

COSC 4370 – Homework 1

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1. Problem

The assignment requires us to rasterize an ellipse defined as $\left(\frac{x}{6}\right)^2 + \left(\frac{y}{12}\right)^2 = 64^2$ where $y \geq 0$. The semi major axis is defined as $b = 768$ and the semi minor axis is defined as $a = 384$. The dimension of the image will be 1600×2000 .

2. Method

It was required that I program a midpoint ellipse algorithm that accepted 5 parameters. First one was BMP object, x coordinate origin, y coordinate origin, the semi major axis and the semi minor axis. General idea behind the method used was to divide the ellipse into 2 quadrants that are $y \geq 0$ and calculate if the points lies between 2 points within the ellipse. Then it renders the pixel at that point.

3. Implementation

Given the point of origin and the semi-major and semi-minor axes. The function first initializes the variables x and px to 0 and y to the semi-major axis and py to the radii values. The function then enters the first region of the algorithm and uses a loop to iterate through the points to check if the points are less than the radii value in the first quadrant of the ellipse. It then plots the points using the `set_pixel` method of the BMP image

object. The setpixel method also has to factor that bitmaps only have positive values, so we adjust where the pixel is rendered using our x and y parameters as the origin. The loop calculates the value of p using the midpoint algorithm formula for the ellipse, and updates the values of x, px, y, py, and p according to the algorithm until the loop condition is met. The function then enters the second region of the algorithm and uses a similar loop to iterate through the points in the second quadrant of the ellipse, again using the set_pixel method to plot the points. The loop in the second region updates the values of y, py, x, px, and p according to the midpoint algorithm until the loop condition is met. The main function initializes the parameters for the ellipse and creates a BMP image object with the specified width and height. The main function calls the drawEllipse function with the BMP image object and ellipse parameters to draw the ellipse on the image. The main function writes the BMP image object to a file and returns 0. Would like to point out that the algorithm was based on from this website: <https://www.geeksforgeeks.org/midpoint-ellipse-drawing-algorithm/>

4. Results

The output of the program was a .bmp file, when viewed through an image viewer, you can see the ellipse with $y \geq 0$.

