Fall 2008

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Graphics in Scmutils

We provide low-level support for plotting graphs and making simple drawings.

One can make a window, draw lines and points in the window, clear the window and close it.

A window is a data object that is made with the procedure frame. So, for example, one may make a window and give it the name win1 as follows:

(define win1 (frame 0 7 -2 2))

The window so constructed will have horizontal coordinates that range from 0 (inclusive) to 7 (exclusive) and vertical coordinates that range from -2 (inclusive) to 2 (exclusive).

Execution of the frame procedure will construct the window and put it up on your screen. However, you must give it a name so that you can refer to the window to draw in it.

Given such a window, you can use it to plot a function:

(plot-function win1 sin 0 7 .01)

This will plot in the window win1 the curve described by (sin theta), in the interval from theta=0 to theta=7, sampling at intervals of delta-theta=.01.

The general pattern is

(plot-function <window> <procedure> <x-min> <x-max> <delta-x>)

where <procedure> takes one numerical argument and produces a numerical value.

We can overlay other plots in the same window:

(plot-function win1 cos 0 7 .01)

If we want, we can clear the window:

(graphics-clear win1)

And we can make the window go away:

(graphics-close win1)

After a window is closed it is no longer useful for plotting so it is necessary to make a new one using frame if you want to plot further.
There are other useful procedures for plotting.

(plot-point <window> <x> <y>)

drops a point at the coordinates (x, y) in the window.

(plot-line <window> <x0> <y0> <x1> <y1>)

draws a line segment from (x0, y0) to (x1, y1) in the window.

(plot-parametric <window> <procedure> <t-min> <t-max> <delta-t>)

draws a parametric curve. The <procedure> must implement a function of one real argument (the parameter) and must return the cons pair of two numbers, the x and the y value for the given value of the parameter.

One can use the pointing device (mouse) to indicate a position. The procedure to interrogate the pointing device is:

(get-pointer-coordinates <window> <continuation>)

where <continuation> is a procedure that is called when the pointing device is positioned and a button is pressed. The continuation takes 3 arguments, the x-coordinate of the hit, the y-coordinate of the hit, and a designator of which mouse button was pressed.

For example:

(get-pointer-coordinates win1 list)
;Value: (.16791979949874686 .5037593984962406 0)

The value returned indicates that the left mouse button was pressed when the pointer was placed at the coordinates .1679... .5037...

The frame procedure takes a large number of optional arguments, allowing one to tailor a window to particular specifications. The default values shown below are for the X window system used with Unix.

(frame xmin ;minimum x coordinate. 0.0
  xmax ;maximum x coordinate. 1.0
  ymin ;minimum y coordinate. 0.0
  ymax ;maximum y coordinate. 1.0
  frame-width ;width of window 400 pixels
  frame-height ;height of window 400 pixels
  frame-x ;horizontal screen position 750 pixels
            ; of left edge of window.
  frame-y ;vertical screen position 0 pixels
            ; of top edge of window
)