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Paper Code : MCA-402

GRAPHICS AND MULTIMEDIA

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

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

GROUP – A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

   i) Refreshing on raster scan display is carried out at the rate of

      a) 60 to frames per sec

      b) 40 to 60 frames per sec

      c) 30 to 60 frames per sec

      d) none of these.

   ii) The maximum number of points that can be displayed without overlap on a referred to as

      a) Resolution b) Persistence

      c) Attenuation d) None of these.

iii) In the Bresenham's Algorithm, error term is initialized to

a) 0 b) 1

c) – 1/2 d) none of these.

iv) In the generation of circle by Bresenham's Algorithm, it is simple to generate

a) all octants

b) one octant first and others by successive reflection

c) one octant first and others by successive rotation

d) one octant first and others by successive translation.

v) A line with end point codes as 0000 and 0100 is

a) partially invisible b) completely visible

c) trivially invisible d) completely invisible.

vi) Which of the following techniques is used in Mid-point subdivision algorithm ?

a) Binary search b) Bubble sort

c) Linear search d) Sequential search.

vii) How many matrices are required to rotate and object about a point (x, y) ?

a) 2 b) 3

c) 4 d) 5.

viii) In 2D graphics, the transformation

$$\begin{vmatrix} 0 & 1 & 0 \\ 1 & 0 & 0 \\ 0 & 0 & 1 \end{vmatrix}$$ results in

a) reflection about the line $y = x$

b) reflection about the line $y = -x$

c) reflection about the line $y = 0$

d) searching about x-axis.

ix) If direction of Z-axis is Z-axis, then direction of position of positive rotation is

a) Y to Z b) Z to X

c) X to Y d) Y to X.

x) Which of the following is not a hidden surface removal algorithm ?

a) Depth sort b) Painter's sort

c) Z-buffer d) None of these.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following $3 \times 5 = 15$

2. a) Obtain the 3 × 3 transformation matrix for translating a point by (–1, 2). Calculate the inverse of this matrix and show that the result is a matrix which translates a point by (1, –2).

   b) Let an object $\begin{pmatrix} -2 & 2 & 6 \\ -3 & 4 & 3 \\ 1 & 1 & 2 \end{pmatrix}$ is scaled by $S_x = 2$, $S_y = 1$, $S_z = 6$ about the origin and then reflected by YZ-plane. Find the co-ordinate position of the transformed object. $2\frac{1}{2} + 2\frac{1}{2}$

3. a) What do you mean by spline ?

   b) Differentiate between Bezier curve and *b*-spline curve. 2 + 3

4. a) The Cohen-Sutherland algorithm uses the concept of region-codes for each end of the line. What are region codes ?

   b) Define the region codes for a typical rectangular clipping area and show all the possible values. 2 + 3

5. What is the basic unit of a display ? What is pixel density ? What is pixel depth ? Does it affect display resolution ? 1 + 1 + 1 + 2

6. Compare between lossy and lossless compression.

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. 3 × 15 = 45

7. a) Calculate the pixel positions along the straight line between *A* (6, 8) and *B* (2, 3) using Bresenham's line drawing algorithm.

   b) Why do we prefer unit x or unit y interval for corresponding slopes $m \leq 1$ and $m \geq 1$ in line drawing technique ?

   c) Explain the Gourad shading method. How is it superior to Phong shading ?

   d) Compare region filling with scan-line filling. Differentiate between boundary-fill and flood-fill techniques with suitable example.

   e) Explain how flood-fill algorithm would fill the rectangular region defined by 7 × 5 pixels grid assuming (3, 3) to be the seed point using 4-connected definition for region pixels.

4 + 2 + 3 + 3 + 3

8. a) Develop the pseudo-code using mid-point circle drawing algorithm to draw a circle $x^2 + y^2 = r^2$, whose circumference thickness is 5 pixels.

   b) Give the transformation matrix for reflection of the polygon whose vertices are $A = (-2, -1)$, $B = (1, 2)$, $C = (1, 0)$ and $D = (2, 4)$ about the line $y = x + 1$. How the new polygon would look like ?

   c) Do scaling and rotation transformations commutative ? Why and /or why not ?

   d) Derive the basis matrix of cubic Bezier curve.

   5 + 5 + 2 + 3

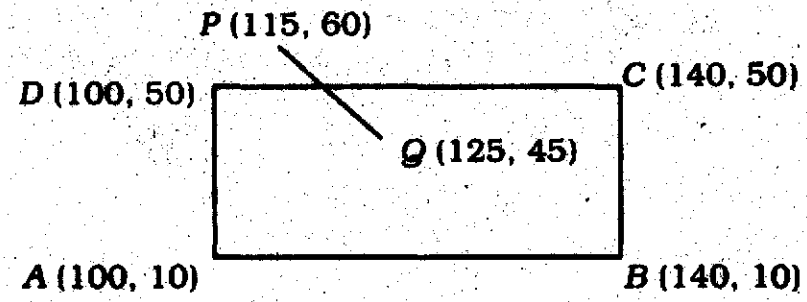
9. a) What is the difference between window and viewport ?

   b) Explain the steps involved in mapping of world coordinate system to display coordinates in physical device coordinate system and hence derive the transformation matrix.

   c) What do you mean by clipping ?

d) Find the generalized parametric representation of the line segment between position vectors A and B.

e) Clip the line segment PQ (figure below) against the clipping window $ABCD$ using Cyrus-Beck line clipping algorithm. 2 + 3 + 2 + 2 + 6



10. a) What is the role of frame buffer ?

b) What is meant by persistence of a display device ?

c) What do you mean by refresh rate ? How does it relate to flicker ? Comment.

d) What is aspect ratio ? Does it relate to display resolution ?

e) Consider two Raster systems with the respective resolutions : 800 × 600 and 1280 × 1024. How many pixels could be accessed per second in each of these systems by a display controller that refreshes the screen at a rate of 64 fps ? Calculate the access time of a single pixel, in microsecond, in each system. Now, what would be the size of the frame buffers (in Mb) for each of these systems to store 12 bits/pixel ?

2 + 1 + 2 + 2 + (4 + 4)

11. a) Write the standard definition of multimedia.

b) What are the common components of a modern multimedia system ? Explain the roles of each component in multimedia content development.

c) How can you incorporate an image or motion video or audio to a Webpage ? Give example for any one.

d) Explain the use of frames in HTML with a specific example.

e) What is Dynamic HTML ? What is <meta> tag ?

2 + (2 + 2) + 3 + 3 + (2 + 1)