COSC 4370 - Homework 1

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1 Problem

This assignment requires the implementation of an algorithm for the rasterization of an ellipse. The ellipse is defined as $(x/6)^2 + (y/12)^2 = 64^2$ where $y \geq 0$. The minor radius is 384 and the major radius is 768 based on the ellipse equation. The dimension of the image will be 800×900

2 Method

The method used in this problem is called the $MidpointEllipse$ algorithm. The parameters are the minor and the major radius of the ellipse. The algorithm divides the curve of the ellipse into two regions of the first quadrant, where the midpoint of the two regions has a slope of -1, the top region (region 1) has a slope of less than -1 and the bottom region (region 2) has a slope of less than -1. By using the midpoint of the pixels, we make a decision parameter that decides which pixel is closest to the coordinates. While the partial derivative of x is less than the partial derivative of y (slope is less than -1), the algorithm plots the point for region 1. For the decision parameter of region 2 is then decided by the last coordinate of region 1.

3 Implementation

We first set the values of x to 0 and y to the major radius. The decision parameter is set based on the midpoint of the pixels and the equation of the ellipse. While the change in y is bigger than the change in x, we will plot the points in region 1. If the decision parameter is less than 0, then the midpoint is inside the ellipse and we choose the pixel outside. If not, we choose the pixel inside of the ellipse and decrement y by 1. We increment x by one in every iteration of the loop and plot the points in the first and second quadrants. Once the change in y is bigger than the change in x, we go to the next region. While y is greater than 0, we plot the points in region 2. If the second decision parameter is less than 0, then the midpoint between x and y is inside the ellipse, and choose the pixel outside and increment x by 1. If the second decision parameter

is greater than or equal to 0, we choose the pixel inside the ellipse. In each iteration, y is decremented and we plot the pixels in quadrants 1 and 2.

4 Results