

ALCCS

Code: CS40
Time: 3 Hours

MARCH 2010

Subject: COMPUTER GRAPHICS
Max. Marks: 100

NOTE:

- **Question 1 is compulsory and carries 28 marks. Answer any FOUR questions from the rest. Marks are indicated against each question.**
 - **Parts of a question should be answered at the same place.**
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Q.1

- a. Write the transformation matrix to get top view of an object on the XY plane of the screen.
- b. Given four control points $P_1(x_1, y_1)$, $P_2(x_2, y_2)$, $P_3(x_3, y_3)$, $P_4(x_4, y_4)$, work out the starting slope of a cubic Bezier curve.
- c. While performing polygon scan conversion, how do you treat the case when a scan line passes through a vertex of the polygon?
- d. Define the terms:
 - (i) foreshortening factor
 - (ii) floating Horizon
 - (iii) B-spline curve
- e. Discuss the relative merits and demerits of Z-buffer hidden surface elimination algorithm over scan line Z-buffer algorithm.
- f. Describe the diffuse and specular light reflection modelling in computer graphics.
- g. Write short notes on:

(i) half-toning	(ii) CSG models	(7×4)
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Q.2

- a. Describe the Boundary fill algorithm.
- b. Using the parametric approach of Cyrus-Beck line clipping algorithm compute the visible portion of the line segment joining $P(15, 0)$ and $Q(15, 40)$ for the window area given by: $P_0(10,10)$, $P_1(20, 10)$, $P_2(20, 30)$ and $P_3(10,30)$. Show all the calculations. **(8+10)**

Q.3

- a. A triangle ABC is given with vertices being $A(3, 5)$, $B(7, 5)$ and $C(5, 10)$. Find the transformation to obtain its reflection about the line $y = 4x$. Also find the coordinates of the reflected triangle.
- b. A unit cube located at the origin is rotated about the X-axis by 45 degrees counter clockwise direction and then projected on the $z = 0$ plane with centre of projection at $(0, 0, -10)$. Find the matrix transformation of the above projection? **(8+10)**

Q.4

- a. Using integer Bresenham circle generation algorithm determine the coordinates of the points on the arc of the circle in the 1st octant with centre at $(0, 0)$ having radius 7 units. Show all the calculations.
- b. Derive the transformation matrix to obtain isometric projection of an object. Use this to obtain the screen coordinates of a rectangular box. Work out XY screen points corresponding to object coordinates $A(0, 0, 10)$, $B(0, 20, 10)$, and

C(30, 10, 0)

(9+9)

- Q.5** a. Explain in detail depth-buffer hidden surface removal algorithm. What are its advantages and disadvantages in comparison with scan line z-buffer algorithm?
- b. Describe the method of constructing terrain model as an example of fractals? **(10+8)**
- Q.6** a. Control points for a cubic Bezier curve are given by:
 $\mathbf{p}_0=(10, 0)$, $\mathbf{p}_1=(20, 20)$, $\mathbf{p}_2=(40, 20)$ and $\mathbf{p}_3=(50, 0)$. Find the parametric equations of the curve. Draw a rough sketch of the curve.
- b. Explain briefly how are the vanishing points obtained in perspective projection.
- c. Discuss the method of choosing the root node of a Binary Space Partitioning Tree. **(6+6+6)**
- Q.7** a. Describe in detail the Gouraud shading algorithm. Also state its advantages over the Phong's shading algorithm.
- b. State the components of the traditional animation.
- c. Explain a method of simulating acceleration at the beginning followed by de-acceleration at the end between two given key frames in an animation clip. **(8+4+6)**