Code No: 07A50503 **R07** **Set No. 2**

III B.Tech I Semester Examinations,May 2011
COMPUTER GRAPHICS
Common to Information Technology, Electronics And Computer Engineering, Computer Science And Engineering, Computer Science And Systems Engineering

Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
All Questions carry equal marks
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1. (a) Use the midpoint to derive decision parameters for generating points along a straight line path with slope in the range 0 < m < 1. Show that the midpoint decision parameters are the same as those in the Bresenham's line algorithm.
   (b) Set up a parallel version of Bresenham's line algorithm for slope in the range 0 < m < 1. [8+8]

2. (a) Discuss the construction and functioning of the following input Devices: Key board, mouse and Joysticks.
   (b) Explain the design issues in color CRT monitors. [8+8]

3. (a) Write a routine to implement rotations in increments of 900 in frame buffer black transfers.
   (b) Prove that uniform Scaling (sx = sy) and a rotation form a commutative pair of operations but that, in general scaling and rotation are not commutative operations. [8+8]

4. (a) Find the normalization transformation which uses a circle of radius five units and center at (1,1) as a window and a circle with radius and center at (1/2, 1/2) as a view port.
   (b) Draw a flowchart corresponding to Cohen-Sutherland line clipping algorithm. [8+8]

5. (a) A rectangular window has the corners A(0,0) and B(16,24). First polygon has vertices A(18,6) B(24,18) and C(28,3)and the second polygon has vertices P(4,3) ,Q(6,18) and R(12,9). Find the relationship between polygon and window using bounding box method.
   (b) Write about Painters algorithm? Justify why it is named as Painters Algorithm. [8+8]

6. Write a program to implement the two-pillbox game. The game can be implemented on a flat plane with fixed pillbox positions or random terrain features and pillbox placements can be generated at the start of the game. [16]

7. (a) Derive the matrix form for the following basic geometric transformations in 3-D graphics:

i. Rotation

ii. Mirror reflection.

(b) An object is viewed from the point (5,0,0). Obtain a transformation matrix to get a projection of a point P(x,y,z) on the yz plane. Obtain the transformation matrix in the projection plane which is now x + 10 =0. [8+8]

8. (a) Show that the Bezier curve always touches the starting point (for u=0) and the ending point (for u=1).

(b) Use a quadratic B-spline curve with five control points to prove that B-spline blending functions sum to unity. [8+8]

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Time: 3 hours **Max Marks: 80**

Answer any FIVE Questions
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1. (a) What are the merits and demerits of raster-scan CRT?
   (b) Explain the basic operation of a Direct View Storage Tube. [8+8]

2. (a) Write a routine to display any specified conic in the xy-plane using a rational Bezier spline representation.
   (b) Set up an Algorithm for loading a quad tree representation of a scene into a frame buffer for display of the scene. [8+8]

3. (a) Discuss the steps involved in the ordered edge list polygon filling algorithm.
   (b) Write Bresenham's algorithm for line generation which is suitable for any slope. [8+8]

4. (a) Apply a suitable 3D transformation matrix to a line joining (1,1,1) and (2,3,4) to align it to the positive z axis and so that it originates from the origin.
   (b) How a point can be translated from one position to another position with the help of matrix operations in 3D? [10+6]

5. (a) Find the workstation transformation that maps the normalized device screen onto a physical device whose x extent is 0 to 199 and y extent is 0 to 639 where the origin is located at the
      i. lower left corner and
      ii. upper left corner of the device.
   (b) Draw a flowchart illustrating the logic of the Sutherland-Hodgeman algorithm. [10+6]

6. (a) Prove that the intersection point of two lines is exactly same as the intersection point of transformed lines drawn after any composite transformation.
   (b) A mirror is placed such that is passes through (2, 0) and (0, 2). Find the reflected view of a triangle with vertices (3, 4), (5, 5) and (4, 7) in this mirror. [8+8]

7. A tetrahedron given position vector A(2,2,-1),B(4,2,-1),C(3,2,-3)and D(3,4,-2).Use Depth buffer method (or Z-buffer method) to find the visible planes of the tetrahedron if the viewing plane is xy - plane i.e. $z = 0$. Consider the screen resolution as

6X6, and background color as black (color value=0). The color of the plane ACD is blue(1), CBD is green(2), BAD is cyan(3) and ACB is red(4).

(a) Will the visible planes change if it rotated about z axis by 450? [16]

(b) Find the visible planes, if it is rotated about x axis by 300 and y axis by 450?

(c) What will be the effect if perspective projection is used for the same?

8. (a) Write a Program to generate the in-betweens for the key frame, Film requires 24 Frames per second, and graphically terminals are refreshed at the rate of 30 to 60 frames per second using linear interpolation.

   (b) Write a morphing program to transform a sphere into a specified polyhedron. [8+8]

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Time: 3 hours **Max Marks: 80**

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1. Write a detailed note of the following rules of animation:
   (a) Stage the action.
   (b) Slow-in and Slow-out. [8+8]

2. (a) Explain briefly curve clipping and text clipping. What are the characteristics of the curve clipping and text clipping?
   (b) Find the normalization transformation sx = sy if and only if aw = av, where aw and av are the aspect ratios of window and viewport respectively. [8+8]

3. (a) Explain the architecture or raster display.
   (b) How are the different shades of color generated on the RGB monitors? [8+8]

4. (a) Derive the transformation matrix for rotation about origin.
   (b) Prove that two successive rotations are commutative.
   (c) Find the transformation matrix that represents rotation of an object by 60^0 clock wise about origin. [6+6+4]

5. (a) Why it is preferred to take unit x-increment when slope of the line is less than 1 and unit y-increment when slope of the line is greater than 1 in DDA.
   (b) Briefly explain how characters and text are generated.
   (c) Enumerate the advantages and disadvantages of flood fill and boundary fill algorithms. [4+6+6]

6. (a) A solid tetrahedron is given by position vectors A(1,1,1),B(3,1,1) C(2,1,3) and D(2,2,2), and a point light source is kept at P(2,3,4). Using back face detection method, find the surfaces on which the light falls and the surfaces which are to be shadowed.
   (b) What happens when two polygons have the same z value and the z-buffer algorithm is used? [10+6]

7. (a) For a standard perspective projection with vanishing point at (0, 0, -d) what is the projected image of a line segment joining P(-1,1,-2d) and Q(2,-2,0).
   (b) Write the composite matrix representation for rotating a 3-D object about an axis that is parallel to one of the coordinate axis. [8+8]

8. (a) Write an application of casteljau algorithm to Bezier Curves. How to Develop Bezier Curves?

   (b) Find the equation of the Bezier curve which through (0, 0) and controlled through (14, 10) and (4, 0). [8+8]

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1. (a) Explain 3D shearing.
   (b) Explain how clipping in 3D can be done.
   (c) Derive the 3D matrix for performing the clipping operations. [4+4+8]
2. (a) Write and explain the midpoint circle generation algorithm.
   (b) Explain with suitable example the scan line seed fill algorithm. [8+8]
3. (a) Differentiate between different types of 2-D transformations with suitable example applications.
   (b) Explain different ways of representing points in 2-D. How this can affect the computation of composite transformation matrix?
   (c) List out the basic transformations and the corresponding transformation matrices. [5+5+6]
4. (a) Show that when Weight factors are unity, a rational B- spline curve coincides with a B-spline curve with same control points and order.
   (b) Is the effect of talking weight factor 2 for a rational B-spline the same as that of taking two control points at the same location on a B-spline curve. [8+8]
5. Write a program to implement the motion of a bouncing ball using a downward gravitational force and a ground plane friction force? Assume that the ball is to be projected into space with a given velocity vector initially. [16]
6. (a) Find the equation of the plane passing through the points (1,3,4), (5,5,5)and (7,9,4).
   (b) Explain the depth-sorting algorithm for visible surface detection. [8+8]
7. Find the complete viewing transformation that maps a window in world coordinates with x extent 1 to 10 and y extent 1 to 10 onto a viewport with x extent $1/4$ to $3/4$ and y extent 0 to $1/2$ in normalized device space, and then maps a workstation window with x extent $1/4$ to $1/2$ and y extent $1/4$ to $1/2$ in the normalized device space into a workstation viewport with x extent 1 to 10 and y extent 1 to 10 on the physical display device? [16]
8. (a) Distinguish between CRT monitors and direct view storage tube (DVST) devices.

(b) What is the role of digital to analog converter (DAC)? Where is it placed in video display devices? [8+8]

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