CS 2, Winter 2010: Midterm 1

Closed books, closed notes, closed computers, closed neighbors.
Ask if you have questions.
As with assignments, you will be graded on both correctness and clarity.

1. **[25 points]** Write a Processing sketch to display a window that looks like the following image. The window is 400x400 with a white background. Draw an unfilled square with a black outline of thickness 4. The square is in the middle of the sketch with each side half the window size. Draw a circle that is inscribed in this square with the same pen stroke. Finally, draw a filled circle of radius 50 centered at each corner of the square, with no outline. The filled circle at the top-left corner should be red, the one at the top-right corner should be green, the one at the bottom-right corner should be blue and the one at the bottom-left corner should be 50% gray. Use smoothing for all shapes. The gridlines are spaced every 25 pixels, to help you determine positions and sizes—don’t draw them.
2. [25 points] Write a Processing sketch with the following behavior. A white circle starts in the middle of a black window of size 400x400. The circle starts with a radius of 15. Every frame, the size of the circle changes by a random amount between -2 to 2. Each time we click the mouse, we scale the radius of the circle by 2 if the mouse is outside the circle, otherwise we move the circle so that its center is at the current mouse location. When scaling the radius, we need to ensure that the radius is no smaller than 5, and no larger than half of the window height. Hint: use constrain and dist.

// Variable declarations

type

void setup()
{
}

void draw()
{
}

void mousePressed()
{
}
3. **[25 points]** Write a Processing sketch that uses iterations to draw the following image in the middle of a white window of size 400x400. You can do this using three separate *for* loops. The first loop draws 9 circles along an horizontal line. The circles centers are equally spaces starting at (100,200) and ending at (300,100) with a spacing of 25. The second loop draws a similar line, but oriented vertically from (200,100) to (200,300). The third loop draws lines that connect the circles generated in the first two loops. A line is drawn to connect the first circle in the first loop to the first circle in the second loop, as so on. Draw everything with no fill and a black outline of thickness 3. All the circles drawn have radius 20.
4. [25 points] Provide short answers to the following (5 points each).

(a) Describe why it is beneficial to define functions that perform specific tasks in your code.

(b) Describe why it is beneficial to define classes and use objects in your code.

(c) Define a new function `squareDonut` that takes as parameters a position and two sizes, and draws two concentric squares centered at the specified location, with the sizes given (e.g., if the sizes are 3 and 5, then you are supposed to draw one square with each side being 3, and one with each side being 5). Draw the larger square first, then set the fill color to white, then draw the smaller square next. You can assume that the first size given is the larger one.

(d) Define a new function `dist2` that computes the squared distance between two given points \((x_1, y_1)\) and \((x_2, y_2)\), as \(dist^2 = (x_1 - x_2)^2 + (y_1 - y_2)^2\).

(e) Write a boolean expression that will be true if the mouse coordinates are in the bottom-left quadrant of the window and the button is pressed.