53 (CS 604) CPGR

2014

COMPUTER GRAPHICS

Paper : CS 604

Full Marks : 100

Time : Three hours

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

*Answer **any five** questions out of **seven.***

1. *(a)* State the Bresenham's algorithm for drawing a straight line. 6

   (b) Plot a circle centered at the origin having a radius of 10 units using midpoint circle algorithm. 6

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

2. *(a)* What do you mean by 2-D geometric transformation ? Explain the 2-D rotation of an object from one position to another through an angle θ. 2+5=7

(b) What is homogeneous coordinate representation ? 2

(c) Define shearing transformation. Explain briefly the various types of shearing transformations. 2+9=11

3. *(a)* Perform a 45° anticlockwise rotation of a triangle A (0, 0), B (1, 1), C (5, 2) about an arbitrary point (–1, –1). 5

(b) Reduce the triangle P (0, 0), Q (1, 1) and R (5, 2) to one third its size while keeping R (5, 2) fixed. 5

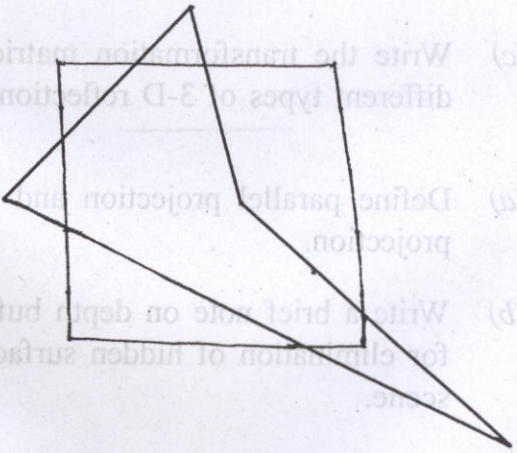
(c) Derive the transformation matrix for reflection of an object about an arbitrary line $y = mx + c$. 10

4. *(a)* Explain in brief 2-D viewing pipeline. 8

(b) 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 Cohen-Sutherland line clipping algorithm. 6

(c) Use the Liang-Barsky line clipping algorithm to clip the line $P1(-15, -30)$—$P2(30, 60)$ against 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) How a spherical surface is represented in computer graphics ? 4

(c) Write the equation for a 3-D ellipse. 2

(d) Discuss *any two* primary colour models used in computer graphics. 6

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

(b) Perform the scaling of the line PQ in the x-direction by 3 keeping point P fixed, then rotate this line by 45° anticlockwise about the z-axis. Given P (1, 2, 3) and Q (4, 6, 3). 5

(c) Write the transformation matrices for the different types of 3-D reflection. 6

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

(b) Write a brief note on depth buffer method for elimination of hidden surface in a 3-D scene. 8

(c) Show the flow of Painter's algorithm to plot the following triangles : 8