C1-R4: ADVANCED COMPUTER GRAPHICS

NOTE:

1. **Answer question 1 and any FOUR from questions 2 to 7.**
2. **Parts of the same question should be answered together and in the same sequence.**

Time: 3 Hours **Total Marks: 100**

1.

a) Define Orthographic Projection. Explain three types of perspective projections.

b) Create a matrix that rotates points 90 degrees anti-clockwise about the point (1,1).

c) What is uniform non-rational B-Spline? Mention its use in computer graphics.

d) Explain Sweep Representation to represent a solid in Computer Graphics.

e) Visible surface detection algorithms are mainly classified into 2 main categories. Explain each category.

f) Explain working of CRT display devices.

g) Define Animation. Explain various animation types.

(7x4)

2.

a) Explain YIQ Color Model.

b) Prove that parallel lines in the world do not always appear as parallel lines with perspective projection.

c) In spatial-partitioning representations, a solid is decomposed into a collection of adjoining, nonintersecting solids that are more primitive than the original solid. Explain Cell Decomposition Method of spatial partitioning.

(6+4+8)

3.

a) Find the scaling transformation matrix to scale by sx, sy and sz units with respect to fixed point p(x,y,z)

b) Develop a Cohen-Sutherland outcode for 3D and example your steps.

c) Consider the operation of double shearing that is, shearing in the x-axis direction followed by shearing in the y-axis direction or vice versa. Is double shearing commutative? Show algebraically, using homogenous coordinates, that your answer is correct.

(6+6+6)

4.

a) What is Hidden Surface Removal and describe Painter's Algorithm?

b) What steps are required to fill a region using the boundary-fill method?

c) What is rendering? Explain Gauraud Shading with mathematical formulations?

(6+4+8)

5.

a) Give equations for RGB to HSV Transformation.

b) What is Ray tracing? What is the importance of it?

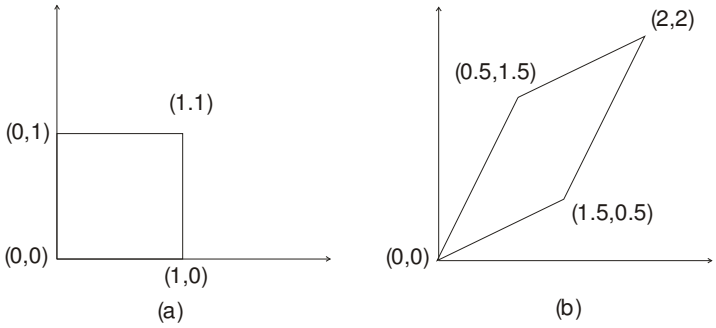
c) Write a short note on: Bump Mapping.

(8+4+6)

6.

a) Given P0[2,2], P1[4,6], P2[8,6] and P3[6,2], the vertices of of a Bezier Curve, determine seven points of Bezier curve.

b) A square as shown in (a) is converted to a parallelogram as in (b) using composite transformation matrix M. Determine such matrix

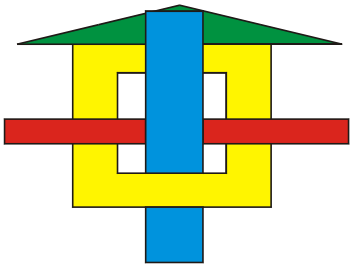


(9+9)

7.

a) What are the computer graphics system main components? Give example on each component. What are the state-of-the-art computer graphics software packages available in the market?

b)



Binary Space Partition (BSP) tree is an efficient method for determining object visibility by painting surfaces onto the screen from back to front, as in painter's algorithm. Explain how does this algorithm work on a given example.

c) Describe generic 2D viewing pipeline.

(6+8+4)