轴 — 一个用于绘制二维图形的程序

1. 一般信息

轴是一个用于绘制二维图形的程序。它具有自动缩放、对数轴、误差条和带有希腊字母、上标和下标以及特殊字符的标签的功能。输出的轴是一个文件，使用UNIX设备独立图形命令的子集，可以被任何可用的图层过滤器所绘制。轴支持大多数UNIX图形程序的选项，但也包含许多附加功能。

轴旨在易于使用，用于简单的绘图。应该能够使用很少的选项或没有选项来制作简单的图表。为了完成图表，带有漂亮的标签等，可能需要许多选项。

在最简单的情况下，输入到轴的是一系列行，每行包含两个值对。例如：

```
1.0 1.0
2.0 2.1
3.0 2.9
```

通过此输入，轴将绘制一个连接所有点的图形。x和y坐标范围将被自动选择以包含所有数据。

有许多选项可以修改轴的行为。这些选项可以在轴命令行中指定，也可以在输入的行中以‘#’字符开头。例如，要将x范围设置为0到1.5，你可以使用

```
axis -x 0 1.5 < data > output
```

“#”符号用于标记数据文件中的选项行。这些行可以在任何位置出现。对于大多数选项，如x或y范围，只定义一次是有意义的。如果重复定义，则最后一次定义生效。文件中的选项规定覆盖命令行中的规定。

轴可以放置标题、x和y轴标签、在任意点的标签，或任何字符作为绘图符号。在整个这些标签中使用的字符集是广泛接受的，如ASCII。

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from the SLAC Unified Graphics System. It contains all the usual ASCII characters, Greek Letters, Math symbols, and some special plotting characters. The non ASCII characters are specified by troff-like escape sequences. See below.

Axis is a descendant of the UNIX graph command. Many of the options are compatible with graph, although axis does require that successive data points be on separate lines. The output of axis is in UNIX device independent graphics format (see plot(5)). To display the results use the plot filters (plot(1)).

The remainder of this document contains information on the various options to axis. They are divided into options affecting the data and how it is plotted and options affecting the labeling. The distinction is not clear. Appendix A displays the UGS character set, appendix B summarizes the escape sequences for special characters, and appendix C summarizes the options.

2. Options affecting the data plotting

2.1 x and y ranges, logarithmic scales

An “x” or a “y” in the options string, followed by two numbers, forces the x or y range to that given by the two numbers. An “xl” or a “yl” makes the corresponding axis logarithmic, and if it is followed by two numbers they are the range. An optional third number following the x or y is the distance between major tick marks along the axis. For example

\[
\begin{align*}
  x & \quad 0 \quad 2 \\
  x & \quad l \\
  x & \quad l \quad 1 \quad 1000
\end{align*}
\]

are all legal options.

2.2 Automatic abscissas

If the “-a” option is specified the x coordinate is missing from the data. Axis will then plot points evenly spaced in x. If a single number is after the “-a”, this number will be the spacing between points, and if two numbers are present they will be the spacing and the initial value of x.

2.3 Size and location of the graph.

Axis by default makes a square graph almost filling the page. To change the size of the graph use “-h number”, where the number is the fraction of the default height, and “-w number” where the number is the fraction of the default width. To move the graph, use “-u number” where the number is the fraction of the graph size to move up, or “-r number” to move right. (It is usually necessary to move right a little if you want to label the y axis. “-r 0.1” usually works.)
2.4 Error bars

A “e” (or a “-e”) in an options string means that subsequent lines of input should contain three numbers: an x value, a y value, and an error on the y value. Axis will then plot error bars. The “e” option may be changed in mid plot. To turn off the error bars and return to normal plotting, use an “e0” in an options line.

2.5 Linestyles

A “m number” in the options changes the linestyle. The recognized values of the number are 0 for no lines (i.e. a point plot), 1 for solid lines (this is the default), 2 for dotted lines, 3 for short dashes, 4 for long dashes, and 5 for dot-dashed lines. Not all output devices will make all of these line styles. This option may be changed in mid plot.

2.6 Labeling points and breaking lines

If the data in an input line is followed by a string in double quotes, that string is used as a label for the point. As noted before, the character set contains a selection of plotting symbols which can be used to plot the points. To set a default label for each point use the option ‘c “label”’, and to turn a default label off use ‘c0’. The label size can be adjusted by the option “cs number”. The default size is 1.5, in units of a terminal’s standard character size. See the section below on labels for a instructions on the use of the special characters.

Any options line causes a break in the data. That is, the point preceding the options line will not be connected to the following point. Thus an options line consisting only of a “#” will cause a break. The default action of axis is also to break the graph after each labeled point or error bar, that is, not to connect it to the next point. To force connections, use the option “-lb0”. The option “-lb1” restores the default action of breaking after labels or error bars. (“-b” is an archaic form of “-lb0”.) Another way to introduce a break is to use a label consisting of a blank (still in double quotation marks!).

2.7 Transposing x and y

The “t” option transposes the x and y axes. It doesn’t work on data with error bars.

2.8 Superimposing graphs

The “-s” option prevents axis from putting a screen clear at the beginning. This allows superimposing graphs, or when combined with the h,u,w, and d options, allows more than one graph on the screen.
2.9 Grid options

Use the “-g number” option to set the grid style. 0 means no grid, 1 means a frame with tick marks, 2 means a full grid, and 3 means the bottom and left sides of the frame only. The default is 1.

Use “-tsx number” and “-tsy number” to set the tick mark style for the x and y axes. 0 is no tick marks, 1 is big marks at the numbers and little marks in between, and 2 is big marks at the numbers only. The default is 1.

Use “-nx” and/or “-ny” to get no numbers on the x and/or y axes.

Use the “-box” option to get a frame with no numbers or tick marks.

3. Labels

Axis will put titles on a graph, labels on the x and y axes, and labels at arbitrary points. There are a host of options to control this. All of the labels use the same character set. Like all UNIX strings, they must be enclosed in double quotes if they are more than one word. To get a real double quote into a label, use ‘"’’. Special characters are given by troff like escape sequences, which are a backslash (\”) followed by two characters. For example, to get a Greek letter use “\gX”, which will produce the Greek equivalent of the Roman letter X. The case of the Greek letter will be the case of X. (The g may be either case, or you can use \*X for compatibility with troff.)

Labels may have superscripts and subscripts. To start a superscript use “\sp”, and to end a superscript use “\ep”. Use “\sb” and “\eb” to start and end a subscript.

To overstrike characters, underline characters, or fill a square root sign, use “\mk” (mark) and “\rt” (return). A “mark” remembers the current point, and a “return” returns to it. Thus to make a square root sign with an “a” in it use the square root symbol, the overbar, and the a: “sq\mk\rn\rt a”

To get a real backslash into the label, use two backslashes (“\\”). The escape sequences are tabulated in appendix B.

3.1 Specifying a title

Use the ‘lt “title”’ option to specify a title, where “title” is a character string enclosed in double quotes. If a title is given, there are other optional options (sorry about that) to modify it. “lts number” modifies the title size, and the default size is 2. “ltx number” and “lty number” modify the placement of the title. The default is top center of the graph, and the coordinate system used is one in which the graph area runs from 0.0 to 1.0 in both the x and y directions.

3.2 Labeling axes

The ‘lx “string”’ and ‘ly “string”’ options to put a label on the x or y axis respectively. The “lxs number” and “lys number” options change the sizes of these labels. The default axis label size is 1.5. “lxx number”, “lx y number”, “ly x number”, and “ly y number” change the x and y coordinates of the x and y axis labels.
3.3 Labels in the graph

As noted above, a line of the form

```
x_value y_value "label"
```

puts a label at the indicated coordinates (in the data’s coordinate system), and the “-c label” option may be used to set a default label, or plotting symbol, for each point. The “cs number” option changes the label size.

Appendix A: The UGS character set

? 

Appendix B: escape sequences for special characters

<table>
<thead>
<tr>
<th>Escape sequence</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>(backslash omitted!)</td>
<td></td>
</tr>
<tr>
<td>Plotting symbols</td>
<td></td>
</tr>
<tr>
<td>pl</td>
<td>plus sign</td>
</tr>
<tr>
<td>cr</td>
<td>cross</td>
</tr>
<tr>
<td>di</td>
<td>diamond</td>
</tr>
<tr>
<td>sq</td>
<td>square</td>
</tr>
<tr>
<td>oc</td>
<td>octagon</td>
</tr>
<tr>
<td>fd</td>
<td>fancy diamond</td>
</tr>
<tr>
<td>fs</td>
<td>fancy square</td>
</tr>
<tr>
<td>fx</td>
<td>fancy cross</td>
</tr>
<tr>
<td>fp</td>
<td>fancy plus</td>
</tr>
<tr>
<td>bu</td>
<td>burst</td>
</tr>
<tr>
<td>Greek letters (both cases)</td>
<td></td>
</tr>
<tr>
<td>ga,gA</td>
<td>alpha</td>
</tr>
<tr>
<td>gb,gB</td>
<td>beta</td>
</tr>
<tr>
<td>gg,gG</td>
<td>gamma</td>
</tr>
<tr>
<td>gd,gD</td>
<td>delta</td>
</tr>
<tr>
<td>ge,gE</td>
<td>epsilon</td>
</tr>
<tr>
<td>gz,gZ</td>
<td>zeta</td>
</tr>
<tr>
<td>gy,gY</td>
<td>eta</td>
</tr>
<tr>
<td>gh,gT</td>
<td>theta</td>
</tr>
<tr>
<td>gi,gI</td>
<td>iota</td>
</tr>
<tr>
<td>gk,gK</td>
<td>kappa</td>
</tr>
<tr>
<td>gl,gL</td>
<td>lambda</td>
</tr>
<tr>
<td>gm,gM</td>
<td>mu</td>
</tr>
</tbody>
</table>
gn, gN
gc, gC
go, gO
gp, gP
gr, gR
gs, gS
gt, gT
gu, gU
gf, gF
gx, gX
gq, gQ
gw, gW

nu
xi
omicron
pi
rho
sigma
tau
upsilon
phi
chi
psi
omega

Special symbols

tm
di
+-
<=
>=
=nb
pt
is
li
pd
dl
sr
ul
rn
hb
lb
de
in
dg
dd
<- 
->
da
ua
la
ra
ib
sc
cu
times
divide
plus or minus
less than or equal
greater than or equal
approximately equal
not equal
proportional to
integral sign
line integral
partial derivative
del (gradient)
square root
underline
overbar (“run”)
h bar
lambda bar
degree
infinity
dagger
double dagger
left arrow
right arrow
down arrow
up arrow
left angle
right angle
interabang
section
cap (intersection)
cup (union)
<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>mo</code></td>
<td>member of</td>
</tr>
<tr>
<td><code>nm</code></td>
<td>not a member of</td>
</tr>
<tr>
<td><code>ex</code></td>
<td>exists</td>
</tr>
<tr>
<td><code>al</code></td>
<td>for all</td>
</tr>
<tr>
<td><code>sb</code></td>
<td>subset</td>
</tr>
<tr>
<td><code>ds</code></td>
<td>direct sum (xor)</td>
</tr>
<tr>
<td><code>dp</code></td>
<td>direct product</td>
</tr>
<tr>
<td><code>sp</code></td>
<td>superset</td>
</tr>
</tbody>
</table>

**Control characters**

<table>
<thead>
<tr>
<th>Character</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>sp</code></td>
<td>start superscript</td>
</tr>
<tr>
<td><code>ep</code></td>
<td>end superscript</td>
</tr>
<tr>
<td><code>sb</code></td>
<td>start subscript</td>
</tr>
<tr>
<td><code>eb</code></td>
<td>end subscript</td>
</tr>
<tr>
<td><code>mk</code></td>
<td>mark location</td>
</tr>
<tr>
<td><code>rt</code></td>
<td>return to mark</td>
</tr>
</tbody>
</table>
Appendix C: summary of options

Square brackets indicate optional modifiers. The minus sign is unnecessary, just conventional.

-\texttt{x [l]} [xmin xmax] [xquant] range of x, and logarithmic flag
-\texttt{y [l]} [xmin xmax] [yquant] range of y, and logarithmic flag
-\texttt{a [spacing] [initial]} automatic abscissas
-\texttt{m style} linestyle
-\texttt{g style} grid style
-\texttt{tsx style} x tick mark style
-\texttt{tsy style} y tick mark style
-\texttt{nx} don’t number x axis
-\texttt{ny} don’t number y axis
-\texttt{box} don’t number or tick axes
-\texttt{s} don’t erase
-\texttt{e} data with errors
-\texttt{-e0} end data with errors
-\texttt{-c “string”} default plot symbol
-\texttt{-c0} turn off default symbol
-\texttt{-cs number} plot symbol size
-\texttt{-lb1} break after labels
-\texttt{-lb0} don’t break at labels
-\texttt{-h number} fraction of height to use
-\texttt{-w number} fraction of width to use
-\texttt{-u number} move up
-\texttt{-r number} move right
-\texttt{-lt “string”} title
-\texttt{-lx “string”} x axis label
-\texttt{-ly “string”} y axis label
-\texttt{-lts number} title size
-\texttt{-lxs number} x label size
-\texttt{-lys number} y label size
-\texttt{-ltx number} title x coordinate
-\texttt{-lty number} title y coordinate
-\texttt{-lxx number} x label x coordinate
-\texttt{-lxy number} x label y coordinate
-\texttt{-lyx number} y label x coordinate
-\texttt{-lyy number} y label y coordinate