German University in Cairo
Media Engineering and Technology
DMET 502 Computer Graphics, Winter 2023
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Practice assignment 2

Graphics Primitives

Q 1: Given a 2D polygon specified by the vertices $[-3, 0]^T$, $[3, -1]^T$, $[1, 0]^T$, and $[4, 2]^T$, test whether it is convex or concave. (Lecture: 2D Graphics, slides: 29-31)

Q 2: A circle having a radius of 5 pixels and centered at $[3, 7]^T$ is to be drawn on a computer screen. Use the 8-way symmetry algorithm to determine what pixels should constitute the circle. (Lecture: 2D Graphics, slides: 23)

Q 3: Shown in Figure 1 is the left upper corner of a computer screen. The horizontal and vertical axes are shown with values representing pixel locations.
Suppose that a curve spanning from $[5, 15]^T$ to $[15, 5]^T$ is drawn as two circle quadrants. The centers of the circles are shown as black dots. Use the 8-way symmetry algorithm to determine what pixels should constitute the curve.

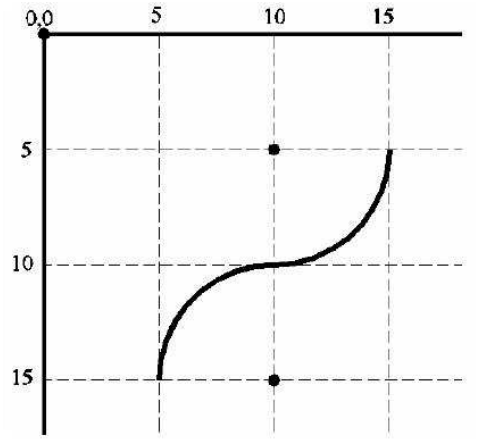

Figure 1: Curve Graph

Q 4: Shown in Figure 2 is the upper left corner of a computer screen. The horizontal and vertical axes are shown with values representing pixel locations.
Suppose that the curve shown consists of 3 segments, two of them are line segments, and the third is one-eighth of a circle whose center is shown as a black dot. The shape extends from $[3, 10]^T$ to $[15, 5]^T$. Use the 8-way symmetry and Bresenham's line drawing algorithms to determine what pixels should constitute the curve.

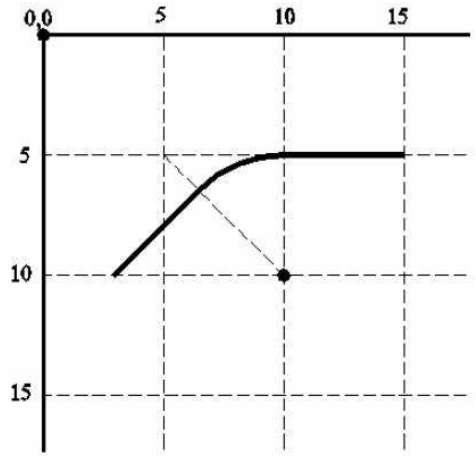

Figure 2: Curve Graph

Q 5: You are asked to draw a line segment between the points $[1, 1]^T$ and $[4, 3]^T$. Use Bresenham's line drawing algorithm to specify the locations of pixels that should approximate the line.

Q 6: Suppose that a clipping window is indicated by its two upper-left and lower-right corners $[100, 50]^T$ and $[300, 200]^T$ as illustrated in Figure 3. Test whether each of the following line segments can be trivially accepted in the window, trivially rejected from the window, or would need further processing:

- A line extending from $[171, 88]^T$ to $[233, 171]^T$
- A line extending from $[150, 101]^T$ to $[233, 39]^T$
- A line extending from $[52, 15]^T$ to $[98, 45]^T$

(Lecture: 2D Graphics, slides: 35-39)

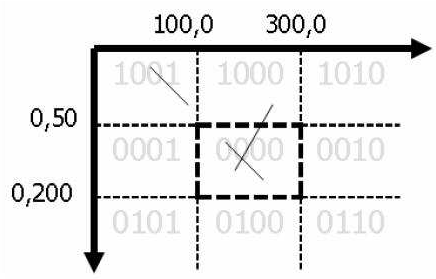

Figure 3: Clipping Window

Q 7: a) In Cohen-Sutherland Algorithm (Lecture: 2D Graphics, slide: 39) for line clipping, if the clip polygon used is a triangle instead of a rectangle, determine the minimum length of each out-

code (i.e., the number of binary digits). Determine all the outcodes in this case.

b) Propose an algorithm to generate these outcodes.

c) Modify the Cohen-Sutherland Algorithm to work with the clip triangle.