DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING
UNIVERSITY OF BARISHAL

FINAL EXAMINATION-2022
Course Title: Computer Graphics
Course Code: CSE-4109
4th Year, 1st Semester, Session: 2018-19

Time: 3 hours **Marks:** 60

Answer any Five (5) Questions from the followings.

1. a) In circle drawing, discuss the uncertain cases that lead to the development of "Midpoint Circle Algorithm". 4
   b) Consider endpoints P1(0,0) and P2(4, 6). Based on Digital Differential Analyzer (DDA), examine the points that make up the line P1P2 . 8

2. Figure 2 shows a viewing (clipping) window with coordinates where a line joining the point p0(x0, y0) and point p1(x1, y1) is required to be clipped. Figure 3 shows Cohen-Sutherland line clipping codes and algorithm to find the intersection points that form the line after clipping.

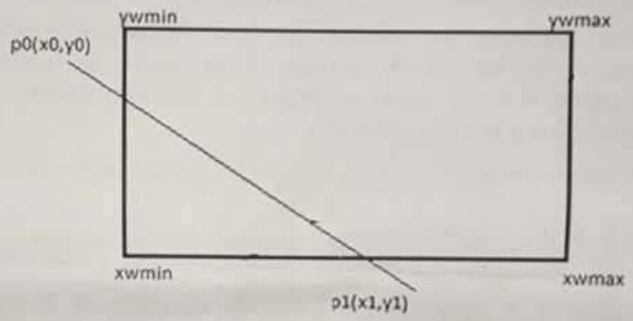
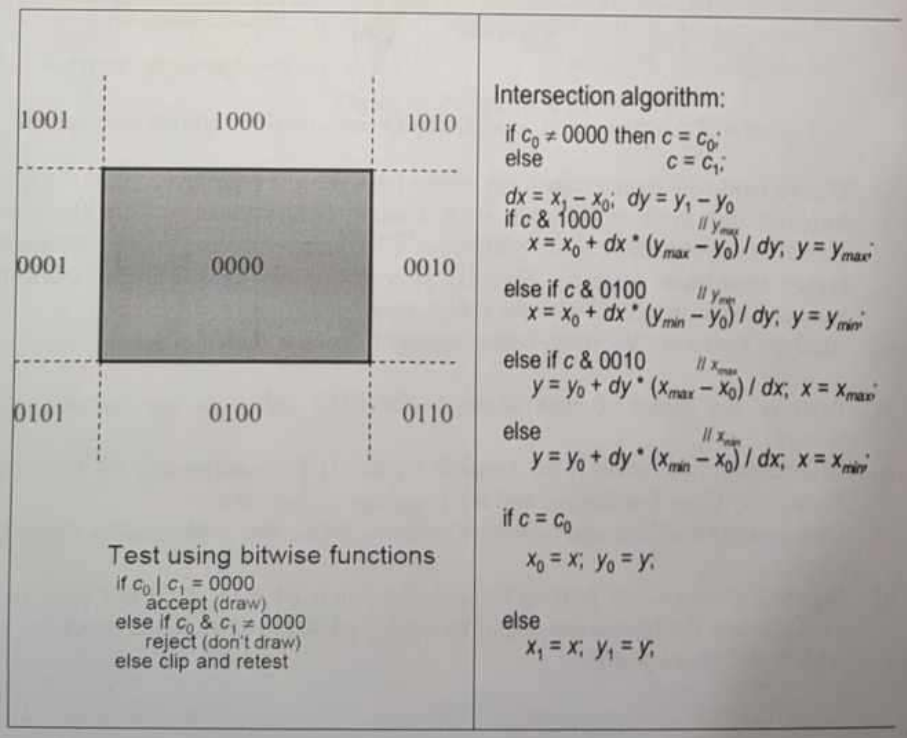


Figure 2: Viewing area and a line to be clipped



(a) Cohen-Sutherland codes (b) Cohen-Sutherland clipping algorithm

Figure 3: Cohen-Sutherland line clipping codes and algorithm

a) Demonstrate the process to find the intersection points that form the line after the clipping using the Cohen-Sutherland algorithm with xwmin = 0, xwmax = 100, ywmin = 0, ywmax = 100, x0 = -10, y0 = -20, x1 = 120 and y1 = 110. 10

b) How viewing-coordinate reference frame can be established? 2

3. a) Distinguish the terms: i) Brightness/luminance, ii) hue/dominant, iii) saturation/excitation purity. 6

b) Find a transformation A_v which aligns a given vector **V** with the vector **K** along the positive z axis. 4

c) Define 2D mirror reflection. Write the matrix form of reflection when an object is reflected with respect to X-axis. 2

4. a) Write down the differences between geometric transformations and coordinate transformation. 2

b) For scaling an object, is it necessary to have a fixed point? 2

c) Explain how to convert standard 3D coordinates, (x; y; z), to homogeneous coordinates, and how to convert homogeneous coordinates to standard 3D coordinates. 4

d) Define 2D Scaling and write the matrix form of Scaling when an object is 1/2 with respect to X-axis. 4

5. Translation, rotation and scaling are basic transformations that can be implemented to accomplish changes from world to screen coordinate transformation. Figure 4 shows an object in a world coordinate system and its transformation in a screen system.

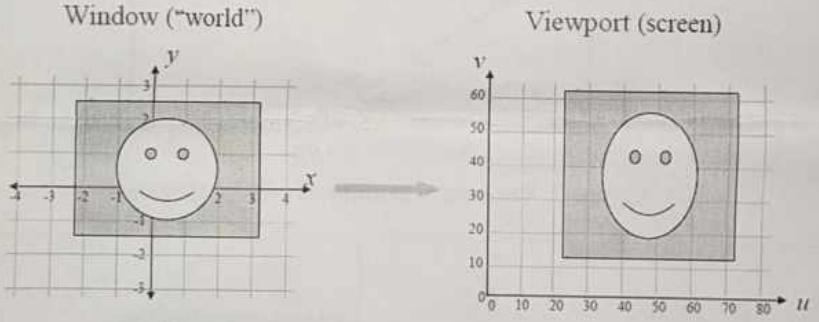


Figure 4: Transformation of a 2D object from world to screen coordinates

a) Derive world-to-screen transform vector for a generic coordinate (x, y). 5

b) Suppose that xmin = -3, ymin = -3, xmax = 2 and ymax = 1 for the world coordinate system and umin = 30, vmin = 10, umax = 80 and vmax = 30 for the screen coordinate system. Simplify your vector obtained from the world-to-screen transform vector with the information. 5

c) Analyze the term "Viewing Transformation" using a suitable figure. 2

6. a) Analyze the cause of peak response for RGB colors in our human visual system. 2

b) Differentiate the terms with suitable figure: i) Foreshortening, ii) Vanishing Points, iii) View Confusion, and iv) Topological distortion. 6

c) Demonstrate the Gouraud Surface Rendering Algorithm with suitable figure(s). 4

7. a) Figure 5 shows a line passing through the points p1 = (1, 3, 2) and p2 = (2, 4, 3). Translate the line to the origin by setting p1 to (0, 0, 0). Then rotate the line with θ=45° about y axis. 7

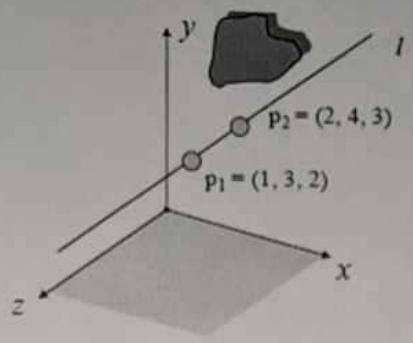


Figure 5: A line passing through p1 and p2 in 3D Cartesian coordinate system

b) Why lighting is important for computer graphics? 2
c) Convert the RGB color model to YIQ color model. 3

8. a) Define the differences between Gouraud and Phong Surface Rendering. 3
b) A perspective transformation is determined by prescribing a center of projection and a view plane. In Figure 6, the object point P is located in world coordinates at (x, y, z). The problem is to determine the image point coordinates P/(x/, y/ ,z/), as described in Figure 6. 9

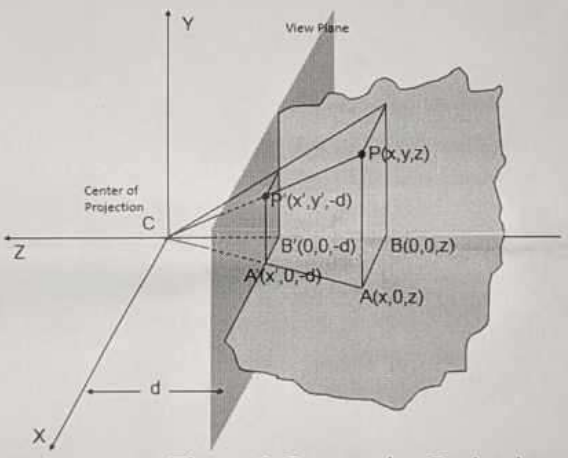


Figure 6: Perspective Projection

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