Imagine

Imagine

```
Imagine
  A pandoc filter that turns fenced codeblocks into graphics or ascii art by
  wrapping some external command line utilities, such as:

    actdiag, asy, asymptote, blockdiag, boxes, circo, ctioga2, ditaa, dot,
    fdp, figlet, flydraw, gle, gnuplot, graph, graphviz, gri, imagine,
    mermaid, mscgen, neato, nwdiag, octave, packetdiag, pic, pic2plot,
    plantuml, plot, ploticus, protocol, pyxplot, rackdiag, seqdiag, sfdp,
    shebang, twopi

Installation

  1. Put `imagine.py` anywhere along $PATH (pandoc's search path for filters).
  2. % sudo pip install (mandatory):
       - pandocfilters
  3. % sudo apt-get install (1 or more of):

       - asymptote,     http://asymptote.sourceforge.net
       - boxes,         http://boxes.thomasjensen.com
       - ctioga2,       http://ctioga2.sourceforge.net
       - ditaa,         http://ditaa.sourceforge.net
       - figlet,        http://www.figlet.org
       - flydraw,       http://manpages.ubuntu.com/manpages/precise/man1/flydraw.1.html
       - gle-graphics,  http://glx.sourceforge.net
       - gnuplot,       http://www.gnuplot.info
       - graphviz,      http://graphviz.org
       - gri,           http://gri.sourceforge.net
       - imagemagick,   http://www.imagemagick.org (gri needs `convert`)
       - mscgen,        http://www.mcternan.me.uk/mscgen
       - octave,        https://www.gnu.org/software/octave
       - plantuml,      http://plantuml.com
       - ploticus,      http://ploticus.sourceforge.net/doc/welcome.html
       - plotutils,     https://www.gnu.org/software/plotutils
```

~~~
       - pyxplot,       http://pyxplot.org.uk

     % sudo pip install:
       - blockdiag,     http://blockdiag.com
       - phantomjs,     http://phantomjs.org/ (for mermaid)

     % git clone
       - protocol,      https://github.com/luismartingarcia/protocol.git

     % npm install:
       - -g mermaid, https://knsv.github.io/mermaid (and pip install phantomjs)


Pandoc usage

    % pandoc --filter imagine.py document.md -o document.pdf


Markdown usage

               or                                  or
  ```cmd       |   ```{.cmd options="extras"}     |   ```{prog=cmd}
  source       |   source                          |   source
  ```          |   ```                             |   ```
  simple           with `options`                      with `prog`

  Imagine understands/consumes these fenced codeblock key,val-attributes:
  - `options` used to feed extra arguments to the external command
  - `prog`    used when cmd is not an appropiate document class
  - `keep`    if True, keeps (a reconstructued copy of) the original CodeBlock

  Notes:
  - if `cmd` is not found, the codeblock is kept as-is.
  - input/output filenames are generated from a hash of the fenced codeblock.
  - subdir `pd-images` is used to store any input/output files
  - if an output filename exists, it is not regenerated but simply linked to.
  - `packetdiag` & `sfdp`s underlying libraries seem to have some problems.
  - when creating a pdf, images are placed `nearest` to their fenced code block


How Imagine works

  The general format for an external command looks something like:

     % cmd <options> <inputfile> <outputfile>
~~~

Input/Output filenames are generated using `pandocfilters.get_filename4code` supplying both the codeblock and its attributes as a string for hashing. If the input file doesn't exist it is generated by writing the code in the fenced codeblock. The output filename is the same, but with a different extension. If the output file does not exist, the command is run, otherwise it is taken as the intended image and simply linked to.

Imagine does no clean up so, after a while, you might want to clear the `pd-images` subdirectory.

Some commands like `figlet` or `boxes` produce output on stdout. This text is captured and used to replace the code in the fenced code block.

Some commands like `plot` interpret the code in the fenced code block as an input filename to convert to some other output format.

If a command fails for some reason, the fenced codeblock is kept as is. In that case, the output produced by Imagine on stderr hopefully provides some usefull info.

Shebang

The Imagine filter also features a `shebang` class for fenced code blocks. In this case, (fenced) code is saved to disk, the executable flag is set and the script is run with the target image filename as its sole argument.

That means that you can use any interpreter and its plotting libraries to create your images and/or plots.

Security

Imagine just hands the fenced code blocks to system commands or simply runs them as system scripts themselves (shebang class). Note that a lot of these plotting tools, implement their own 'little' language which can create beautiful images but can also do *great* harm.

There is no way to check for 'side effects' in advance, so make sure you know what the fenced code blocks will do before running them through this filter.

Imagine command

Finally, a quick way to read this help text again, is to include a fenced codeblock in your markdown document as follows:

~~~
    ```imagine
    ```

  That's it, enjoy!
~~~

Noop's

Only codeblocks with one of Imagine's classes will be recognized and processed.

Anonymous CodeBlock

Anonymous codeblocks are not processed.

```
This code block is anonymous and not processed by Imagine.
```

A Python CodeBlock

Neither is a python codeblock processed.

```python
if processed_by(Imagine):
    raise Expection('Not ignored by Imagine!')
else:
    print "Great, if you're reading this, it passed through Imagine unharmed"
```

Asymptote

Notes:

- eps formatted images don't go well together with pandoc.

a plot

~~~
```{.asy keep="True" caption="Created by Asymptote"}
settings.outformat="png";
settings.prc=false;
settings.render=0;
import three;
size(6cm,0);
draw(O--2X ^^ O--2Y ^^ O--2Z);
triple circleCenter = (Y+Z)/sqrt(2) + X;
~~~

~~~
path3 mycircle = circle(c=circleCenter, r=1, normal=Y+Z);
draw(plane(O=sqrt(2)*Z, 2X, 2*unit(Y-Z)), gray + 0.1cyan);
draw(mycircle, blue);
draw(shift(circleCenter) * (O -- Y+Z), green, arrow=Arrow3());
```
~~~

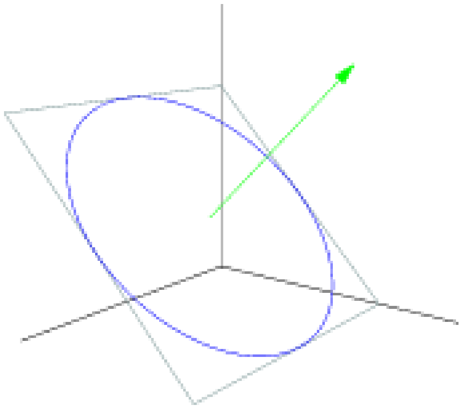


Figure 1: Created by Asymptote

a sphere

~~~
```{.asy keep="True" caption="Created by Asymptote"}
settings.outformat="png";
settings.prc=false;
settings.render=0;
import graph3;
size(8cm,0);
path3 myarc = rotate(18,Z) * Arc(c=O, normal=X, v1=-Z, v2=Z, n=10);
surface backHemisphere = surface(myarc, angle1=0, angle2=180, c=O, axis=Z, n=10);
surface frontHemisphere = surface(myarc, angle1=180, angle2=360, c=O, axis=Z, n=10);
draw(backHemisphere, surfacepen=material(white+opacity(0.8), ambientpen=white), meshpen=gray
draw(O--X, blue+linewidth(1pt));
```
~~~

blockdiag site:

blockdiag command

~~~
```{.blockdiag prog="blockdiag" keep="True" width="100%" caption="Created by Blockdiag"}
blockdiag {
~~~

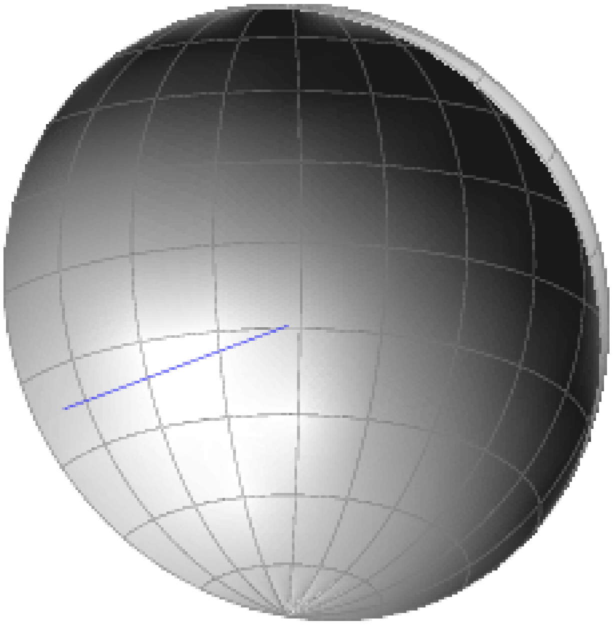


Figure 2: Created by Asymptote

```
// standard node shapes
box [shape = "box"];
roundedbox [shape = "roundedbox"];
diamond [shape = "diamond"];
ellipse [shape = "ellipse"];
note [shape = "note"];
cloud [shape = "cloud"];
mail [shape = "mail"];
beginpoint [shape = "beginpoint"];
endpoint [shape = "endpoint"];
minidiamond [shape = "minidiamond"];
actor [shape = "actor"];
dots [shape = "dots"];
box -> roundedbox -> diamond -> ellipse;
cloud -> note -> mail -> actor;
minidiamond -> beginpoint -> endpoint -> dots;
// node shapes for flowcharts
condition [shape = "flowchart.condition"];
database [shape = "flowchart.database"];
input [shape = "flowchart.input"];
loopin [shape = "flowchart.loopin"];
loopout [shape = "flowchart.loopout"];
terminator [shape = "flowchart.terminator"];
```

~~~
condition -> database -> terminator -> input;
loopin -> loopout;
}
```
~~~

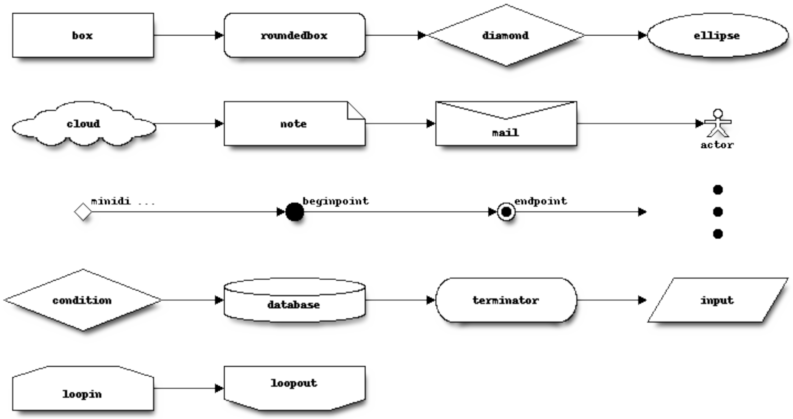


Figure 3: Created by Blockdiag

seqdiag

~~~
```{.seqdiag keep="True" width="80%" height="50%" caption="Created by seqdiag"}
{
browser -> webserver [label = "GET /index.html"];
browser <-- webserver;
browser -> webserver [label = "POST /blog/comment"];
webserver -> database [label = "INSERT comment"];
webserver <- database;
browser <- webserver;
}

```
~~~

nwdiag

~~~
```{.nwdiag keep="True" caption="Created by nwdiag"}
{
  network dmz {
      address = "210.x.x.x/24"
~~~

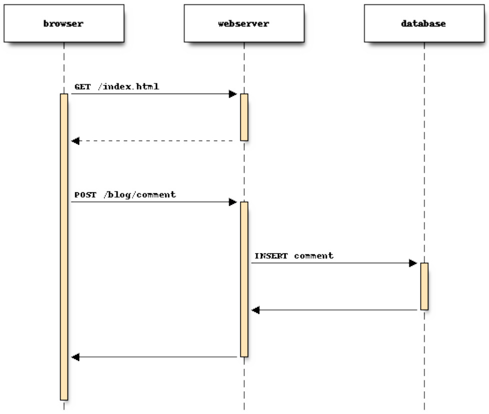
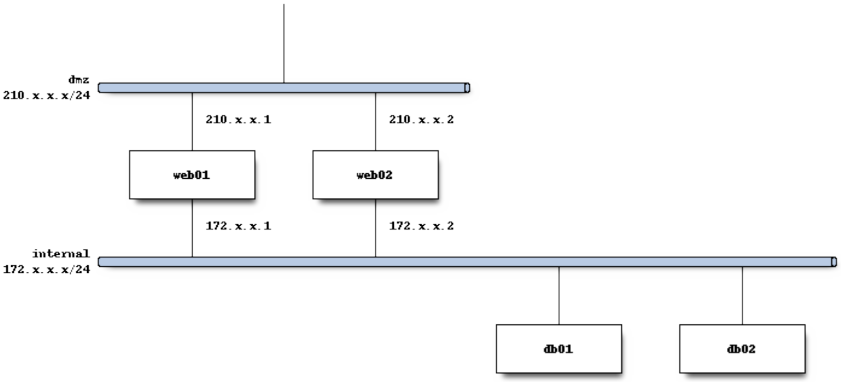
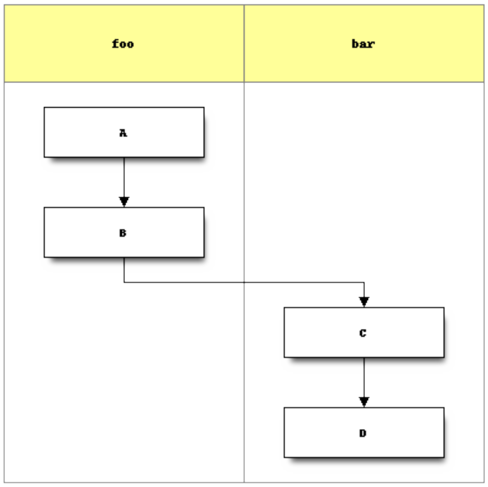
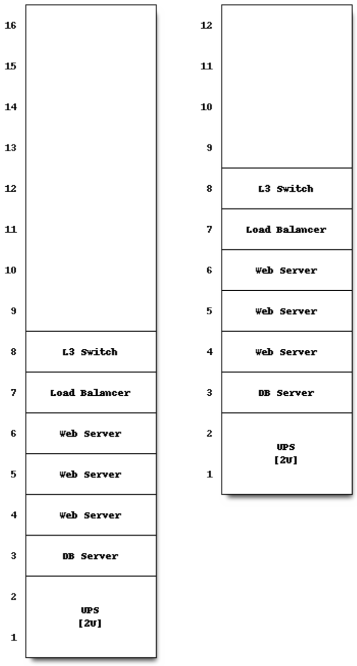
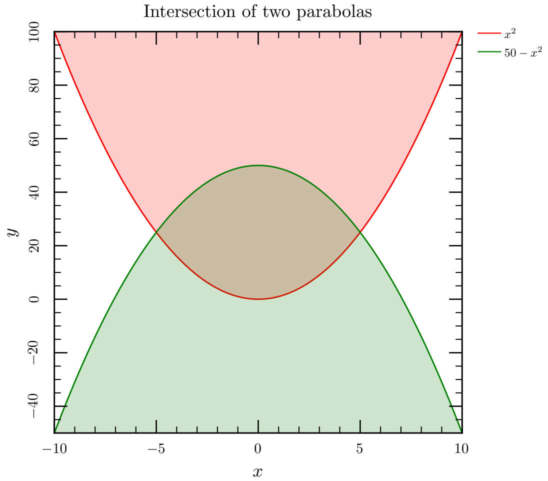
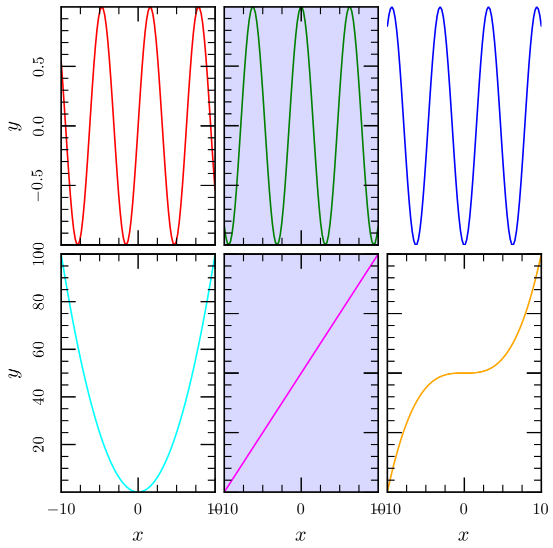
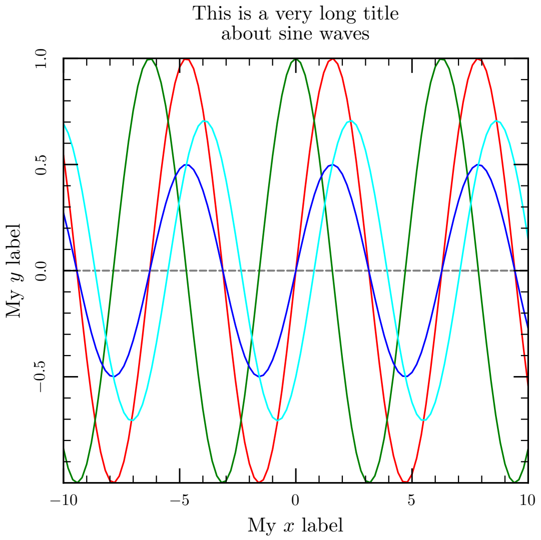
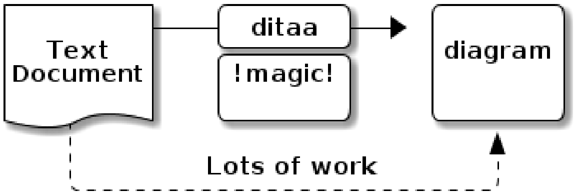
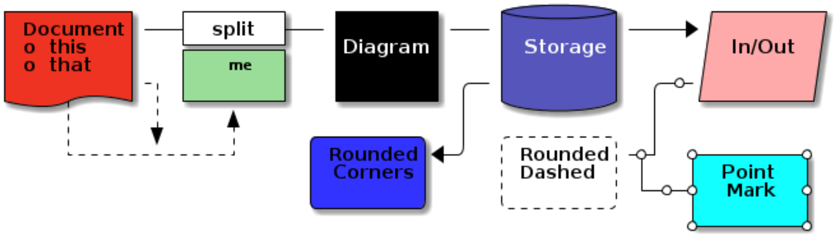
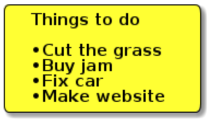


Figure 4: Created by seqdiag

~~~~
      web01 [address = "210.x.x.1"];
      web02 [address = "210.x.x.2"];
  }
  network internal {
      address = "172.x.x.x/24";

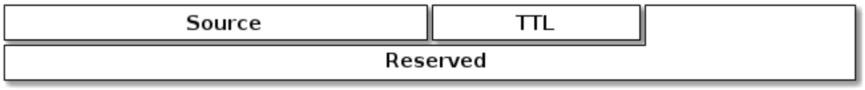
      web01 [address = "172.x.x.1"];
      web02 [address = "172.x.x.2"];
      db01;
      db02;
  }
}
```
~~~~

actdiag

~~~~
```{.actdiag keep="True" height="60%" caption="Created by actdiag"}
{
   A -> B -> C -> D;

  lane foo {
    A; B;
  }
  lane bar {
    C; D;
  }
~~~~



Figure 5: Created by nwdiag

~~~
}
```
~~~

rackdiag

~~~
```{.rackdiag keep="True" height="80%" caption="Created by rackdiag"}
{
  // define 1st rack
  rack {
    16U;

    // define rack items
    1: UPS [2U];
    3: DB Server
    4: Web Server
    5: Web Server
    6: Web Server
    7: Load Balancer
    8: L3 Switch
  }

  // define 2nd rack
  rack {
    12U;
~~~



Figure 6: Created by actdiag

~~~
    // define rack items
    1: UPS [2U];
    3: DB Server
    4: Web Server
    5: Web Server
    6: Web Server
    7: Load Balancer
    8: L3 Switch
  }
}
```
~~~

packetdiag

Unfortunately, packetdiag doesn't work properly due to a problem with some library:

```
Imagine:BlockDiag:  packetdiag -> ERROR: images do not match
```

```
{
  colwidth = 32
  node_height = 72

  0-15: Source Port
```



Figure 7: Created by rackdiag

```
  16-31: Destination Port
  32-63: Sequence Number
  64-95: Acknowledgment Number
  96-99: Data Offset
  100-105: Reserved
  106: URG [rotate = 270]
  107: ACK [rotate = 270]
  108: PSH [rotate = 270]
  109: RST [rotate = 270]
  110: SYN [rotate = 270]
  111: FIN [rotate = 270]
  112-127: Window
  128-143: Checksum
  144-159: Urgent Pointer
  160-191: (Options and Padding)
  192-223: data [colheight = 3]
}
```

boxes

boxes Boxes is a command line program that draws a box around its input text. It can remove and repair those boxes, too.

design ‘peek’

~~~
```{.boxes options="-d peek -a c -s 40x3" keep="true" caption="boxes"}
boxes
```
~~~

```
/*       _\|/_
         (o o)
 +----oOO-{_}-OOo-----------------------+
 |                boxes                 |
 +-------------------------------------*/
```

design ‘ian_jones’

~~~
```{.boxes options="-d ian_jones -a c -s 40x6" keep="True" caption="boxes"}
There are about 52 available styles, and you can create your own if
none of them suit your needs.
```
~~~

```
                                \\\///
```

```
                               / _  _ \
                             (| (.)(.) |)
.--------------------------.OOOo--()--oOOO.-------------------------.
|There are about 52 available styles, and you can create your own if|
|                   none of them suit your needs.                   |
'-------------------------.oooO-------------------------------------'
                           (   )   Oooo.
                            \ (    (   )
                             \_)    ) /
                                   (_/
```

ctioga2

Parabolas, filling & intersection

~~~~
```{.ctioga2 keep="true" caption="Created by ctioga2" width="60%"}
title "Intersection of two parabolas"
math
plot x*x /fill=top /fill-transparency 0.8 /legend '$x^2$'
plot 50-x*x /fill=bottom /fill-transparency 0.8 /legend '$50 - x^2$'
```
~~~~



Figure 8: Created by ctioga2

a grid system

~~~
```{.ctioga2 keep="true" caption="Created by ctioga2" width="60%"}
define-axis-style '.grid-non-left axis.left' /decoration=ticks /axis-label-text=' '
define-axis-style '.grid-non-bottom axis.bottom' /decoration=ticks /axis-label-text=' '
define-background-style '.grid-odd-column background' /background-color Blue!15
define-axis-style '.grid-2-0 axis' /decoration=None

setup-grid 3x2 /top=1mm /right=2mm /dy=2mm /dx=2mm
math


inset grid:next
  plot sin(x)
next-inset grid:next
  plot cos(x)
next-inset grid:next
  plot -cos(x)
next-inset grid:next
  plot x**2
next-inset grid:next
  plot 10*x
next-inset grid:next
  plot 0.1*x**3
end
```
~~~

plotting data

The data file's name `../dta/cr2-ex01.dat` is relative to the saved fenced code block in pd-images. Hence the `../dta` part.

~~~
```{.ctioga2 keep="true" caption="Created by ctioga2" width="60%"}
draw-line -15,0 15,0 /style=Dashes /color=Gray
plot ../dta/ct2-ex01.dat
plot ../dta/ct2-ex01.dat@1:3
title '\centering This is a very long title about sine waves'  \
      /text-width=5cm /shift=1.3
xlabel 'My $x$ label'
ylabel 'My $y$ label'
plot ../dta/ct2-ex01.dat@'$1:$2*0.5'
plot ../dta/ct2-ex01.dat@'$1:0.5*($2-$3)'
```
~~~



Figure 9: Created by ctioga2



Figure 10: Created by ctioga2

ditaa site:

Ditaa with options=“-r”

~~~
```{.ditaa options="-r" keep="True" width="70%" caption="Created by Ditaa"}
+--------+   +-------+    +-------+
|        +---+ ditaa +--> |       |
|  Text  |   +-------+    |diagram|
|Document|   |!magic!|    |       |
|     {d}|   |       |    |       |
+---+----+   +-------+    +-------+
    :                         ^
    |       Lots of work      |
    +-------------------------+
```
~~~



Figure 11: Created by Ditaa

Ditaa normal

~~~
```{.ditaa keep="True" caption="Created by Ditaa"}
   +---------+   +-------+   +-------+    +--------+      +--------+
   | Document|---+ split +---|       |----|        |----->|        |
   | o  this |   +-------+   |Diagram|    | Storage|      | In/Out |
   | o  that |   |   me  |   |       |    |        |      |        |
   |  cRED{d}|-+ |   cGRE|   |   cBLK| /--| cBLU{s}|  /-*-|cPNK{io}|
   +----+----+ : +-------+   +-------+ |  +--------+  |   +--------+
        :      |     ^                 |              |
        |      v     |     /--------\  |  /--------\  |
        +------------+     | Rounded|<-/  | Rounded|-*+  *--------*
                           | Corners|     | Dashed | |   | Point  |
                           |    c33F|     |        | +-*-*  Mark  *
                           \-+------/     \-=------/     |    c1FF|
~~~

~~~
                                                          *---------*
```
~~~



Figure 12: Created by Ditaa

ditaa reminder

~~~
```{.ditaa keep="True" height="20%" caption="Created by Ditaa"}
/-----------------\
| Things to do    |
| cYEL            |
| o Cut the grass |
| o Buy jam       |
| o Fix car       |
| o Make website  |
\-----------------/
```
~~~



Figure 13: Created by Ditaa

Ditaa on protocol result

~~~
```{.ditaa keep="True"}
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|             Source            |      TTL      |               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+               +
~~~

```
|                            Reserved                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

```
```


Source
TTL
Reserved

Figlet

figlet

```
```{#FIGLET .figlet options="-f slant" keep="True" caption="Figlet"}
figlet
```
```

```
    _____       __     __
   / __(_)___ _/ /__  / /_
  / /_/ / __ `/ / _ \/ __/
 / __/ / /_/ / /  __/ /_
/_/ /_/__, /_/___/__/
      /____/
```

hello world.

```
```{.figlet keep="true"}
hello, world!
```
```

```
 _          _ _                            _     _ _
| |__   ___| | | ___    __      _____  _ __| | __| | |
| '_ \ / _ \ | |/ _ \   \ \ /\ / / _ \| '__| |/ _` | |
| | | |  __/ | | (_) |   \ V  V / (_) | |  | | (_| |_|
|_| |_|___|_|_|___( )   _/_/ ___/|_|  |_|__,_(_)
                    |/
```

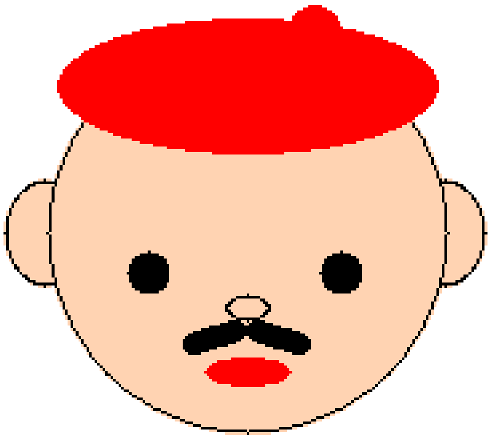
Flydraw

Notes:
```

- seems to only want to produce GIF, despite the manual's mention of PNG.
- only reads from stdin

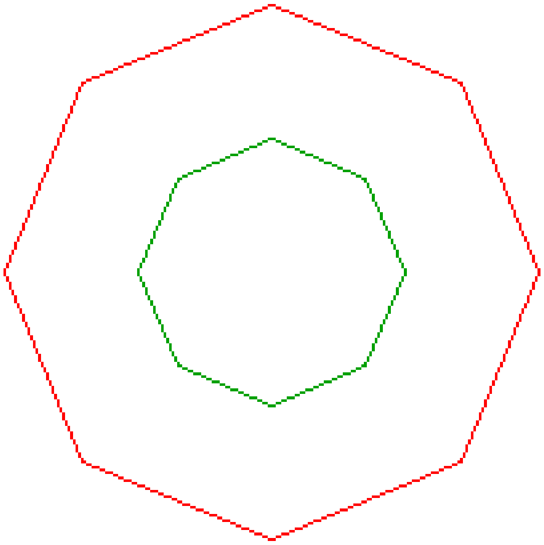
## frenchman

~~~
```{.flydraw keep="true"}
comment : from KhanAcademy
new 200,200
comment ears
fellipse 24, 100, 30, 40,255, 211, 178
fellipse 174, 100, 30, 40,255, 211, 178
ellipse 24, 100, 30, 40,black
ellipse 174, 100, 30, 40,black
comment face
fellipse 100, 100, 150, 150,255, 211, 178
ellipse 100, 100, 150, 150,black
comment nose
ellipse 100, 128, 17, 10,black
comment beret
fellipse 125, 25, 20, 20,red
fellipse 100, 45, 142, 50, red
comment mouth
fellipse 100, 152, 32, 10,red
linewidth 16
point 63, 115,black
point 135, 115 ,black
linewidth 8
line 80, 142, 96, 137, black
line 120, 142, 104, 137,black
```
~~~



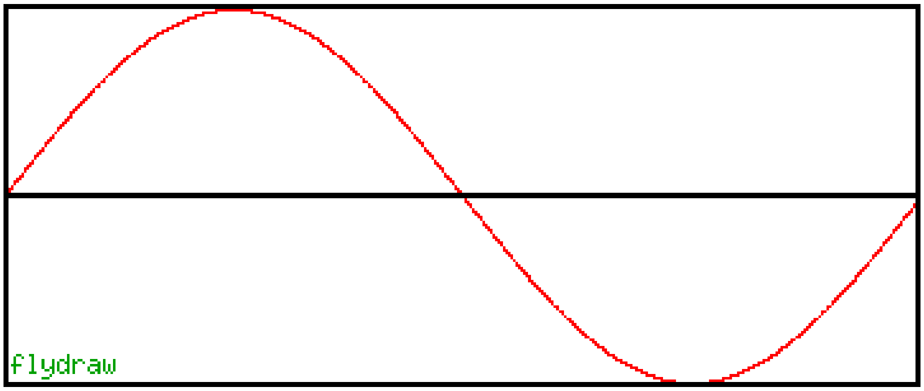
hexagons

~~~
```{.flydraw keep="true"}
comment x=horizontal, x=0 is left
comment y=vertical,   y=0 is top
new 300,300
x0=150
y0=150
r=100
t1=0
t2=t1+2*pi
linewidth=1
plotstep 8
trange t1,t2
plot red,r*cos(t)+x0,r*sin(t)+y0
plot green,r*0.5*cos(t)+x0,r*0.5*sin(t)+y0
```
~~~



plotting a function

~~~
```{.flydraw keep="true"}
w=360
h=150
new w,h
linewidth=1
plotstep=9000
r=-2+h/2
y0=h/2
plot red,y0-r*sin(2*pi*x/w)
linewidth=2
rect 1,1, w-1,h-1, black
line 0,y0,w,y0, black
text green,3,h-16,normal,"flydraw"
```
~~~



GLE

Baudrate

Notes:

- ../test.dat is relative to the input file in pd-images …

~~~
```{.gle keep="true" caption="Created by GLE"}
size 18 19

amove 2 1
box 15 16 fill gray60
rmove -1 1
box 15 16 fill white
rmove 2 4
box 11 8 fill gray5

set font texcmr hei 0.6

begin graph
    fullsize
    size 11 8
    title "BAUD Rate = 9600 bit/sec"
    xtitle "Seconds"
    ytitle "Bits"
    data "../dta/test.dat"
    d1 line marker wsquare
    xaxis min -1 max 6
    yaxis min 0 max 11
end graph
~~~

~~~
```
~~~

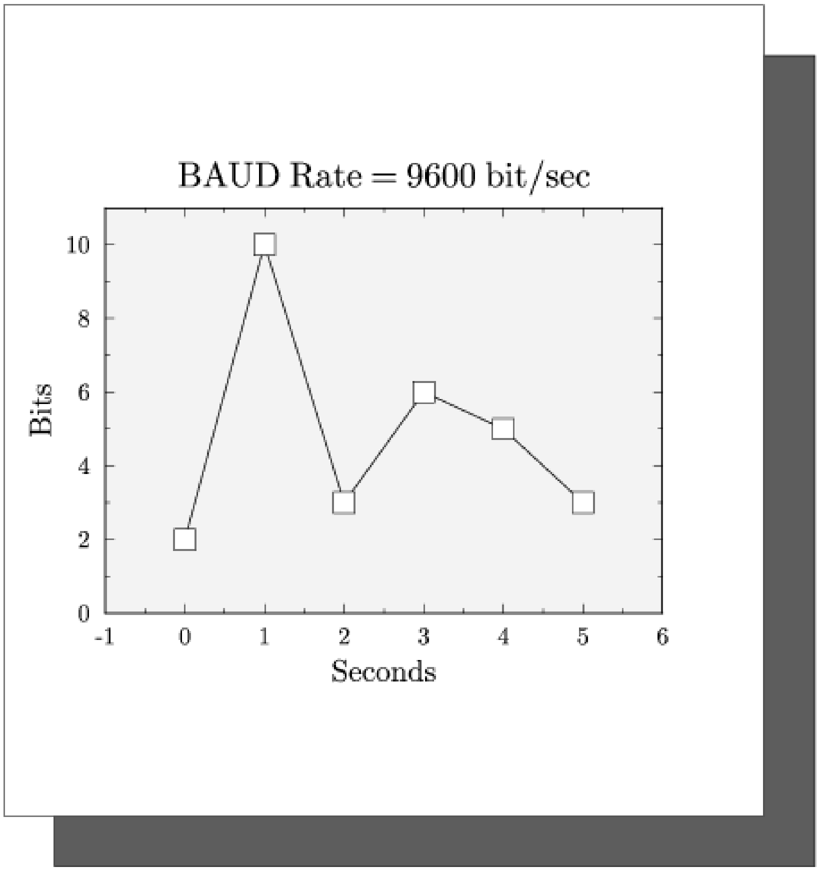


Figure 14: Created by GLE

simple 2D

~~~
```{.gle keep="true" caption="Created by GLE"}
size 12 10

set font texcmr
begin graph
   math
   title "f(x) = sin(x)"
~~~

~~~~
   xaxis min -2*pi max 2*pi ftick -2*pi dticks pi/2 format "pi"
   yaxis dticks 0.25 format "frac"
   let d1 = sin(x)
   d1 line color red
end graph
```
~~~~

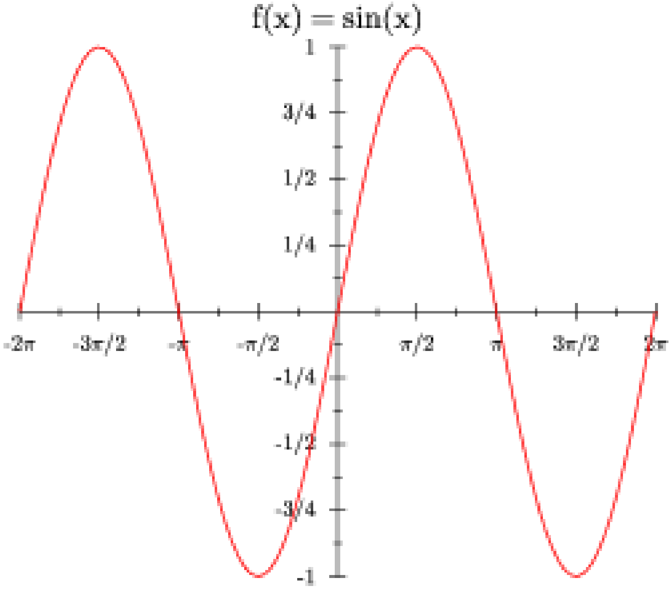
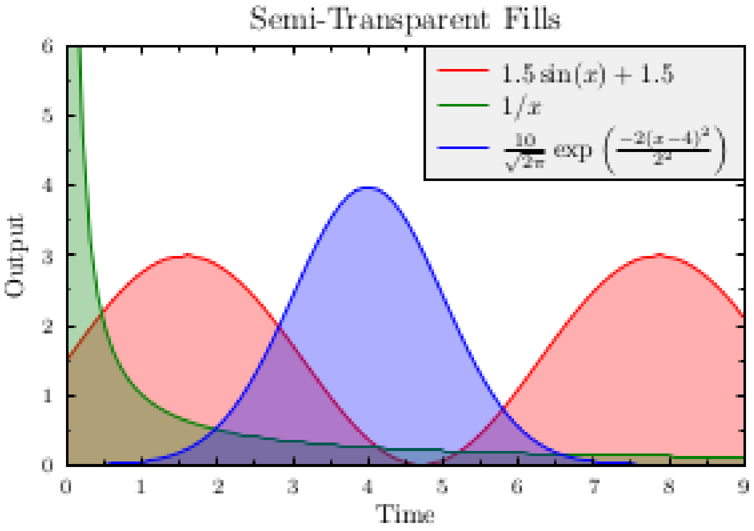
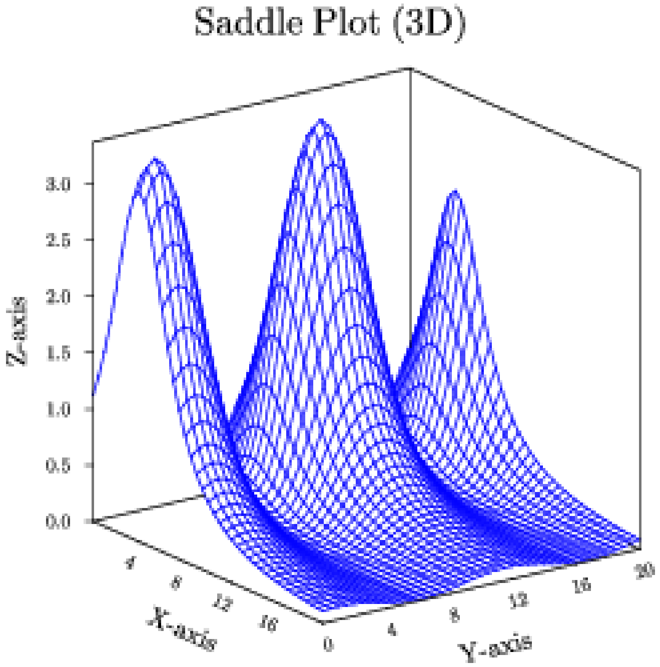
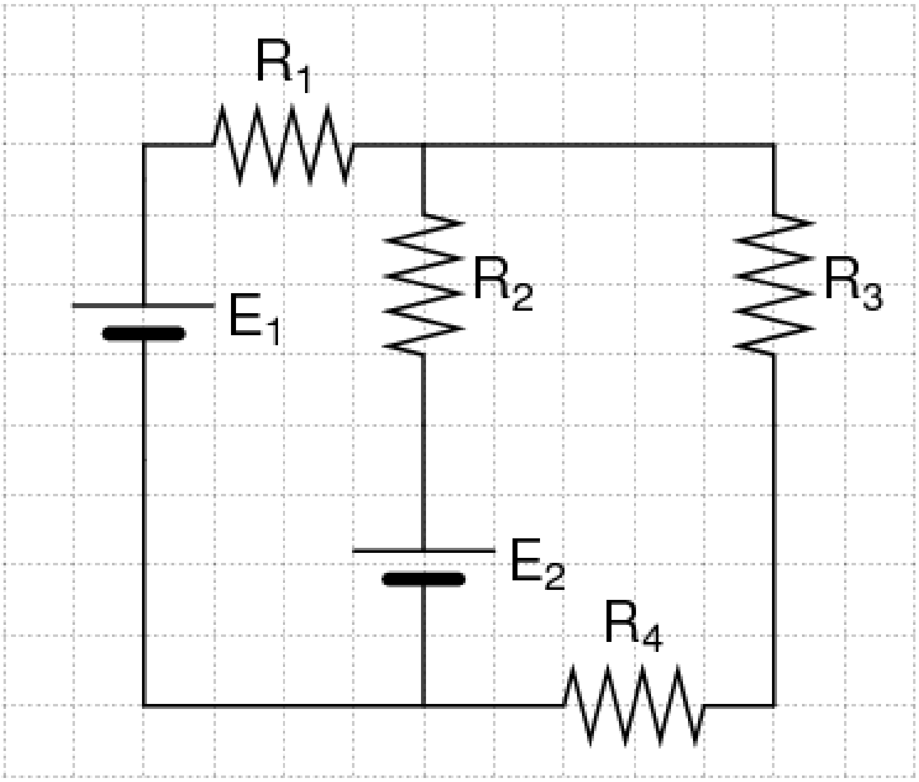
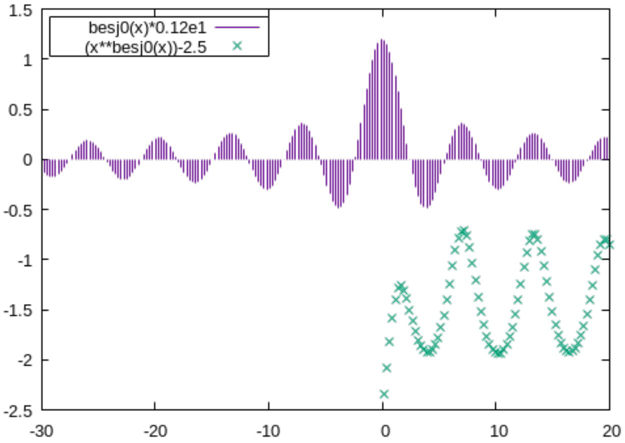
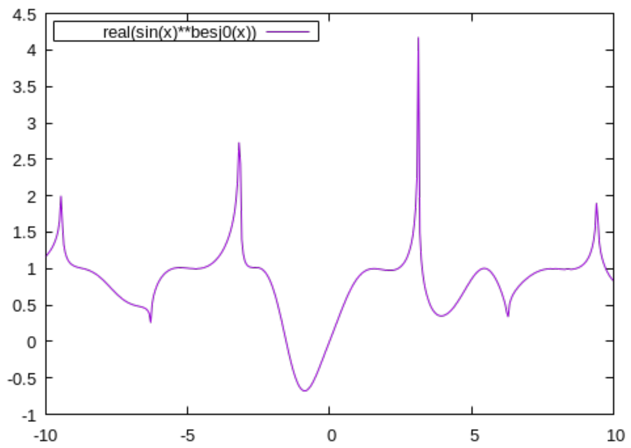
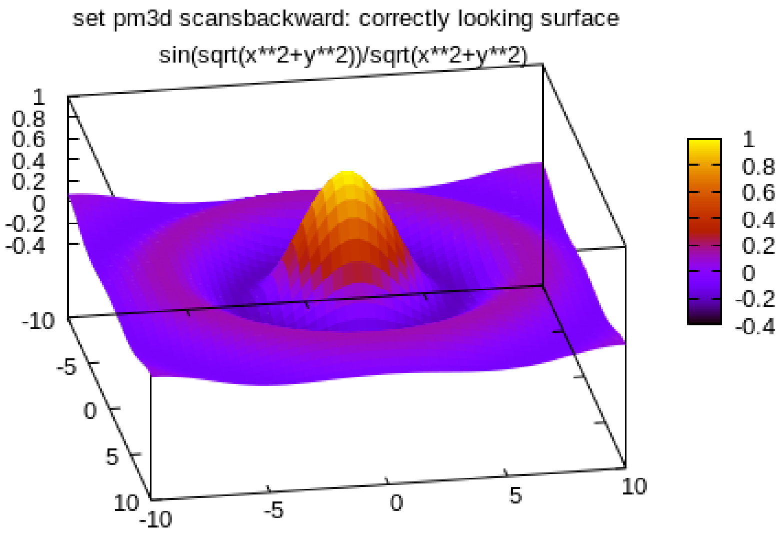
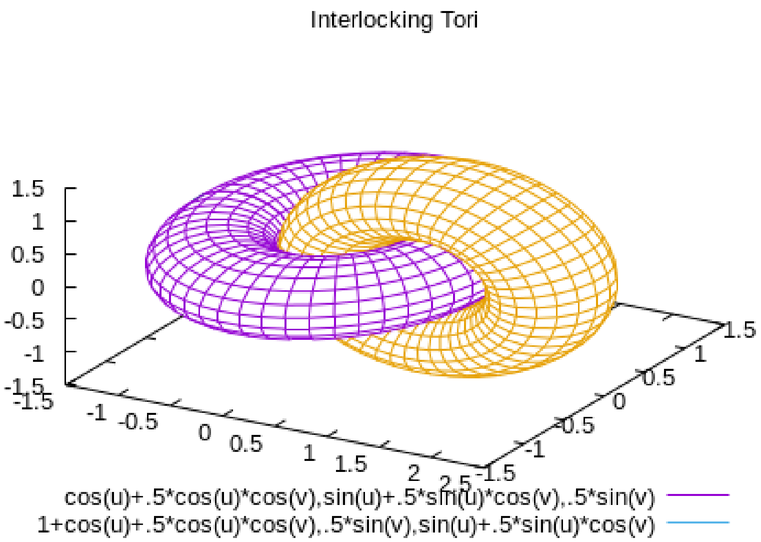
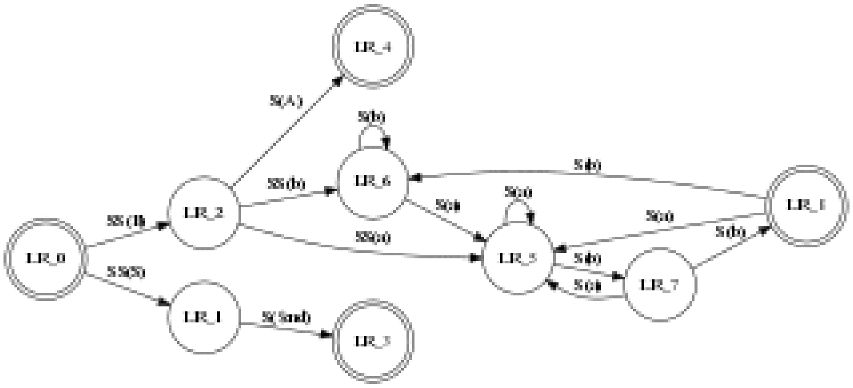
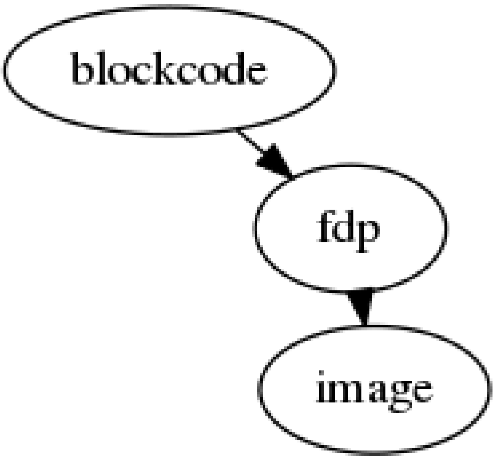
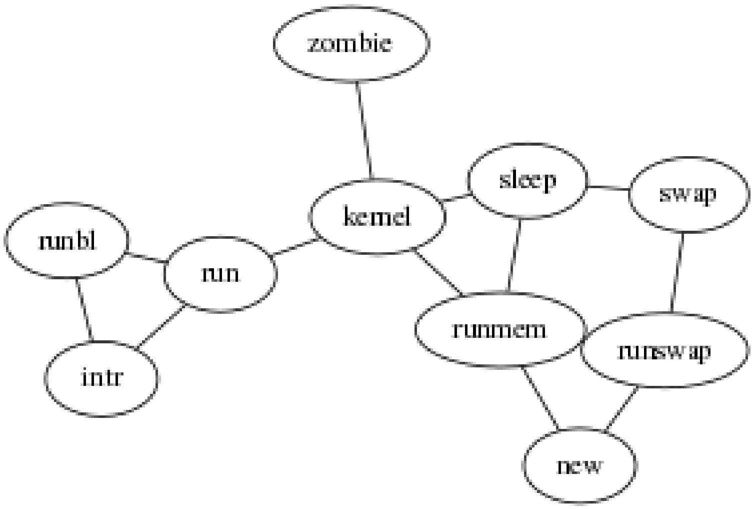
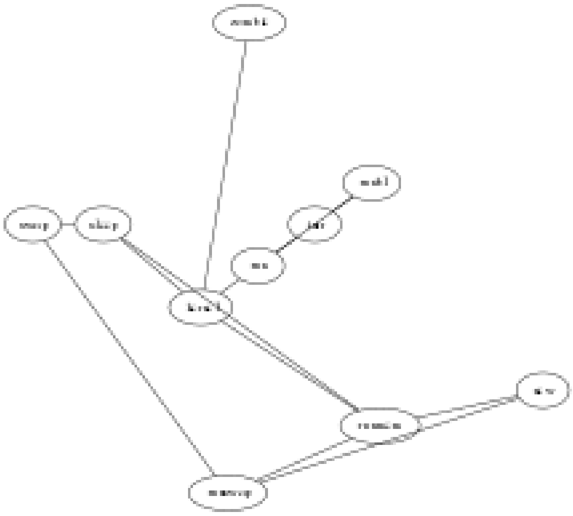


Figure 15: Created by GLE

Semi-transparant fills

Needs the `-cairo` option.

~~~~
```{.gle options="-cairo" keep="true" caption="Created by GLE"}
size 10 7

set texlabels 1

begin graph
   scale auto
~~~~

~~~
   title  "Semi-Transparent Fills"
   xtitle "Time"
   ytitle "Output"
   xaxis min 0 max 9
   yaxis min 0 max 6 dticks 1
   let d1 = sin(x)*1.5+1.5 from 0 to 10
   let d2 = 1/x from 0.01 to 10
   let d3 = 10*(1/sqrt(2*pi))*exp(-2*(sqr(x-4)/sqr(2))) from 0 to 10
   key background gray5
   begin layer 300
      fill x1,d1 color rgba255(255,0,0,80)
      d1 line color red key "$1.5\sin(x)+1.5$"
   end layer
   begin layer 301
      fill x1,d2 color rgba255(0,128,0,80)
      d2 line color green key "$1/x$"
   end layer
   begin layer 302
      fill x1,d3 color rgba255(0,0,255,80)
      d3 line color blue key "$\frac{10}{\sqrt{2\pi}}\exp\left(\frac{-2(x-4)^2}{2^2}\right)
   end layer
end graph
```
~~~



Figure 16: Created by GLE

saddle up

The following GLE script creates saddle.dta, which we want to be put in the dta directory so the file name is given relative to the pd-images directory.

~~~
```{.gle keep="true" caption="Created by GLE"}
size 10 9

set font texcmr hei 0.5 just tc

begin letz
   data "../dta/saddle.z"
   z = 3/2*(cos(3/5*(y-1))+5/4)/(1+(((x-4)/3)^2))
   x from 0 to 20 step 0.5
   y from 0 to 20 step 0.5
end letz

amove pagewidth()/2 pageheight()-0.1
write "Saddle Plot (3D)"

begin object saddle
   begin surface
      size 10 9
      data "../dta/saddle.z"
      xtitle "X-axis" hei 0.35 dist 0.7
      ytitle "Y-axis" hei 0.35 dist 0.7
      ztitle "Z-axis" hei 0.35 dist 0.9
      top color blue
      zaxis ticklen 0.1 min 0 hei 0.25
      xaxis hei 0.25 dticks 4 nolast nofirst
      yaxis hei 0.25 dticks 4
   end surface
end object

amove pagewidth()/2 0.2
draw "saddle.bc"
```
~~~

An electronic circuit

~~~
```{.gle keep="true" caption="Created by GLE"}
! An H-Bridge

size 13 11
include "electronics.gle"
~~~



Figure 17: Created by GLE

~~~
set lwidth 0.05 cap round font psh

! Draw a grid if the line below is uncommented
drawgrid 1

! Top left of diagram
amove 2.0 9.0

! Battery leg
gsave
rline 0 -0.5
cell_v "E_1"
rline 0 -3.5
rline 5 0
rresistor_h R_4
grestore

rresistor_h R_1

gsave
rresistor_v R_2
cell_v "E_2"
grestore

rline 5 0
rresistor_v R_3
rline 0 -4
```
~~~

Gnuplot

Note:

- Imagine catches gnuplot's output on stdout and saves it to an output file. So don't `set output <name>` or Imagine will get confused and die miserably.

Line

~~~
```{.gnuplot keep="True" height="50%" caption="Created by GnuPlot"}
set terminal pngcairo  transparent enhanced font "arial,10" fontscale 1.0 size 500, 350
set key inside left top vertical Right noreverse enhanced autotitles box linetype -1 linewic
set samples 200, 200
~~~



Figure 18: Created by GLE

~~~
plot [-30:20] besj0(x)*0.12e1 with impulses, (x**besj0(x))-2.5 with points
```
~~~



Figure 19: Created by GnuPlot

real sine

~~~
```{.gnuplot keep="True" height="50%" caption="Created by GnuPlot"}
set terminal pngcairo  transparent enhanced font "arial,10" fontscale 1.0 size 500, 350
set key inside left top vertical Right noreverse enhanced autotitles box linetype -1 linewic
set samples 400, 400
plot [-10:10] real(sin(x)**besj0(x))
```
~~~

Surface

~~~
```{.gnuplot keep="True" caption="Another GnuPlot example"}
set terminal pngcairo  transparent enhanced font "arial,10" fontscale 1.0 size 500, 350
set border 4095 front linetype -1 linewidth 1.000
set view 130, 10, 1, 1
set samples 50, 50
set isosamples 50, 50
unset surface
set title "set pm3d scansbackward: correctly looking surface"
set pm3d implicit at s
set pm3d scansbackward
splot sin(sqrt(x**2+y**2))/sqrt(x**2+y**2)
```
~~~



Figure 20: Created by GnuPlot



Figure 21: Another GnuPlot example

Interlocking Tori

~~~
```{.gnuplot keep="True" caption="Gnuplot's interlocking Tori example"}
set terminal pngcairo  transparent enhanced font "arial,10" fontscale 1.0 size 500, 350
set dummy u,v
set key bmargin center horizontal Right noreverse enhanced autotitles nobox
set parametric
set view 50, 30, 1, 1
set isosamples 50, 20
set hidden3d back offset 1 trianglepattern 3 undefined 1 altdiagonal bentover
set ticslevel 0
set title "Interlocking Tori"
set urange [ -3.14159 : 3.14159 ] noreverse nowriteback
set vrange [ -3.14159 : 3.14159 ] noreverse nowriteback
splot cos(u)+.5*cos(u)*cos(v),sin(u)+.5*sin(u)*cos(v),.5*sin(v) with lines,       1+cos(u)+.
```
~~~



Figure 22: Gnuplot's interlocking Tori example

graphviz.org site:

Graphviz defaults to dot

~~~
```{prog="dot" options="-Gsize=4,1.5" caption="FSM layout by dot" keep="True"}

digraph finite_state_machine {
    rankdir=LR;
    size="6,3"
    node [shape = doublecircle]; LR_0 LR_3 LR_4 LR_8;
    node [shape = circle];
    LR_0 -> LR_2 [ label = "SS(B)" ];
    LR_0 -> LR_1 [ label = "SS(S)" ];
    LR_1 -> LR_3 [ label = "S($end)" ];
    LR_2 -> LR_6 [ label = "SS(b)" ];
    LR_2 -> LR_5 [ label = "SS(a)" ];
    LR_2 -> LR_4 [ label = "S(A)" ];
    LR_5 -> LR_7 [ label = "S(b)" ];
    LR_5 -> LR_5 [ label = "S(a)" ];
    LR_6 -> LR_6 [ label = "S(b)" ];
    LR_6 -> LR_5 [ label = "S(a)" ];
    LR_7 -> LR_8 [ label = "S(b)" ];
    LR_7 -> LR_5 [ label = "S(a)" ];
    LR_8 -> LR_6 [ label = "S(b)" ];
    LR_8 -> LR_5 [ label = "S(a)" ];
}

```
~~~



Figure 23: FSM layout by dot

`fdp`

~~~
```{.graphviz prog="fdp" options="-Gsize=2,3" caption="Created by fdp" keep="True"}

digraph {
 blockcode -> fdp;
 fdp -> image;
 }

```
~~~



Figure 24: Created by fdp

`sfdp` *(fails)*

```
graph G {
size="2,2"
run -- intr;
intr -- runbl;
runbl -- run;
run -- kernel;
kernel -- zombie;
kernel -- sleep;
kernel -- runmem;
sleep -- swap;
swap -- runswap;
runswap -- new;
runswap -- runmem;
new -- runmem;
```

```
sleep -- runmem;
}
```

neato

States in a kernel OS plotted by `neato`:

~~~
```{.graphviz prog="neato" caption="Created by neato" keep="True"}
graph G {
size="3,2"
run -- intr;
intr -- runbl;
runbl -- run;
run -- kernel;
kernel -- zombie;
kernel -- sleep;
kernel -- runmem;
sleep -- swap;
swap -- runswap;
runswap -- new;
runswap -- runmem;
new -- runmem;
sleep -- runmem;
}
```
~~~



Figure 25: Created by neato

twopi

The same, but by `twopi`:

~~~
```{.graphviz prog="twopi" caption="Created by twopi" keep="True"}
graph G {
size="3,2"
run -- intr;
intr -- runbl;
runbl -- run;
run -- kernel;
kernel -- zombie;
kernel -- sleep;
kernel -- runmem;
sleep -- swap;
swap -- runswap;
runswap -- new;
runswap -- runmem;
new -- runmem;
sleep -- runmem;
}
```
~~~



Figure 26: Created by twopi

circo

Again, the same but by `circo`:

~~~
```{.graphviz prog="circo" caption="created by circo" keep="True"}

graph G {
size="3,2"
run -- intr;
intr -- runbl;
runbl -- run;
run -- kernel;
kernel -- zombie;
kernel -- sleep;
kernel -- runmem;
sleep -- swap;
swap -- runswap;
runswap -- new;
runswap -- runmem;
new -- runmem;
sleep -- runmem;
}
```
~~~

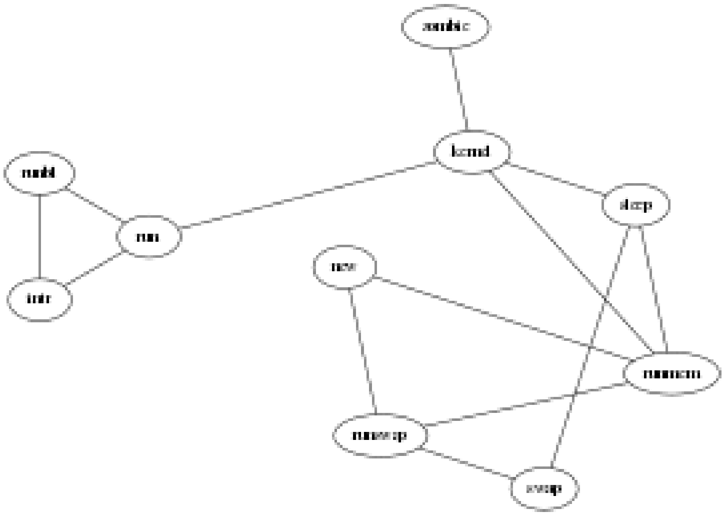


Figure 27: created by circo

GRI

Single plot

With the following in `gri-01.dat`

~~~
1  8 11  9
2 22 21 20
3 11 10  9
4 20 15 10
~~~

plot the first two columns like so:

~~~~
```{.gri keep="true" caption="Created by Gri"}
open dta/gri-01.dat
read columns x y
draw curve
draw title "http://gri.sf.net"

```
~~~~

Multiple curves

~~~~
```{.gri keep="true" caption="Created by Gri"}
`draw curves' \xname \y1name ...'`
Draw multiple y columns versus an x column.  Assumes
that the datafile is open, and that x is in the first
column, with the y values in one or more following
columns.


The number of columns is figured out from the options,
as is the name of the x-axis, and the labels to be
used on each of the y curves.
{
  # NB. the 3 below lets us skip the words 'draw'
  # and 'curves', and the name of the x-column.
  .num_of_y_columns. = {rpn wordc 3 -}
  if {rpn .num_of_y_columns. 1 >}
    show "ERROR: 'draw curves' needs at least 1 y column!"
    quit
  end if


  set x name {rpn 2 wordv}
  set y name ""


  # Loop through the columns.
  .col. = 0
  while {rpn .num_of_y_columns. .col. <}
    # The x-values will be in column 1, with y-values
~~~~

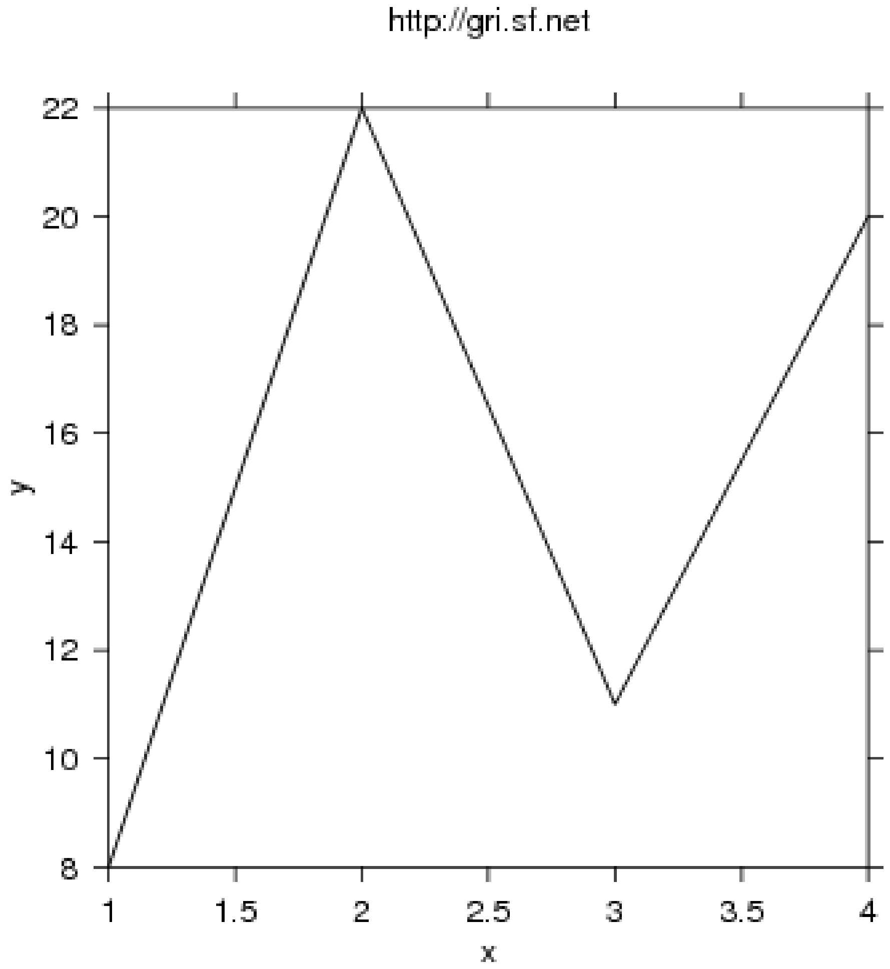


Figure 28: Created by Gri

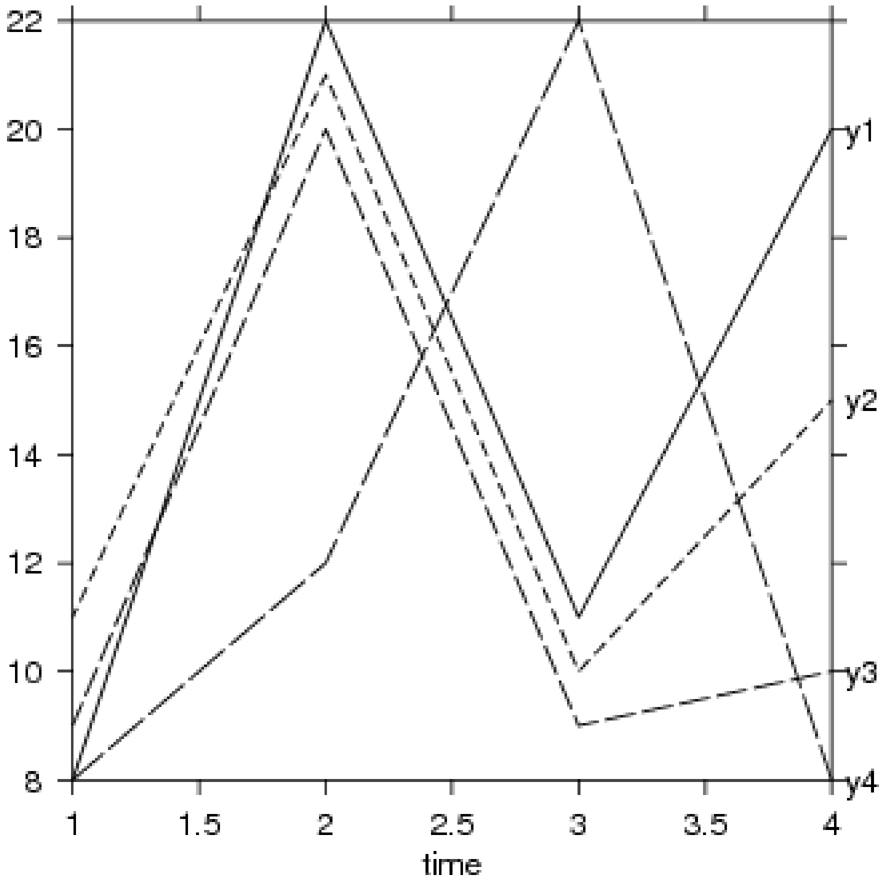
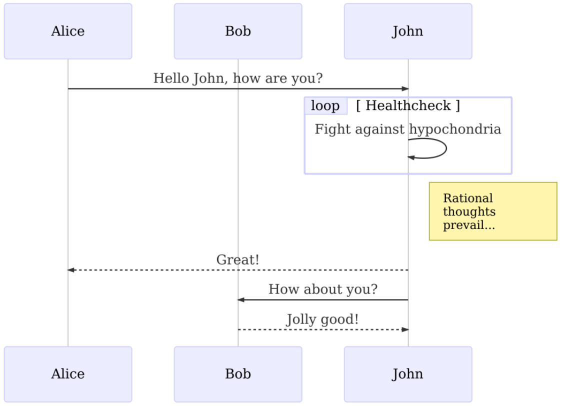
~~~
    # in columns 2, 3, ..., of the file.
    .ycol. = {rpn .col. 2 +}
    rewind
    read columns x=1 y=.ycol.
    # At this point, you may want to change line thickness,
    # thickness, color, dash-type, etc.  For illustration,
    # let's set dash type to the column number.
    set dash .col.
    draw curve
    draw label for last curve {rpn .col. 3 + wordv}
    .col. += 1
  end while
}


open dta/gri-01.dat
draw curves time y1 y2 y3 y4

```
~~~

Mermaid

sequence graph

~~~
```{.mermaid keep="True" width="70%" caption="Created by mermaid"}
sequenceDiagram
    participant Alice
    participant Bob
    Alice->>John: Hello John, how are you?
    loop Healthcheck
        John->>John: Fight against hypochondria
    end
    Note right of John: Rational thoughts<br/>prevail...
    John-->>Alice: Great!
    John->>Bob: How about you?
    Bob-->>John: Jolly good!
```
~~~

gantt diagram

~~~
```{.mermaid keep="True" caption="Created by mermaid"}
gantt
    title A Gantt Diagram
~~~



Figure 29: Created by Gri



Figure 30: Created by mermaid

~~~~
    section Section
    A task           :a1, 2014-01-01, 30d
    Another task     :after a1  , 20d
    section Another
    Task in sec      :2014-01-12  , 12d
    another task      : 24d
```
~~~~

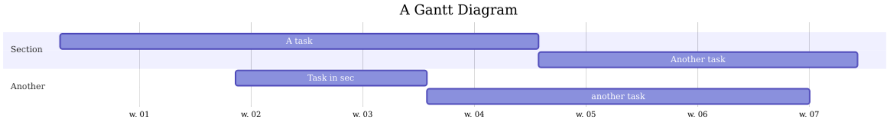


Figure 31: Created by mermaid

Mscgen site:

example w/ boxes

~~~~
```{.mscgen keep="True" caption="Created by mscgen"}
msc {

   # The entities
   A, B, C, D;

   # Small gap before the boxes
   |||;

   # Next four on same line due to ','
   A box A [label="box"],
   B rbox B [label="rbox"],
   C abox C [label="abox"],
   D note D [label="note"];

   # Example of the boxes with filled backgrounds
   A abox B [label="abox", textbgcolour="#ff7f7f"];
   B rbox C [label="rbox", textbgcolour="#7fff7f"];
   C note D [label="note", textbgcolour="#7f7fff"];
}
~~~~

```
```

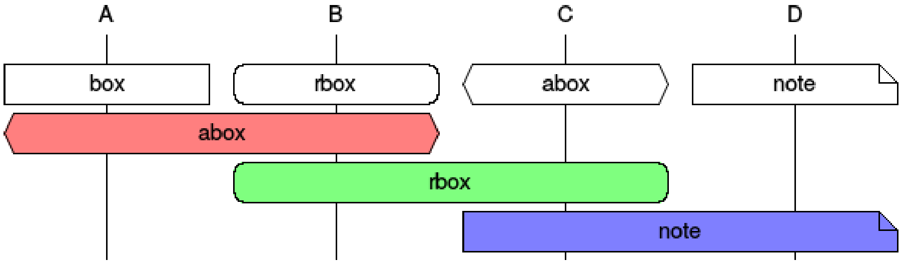
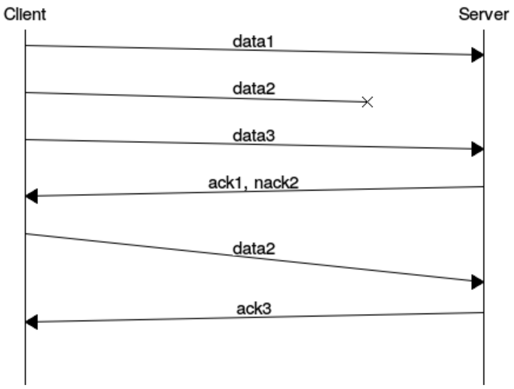
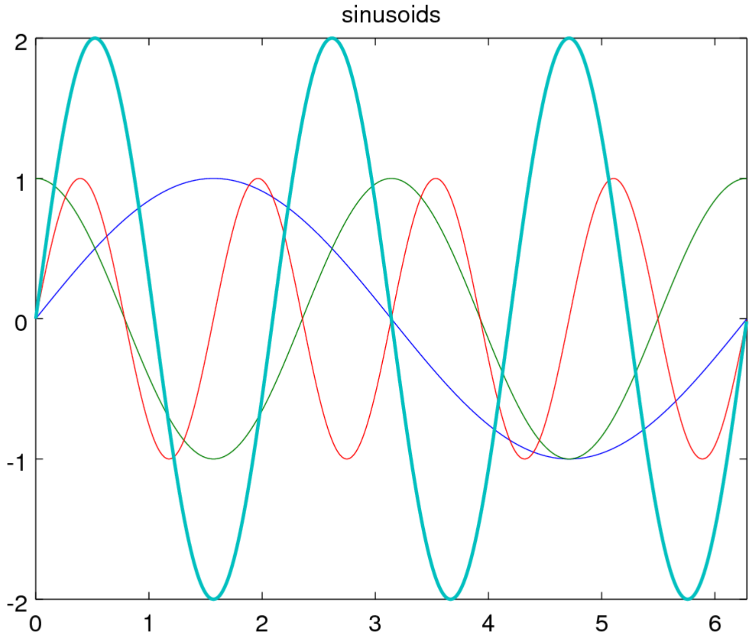
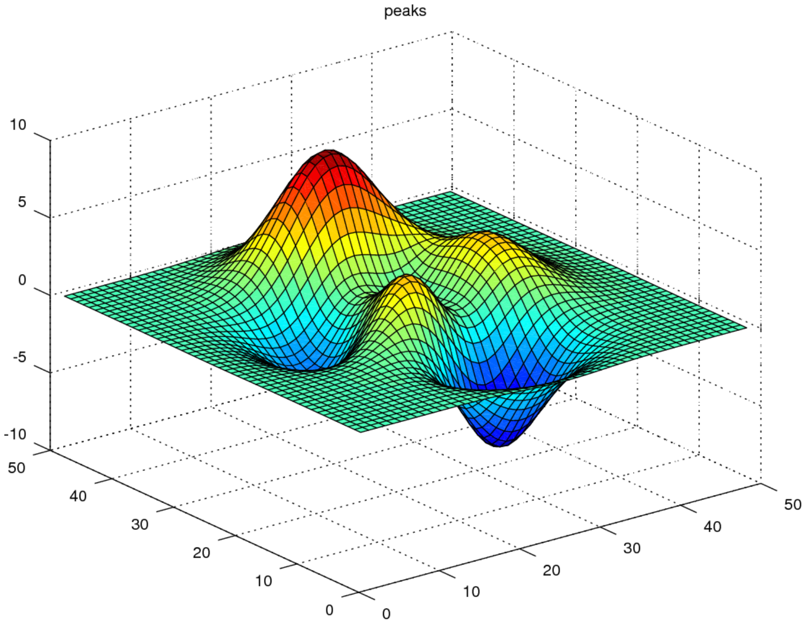
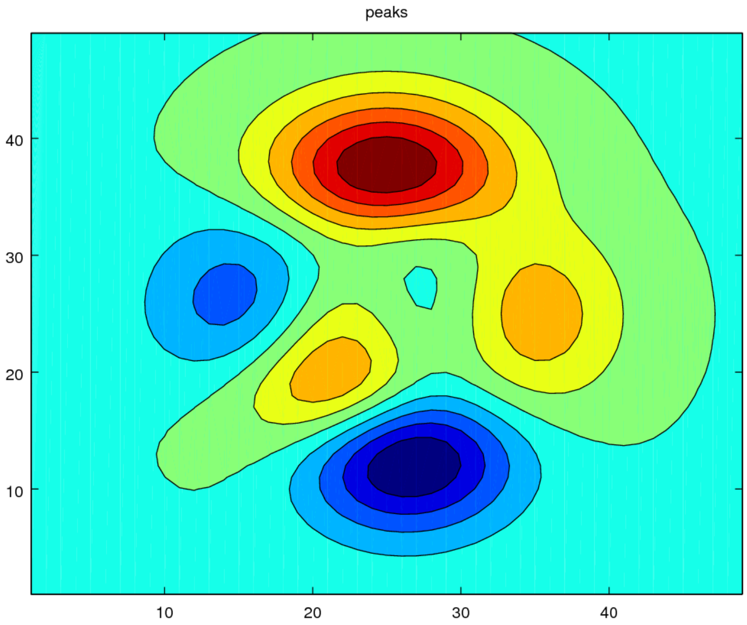
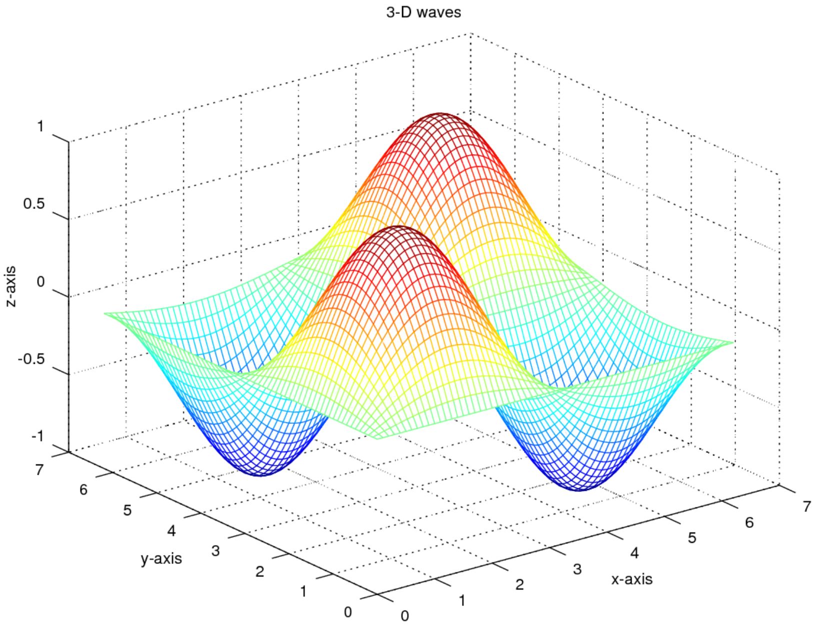
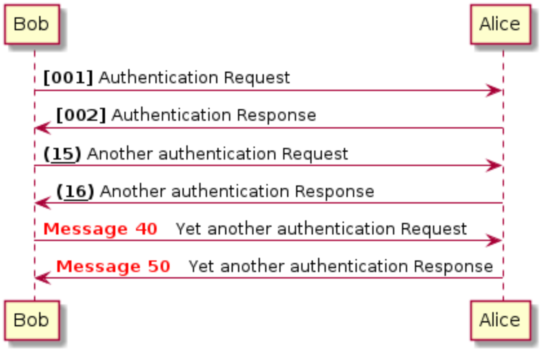
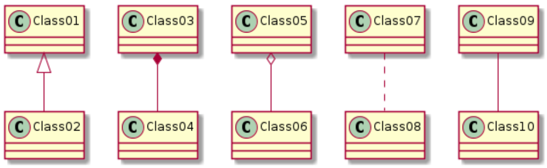


Figure 32: Created by mscgen

client-server interaction

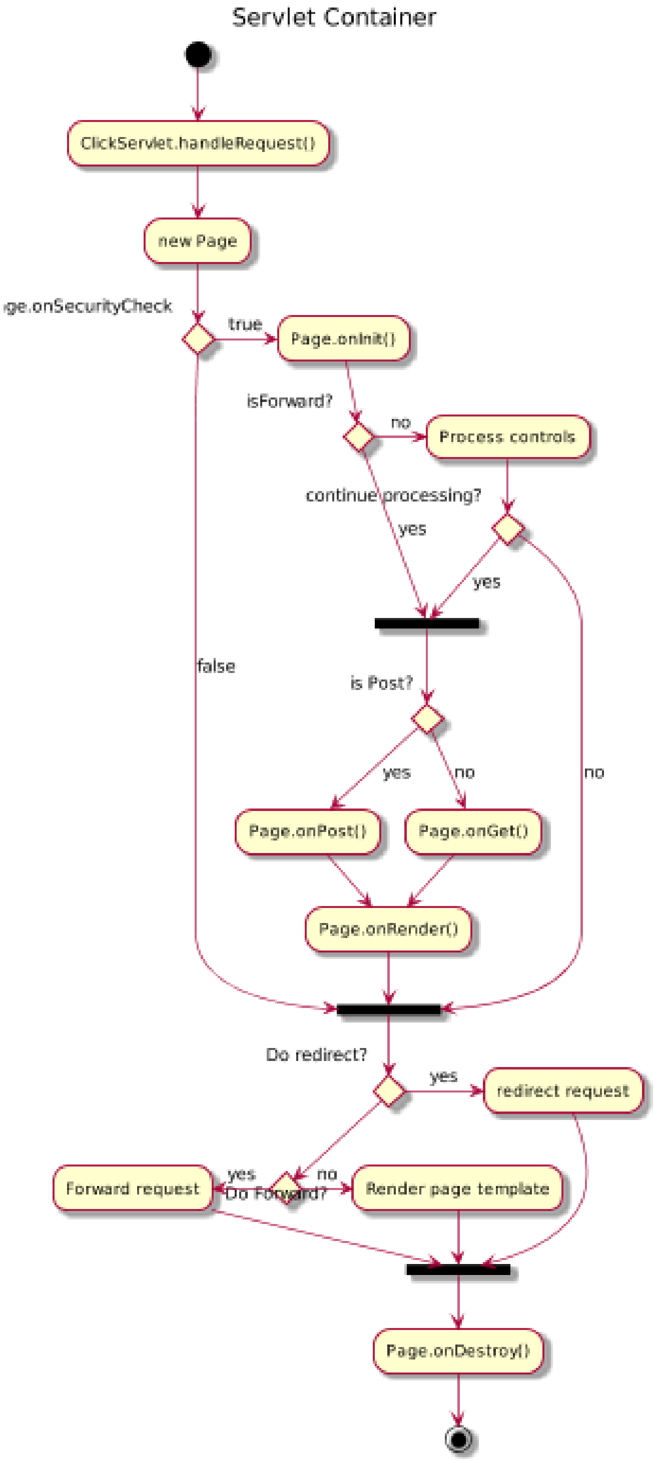
~~~
```{.mscgen keep="True" caption="Created by mscgen"}
msc {
 hscale="1.3", arcgradient = "8";

 a [label="Client"],b [label="Server"];

 a=>b [label="data1"];
 a-xb [label="data2"];
 a=>b [label="data3"];
 a<=b [label="ack1, nack2"];
 a=>b [label="data2", arcskip="1"];
 |||;
 a<=b [label="ack3"];
 |||;
}
```
~~~

Octave

Hints for using `Octave` as batch processor:

- `;` makes statements silent
- `figure(1, "visibility", "off")` prevents pop-up window
- `print(1, argv(){1});` prints to intended output filename
- octave will infer image type from output filename extension
- `imagine` calls `octave --no-gui -q <options> <inpfile> <outfile>`, where
  - `<options>` come from options="..." in the fenced code blocks attributes



Figure 33: Created by mscgen

  - `<inpfile>` is `pd-images/hashed-name.octave` containing the code text
  - `<outfile>` is `pd-images/hashed-name.png` by default

Sinus plot

~~~
```{.octave keep="true" caption="Created by Octave"}
outname = argv(){1}
figure(1, 'visible', 'off');

x = 0:0.01:2*pi;
a = sin(x);
b = cos(2*x);
c = sin(4*x);
d = 2*sin(3*x);
plot(x,a,x,b,x,c,x,d, "linewidth", 2);
set(gca, "xlim", [0,2*pi], "fontsize", 15);
title("sinusoids");

print(1, outname, '-dpng');
```
~~~

Peaks surface

~~~
```{.octave keep="true" caption="Created by Octave"}
figure(1, 'visible', 'off');

surf(peaks);
~~~



Figure 34: Created by Octave

~~~
title("peaks");

print(1, argv(){1});
```
~~~



Figure 35: Created by Octave

Peaks contour

~~~
```{.octave keep="true" caption="Created by Octave"}
figure(1, 'visible', 'off');

contourf(peaks);
title("peaks");

print(1, argv(){1});
```
~~~

3-D wave

~~~
```{.octave keep="True" caption="Created by Octave"}
~~~



Figure 36: Created by Octave

~~~
outname = argv(){1}
figure(1, 'visible', 'off');

x = 0:0.1:2*pi;
y = 0:0.1:2*pi;
z = sin(x)' * sin(y);
mesh(x, y, z);
xlabel("x-axis");
ylabel("y-axis");
zlabel("z-axis");
title("3-D waves");

print(1, outname, '-dpng');
```
~~~



Figure 37: Created by Octave

Plantuml site:

sequence diagrams

~~~
```{.plantuml keep="True" width="60%" caption="Created by plantuml"}
@startuml
autonumber "<b>[000]"
Bob -> Alice : Authentication Request
Bob <- Alice : Authentication Response

autonumber 15 "<b>(<u>##</u>)"
Bob -> Alice : Another authentication Request
Bob <- Alice : Another authentication Response

autonumber 40 10 "<font color=red><b>Message 0  "
Bob -> Alice : Yet another authentication Request
Bob <- Alice : Yet another authentication Response

@enduml
```
~~~


Bob
Alice
[001] Authentication Request
[002] Authentication Response
(15) Another authentication Request
(16) Another authentication Response
Message 40 Yet another authentication Request
Message 50 Yet another authentication Response
Bob
Alice

Figure 38: Created by plantuml

class diagrams

~~~
```{.plantuml keep="True" width="60%" caption="Created by plantuml"}
@startuml
Class01 <|-- Class02
Class03 *-- Class04
Class05 o-- Class06
Class07 .. Class08
Class09 -- Class10
~~~

~~~
@enduml
```
~~~



Figure 39: Created by plantuml

larger plantuml

~~~
```{.plantuml keep="True" caption="Created by plantuml"}
@startuml
scale 580*690
title Servlet Container
(*) --> "ClickServlet.handleRequest()"
--> "new Page"
if "Page.onSecurityCheck" then
->[true] "Page.onInit()"
if "isForward?" then
->[no] "Process controls"
if "continue processing?" then
-->[yes] ===RENDERING===
else
-->[no] ===REDIRECT_CHECK===
endif
else
-->[yes] ===RENDERING===
endif
if "is Post?" then
-->[yes] "Page.onPost()"
--> "Page.onRender()" as render
--> ===REDIRECT_CHECK===
else
-->[no] "Page.onGet()"
--> render
endif
else
-->[false] ===REDIRECT_CHECK===
endif
if "Do redirect?" then
->[yes] "redirect request"
~~~

~~~~
--> ==BEFORE_DESTROY===
else
if "Do Forward?" then
-left->[yes] "Forward request"
--> ==BEFORE_DESTROY===
else
-right->[no] "Render page template"
--> ==BEFORE_DESTROY===
endif
endif
--> "Page.onDestroy()"
-->(*)
@enduml
```
~~~~

Ploticus

prefab

Ploticus scripts are pretty verbose, it also has a `prefab` method of quickly creating a graphic from a data-file, but that is not supported at the moment.

Curves script

~~~~
```{.ploticus keep="True" caption="Created by Ploticus"}
#proc getdata
  data:
  0 1
  1 4
  2 2
  3 5
  4 7
  5 10
  6 7
  7 8
  8 4
  9 8
  10 7
  11 3

#proc areadef
  rectangle: 1 1 4 3
  xrange: 0 12
~~~~



Figure 40: Created by plantuml

```
  yrange: 0 12
  xaxis.stubs: inc
  yaxis.stubs: inc

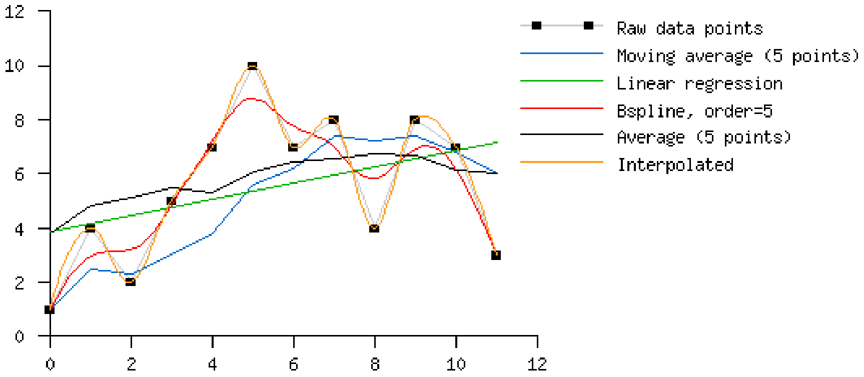
#proc lineplot
  xfield: 1
  yfield: 2
  pointsymbol: radius=0.03 shape=square style=filled
  linedetails: color=gray(0.8) width=0.5
  legendlabel: Raw data points
  legendsampletype: line+symbol

#proc curvefit
  xfield: 1
  yfield: 2
  curvetype: movingavg
  order: 5
  linedetails: color=blue width=0.5
  legendlabel: Moving average (5 points)

#proc curvefit
  xfield: 1
  yfield: 2
  curvetype: regression
  linedetails: color=green width=0.5
  legendlabel: Linear regression

#proc curvefit
  xfield: 1
  yfield: 2
  curvetype: bspline
  order: 5
  linedetails: color=red width=0.5
  legendlabel: Bspline, order=5

#proc curvefit
  xfield: 1
  yfield: 2
  curvetype: average
  order: 5
  linedetails: color=black width=0.5
  legendlabel: Average (5 points)

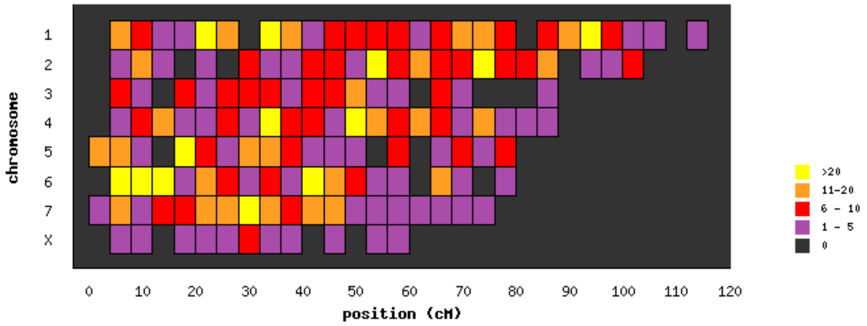
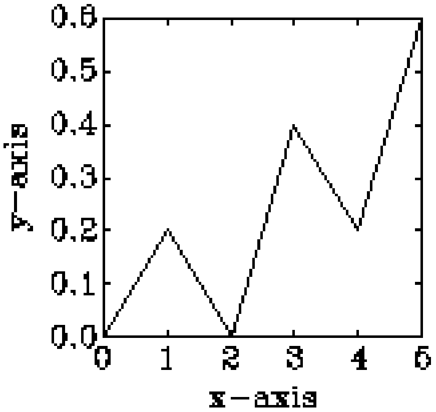
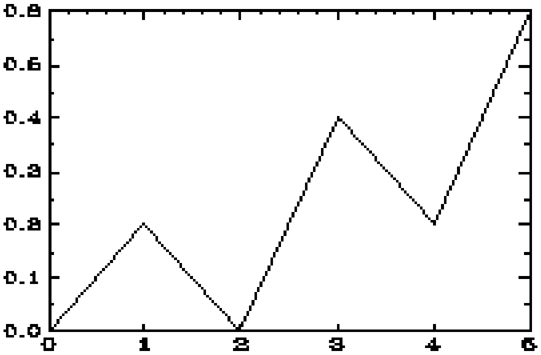
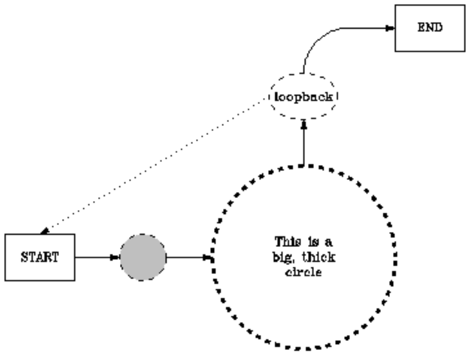
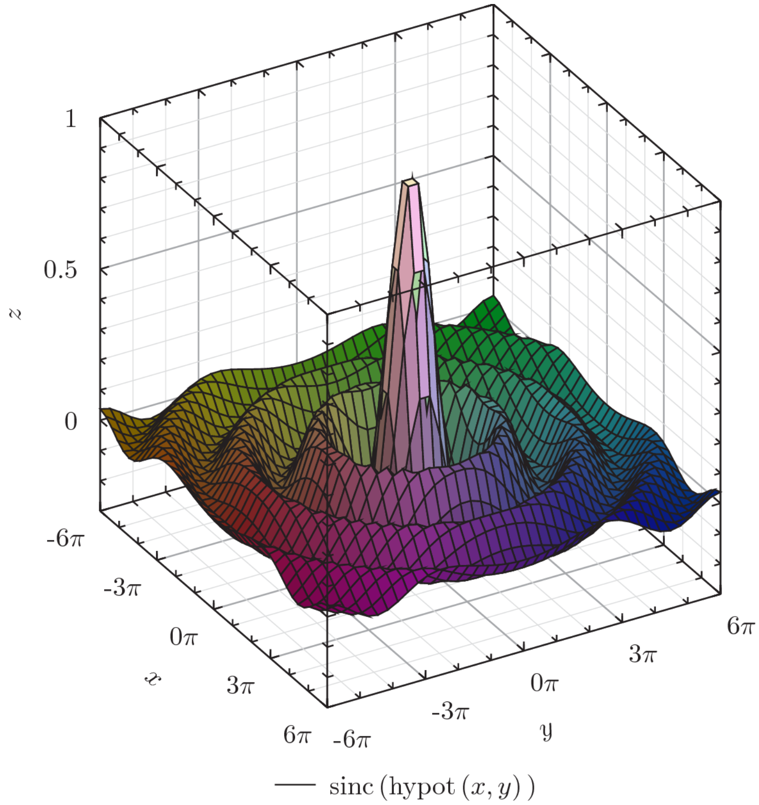
#proc curvefit
  xfield: 1
  yfield: 2
```

~~~
  curvetype: interpolated
  linedetails: color=orange width=0.5
  legendlabel: Interpolated

#proc legend
  location: max+0.5 max

```
~~~



Figure 41: Created by Ploticus

Heatmap (script)

~~~
```{.ploticus keep="True" caption="Created by Ploticus"}
#set SYM = "radius=0.08 shape=square style=filled"
#setifnotgiven CGI = "http://ploticus.sourceforge.net/cgi-bin/showcgiargs"


// read in the SNP map data file..
#proc getdata
file: dta/snpmap.dat
fieldnameheader: yes

// group into bins 4 cM wide..
filter:
   ##set A = $numgroup( @@2, 4, mid )
   @@1 @@A

// set up the plotting area
#proc areadef
~~~

```
rectangle: 1 1 6 3
areacolor: gray(0.2)
yscaletype: categories
clickmapurl: @CGI?chrom=@@YVAL&cM=@@XVAL
ycategories:
    1
    2
    3
    4
    5
    6
    7
    X

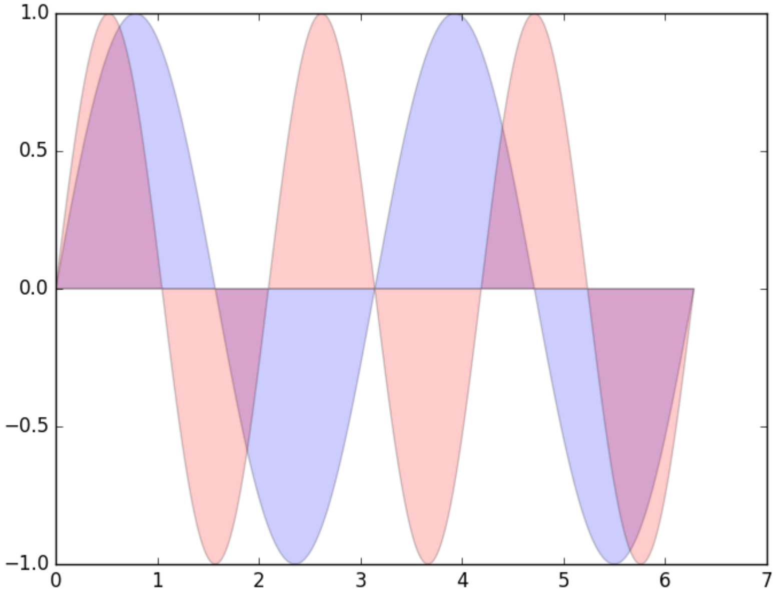
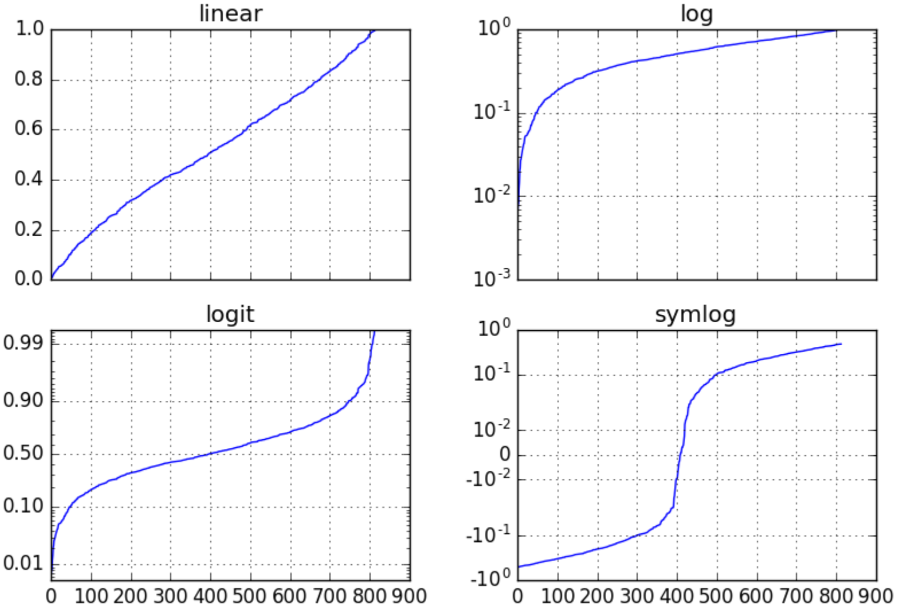
yaxis.stubs: usecategories
// yaxis.stubdetails: adjust=0.2,0
//yaxis.stubslide: 0.08
yaxis.label: chromosome
yaxis.axisline: no
yaxis.tics: no
yaxis.clickmap: xygrid

xrange: -3 120
xaxis.label: position (cM)
xaxis.axisline: no
xaxis.tics: no
xaxis.clickmap: xygrid
xaxis.stubs: inc 10
xaxis.stubrange: 0
// xaxis.stubdetails: adjust=0,0.15

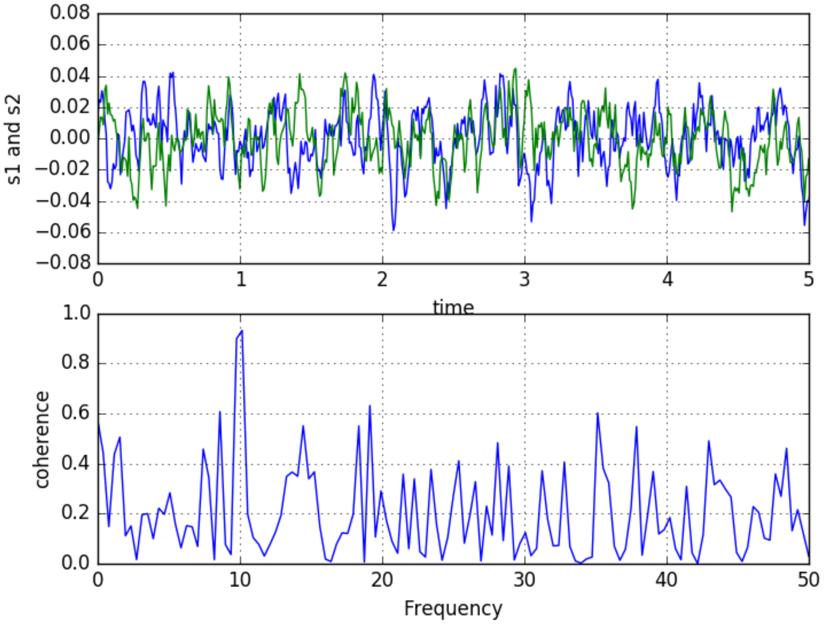
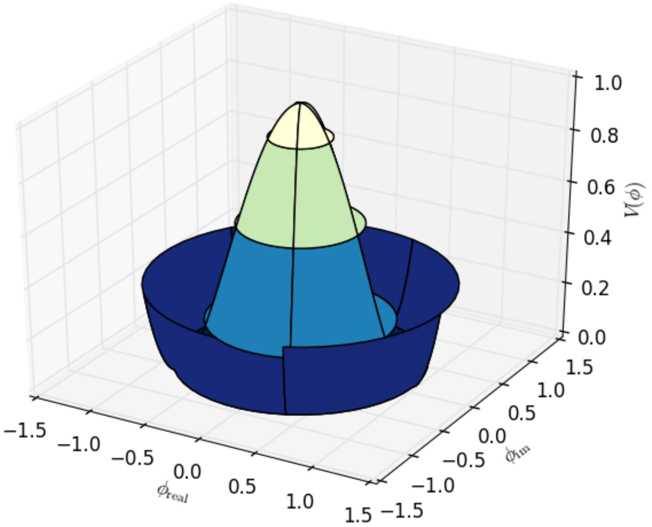
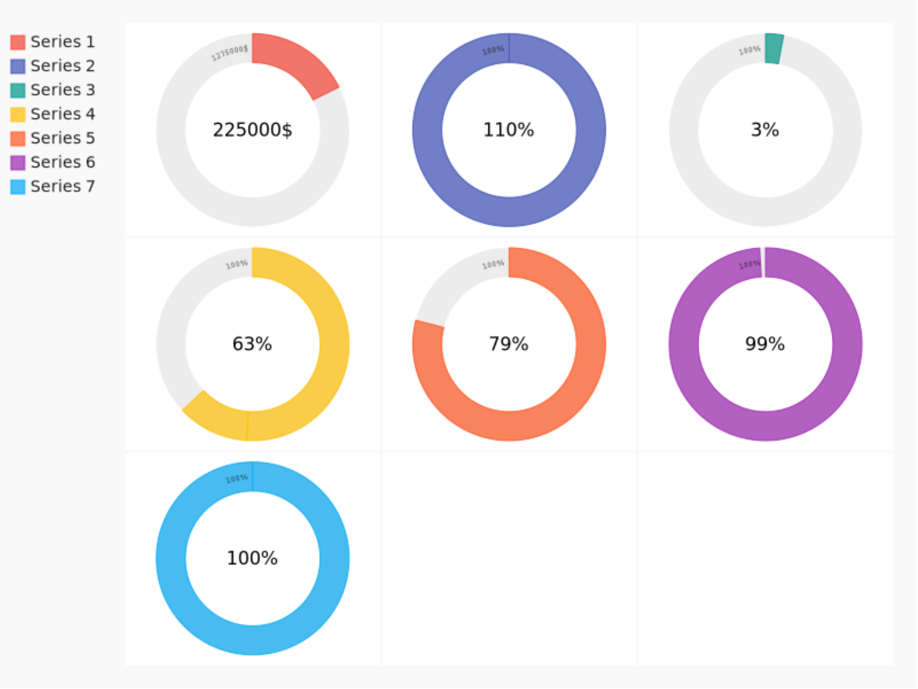
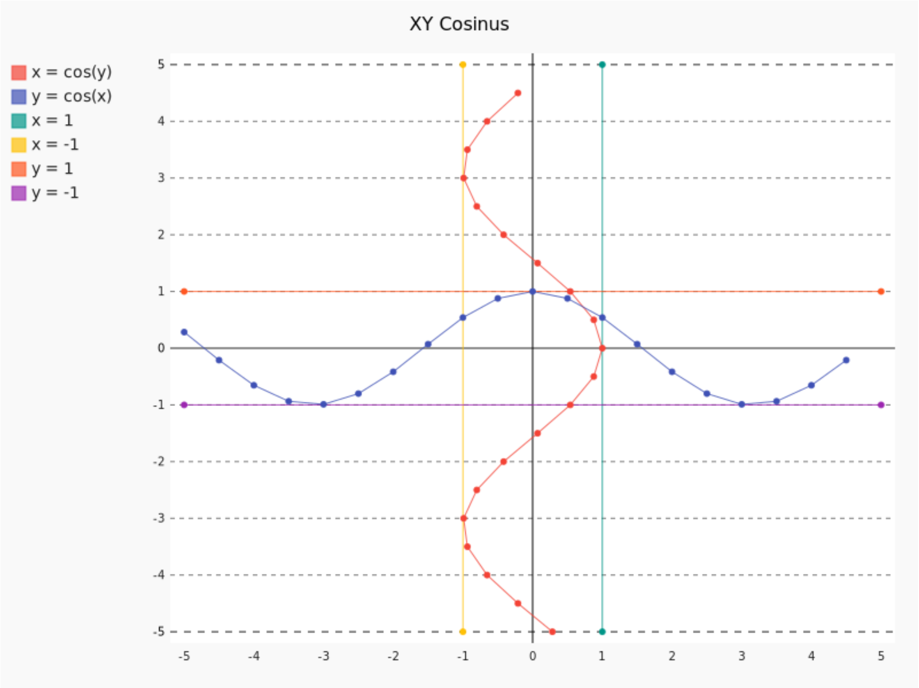

// set up legend for color gradients..
#proc legendentry
sampletype: color
details: yellow
label: >20
tag: 21

#proc legendentry
sampletype: color
details: orange
label: 11-20
tag: 11

#proc legendentry
```

~~~
sampletype: color
details: red
label: 6 - 10
tag: 6

#proc legendentry
sampletype: color
details: lightpurple
label: 1 - 5
tag: 1

#proc legendentry
sampletype: color
details: gray(0.2)
label: 0
tag: 0


// use proc scatterplot to count # of instances and pick appropriate color from legend..
#proc scatterplot
yfield: chr
xfield: cM
cluster: yes
dupsleg: yes
rectangle: 4 1 outline


// display legend..
#proc legend
location: max+0.7 min+0.8
textdetails: size=6

```
~~~

Plotutils site

It includes:

- GNU *graph*, which plots 2-D datasets or data streams in real time.
- GNU *plot*, which translates GNU Metafile format to any of the other formats.
- GNU *tek2plot*, for translating legacy Tektronix data to any of the above formats.
- GNU *pic2plot*, for translating the pic language (a scripting language for



Figure 42: Created by Ploticus

designing box-and-arrow diagrams) to any of the above formats. The pic language was designed at Bell Labs as an enhancement to the troff text formatter.

- GNU *plotfont*, for displaying character maps of the fonts that are available in the above formats.
- GNU *spline*, which does spline interpolation of data. It normally uses either cubic spline interpolation or exponential splines in tension, but it can function as a real-time filter under some circumstances.
- GNU *ode*, which numerically integrates a system consisting of one or more ordinary differential equations.

Note:

- Imagine only wraps `plot` and `pic2plot` (`pic` is an alias for `pic2plot`).

graph

Each invocation of graph reads one or more datasets from files named on the command line or from standard input, and prepares a plot. There are many command-line options for adjusting the visual appearance of the plot. The following sections explain how to use the most frequently used options, by giving examples.

~~~
```{.graph options="-X x-axis -Y y-axis -f 0.1 --bitmap-size 200x200" keep="True" caption="
0.0  0.0
1.0  0.2
2.0  0.0
3.0  0.4
4.0  0.2
5.0  0.6
```
~~~



Figure 43: PlotUtil's graph

plot

The GNU *plot* filter displays GNU graphics metafiles or translates them to other formats. It will take input from files specified on the command line or from standard input. The '-T' option is used to specify the desired output format. Supported output formats include "X", "png", "pnm", "gif", "svg", "ai", "ps", "cgm", "fig", "pcl", "hpgl", "regis", "tek", and "meta" (the default).

The metafile format is a device-independent format for storage of vector graphics. By default, it is a binary rather than a human-readable format (see Metafiles). Each of the graph, pic2plot, tek2plot, and plotfont utilities will write a graphics metafile to standard output if no '-T' option is specified on its command line. The GNU libplot graphics library may also be used to produce metafiles. Metafiles may contain arbitrarily many pages of graphics, but each metafile produced by graph contains only a single page.

plot, like the metafile format itself, is useful if you wish to preserve a vector graphics file, and display or edit it with more than one drawing editor.

~~~
```{.plot options="--bitmap-size 300x200" keep="True" caption="Created by plot"}
dta/input.meta
```
~~~

pic2plot

From the gnu website:



Figure 44: Created by plot

The pic language is a ‘little language’ that was developed at Bell Laboratories for creating box-and-arrow diagrams of the kind frequently found in technical papers and textbooks. A directory containing documentation on the pic language is distributed along with the plotting utilities. On most systems it is installed as /usr/share/pic2plot or /usr/local/share/pic2plot. The directory includes Brian Kernighan’s original technical report on the language, Eric S. Raymond’s tutorial on the GNU implementation, and some sample pic macros contributed by the late W. Richard Stevens.

~~~
```{.pic keep="True" width="80%" caption="Created by pic"}
.PS
box "START"; arrow; circle dashed filled; arrow
circle diam 2 thickness 3 "This is a" "big, thick" "circle" dashed; up
arrow from top of last circle; ellipse "loopback" dashed
arrow dotted from left of last ellipse to top of last box
arc cw radius 1/2 from top of last ellipse; arrow
box "END"
.PE
```
~~~

Protocol:

Protocol is a simple command-line tool that serves two purposes:

- Provide a simple way for engineers to have a look at standard network



Figure 45: Created by pic

protocol headers, directly from the command-line, without having to google for the relevant RFC or for ugly header image diagrams.

- Provide a way for researchers and engineers to quickly generate ASCII RFC-like header diagrams for their own custom protocols.

TCP Header

~~~
```{.protocol keep="True" caption="protocol"}
tcp
```
~~~

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Source Port          |        Destination Port       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        Sequence Number                        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                     Acknowledgment Number                     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Offset|  Res. |     Flags     |             Window            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|            Checksum           |         Urgent Pointer        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                    Options                    |    Padding    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

and even custom layouts:

Customer packet

~~~
```{.protocol options="--no-numbers" keep="True" caption="protocol"}
Source:16,TTL:8,Reserved:40
```
~~~

```
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|             Source            |      TTL      |               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+               +
|                            Reserved                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

PyxPlot

ex01

~~~
```{.pyxplot keep="True" caption="Created by PyxPlot"}
set numerics complex
set xlabel r"$x$"
set ylabel r"$y$"
set zlabel r"$z$"
set xformat r"%s$\pi$"%(x/pi)
set yformat r"%s$\pi$"%(y/pi)
set xtics 3*pi ; set mxtics pi
set ytics 3*pi ; set mytics pi
set ztics
set key below
set size 6 square
set grid
plot 3d [-6*pi:6*pi][-6*pi:6*pi][-0.3:1] sinc(hypot(x,y)) \
     with surface col black \
     fillcol hsb(atan2($1,$2)/(2*pi)+0.5,hypot($1,$2)/30+0.2,$3*0.5+0.5)
```
~~~

SheBang

The `imagine` filter also features the `shebang` class which will run the fenced code block as a system script.

~~~
```shebang
#!/bin/bash
echo "This script is saved as :" $0
echo "and its (user) executable flag is set:"
echo
echo $(ls -lpah $0 | cut -d' ' -f1,9) | boxes -d peek
echo
echo "When run, it should produce: $1"
echo
echo "If it doesn't, Imagine will report a missing image on stderr and"
echo "will retain the original CodeBlock as-is.  The same holds true"
echo "if the script returns with an exit code other than 0 (zero)"
echo
echo "Also, any text on stdout (like these echo's) is included in its own CodeBlock"
```
~~~

```
This script is saved as : pd-images/f1ef0bd803f58e49ce0ccd69ae15e7ab90af417c.shebang
```



Figure 46: Created by PyxPlot

```
and its (user) executable flag is set:

/*       _\|/_
         (o o)
 +----oOO-{_}-OOo------------------------------------------------------+
 |-rwxrw-r-- pd-images/f1ef0bd803f58e49ce0ccd69ae15e7ab90af417c.shebang|
 +--------------------------------------------------------------------*/

When run, it should produce: pd-images/f1ef0bd803f58e49ce0ccd69ae15e7ab90af417c.png

If it doesn't, Imagine will report a missing image on stderr and
will retain the original CodeBlock as-is.  The same holds true
if the script returns with an exit code other than 0 (zero)

Also, any text on stdout (like these echo's) is included in its own CodeBlock
```

The code text is saved and its executable flag is set, after which is it used as a system command with the intended output filename as its sole argument. If that file exists after the script returns, it is linked to as an Image. Any output produced on stdout will be added after the figure in a separate codeblock. If the script does not produce the intended image or exits with an error code, the original CodeBlock is retained as well.

Matplotlib

Agg

~~~
```{.shebang keep="true" caption="Created by Matplotlib"}
#!/usr/bin/env python

import sys
import numpy as np
import matplotlib as mpl
# mpl.use('Agg')
import matplotlib.pyplot as plt

t = np.arange(0.0, 2.0, 0.01)
s = 1 + np.sin(2*np.pi*t)
plt.plot(t, s)

plt.xlabel('time (s)')
plt.ylabel('voltage (mV)')
plt.title('A simple plot')
plt.grid(True)
#plt.savefig(sys.argv[-1])
~~~

~~~
print "Saved as -->", sys.argv[-1]
```

Saved as --> pd-images/8aed8c78d695f0fb5164bd5cff6d11cf325e8316.png
~~~

Fill with alpha

~~~
```{.shebang keep="true" caption="Created by Matplotlib"}
#!/usr/bin/env python

import sys
import numpy as np
import matplotlib.pyplot as plt

x = np.linspace(0, 2 * np.pi, 500)
y1 = np.sin(2 * x)
y2 = np.sin(3 * x)

fig, ax = plt.subplots()
ax.fill(x, y1, 'b', x, y2, 'r', alpha=0.2)
fig.savefig(sys.argv[-1])
```
~~~

Axis scale transformations

~~~
```{.shebang keep="true" caption="Created by Matplotlib"}
#!/usr/bin/env python

import sys
import numpy as np
import matplotlib.pyplot as plt
from matplotlib.ticker import NullFormatter

np.random.seed(1)
# make up some data in the interval ]0, 1[
y = np.random.normal(loc=0.5, scale=0.4, size=1000)
y = y[(y > 0) & (y < 1)]
y.sort()
x = np.arange(len(y))

# plot with various axes scales
fig, axs = plt.subplots(2, 2, sharex=True)
fig.subplots_adjust(left=0.08, right=0.98, wspace=0.3)

# linear
~~~



Figure 47: Created by Matplotlib

~~~
ax = axs[0, 0]
ax.plot(x, y)
ax.set_yscale('linear')
ax.set_title('linear')
ax.grid(True)


# log
ax = axs[0, 1]
ax.plot(x, y)
ax.set_yscale('log')
ax.set_title('log')
ax.grid(True)


# symmetric log
ax = axs[1, 1]
ax.plot(x, y - y.mean())
ax.set_yscale('symlog', linthreshy=0.02)
ax.set_title('symlog')
ax.grid(True)

# logit
ax = axs[1, 0]
ax.plot(x, y)
ax.set_yscale('logit')
ax.set_title('logit')
ax.grid(True)
ax.yaxis.set_minor_formatter(NullFormatter())

fig.savefig(sys.argv[-1])
```
~~~

Coherence of two signals

~~~
```{.shebang keep="true" caption="Created by Matplotlib"}
#!/usr/bin/env python

import sys
import numpy as np
import matplotlib.pyplot as plt

plt.subplots_adjust(wspace=0.5)                # space the subplots

dt = 0.01
~~~



Figure 48: Created by Matplotlib

~~~~
t = np.arange(0, 30, dt)
nse1 = np.random.randn(len(t))                 # white noise 1
nse2 = np.random.randn(len(t))                 # white noise 2
r = np.exp(-t/0.05)

cnse1 = np.convolve(nse1, r, mode='same')*dt   # colored noise 1
cnse2 = np.convolve(nse2, r, mode='same')*dt   # colored noise 2

# two signals with a coherent part and a random part
s1 = 0.01*np.sin(2*np.pi*10*t) + cnse1
s2 = 0.01*np.sin(2*np.pi*10*t) + cnse2

plt.subplot(211)
plt.plot(t, s1, t, s2)
plt.xlim(0, 5)
plt.xlabel('time')
plt.ylabel('s1 and s2')
plt.grid(True)

plt.subplot(212)
cxy, f = plt.cohere(s1, s2, 256, 1./dt)
plt.ylabel('coherence')
plt.savefig(sys.argv[-1])
```
~~~~

3D image

~~~~
```{.shebang keep="true" caption="Created by Matplotlib"}
#!/usr/bin/env python
import sys
from mpl_toolkits.mplot3d import Axes3D
from matplotlib import pyplot as plt
import numpy as np


fig = plt.figure()
ax = fig.add_subplot(111, projection='3d')

# Create the mesh in polar coordinates and compute corresponding Z.
r = np.linspace(0, 1.25, 50)
p = np.linspace(0, 2*np.pi, 50)
R, P = np.meshgrid(r, p)
Z = ((R**2 - 1)**2)

# Express the mesh in the cartesian system.
~~~~



Figure 49: Created by Matplotlib

~~~
X, Y = R*np.cos(P), R*np.sin(P)

# Plot the surface.
ax.plot_surface(X, Y, Z, cmap=plt.cm.YlGnBu_r)

# Tweak the limits and add latex math labels.
ax.set_zlim(0, 1)
ax.set_xlabel(r'$\phi_\mathrm{real}$')
ax.set_ylabel(r'$\phi_\mathrm{im}$')
ax.set_zlabel(r'$V(\phi)$')

plt.savefig(sys.argv[-1])
```
~~~



Figure 50: Created by Matplotlib

Pygal

- uses python3
- needs cairosvg, tinycss, cssselect to render to png

Solid Gauges

~~~
```{.shebang keep="true" caption="Created by Pygal"}
#!/usr/bin/env python3

import sys
import pygal

gauge = pygal.SolidGauge(inner_radius=0.70)
percent_formatter = lambda x: '{:.10g}%'.format(x)
dollar_formatter = lambda x: '{:.10g}$'.format(x)
gauge.value_formatter = percent_formatter

gauge.add('Series 1', [{'value': 225000, 'max_value': 1275000}],
          formatter=dollar_formatter)
gauge.add('Series 2', [{'value': 110, 'max_value': 100}])
gauge.add('Series 3', [{'value': 3}])
gauge.add(
    'Series 4', [
        {'value': 51, 'max_value': 100},
        {'value': 12, 'max_value': 100}])
gauge.add('Series 5', [{'value': 79, 'max_value': 100}])
gauge.add('Series 6', 99)
gauge.add('Series 7', [{'value': 100, 'max_value': 100}])

gauge.render_to_png(sys.argv[-1])
```
~~~

Basic XY line

~~~
```{.shebang keep="true" caption="Created by Pygal"}
#!/usr/bin/env python3

import sys
import pygal
from math import cos

xy_chart = pygal.XY()
xy_chart.title = 'XY Cosinus'
xy_chart.add('x = cos(y)', [(cos(x / 10.), x / 10.) for x in range(-50, 50, 5)])
xy_chart.add('y = cos(x)', [(x / 10., cos(x / 10.)) for x in range(-50, 50, 5)])
xy_chart.add('x = 1',  [(1, -5), (1, 5)])
xy_chart.add('x = -1', [(-1, -5), (-1, 5)])
xy_chart.add('y = 1',  [(-5, 1), (5, 1)])
xy_chart.add('y = -1', [(-5, -1), (5, -1)])
~~~



Figure 51: Created by Pygal

~~~
xy_chart.render_to_png(sys.argv[-1])
```
~~~



Figure 52: Created by Pygal

Octave

Earlier example of Octave, but now run as a script.

~~~
```{.shebang keep="true" caption="Created by Octave"}
#!/usr/bin/env octave

figure(1, 'visible', 'off');

x = 0:0.01:2*pi;
a = sin(x);
b = cos(2*x);
c = sin(4*x);
d = 2*sin(3*x);
plot(x,a,x,b,x,c,x,d, "linewidth", 2);
set(gca, "xlim", [0,2*pi], "fontsize", 15);
title("sinusoids");
~~~

```
print(1, argv(){1})
```
```

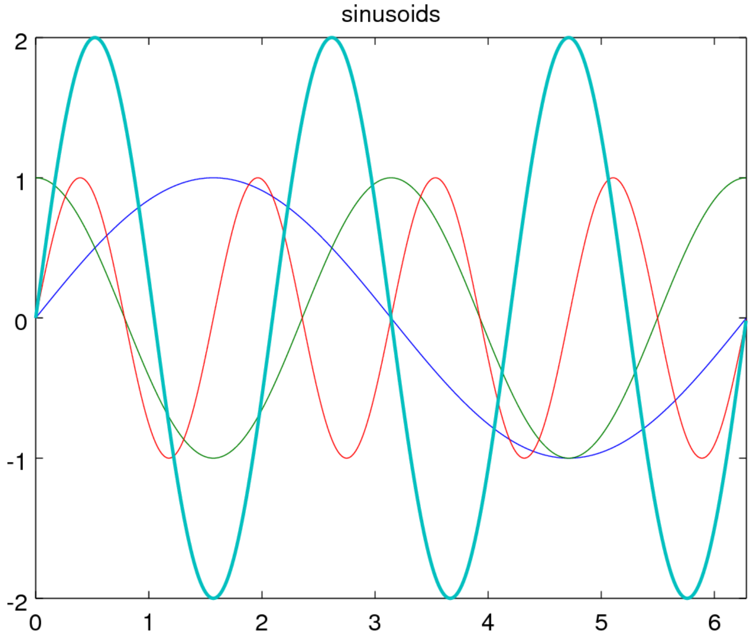

sinusoids
2
1
0
-1
-2
0
1
2
3
4
5
6

Figure 53: Created by Octave

ChartDirector

The yellow bars below the images created by ChartDirector are because this is the demo-version without a license.

Line Chart

```
```{.shebang keep="true" caption="Created by ChartDirector"}
#!/usr/bin/python
import sys
from pychartdir import *

data0 = [42, 49, NoValue, 38, 64, 56, 29, 41, 44, 57]
data1 = [65, 75, 47, 34, 42, 49, 73, NoValue, 90, 69, 66, 78]
data2 = [NoValue, NoValue, 25, 28, 38, 20, 22, NoValue, 25, 33, 30, 24]
```

```
labels = ["Jan", "Feb", "Mar", "Apr", "May", "Jun", "Jul", "Aug", "Sep", "Oct", "Nov", "Dec'
c = XYChart(600, 360, brushedSilverColor(), Transparent, 2)
c.setRoundedFrame()
title = c.addTitle("Product Line Global Revenue", "timesbi.ttf", 18)
title.setMargin2(0, 0, 6, 6)
c.addLine(10, title.getHeight(), c.getWidth() - 11, title.getHeight(), LineColor)
legendBox = c.addLegend(c.getWidth() / 2, title.getHeight(), 0, "arialbd.ttf", 10)
legendBox.setAlignment(TopCenter)
legendBox.setBackground(Transparent, Transparent)
c.setPlotArea(70, 75, 460, 240, -1, -1, Transparent, 0x000000, -1)
c.xAxis().setLabels(labels)
c.syncYAxis()
c.yAxis().setTickDensity(30)
c.xAxis().setColors(Transparent)
c.yAxis().setColors(Transparent)
c.yAxis2().setColors(Transparent)
c.xAxis().setMargin(15, 15)
c.xAxis().setLabelStyle("arialbd.ttf", 8)
c.yAxis().setLabelStyle("arialbd.ttf", 8)
c.yAxis2().setLabelStyle("arialbd.ttf", 8)
c.yAxis().setTitle("Revenue in USD millions", "arialbi.ttf", 10)
c.yAxis2().setTitle("Revenue in USD millions", "arialbi.ttf", 10)
layer0 = c.addLineLayer2()
layer0.addDataSet(data0, 0xff0000, "Quantum Computer").setDataSymbol(GlassSphere2Shape, 11)
layer0.setLineWidth(3)
layer1 = c.addLineLayer2()
layer1.addDataSet(data1, 0x00ff00, "Atom Synthesizer").setDataSymbol(GlassSphere2Shape, 11)
layer1.setLineWidth(3)
layer1.setGapColor(c.dashLineColor(0x00ff00))
layer2 = c.addLineLayer2()
layer2.addDataSet(data2, 0xff6600, "Proton Cannon").setDataSymbol(GlassSphere2Shape, 11)
layer2.setLineWidth(3)
layer2.setGapColor(SameAsMainColor)
c.layoutLegend()
c.packPlotArea(15, legendBox.getTopY() + legendBox.getHeight(), c.getWidth() - 16, c.getHeig
    ) - 25)

c.makeChart(sys.argv[-1])
```

Surface

```{.shebang keep="true" caption="Created by ChartDirector"}
#!/usr/bin/python
import sys
```

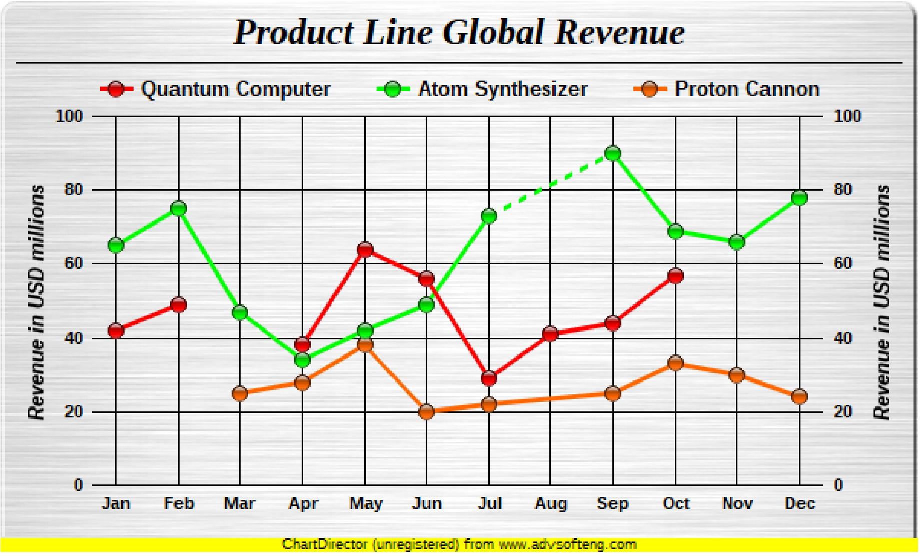


Figure 54: Created by ChartDirector

```
from pychartdir import *

dataX = [0.5, 1.9, 4.9, 1.0, 8.9, 9.8, 5.9, 2.9, 6.8, 9.0, 0.0, 8.9, 1.9, 4.8, 2.4, 3.4, 7.9
    4.8, 7.5, 9.5, 0.4, 8.9, 0.9, 5.4, 9.4, 2.9, 8.9, 0.9, 8.9, 10.0, 1.0, 6.8, 3.8, 9.0, 5.
    4.9, 4.5, 2.0, 5.4, 0.0, 10.0, 3.9, 5.4, 5.9, 5.8, 0.3, 4.4, 8.3]
dataY = [3.3, 3.0, 0.7, 1.0, 9.3, 4.5, 8.4, 0.1, 0.8, 0.1, 9.3, 1.8, 4.3, 1.3, 2.3, 5.4, 6.9
    9.8, 7.5, 1.8, 1.4, 4.5, 7.8, 3.8, 4.0, 2.9, 2.4, 3.9, 2.9, 2.3, 9.3, 2.0, 3.4, 4.8, 2.3
    2.3, 1.5, 7.8, 4.5, 0.9, 6.3, 2.4, 6.9, 2.8, 1.3, 2.9, 6.4, 6.3]
dataZ = [6.6, 12.5, 7.4, 6.2, 9.6, 13.6, 19.9, 2.2, 6.9, 3.4, 8.7, 8.4, 7.8, 8.0, 9.4, 11.9,
    15.7, 12.0, 13.3, 9.6, 6.4, 9.0, 6.9, 4.6, 9.7, 10.6, 9.2, 7.0, 6.9, 9.7, 8.6, 8.0, 13.6
    5.9, 9.0, 3.2, 8.3, 9.7, 8.2, 6.1, 8.7, 5.6, 14.9, 9.8, 9.3, 5.1, 10.8, 9.8]
c = SurfaceChart(680, 550, brushedSilverColor(), 0x888888)
c.setRoundedFrame(0xffffff, 20, 0, 20, 0)
title = c.addTitle("Surface Created Using Scattered Data Points", "timesi.ttf", 20)
title.setMargin2(0, 0, 8, 8)
c.addLine(10, title.getHeight(), c.getWidth() - 10, title.getHeight(), 0x000000, 2)
c.setPlotRegion(290, 235, 360, 360, 180)
c.setViewAngle(45, -45)
c.setPerspective(30)
c.setData(dataX, dataY, dataZ)
cAxis = c.setColorAxis(660, 80, TopRight, 200, Right)
cAxis.setTitle("Z Title Placeholder", "arialbd.ttf", 12)
cAxis.setBoundingBox(0xeeeeee, 0x888888)
cAxis.setRoundedCorners(10, 0, 10, 0)
c.setSurfaceAxisGrid(0xcc000000)
```

~~~~
c.setContourColor(0x80ffffff)
c.setWallColor(0x000000)
c.setWallGrid(0xffffff, 0xffffff, 0xffffff, 0x888888, 0x888888, 0x888888)
c.setWallThickness(0, 0, 0)
c.setWallVisibility(1, 0, 0)
c.xAxis().setTitle("X Title\nPlaceholder", "arialbd.ttf", 12)
c.yAxis().setTitle("Y Title\nPlaceholder", "arialbd.ttf", 12)
c.makeChart(sys.argv[-1])
```
~~~~

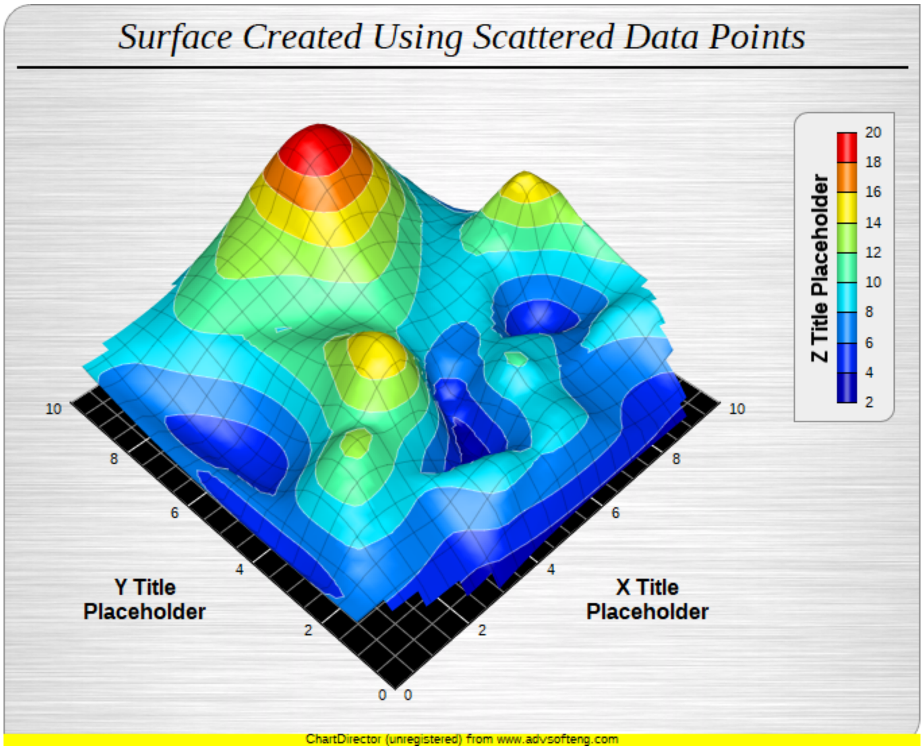


Figure 55: Created by ChartDirector

Gauge

~~~~
```{.shebang keep="true" caption="Created by ChartDirector"}
#!/usr/bin/python
import sys
from pychartdir import *

value = 54
~~~~

```
colorList = [0x0033dd, 0xaaaa00]
mainColor = colorList[1]
size = 300
outerRadius = int(size / 2 - 2)
scaleRadius = int(outerRadius * 92 / 100)
colorScaleRadius = int(scaleRadius * 43 / 100)
colorScaleWidth = int(scaleRadius * 10 / 100)
tickLength = int(scaleRadius * 10 / 100)
tickWidth = int(scaleRadius * 1 / 100 + 1)
fontSize = int(scaleRadius * 13 / 100)
readOutRadiusRatio = 0.333333333333
readOutFontSize = int(scaleRadius * 24 / 100)
m = AngularMeter(size, size, 0x000000)
m.setColor(TextColor, 0xffffff)
m.setColor(LineColor, 0xffffff)
m.setMeter(size / 2, size / 2, scaleRadius, -180, 90)
bgGradient = [0, mainColor, 0.5, m.adjustBrightness(mainColor, 0.75), 1, m.adjustBrightness(
    mainColor, 0.15)]
m.addRing(0, outerRadius, m.relativeRadialGradient(bgGradient, outerRadius * 0.66))
neonGradient = [0.89, Transparent, 1, mainColor, 1.07, Transparent]
m.addRing(int(scaleRadius * 85 / 100), outerRadius, m.relativeRadialGradient(neonGradient))
m.addRing(scaleRadius, int(scaleRadius + scaleRadius / 80), m.adjustBrightness(mainColor, 2)
m.setScale(0, 100, 10, 5, 1)
m.setLabelStyle("ariali.ttf", fontSize)
m.setTickLength( - tickLength,  - int(tickLength * 80 / 100),  - int(tickLength * 60 / 100))
m.setLineWidth(0, tickWidth, int((tickWidth + 1) / 2), int((tickWidth + 1) / 2))
smoothColorScale = [0, 0x0000ff, 25, 0x0088ff, 50, 0x00ff00, 75, 0xdddd00, 100, 0xff0000]
highColorScale = [70, Transparent, 100, 0xff0000]
m.addColorScale(highColorScale)
m.addPointer2(value, 0xff0000, -1, TriangularPointer2, 0.4, 0.6, 6)
m.setCap2(Transparent, m.adjustBrightness(mainColor, 0.3), m.adjustBrightness(mainColor, 1.5
    0.75, 0, readOutRadiusRatio, 0.015)
m.addText(size / 2, size / 2, m.formatValue(value, "{value|0}"), "ariali.ttf", readOutFontSi
    m.adjustBrightness(mainColor, 2.5), Center).setMargin(0)
m.addGlare(scaleRadius)
m.makeChart(sys.argv[-1])
```

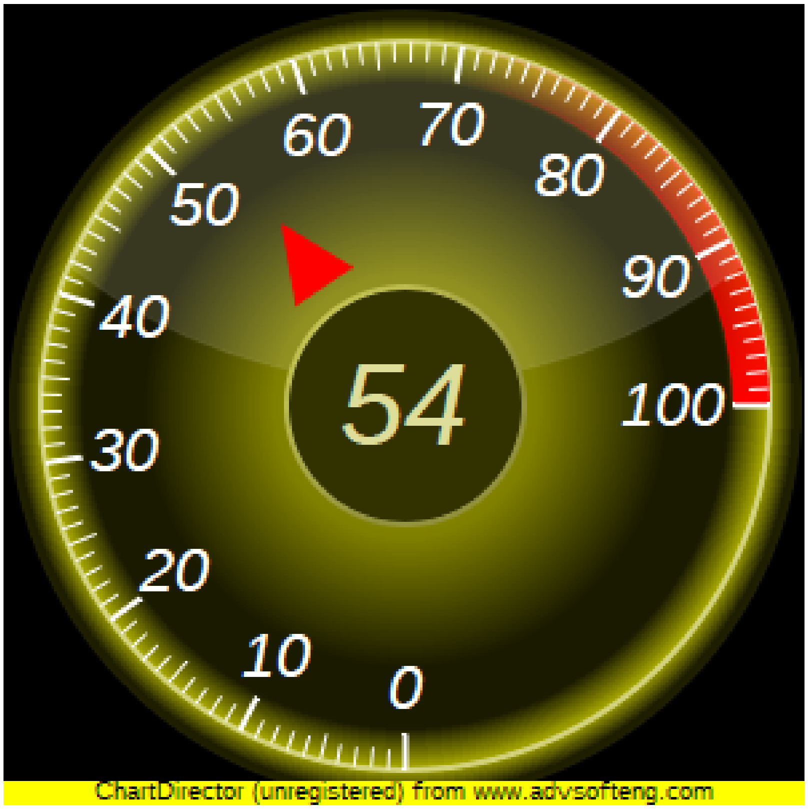


Figure 56: Created by ChartDirector