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) Derive a translation matrix to translate a point P from (h, k) to the origin.
b) Discuss merits and demerits of z-buffer algorithm.
c) Define a polyline. When a polygon is said to be convex?
d) What is rendering? What are the differences between software rendering and hardware rendering?
e) The homogeneous unit cube is projected onto xy plane. Note the position of the x, y, and z axes. Find the projected image co-ordinates using the standard perspective transformation with unit distance from the view plane.
f) What is the relationship between geometric and coordinate transformation matrices? Write mathematically and explain it theoretically.
g) What are the four basic steps of animation?

(7×4)

2.

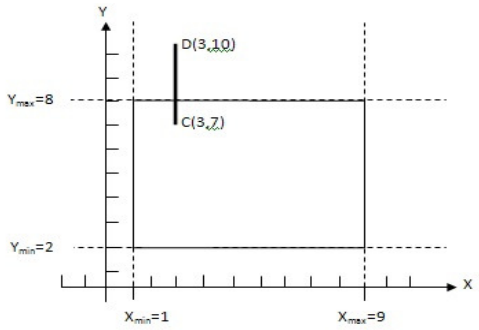
a) Write an algorithm to describe the DDA algorithm for scan converting a line whose slope is between 45º and -45º.
b) What is cavalier and cabinet parallel projection? Find the transformation for cavalier projection with $\theta = 45^{\circ}$ and cabinet projection with $\theta = 30^{\circ}$.
c) Show that the following matrix represents pure rotation:

$$[T] = \begin{bmatrix} \frac{1-t^2}{1+t^2} & \frac{2t}{1+t^2} \\ \frac{-2t}{1+t^2} & \frac{1-t^2}{1+t^2} \end{bmatrix}$$

(6+7+5)

3.

a) Use the Liang-Barsky algorithm to clip the lines in the following figure:



b) Plot a circle using Bresenham's algorithm whose radius is 8 and center at (0, 0).
c) Find the equation of the Bezier curve which passes through (0,0) and (-4, 2) and controlled through (14,10) and (4,0).

(6+7+5)

4.

a) Difference between Bezier Curves and B-Spline Curves.

b) Discuss the advantages and disadvantages of two different solid model representation schemes such as Constructive solid geometry and Boundary representation.

c) Difference between Additive color model and Subtractive color model?

d) What is an Octree?

(6+6+3+3)

5.

a) Write a pseudo code of basic ray-tracing algorithm.

b) Write the relationship between HIS and RGB model.

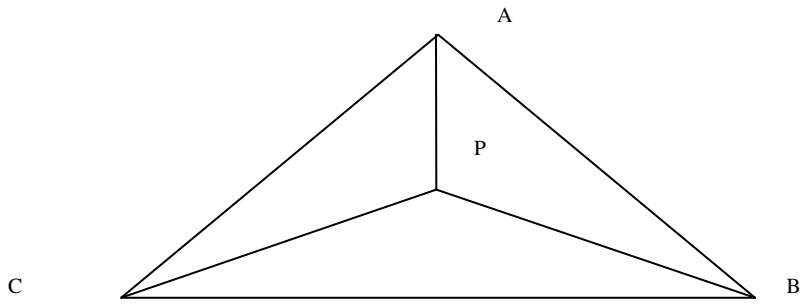
c) Define Specular and Diffuse Reflection.

d) How many key frames are required for a three minute sports sequence?

(6+3+6+3)

6.

a) Calculate the vertex normal at the point P for the tetrahedron shown below:



A(0,1,0); B(0.9,-0.5,0); C(-0.9,-0.5,0); and P(0,0,0.2).

b) Write some advantages and disadvantages of Gouraud Shading.

c) A glass has refractive index 1.025 and its surface normal is $\vec{N} = \hat{j}$. The vector to light source is given by $L = -\hat{i} + \hat{j}$. Find the transmitted light vector, T, into the glass and the reflected light vector, R.

(6+4+8)

7.

a) Write down two different visual-surface algorithms.

b) What do you mean by coherence? And explain about the different types of coherence.

c) What is back-face culling?

d) Find the CMY coordinate of a color at (0.2,1,0.5) in the RGB space.

(6+8+2+2)