



WEST BENGAL UNIVERSITY OF TECHNOLOGY

CS-604B

COMPUTER GRAPHICS

Time Allotted: 3 Hours

Full Marks: 70

The questions are of equal value.

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

All symbols are of usual significance.

GROUP A

(Multiple Choice Type Questions)

1. Answer *all* questions.

10×1 = 10

(i) After arbitrary 2D transformation, a pair of parallel lines

(A) become intersecting

(B) become coincident

(C) remain parallel

(D) become circular arcs

(ii) The matrix representation of reflection about $y = -x$ is

(A) $\begin{bmatrix} 1 & 0 & 0 \\ 0 & -1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(B) $\begin{bmatrix} -1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(C) $\begin{bmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

(D) $\begin{bmatrix} 0 & -1 & 0 \\ -1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

- (iii) In view-port clipping of 3D viewing, the region code contains ____ number of bits
- (A) 6 (B) 4
(C) 5 (D) 7
- (iv) If X_L, X_R, Y_B, Y_T represent the four parameters of x -left, x -right, y -bottom and y -top of a clipping window and (x, y) is a point inside the window then
- (A) $X_L \leq x \leq X_R$ and $Y_B \leq y \leq Y_T$ (B) $X_L \leq x \leq X_R$ and $Y_B \geq y \geq Y_T$
(C) $X_L \geq x \geq X_R$ and $Y_B \leq y \leq Y_T$ (D) $X_L \geq x \geq X_R$ and $Y_B \geq y \geq Y_T$
- (v) CMY coordinates of a color at (0.2, 1, 0.5) in the RGB space are
- (A) (1.2, 2, 1.5) (B) (2.2, 2, 2.5)
(C) (0.8, 0, 0.5) (D) (0.1, 0.5, 0.25)
- (vi) If (x, y, h) , $h \neq 0$, is a point in the homogenous co-ordinate system then its equivalent in the two dimension system is
- (A) $(x, y, 1)$ (B) $(x, y, 0)$
(C) $(x/h, y/h)$ (D) $(x, y, x + y)$
- (vii) When projection lines are perpendicular to the view plane then such type of projection is called
- (A) Parallel (B) Perspective
(C) Orthographic (D) Oblique
- (viii) Which of the following is not a hidden surface removal algorithm?
- (A) Depth sort (B) Painter's algorithm
(C) Z-buffer (D) None of these
- (ix) In raster scanning system, the screen is scanned
- (A) top to bottom and right to left (B) left to right and top to bottom
(C) bottom to top and left to right (D) bottom to top and right to left
- (x) An object is viewed by using perspective transformation. The maximum number of principal vanishing point(s) possible is
- (A) 1 (B) 2
(C) 3 (D) infinite

GROUP B
(Short Answer Type Questions)

Answer any *three* questions.

3×5 = 15

2. A monochromatic graphics display system has 525 scan lines with an aspect ratio 9:16. If each pixel is displaceable in 512 shades. 2+3
- (i) How many pixels are displayed on the screen?
- (ii) What is the picture storage memory size?
3. Prove that successive scaling is multiplicative. 5
4. What do you mean by “window” and “viewport”? Describe the relationship for window to viewport mapping. 5
5. Write down the seed-fill algorithm to fill an eight-connected region. 5
6. Write down the Boundary fill algorithm for region filling. Compare and contrast the Boundary fill algorithm and Flood-fill algorithm. 3+2

GROUP C
(Long Answer Type Questions)

Answer any *three* questions.

3×15 = 45

7. (a) Show that a 2D reflection through x-axis followed by a 2D reflection through the line $y = -x$ is equivalent to a pure rotation about the origin. 5
- (b) Derive transformation matrix to reflect a 2D object about a line $y = mx + c$. 5
- (c) Find the final co-ordinates of a triangle (2, 3), (4, 5) and (4, 1) when it is scaled to twice its size keeping the vertex (4, 5) fixed. 5

8. (a) Write down mid-point ellipse drawing algorithm. 5
- (b) Find out intermediate points of a line having end points (1, 1) and (8, 5) using Bresenham's line drawing algorithm. 5
- (c) Using mid-point circle generation algorithm, find out the pixels in the first quadrant of a circle having radius 4 units and centre at (4, 5). 5
9. (a) Describe Sutherland-Hodgman polygon clipping algorithm. 7
- (b) A rectangular 2D clipping window has its lower left corner at (100, 10) and upper right corner at (160, 40). Find visible portion of lines A(50, 0), B(120, 30) and C(120, 20), D(140, 80) using mid-point subdivision algorithm. 8
- 10.(a) Write down the procedure for drawing B-spline curves and also write down its property. 4
- (b) What is homogeneous coordinate system? What is the advantage of using it? How is it related to Cartesian coordinate system? 2+1+3
- (c) Derive the conditions to be satisfied when joining two Bezier curves with second order continuity at the joint. 5
11. Write short notes on any *three* of the following: 3×5
- (a) Raster scan technique
- (b) Gouraud shading
- (c) Z-buffer algorithm
- (d) RGB color model
- (e) Cohen-Sutherland line dipping algorithm.