

# Department of Computer Science and Engineering

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Couse Name: Computer Graphics Lab

1. Primitives: The purpose of this programming assignment is to introduce students to graphics programming with Python and to increase the understanding of the Bresenham technique for drawing a line, circle and an ellipse. You have to include the path of the Python library in the program then initialize graphics.

Viewing Transformation: Define a Window( $X_{wmin}$ ,  $Y_{wmin}$ ,  $X_{wmax}$ ,  $Y_{wmax}$ ) in user coordinates and map it to a Viewport( $X_{vmin}$ ,  $Y_{vmin}$ ,  $X_{vmax}$ ,  $Y_{vmax}$ ) in device coordinates. Construct multiple windows and map them to different viewports. Map atleast one of the windows in negative coordinates to a viewport. Now in this mapped viewport draw various inbuilt primitives and practice with their various attributes.

All the rest of the assignments would be using this mapping for the display. None of the assignment would be accepted in device coordinates.

Scan Conversion: You are to write procedures as drawLine.py, drawCircle.py, drawEllipse.py and drawPolygon.py which are used to generate line, circle, ellipse and polygons respectively. Use the python routine to draw a point, and using Bresenham techniques discussed in class and in your textbook draw lines, circles, and ellipse.

The aim is to i) To study and Implement Midpoint line algorithm given the two end points of the line. The algorithm should handle all slopes and be able to draw line in all the four quadrants and with any limit in any order of the end points. Ii) To study and implement Midpoint circle algorithm given the points of the center and the radius. You have to design a program which will take input the coordinates of the center of the circle as well as the radius. ii) To study and Implement Midpoint

Ellipse algorithm. You have to design a program which will take input the coordinates of the center of the ellipse as well as the major and minor axis. Like,

Enter the coordinates of the centre:

X-coordinate = 350 Y-coordinate = 250

Enter the Minor axis: 50

Enter the Major axis: 100

After that you have to draw the ellipse with the supplied parameters.

I should be able to compile and execute your final product on a Linux system.

Drawing Polygons: Using the above line primitive draw a polygon (having atleast three planar surfaces). The polygon is defined as an object containing multiple surfaces, where a surface is defined as a plane  $Ax + By + Cz + D = 0$  and has a property color.

Now draw the polygon as a list of multiple planar surfaces. Where every planar surface is defined as a list of edges and every edge is defined as a pair of vertices. From the vertex list of a polygon surface you could calculate the planar coefficients defined above.

### **Assessment**

Your overall programming assignment grade will be based on the following: Does your drawLine routine handle all kinds of lines (shallow or steep/positive or negative slopes, vertical, diagonal, or horizontal lines), starting from either endpoint? Does your drawCircle and drawEllipse routine handles circle (ellipse) with any point as origin? Does your drawPolygon routine generate both concave and convex polygons; regardless of order of entry of vertices.

