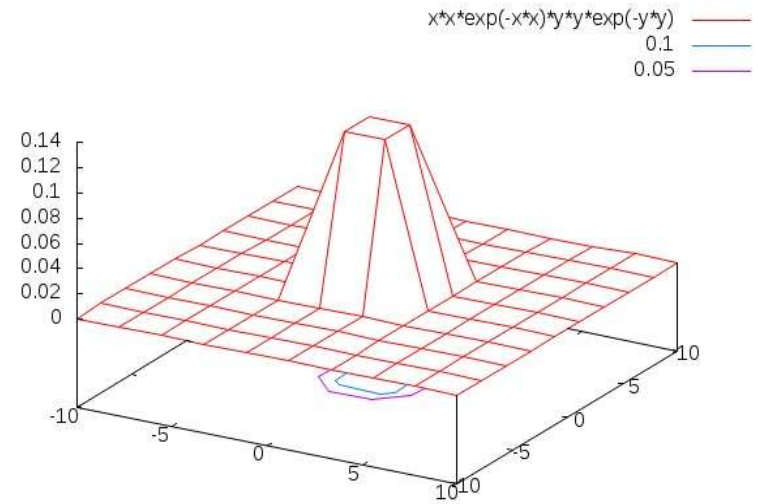


fig1

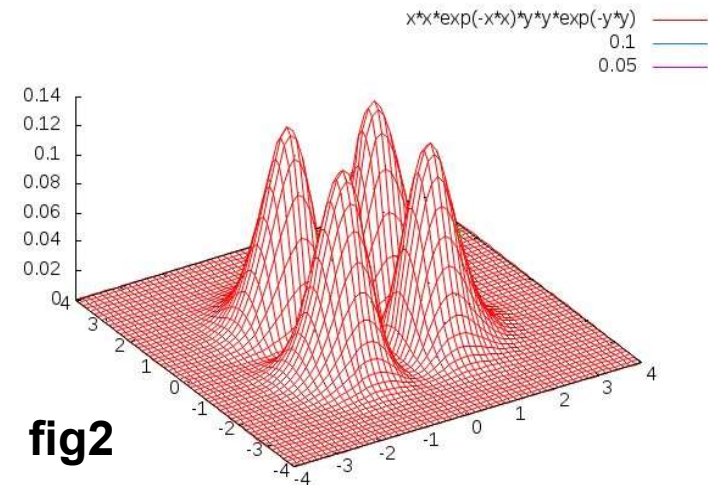
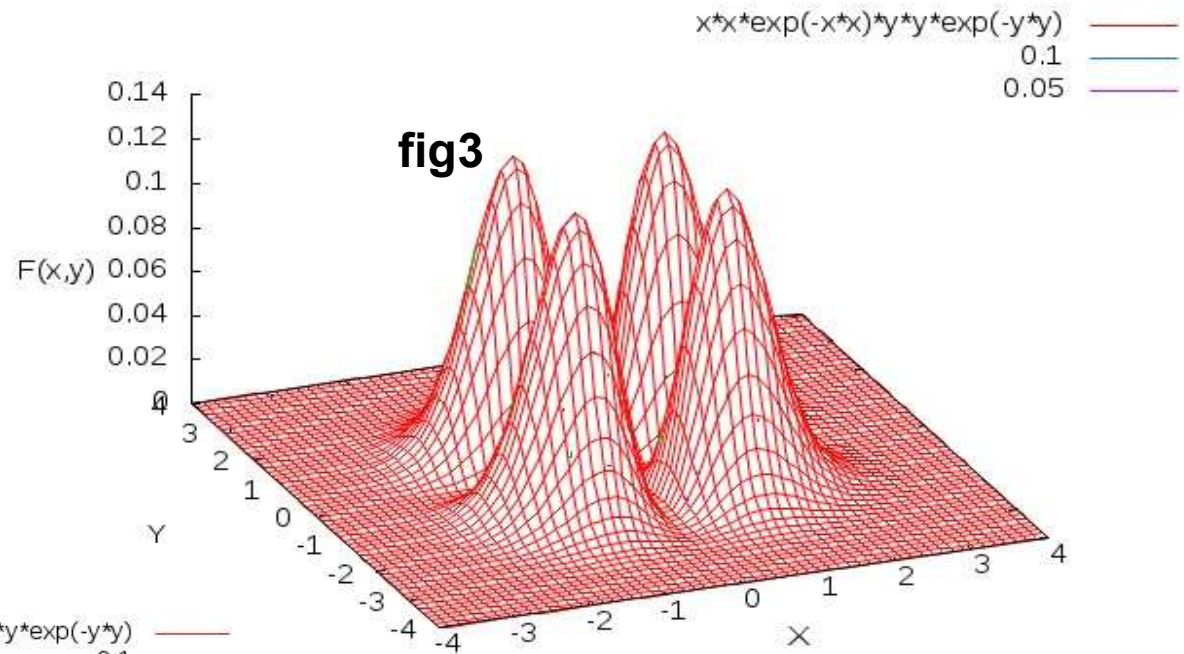
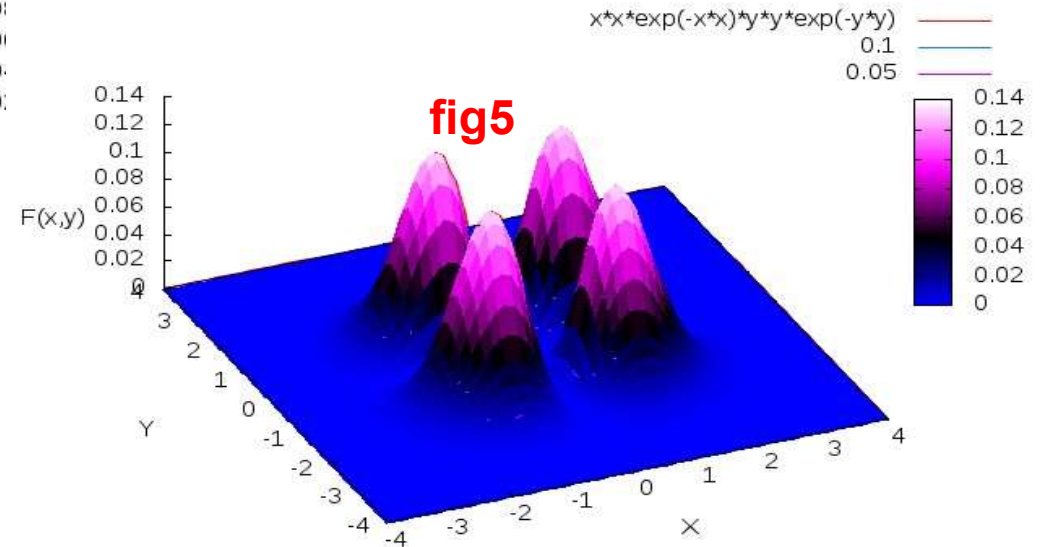
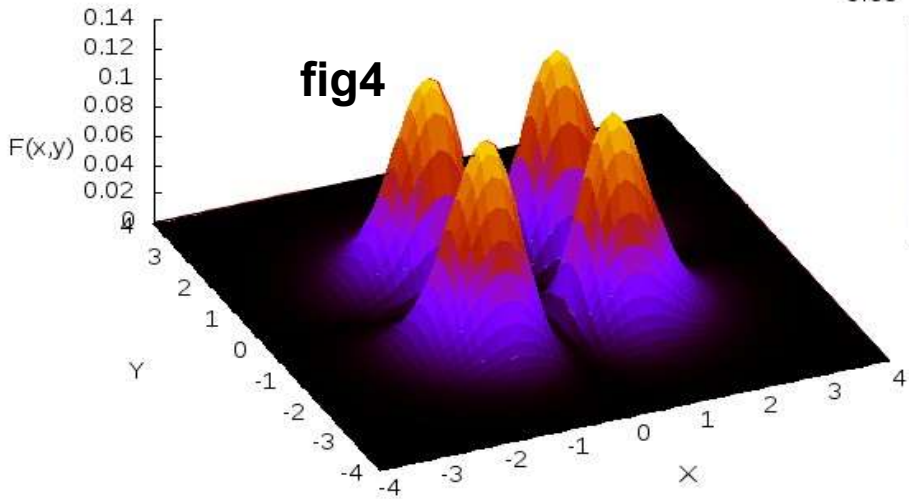
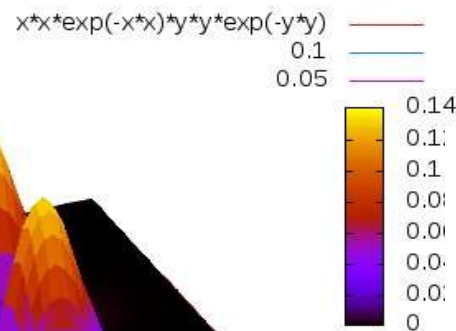


fig2

```
gnuplot> set xlabel "X"
gnuplot> set ylabel "Y"
gnuplot> set zlabel " F(x,y)"
gnuplot> replot
Output is shown in fig3
```



```
gnuplot> set pm3d
gnuplot> replot
Output is shown in fig4
```



```
gnuplot> set palette model RGB rgbformulae
22,23,24
gnuplot> replot
Output is shown in fig5
```

```
gnuplot> show palette rgbformulae
```