Assignment Problem:

Implement an algorithm for rasterizing circles - 1 half circle $x^2 + y^2 = R^2$ where $x \geq 0$ and $R = 100$, as well as another half circle $x^2 + y^2 = R^2$ where $y \geq 0$ and $R = 150$. The centers are at the center of the canvas.

Methods:

A second-order midpoint circle algorithm was used to make 1/8th of a circle and is used to generate the rest of the image through symmetry in the renderPixel function(see figure 3.18 in the reading pdf file). The algorithm finds which pixel the line of the circle is closer to in order to identify which one to render using the midpoint between the two pixels. Second-order is used to compute the increment more precisely by finding the increments directly due to the change in increments being a linear formula of $2(x + 1) + 3$ (see page 85). The example code on page 87 is made using that formula to create an octant of a circle which is the base for the rest of the sections generated by symmetry.

The formula is used in the rasterizeArc function which only needs a radius parameter in order to calculate the midpoints and the differences for second-point calculation. Once the renderPixel function is called, the radius is also passed in to check to see if it is the outer circle or the inner circle. The base is generated at the centerline and as far right as the radius allows and starts going up following the formula pattern until it reaches the 45 degree mark. At the same time, the other sections of the image are also built at the same time using the 2d array like a graph to mark what coordinate the pixel should be drawn at.

Lastly the numbers are written in a ppm file using specific header lines for the size and the maximum number of 1 in order to specifically draw out which pixel to color and which ones not do in the same way the 2d array was mapped. The result is the ppm file (opened with gimp or a pdf application) that has a half circle arc facing down and an inner half circle facing left. The image matrix is a bool matrix for the reason of saving space as a bool is ¼ the size of an integer which results in the color of red and a black background.