MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WEST BENGAL

Paper Code : CS-604B

COMPUTER GRAPHICS

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) The orthographic projections have the projectors where
      a) the direction of these projectors is parallel to the view plane
      b) the direction of these projectors is perpendicular to the image plane
      c) the direction of these projectors is perpendicular to the view plane
      d) the direction of these projectors is parallel to the image plane.

   ii) The blending functions of Bezier curves are
      a) Splines
      b) Bernstein polynomials
      c) Lagrangian polynomials
      d) Newton polynomials.

   iii) In Breshenham's circle algorithm, if points are generated from 90° to 45° and (x, y) are the coordinates of last scan converted pixel then the next pixel coordinate is
      a) $(x+1, y+1)$ or $(x-1, y-1)$
      b) $(x+1, y)$ or $(x, y+1)$
      c) $(x+1, y+1)$ or $(x+1, y-1)$
      d) $(x+1, y)$ or $(x+1, y-1)$.

   iv) The term that is not synonymous with 'vector CRT' is
      a) Calligraphic CRT b) Raster CRT
      c) Stroke-writing CRT d) Random-scan CRT.

   v) A monitor can display 4 shades of red, 8 shades of blue and 16 shades of green. The colour depth supported by the monitor is
      a) 7 bits b) 8 bits
      c) 9 bits d) 10 bits.

   vi) If X_L, X_R, Y_B, Y_T represent the four parameters of x-left, x-right, y-bottom, y-top of the clipping window respectively and (x, y) is a point inside the window then
      a) $X_L \le x \le X_R$ and $Y_B \le y \le Y_T$
      b) $X_L \le x \le X_R$ and $Y_B \ge y \ge Y_T$
      c) $X_L \ge x \ge X_R$ and $Y_B \le y \le Y_T$
      d) $X_L \ge x \ge X_R$ and $Y_B \ge y \ge Y_T$.

vii) Resolution can be defined by
  a) number of small square boxes
  b) number of pixels
  c) number of pixels per unit length
  d) none of these.

viii) The viewing transformation is formed by
  a) Translations
  b) Translation and Scaling
  c) Translation, Scaling and Translation
  d) Translation, Scaling and Rotation.

ix) For the scan-line polygon fill algorithm, each horizontal edge should be
  a) ignored
  b) treated as a single intersection point
  c) treated as two intersection points
  d) treated as one or two intersection points, depending on the adjacent vertices.

x) Line end point codes of 4 lines are given below. Which one of the following is totally invisible ?
  a) 1010, 0110 b) 0000, 0000
  c) 1001, 0000 d) 0001, 0100.

GROUP – B

(Short Answer Type Questions)

Answer any *three* of the following. 3 × 5 = 15

2. Write two techniques for producing colour displays with a CRT.
3. What is horizontal retrace of the electron beam ?
4. What is run length coding ?
5. What are the two classifications of shear transformation ?
6. What is the need of homogeneous coordinates ?
7. How does a video controller work ?

GROUP – C

(Long Answer Type Questions)

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

8. a) What are the side effects of scan conversion ?
  b) Write the Bresenham's Line drawing algorithm (with mathematical derivations).
  c) Using Mid-point circle drawing algorithm, draw a circle whose centre is (3, 5) with radius 10 units. 3 + 6 + 6

9. a) What is the difference between a viewport and window ?
  b) Derive the transformation matrices for 2D reflection about *X*-axis and *Y*-axis.
  c) A clipping window *ABCD* is located as follows : *A* (100, 10), *B* (160, 10), *C* (160, 40), *D* (100, 40); Using Cohen-Sutherland clipping algorithm find the visible portion of the line segment p_1p_2, where p_1 (120, 5), p_2 (180, 30). 3 + 4 + 8

10. a) A cubic Bezier curve with control points P_0 (10, 10), P_1 (20, 30), P_2 (30, –10) and P_3 (50, 50) is to be joined smoothly with another cubic Bezier curve S_0, S_1, S_2 and S_3. Find the control points S_0, S_1, S_2 and S_3.
  b) Explain Painter's algorithm. 7 + 8

11. a) Derive a composite matrix to reflect any object along any arbitrary line $y = mx + c$.
  b) Derive a composite matrix to scale a square by a factor 2 along one of its diagonal.
  c) Show for what condition rotation and scaling are commutative. 6 + 5 + 4

12. Write an algorithm to display $\sin(x)/x$, $0 \le x \le 8\pi$ on a text-only display, however crude it may look. The *x*-axis runs horizontally at the middle of the display.