

II B.Tech II Semester Regular Examinations, Apr/May 2008
COMPUTER GRAPHICS
(Common to Information Technology and Computer Science & Systems
Engineering)

Time: 3 hours

Max Marks: 80

Answer any FIVE Questions
All Questions carry equal marks

1. (a) Assuming that a certain full-color (24-bit per pixel) RGB raster system has a 512 by 512 frame buffer, how many distinct color choices (intensity levels) would be available.
(b) Explain how virtual reality systems can be used in design applications. [10+6]
2. (a) Write an algorithm for generating the intermediate points using Bresenham's algorithm when two-end points are given as input.
(b) Write an algorithm for polyline function which calls the above algorithm, given any number (n) of input points. A single point to be plotted when n=1. [8+8]
3. Show that the transformation matrix for a reflection about the line $y=x$ is equivalent to a reflection relative to the x axis followed by a counter clockwise rotation of 90° . [16]
4. (a) Give a brief note about two dimensional viewing functions. Give an example which uses two dimensional viewing functions.
(b) Explain the Cohen-Sutherland line clipping algorithm. [8+8]
5. (a) Determine the blending functions for uniform periodic B-spline curve for $d=6$.
(b) Write the equation for the basic illumination model using a single point light source and constant surface shading for the faces of a specified polyhedron. [8+8]
6. (a) Derive the quaternion rotation matrix for rotation about an arbitrary axis in three-dimensional domain.
(b) Classify the perspective projections and explain about each. [8+8]
7. (a) Explain the depth-buffer (z-buffer) algorithm for hidden surface removal.
(b) Explain the procedure to compute the z-values in two successive locations in a scan-line and intersection positions on two successive scan lines. [8+8]
8. What are the steps in design of animation sequence? Describe about each step briefly. [16]

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1. (a) List and explain the applications of Computer Graphics.
(b) With a neat cross-sectional view explain the functioning of CRT devices. [8+8]
2. (a) Show graphically that an ellipse has four-way symmetry by plotting four points on the ellipse:
 $x = a \cos \theta + h$, $y = b \sin \theta + k$ where $a = 2$, $b = 1$, $h = 0$ and $k = 0$.
(b) When 8-way symmetry of circle is used to obtain a full circle from pixel coordinates generated from first octant, does overstrike occur? Where? [8+8]
3. Determine the form of the transformation matrix for a reflection about an arbitrary line defined with equation $y = m x + b$. [16]
4. Explain the algorithm for line clipping by Cohen-Sutherland algorithm. Demonstrate with an example all the three cases of lines. [16]
5. Given the plane parameters A, B, C and D for all surfaces of an object, explain the procedure to determine whether any specified point is inside or outside the object. [16]
6. A pyramid defined by the coordinates A(0, 0, 0), B(1, 0, 0), C(0, 1, 0) and D(0, 0, 1) is rotated 45° about the line L that has the direction $V = J + K$ and passing through point C(0, 1, 0). Find the coordinates of rotated figure. [16]
7. Write an algorithm for generating a quad tree representation for the visible surfaces of an object by applying the area subdivision tests to determine the values of the quad tree elements. [16]
8. List the general-purpose animation languages. Explain the characteristics any are language. [16]

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1. Explain the construction of the following devices with suitable sketches and their operating characteristics
 - (a) Raster- refresh devices
 - (b) Vector- refresh devices. [8+8]
2. (a) Explain how the pixel screen positions are stored and retrieved from frame buffer.
 - (b) What are the steps involved in mid point circle algorithm? [8+8]
3. (a) Derive the transformation matrix for rotation about origin.
 - (b) Explain the terms: [8+8]
 - i. Homogeneous Coordinates
 - ii. Rigid-body transformations
 - iii. Composite transformations.
4. Let R be a rectangular window whose lower left corner is at L (-3,1) and upper right-hand corner is at R(2,6). If the line segment is defined with two end points with A (-4,2) and B (-1,7).
 - (a) The region codes of the two end points,
 - (b) Its clipping category and
 - (c) Stages in the clipping operations using Cohen-Sutherland algorithm. [16]
5. (a) Distinguish between boundary representation and space-partitioning representation of solid object representation schemes.
 - (b) List and describe the polygon tables representation for polygon surfaces of a 3-D object. Give an example. [8+8]
6. Given a unit cube with one corner at (0, 0, 0) and the opposite corner at (1, 1, 1), derive the transformations necessary to rotate the cube by θ degrees about the main diagonal (from (0, 0, 0) to (1, 1, 1) in the counter clock-wise direction when looking along the diagonal toward the origin. [16]
7. (a) Illustrate the procedure for implementing area-sub division method.

(b) Explain how the BSP-tree method is implemented for visible surface detection. [8+8]

8. (a) List and explain about the steps of animation.

(b) What are the various types of interpolation used in animation. [8+8]

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1. (a) Consider a non interlaced raster monitor with a resolution of n by m (m scan lines and n pixels per scan line), a refresh rate of r frames per second, a horizontal retrace time of t_{horiz} and vertical retrace time of t_{vert} . What is the fraction of total refresh time per frame spent in retrace of the electron beam.
(b) Explain the applications for large-screen displays. What graphical output devices support it? [12+4]
2. (a) List the algorithm steps for ellipse generation using mid-point ellipse generation.
(b) Explain how the interior and exterior regions are identified using odd parity rule. [8+8]
3. (a) List the basic transformation techniques. What are their respective mathematical and matrix representations?
(b) Prove or disprove that two successive rotations in 2-D space are commutative. [8+8]
4. (a) What are the stages involved in two-dimensional viewing transformation pipeline. Explain briefly about each stage.
(b) What is parametric representation of a line? What is its form? What are the typical range of values for parametric variable. [10+6]
5. Given the plane parameters A , B , C and D for all surfaces of an object, explain the procedure to determine whether any specified point is inside or outside the object. [16]
6. Prove that the multiplication of three-dimensional transformation matrices for each of the following sequence of operations is commutative.
 - (a) Any two successive translations
 - (b) Any two successive scaling operations
 - (c) Any two successive rotations about any one of the coordinate axes. [16]
7. (a) Assuming that one allows 2^{24} depth value levels to be used, how much memory would a 1024×768 pixel display requires to store the z-buffer.

- (b) How can the amount of computation required by the scan-line method be reduced? [8+8]
8. What are the issues involved in design of a story board layout with accompanying key frames for an animation of a single polyhedron. [16]
