Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/B.TECH(IT)/SEPARATE SUPPLE/SEM-7/IT-703A/2011

2011

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) Interlacing

a) refers to mixing shades on the graphics screen

b) refers to displaying alternative columns on the screen

c) refers to displaying alternative rows on the screen

d) is another term for refreshing the screen.

ii) Oblique projection with an angle of 45° to the horizontal plane is called

a) Cabinet projection b) Cavalier projection

c) Isometric projection d) none of these.

iii) The slope of a cubic Bezier curve at the start of the curve is controlled by

a) first control point

b) first two control points

c) first three control points

d) all four control points.

iv) An object is viewed by using perspective transformation. The maximum number of principal vanishing points possible are

a) 1 b) 2

c) 3 d) infinite.

v) Assuming that one allows 256 depth value levels to be used, how much memory a 512 × 512 pixel display require to store the *Z*-buffer ?

a) 512 K b) 256 K

c) 1024 K d) 128 K.

vi) A circle, if scaled in only one dimension becomes a/an

a) ellipse b) parabola

c) hyperbola d) remains a circle.

vii) Backface removal algorithm is an example of

a) object space method

b) image space method

c) combination of both

d) none of these.

viii) Find the correct statement (s)

a) A perspective projection produces realistic views

b) A parallel projection preserves realistic dimensions

c) A perspective projection preserves realistic dimensions

d) A parallel projection gives realistic presentation of 3-D objects.

ix) Pixel phasing is a technique for

a) shading b) anti-aliasing

c) hidden line removal d) none of these.

x) In Sutherland-Hodgman algorithm for polygon clipping, assume P (present point) lies inside the window and S (previous point) lies outside the window. Then, while processing through the window boundary, we should

a) store the intersection point of the line PS (S') only

b) store the points P and S'

c) store the point P only

d) store the points S and S'.

GROUP – B

(Short Answer Type Questions)

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

2. Indicate which pixels would be chosen by Bresenham's line drawing algorithm when scan converting a line from pixel coordinate (1 , 1) to pixel coordinate (8 , 5). Clearly state the formulas you have used.

3. Magnify the triangle with vertices A (0, 0), B (1 , 1) and C (5 , 2) to twice its size while keeping C (5 , 2) fixed.

4. Derive the transformation matrix for mapping a point (x_w, y_w) defined in window to viewport location (x_v, y_v).

5. Explain the methodology used in gourad shading.

6. What is meant by a colour model and what is its necessity ? Why RGB is called additive and CMY is called subtractive colour model ?

GROUP – C

(Long Answer Type Questions)

Answer any *three* of the following. $3 \times 15 = 45$

7. a) Show that the composition of two rotations is additive.

   b) What is homogenous coordinate ?

   c) Reflect the diamond shaped polygon whose vertices are A (–1, 0), B (0, –2), C (1, 0), and D (0, 2) about

      i) the horizontal line $y = 2$

      ii) the vertical line $x = 2$

      iii) the line $y = x + 2$ 3 + 2 + (2 + 2 + 6)

8. a) Discuss midpoint circle drawing algorithm.

   b) Using midpoint circle drawing algorithm find the pixels of a circle in the first octant whose radius is 8 unit. Take origin as the centre of the circle.

   c) What are the differences between flood-fill and boundary-fill algorithm ?

   d) What are the side effects of scan conversion algorithm ?

   6 + 4 + 2 + 3

9. a) Discuss in brief the Sutherland-Hodgman's polygon clipping algorithm. What are the drawbacks of this algorithm ?

   b) A clipping window *ABCD* is located as follows

   A (100, 10), *B* (160, 10), *C* (160, 40) and *D* (100, 40).

   Using Cohen-Sutherland's line clipping algorithm find visible portion of a straight-line between P_1 (120, 5) and P_2 (180, 30). (7 + 3) + 5

10. a) Derive the equation for a cubic Bezier curve. Hence find the basic matrix and blending functions of a cubic Bezier curve.

    b) What are the advantages of *B*-spline curve over Bezier curve ? Under what special circumstances, a Bezier curve can be thought of as a specific case of *B*-spline curve ? (6 + 2 + 2) + (3 + 2)

11. a) Discuss the back-face removal algorithm.

    b) Using the origin as the centre of projection derive the perspective transformation onto the plane passing through the point $R_0 (x_0, y_0, z_0)$ and having a normal vector $\vec{N} = n_1\hat{i} + n_2\hat{j} + n_3\hat{k}$.

    Use above result to obtain perspective transformation matrix when centre of projection is at (*a, b, c*).

    c) Differentiate between cabinet and cavalier projection.

    5 + 8 + 2

12. Write short notes on any *three* of the following : 3×5

a) Perspective anomalies

b) *Z*-buffer algorithm

c) 3D general axis rotation

d) Spline curve.

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