1. (a) What are the limitations of DDA line generation algorithm? Explain the algorithm that was proposed to overcome the limitation of DDA line generation algorithm. 5

(b) Write 3D transformation matrices for rotation using homogeneous coordinate system with respect to X, Y and Z axes respectively. 5

(c) Draw the tree structure to describe the taxonomy of projection. 5

(d) How is frame buffer used to control the color and intensity of the computer screen? 5
(e) Determine the general expression for a cubic Bezier curve, with vertices (control points) \(P_0(0, 40); P_1(40, 40); P_2(60, 20); P_3(60, -10)\).

(f) How many key frames are required to produce a five-minute animation film sequence with no duplicates?

(g) Explain Window-to-Viewport transformation with the help of a diagram.

(h) Explain how ray tracing differs from ray casting with the help of a diagram.

2. (a) Derive the conditions for generating the line segment, by using DDA line generation algorithm for both cases (i.e., when slope < 1 and slope > 1). Write the pseudo code of DDA line generation algorithm, and use it to produce a line segment between points (2, 4) and (9, 9).

(b) Explain the Area-subdivision method of visible surface detection.

(c) Explain the mathematical expression for the combined effect of Ambient, Diffused and Specular reflection for Phong's Specular Reflection Model.
3. (a) Determine the point of intersection of the projection of edges AB and CD of a unit cube, on z = 0 plane, where the centre of projection is at (0, 0, -d).

(b) Verify that two successive rotations are additive in nature i.e.

\[ R(Q_1) \cdot R(Q_2) = R(Q_1 + Q_2) \]

where \( R(Q_1) \), \( R(Q_2) \) and \( R(Q_1 + Q_2) \) are 2D-rotational transformations, respectively.

(c) Compare and contrast the Cohen-Sutherland line clipping algorithm with the Cyrus-Beck line clipping algorithm with the help of a diagram.

4. (a) How does simulation of zero acceleration differ from non-zero acceleration, in an animation? Briefly discuss the formulation of a mathematical function, that regulates the frame spacing in an animation with positive acceleration.
(b) Explain any **two** of the following :  
(i) Keyframe Systems  
(ii) Scripting Systems  
(iii) Morphing  

(c) Explain the differences between parametric and geometric continuities in Bezier curve.  

5. (a) Differentiate between any **two** of the following :  
(i) Graphics and Animation  
(ii) Printer and Plotter  
(iii) Hypertext and Hypermedia  

(b) Briefly describe any **two** of the following file formats :  
(i) jpeg  
(ii) tiff  
(iii) bmp  
(iv) gif  

(c) Explain any **two** of the following :  
(i) Authoring tools  
(ii) Z-buffer algorithm  
(iii) Video file formats  

(d) What is Video Conferencing ? Discuss the challenges related to such facilities.  

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