Chapter 7. pxgraph — The Plotting Program

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7.1 Introduction

The *pxgraph* program draws a graph on an X display given data read from either data files or from standard input if no files are specified. In Ptolemy, this program is invoked by several stars in several domains, and by the plot command in Pigi. The program is also available for stand-alone use, independent of Ptolemy. Pxgraph can display up to 64 independent data sets using different colors and/or line styles for each set. It annotates the graph with a title, axis labels, grid lines or tick marks, grid labels, and a legend. There are options to control the appearance of most components of the graph.

Pxgraph is a slight variant of *xgraph*, modified to handle unusual IEEE floating-point numbers such as Inf and Nan, and to accept binary as well as ASCII input.

7.2 Invoking xgraph

The synopsis for stand-alone invocation of pxgraph is

pxgraph [options] [=WxH+X+Y] [-display host:display.screen] [file ...]

The options are explained below. When invoking pxgraph through a Ptolemy star, or the plot command, any of the options can be specified. Hence the full flexibility of the program is available to the user.

7.3 Detailed description

The input format is similar to *graph(1G)* but differs slightly. The data consists of a number of "*data sets*." Data sets are separated by a blank line. A new data set is also assumed at the start of each input file. A data set consists of an ordered list of points of the form "{directive} X Y". The directive is either "draw" or "move" and can be omitted. If the directive is "draw", a line will be drawn between the previous point and the current point (if a line graph is chosen). Specifying a "move" directive tells pxgraph not to draw a line between the points. If the directive is omitted, "draw" is assumed for all points in a data set except the first point where "move" is assumed. The "move" directive is used most often to allow discontinuous data in a data set. The name of a data set can be specified by enclosing the name in double quotes on a line by itself in the body of the data set. The trailing double quote is optional. Overall graphing options for the graph can be specified in data files by writing lines of the form "<option>: <value>". The option names are the same as those used for specifying X resources (see below). The option and value must be separated by at least one space. An example input file with three data sets is shown below. Note that set three is not named, set two has discontinuous data, and the title of the graph is specified near the top of the file.

```
TitleText: Sample Data
0.5 7.8
1.0 6.2
"set one"
1.5 8.9
"set two"
-3.4 1.4e-3
-2.0 1.9e-2
move -1.0 2.0e-2
-0.65 2.2e-4

2.2 12.8
2.4 -3.3
2.6 -32.2
2.8 -10.3
```

After *pxgraph* has read the data, it will create a new window to graphically display the data. The interface used to specify the size and location of this window depends on the window manager currently in use. Refer to the reference manual of the window manager for details.

Once the window has been opened, all of the data sets will be displayed graphically (subject to the options explained below) with a legend in the upper right corner of the screen. To zoom in on a portion of the graph, depress a mouse button in the window and sweep out a region. *Pxgraph* will then open a new window looking at just that portion of the graph. *Pxgraph* also presents three control buttons in the upper left corner of each window: *Close, Hardcopy,* and *About.* Windows are closed by depressing a mouse button while the mouse cursor is inside the *Close* button. Typing EOF (control-D) in a window also closes that window. Depressing a mouse button while the mouse cursor is in the *Hardcopy* button causes a dialog to appear asking about hardcopy (printout) options. These options are described below:

"Output Device"
: Specifies the type of the output device (e.g. "HPGL", "Postscript", etc.). An output device is chosen by depressing the mouse inside its name. The default values of other fields will change when you select a different output device.

"Disposition"
: Specifies whether the output should go directly to a device or to a file. Again, the default values of other fields will change when you select a different disposition.

"File or Device Name"
: If the disposition is "To Device", this field specifies the device name. A device name is the same as the name given for the -P command of lpr(1). If the disposition is "To File", this field specifies the name of the output file.

"Maximum Dimension"

This specifies the maximum size of the plot on the hardcopy device in centimeters. *Pxgraph* takes in account the aspect ratio of the plot on the screen and will scale the plot so that the longer side of the plot is no more than the value of this parameter. If the device supports it, the plot may also be rotated on the page based on the value of the maximum dimension.

"Include in Document"
: If selected, this option causes *pxgraph* to produce hardcopy output that is suitable for inclusion in other larger documents. As an example, when this option is selected the Postscript output produced by pxgraph will have a bounding box suitable for use with psfig.

"Title Font Family"
: This field specifies the name of a font to use when drawing the graph title. Suitable defaults are initially chosen for any given hardcopy device. The value of this field is hardware specific -- refer to the device reference manual for details.

"Title Font Size"
: This field specifies the desired size of the title fonts in points (1/72 of an inch). If the device supports scalable fonts, the font will be scaled to this size.

"Axis Font Family and Axis Font Size"
: These fields are like *"Title Font Family*" and *"Title Font Size*" except they specify values for the font *pxgraph* uses to draw axis labels, and legend descriptions.

"Control Buttons"
: After specifying the parameters for the plot, the "Ok" button causes *pxgraph* to produce a hardcopy. Pressing the "Cancel" button will abort the hardcopy operation. Depressing the *About* button causes pxgraph to display a window containing the version of the program and an electronic mailing address for the author for comments and suggestions.

7.4 Options

Pxgraph accepts a large number of options most of which can be specified either on the command line, in the user's .Xdefaults or .Xresources file, or in the data files themselves. A list of these options is given below. The command line option is specified first with its X default or data file name (if any) in parenthesis afterward. The format of the option in the X defaults file is "program.option: value" where program is the program name (pxgraph) and the option name is the one specified below. Option specifications in the data file are similar to the X defaults file specification except the program name is omitted.

=WxH+X+Y (Geometry)
: Specifies the initial size and location of the pxgraph window.

-<digit> <name>
: These options specify the data set name for the corresponding data set. The digit should be in the range "0" to "63". This name

will be used in the legend.

-bar (BarGraph) Specifies that vertical bars should be drawn from the data points to a base point which can be specified with -brb. Usually, the -nl flag is used with this option. The point itself is located at the center of the bar.

-bb (BoundBox) Draw a bounding box around the data region. This is very useful if you prefer to see tick marks rather than grid lines (see -tk).

-bd <color> (Border) This specifies the border color of the *pxgraph* window.

-bg <color> (Background)
Background color of the *pxgraph* window.

-binary This specifies that the input is a binary file rather than an ASCII file.

-brb <base> (BarBase)
This specifies the base for a bar graph. By default, the base is zero.

-brw <width> (BarWidth)
This specifies the width of bars in a bar graph. The amount is specified in the user's units. By default, a bar one pixel wide is drawn.

-bw <size> (BorderSize)
Border width (in pixels) of the *pxgraph* window.

-db (Debug) Causes pxgraph to run in synchronous mode and prints out the values of all known defaults.

-fg <color> (Foreground)
Foreground color. This color is used to draw all text and the normal grid lines in the window.

-gw (GridSize) Width, in pixels, of normal grid lines.

-gs (GridStyle) Line style pattern of normal grid lines.

-lf <fontname> (LabelFont)
Label font. All axis labels and grid labels are drawn using this font. A font name may be specified exactly (e.g. "9x15" or "-*-courier-bold-r-normal-*-140-*") or in an abbreviated form: <family>-<size>. The family is the family name (like helvetica) and the size is the font size in points (like 12). The default for this parameter is "helvetica-12".

-lnx (LogX) Specifies a logarithmic X axis. Grid labels represent powers of ten.

-lny (LogY) Specifies a logarithmic Y axis. Grid labels represent powers of ten.

-lw width (LineWidth)
: Specifies the width of the data lines in pixels. The default is zero.

-lx <xl,xh> (XLowLimit, XHighLimit)
: This option limits the range of the X axis to the specified interval. This (along with -ly) can be used to “zoom in” on a particularly interesting portion of a larger graph.

-ly <yl,yh> (YLowLimit, YHighLimit)
: This option limits the range of the Y axis to the specified interval.

-m (Markers)
: Mark each data point with a distinctive marker. There are eight distinctive markers used by pxgraph. These markers are assigned uniquely to each different line style on black and white machines and varies with each color on color machines.

-M (StyleMarkers)
: Similar to -m but markers are assigned uniquely to each eight consecutive data sets (this corresponds to each different line style on color machines).

-nl (NoLines)
: Turn off drawing lines. When used with -m, -M, -p, or -P this can be used to produce scatter plots. When used with -bar, it can be used to produce standard bar graphs.

-p (PixelMarkers)
: Marks each data point with a small marker (pixel sized). This is usually used with the -nl option for scatter plots.

-P (LargePixels)
: Similar to -p but marks each pixel with a large dot.

-rv (ReverseVideo)
: Reverse video. On black and white displays, this will invert the foreground and background colors. The behavior on color displays is undefined.

-t <string> (TitleText)
: Title of the plot. This string is centered at the top of the graph.

-tf <fontname> (TitleFont)
: Title font. This is the name of the font to use for the graph title. A font name may be specified exactly (e.g. “9x15” or “-*-courier-bold-r-normal-*-140-*”) or in an abbreviated form: <family>-<size>. The family is the family name (like helvetica) and the size is the font size in points (like 12). The default for this parameter is “helvetica-18”.

-tk (Ticks)
: This option causes *pxgraph* to draw tick marks rather than full grid lines. The -bb option is also useful when viewing graphs with tick marks only.

-x <unitname> (XUnitText)
: This is the unit name for the X axis. Its default is “X”.

-y <unitname> (YUnitText)
: This is the unit name for the Y axis. Its default is “Y”.

-zg <color> (ZeroColor)
: This is the color used to draw the zero grid line.

-zw <width> (ZeroWidth)
: This is the width of the zero grid line in pixels.

Some options can only be specified in the X defaults file or in the data files. These options are described below:

<digit>.Color
: Specifies the color for a data set. Eight independent colors can be specified. Thus, the digit should be between ‘0’ and ‘7’. If there are more than eight data sets, the colors will repeat but with a new line style (see below).

<digit>.Style
: Specifies the line style for a data set. A string of ones and zeros specifies the pattern used for the line style. Eight independent line styles can be specified. Thus, the digit should be between ‘0’ and ‘7’. If there are more than eight data sets, these styles will be reused. On color workstations, one line style is used for each of eight colors. Thus, 64 unique data sets can be displayed.

Device
: The default output form presented in the hardcopy dialog (i.e. “Postscript”, “HPGL”, etc.).

Disposition
: The default setting of whether output goes directly to a device or to a file. This must be one of the strings “To File” or “To Device”.

FileOrDev
: The default file name or device string in the hardcopy dialog.

ZeroWidth
: Width, in pixels, of the zero grid line.

ZeroStyle
: Line style pattern of the zero grid line.

7.5 Bugs

- Zooming in on bar graphs doesn’t work right.
- There is no way to produce hardcopy without running pxgraph interactively.
- Specifying the colors for data sets using X resources does not work.