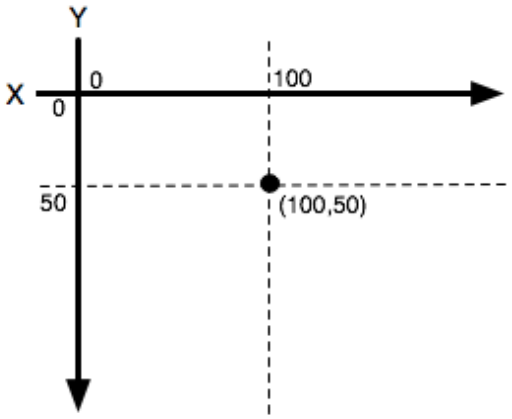
CS 141 Graphics Library (Simplegraphics)

The graphics library uses the concept of a "canvas," which is a dedicated window on the screen that can be drawn on. The library includes functions that draw shapes and show text on the canvas window. There are also functions that will detect mouse clicks in on the canvas.

The canvas is based on a grid of pixels, set up in a coordinate system with (0, 0) at the top-left corner. The x-coordinate increases left to right (as you'd expect), but the y-coordinate increases from top to bottom, unlike in the Cartesian plane, where the y-coordinate increases bottom to top.



Using the library

Make sure both the files "simplegraphics.py" and "cs1graphics.py" are in the same directory as your program. Make sure your program has the following line at the top:

Every program that uses this library must have the line

```
from simplegraphics import *
```

at the top of the program, after the comments you place at the very beginning of your code.

Before doing any drawing, you must open a new blank canvas by calling `open_canvas()`. Then you may call any drawing functions you want, and your program should end with either `close_canvas()` or `close_canvas_after_click()`. The latter is probably more useful, as waiting for a mouse click will let the user see their drawing before the program ends and the canvas disappears.

Functions in the library

Doing things with the canvas:

- `open_canvas(width, height)`: Creates a new canvas in a new window of the given width and height in pixels (as integers). There can only be one canvas open at a time.
- `set_background_color(color)`: Sets the background color of the canvas to the color specified as a **string**. Can be set multiple times and will be redrawn every time called.
- `set_background_color_rgb(r, g, b)`: Sets the background color of the canvas to the color specified as an RGB triple. Each argument must be an integer between 0 and 255.
- `clear_canvas()`: Removes all shapes and text from the canvas.
- `close_canvas()`: Immediately closes the canvas window. Everything drawn is lost.
- close_canvas_after_click(): Waits for a mouse click anywhere in the canvas window, then closes the window. The program temporarily pauses while waiting for the click.

Drawing shapes, lines, and text:

- `draw_circle(centerx, centery, radius)`: Draws a circle of the specified radius with the center at the point (centerx, centery).
- `draw_filled_circle(centerx, centery, radius)`: Same as above, but the circle is filled in with the current pen color.
- `draw_oval(centerx, centery, radiusx, radiusy)`: Draws an oval centered at the point (centerx, centery), with a radius in the x direction of radiusx, and in the y direction as radiusy.
- `draw_filled_oval(centerx, centery, radiusx, radiusy)`: Same as above, but the oval is filled in with the current pen color.
- `draw_line(x1, y1, x2, y2)`: Draws a line from the point (x1, y1) to (x2, y2).
- `draw_rect(x, y, width, height)`: Draws a rectangle with the upper-left corner at (x, y) and the width and height as specified.
- `draw_filled_rect(x, y, width, height)`: Same as above, but the rectangle is filled in with the current pen color.
- `draw_polygon(x1, y1, x2, y2, ...)`: Draws a polygon on the canvas. The points of the polygon are (x, y) pairs specified as one big list. E.g.: `draw_polygon(10, 10, 20, 20, 30, 40)` draws a polygon bounded by the line segments between the points (10, 10), (20, 20), (30, 40), and (10, 10).
- `draw_filled_polygon(x1, y1, x2, y2, ...)`: Same as above, but the polygon is filled with the current pen color.
- `draw_polyline(x1, y1, x2, y2, ...)`: Similar to drawing a polygon, except no line segment is drawn back to the starting point from the final point.
- `draw_string(message, x, y, text_size)`: Displays the given message (must be a string) the text size specified in points. (x, y) will be where the midpoint of the message is placed.

Changing the pen color: The canvas has a colored "pen" that it uses to draw shapes. The pen starts out as black; all shapes will be drawn in black unless you change the pen's color. You can also change the thickness of the pen to get a thicker border on the shapes. Note that when you change the pen's color or thickness, it only affects shapes drawn after the change.

- `set_color(color)`: Sets the color of the drawing pen to the color specified as a **string**. Examples: "red", "blue", "green", etc.[1]
- `set_color_rgb(r, g, b)`: Sets the color of the drawing pen to the color specified as an RGB triple. Each argument must be an integer between 0 and 255.
- `set_line_thickness(thickness)`: Sets the pen thickness (width of lines drawn) to the given thickness value in pixels (as an integer).

Mouse clicks:

- `wait_for_click()`: Pauses the program until the mouse is clicked in the canvas window. Then the program continues as soon as the user clicks the mouse.
- `get_last_click_x()`: Returns the x coordinate of the location on the canvas of the last mouse click. **Only can be used after `wait_for_click()`!**
- `get_last_click_y()`: Same as previous function, but returns the y coordinate.

[1] Google for "Tcl/tk colors" to get a list of named colors.