2020

COMPUTER SCIENCE — HONOURS

Paper : SEC-A-1

(Computer Graphics)

Full Marks : 80

The figures in the margin indicate full marks.

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

Answer ***question no.* 1** and ***any four*** from the rest.

1. Answer ***any ten*** questions : 2×10

(a) What do you understand by point clipping?

(b) Write the two dimensional scaling matrix (about x-axis and about y-axis).

(c) Define raster scan.

(d) Mention the importance of homogeneous coordinate system.

(e) What do you understand by resolution of a monitor?

(f) Write down the three-dimensional translation matrix.

(g) Give the fundamental difference between animation and morphing.

(h) Define view port and window port.

(i) Define world coordinate system.

(j) Mention the importance of inverse transformation.

(k) State the purpose of any clipping algorithm.

(l) Differentiate between perspective projection and parallel projection.

(m) Transformation depends on reference point. — Justify your answer.

(n) Briefly discuss about LCD display system.

2. (a) Discuss and derive Midpoint line drawing algorithm.

(b) Discuss and derive Digital Differential Analyzer scan conversion line drawing algorithm.

(c) Mention the advantages of Midpoint line drawing algorithm over Digital Differential Analyzer. 5+5+5

3. (a) Write the two dimensional reflection matrix—reflection about x-axis, reflection about y-axis and reflection about origin.

(b) Show that scaling followed by rotation and rotation followed by scaling are commutative with some conditions.

(c) Derive the matrix in two-dimension for reflection of an object about a line $y = 2x$. (2×3)+5+4

4. (a) ABCD is a square with coordinate points A(0, 4), B(4, 4), C(4, 0) and D(0, 0). Apply translation with distance 2 towards x-axis and 2 towards y-axis. Obtain the new coordinates of the square.

(b) What do you understand by Affine transformation?

(c) ABC is a triangle with coordinate points A(2, 2), B(4, 2) and C(4, 4). Find the rotation matrix after applying rotation with an angle 90º about origin in anti-clockwise direction. Find the new coordinates after rotation. 5+2+(4+4)

5. (a) Derive and discuss Bresenham's line drawing algorithm.

(b) Discuss Sutherland Hudgeman polygon clipping algorithm with an example.

(c) Apply the Cohen-Sutherland line clipping algorithm to clip the line segment AB with coordinate points A(40, 50) and B(50, 70) against the window (30, 60) and (60, 100). 5+5+5

6. (a) Show that the 2×2 matrix T such that

$$[T] = \begin{bmatrix} \frac{1-t^2}{1+t^2} & \frac{2t}{1+t^2} \\ \frac{-2t}{1+t^2} & \frac{1-t^2}{1+t^2} \end{bmatrix}$$

represents pure rotation.

(b) Let (x_1, y_1, w_1) and $(x_2, y_2, 1)$ be the homogeneous coordinate representation of points P_1 and P_2, respectively and let $(x'_1, y'_1, 1)$ be the homogeneous coordinates of P'_1— a point obtained after rotating P_1 around P_2 by α degrees. Express x'_1 and y'_1 in terms of $x_1, y_1, w_1, x_2, y_2, \alpha$.

(c) Briefly write about keyframes and in-between as used in animation. 5+5+5

7. (a) Derive and discuss Midpoint circle drawing algorithm.

(b) Discuss eight-way symmetry circle drawing algorithm.

(c) Mention the disadvantages of scan converting circle drawing algorithm over Midpoint circle drawing algorithm. 5+5+5

8. (a) Apply Cohen-Sutherland line clipping algorithm to check whether the following line segments are totally visible against the window (20, 40) and (60, 80).

(i) line segment AB with coordinates A(30, 50), B(50, 60).

(ii) line segment CD with coordinate C(10, 10), D(20, 10).

(iii) line segment EF with coordinate E(40, 50), F(50, 85).

(b) Discuss about interior clipping and exterior clipping. (4×3)+3
