53 (CS 604) CMGR

2012C
2013
(May)

COMPUTER GRAPHICS

Paper : CS 604

Full Marks : 100

Pass Marks : 30

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* Digitize a line from $(1,2)$ to $(11,9)$ on a raster screen using Brisenham's line drawing algorithm. 6

   (b) Plot a circle centered at $(5,5)$ having a radius of 10 units using midpoint circle algorithm. 8

   (c) Plot an ellipse centered at $(0,0)$ in the first quadrant with $r_x = 8$ and $r_y = 6$ using midpoint ellipse algorithm. 6

Contd.

2. *(a)* Reduce the triangle $A(0,0)$, $B(1,1)$, $C(5,2)$ to half its size while keeping $C(5,2)$ fixed. 5

(b) What do you mean by reflection of an object? Discuss the 2D reflection of an object with respect to the diagonal axis $y=-x$. 2+4=6

(c) A square ABCD is given with vertices $A(0,0)$ $B(1,0)$, $C(1,1)$ and $D(0,1)$. Illustrate the effect of

i) x – shear

ii) y – shear

iii) xy – shear on the given square when $sh_x=2$, $sh_y=3$. 9

3. *(a)* Locate the new position of the triangle $[(5,4),(8,3),(8,8)]$ after its rotation by 90° clockwise about its centroid.

[Hint : centroid of a triangle = sum of x coordinates /3, sum of y coordinates /3] 5

(b) Prove that a midpoint of a straight line PQ$[(0,2),(3,2)]$ after transformation $\begin{bmatrix} 1 & 3 \\ 2 & 1 \end{bmatrix}$ will be the same as midpoint of the transformed straight line $P'Q'$ drawn after transformation. 5

(c) Derive the transformation matrix for reflection of an object about an arbitrary line $y = mx + c$. 10

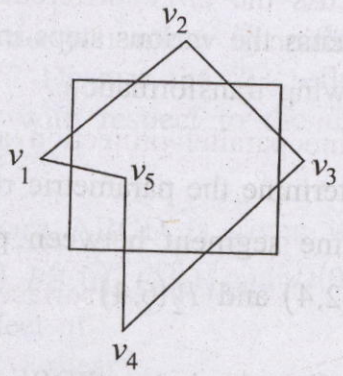
4. (a) Discuss the various steps involved in a 2D viewing transformation. 5

(b) Determine the parametric representation of a line segment between position vectors $P_1(2,4)$ and $P_2(6,4)$. 3

(c) A clipped window PQRS has bottom left corner at $(3,4)$ and upper right corner at $(10,9)$. Find the section of the clipped line $AB[A(2,11)$ and $B(11,7)]$ using the Cohen Sutherland line clipping algorithm. 6

(d) use the Liang-Barsky line clipping algorithm to clip the line with endpoints $P_1(-15,-30)$ and $P_2(30,60)$ against a window having diagonally opposite corners $(5,0)$ and $(15,15)$. 6

5. *(a)* Write the steps for clipping the polygon given in the figure below using Sutherland-Hodgman polygon clipping algorithm 8



(b) A sphere of radius 5 units and centre at $(5,5,5)$ is given. Calculate the points on all the octants of the sphere that are symmetrical to the point at $\left(\phi = \frac{\pi}{4} \text{ and } \theta = \frac{\pi}{4}\right)$. 6

(c) Discuss the two primary colour models used in computer graphics. 6

6. *(a)* Derive the transformation matrices for 3D rotation of an object about all the three different axes. 9

(b) Show the representation of an ellipsoid with the help of a diagram. 5

(c) Discuss the *three* different types of 3-D reflection. 6

7. (a) Define parallel projection and perspective projection. 2+2 =4

(b) Discuss the depth-buffer algorithm for elimination of hidden surface in a 3-D scene. 6

(c) Show the flow of Painter's algorithm to plot the following triangles : 10