KATHMANDU UNIVERSITY
End Semester Examination
January/February 2024

Level : B.Sc.
Year : III
Time : 2 hrs. 30mins.

31 JAN 2024

Course : COMP 342
Semester : I
F. M. : 40

SECTION "B"
[6 Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. Explain how computer Graphics can be effectively used in the field of Education and Training; justify your answer with relevant examples?

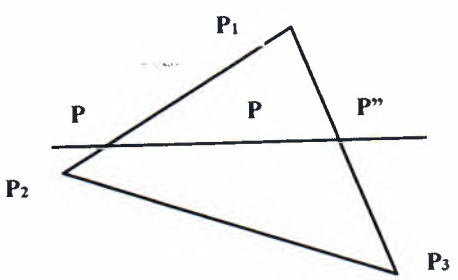
2. Describe run length encoding technique used in computer graphics? What is the fraction of the total refresh time per frame spent in retrace of the electron beam for a non-interlaced raster system with a resolution of 1280 by 1024, a refresh rate of 60 Hz, a horizontal retrace time of 5 microseconds, and a vertical retrace time of 500 microseconds? [1+3]

3. What are the advantages of a Cartesian coordinate system over a homogeneous coordinate system? Determine a sequence of basic transformation that is equivalent to the x-direction shearing matrix? [1+3]

4. What operations are performed during Normalized view coordinate to device coordinate transformation in 2D viewing? Clip the line ***L1 (-4, 2, -1, 7)*** against the rectangular window ***R (-3, 1, 2, 6)*** using Cohen-Sutherland algorithm? [1+3]

5. Mention the conditions under which the back face detection technique is preferable? Describe Scan line method for hidden surface detection technique with suitable example and also lists its advantage over depth buffer method? [1+3]

6. When a light source is relatively far away from a polyhedron, the diffuse reflection determined by the Phong formula varies little within each polygonal face. Why? How can you compute the color of ***P, P', P''*** using Intensity interpolation technique from the given figure? [1+3]



7. Write short notes on: [2+2]
   a. CMY color model
   b. Morphing

SECTION "C"

[2Q × 8 =16 marks]

Attempt *ANY TWO* questions.

8. Derive the conditions for identifying the boundary between the two octants in a Circle? Derive all the required decision parameters and write an algorithm for plotting the first region of an ellipse using the Mid-point algorithm? Digitize a line with endpoints (20, 15) (10, 18) using the DDA algorithm? [1+5+2]

9. Find the transformation co-ordinates of a pyramid whose co-ordinates are A(0,0,0), B(1,0,0), C(0,1,0) and D(0,0,1) after performing a **cavalier projection** that makes an angle **45°** with horizontal axis in $\mathbf{X_v}$, $\mathbf{Y_v}$ plane ? Derive the composite transformation matrix for rotating any 3D object by **30°** about an axis passing through origin and point (10, 0, 10) using homogeneous coordinate system? [3+5]

10. a. What are the various assumptions being made while simulating the ambient light in Computer Graphics? Differentiate between Diffused and Specular reflections? [1+3]

    b. What is the relationship between the rotations R_β, $R_{-\beta}$ and R_β^{-1} Derive the general form of the matrix for rotation about a point ***P (m, n)***? [1+3]

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Marks Scored:

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Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date :

SECTION "A"
[20Q. × 0.5 = 10 marks]

Choose and mark [X] in the appropriate option.

1. "A circuit board layout is transformed into a description of the individual processes needed to construct the layout", the given statement describes the _____application of Computer Graphics.
   [ ] CAD [ ] CAM
   [ ] Education and Training [ ] Image Processing

2. In DDA, if the slope of the line is less than or equal to 1, we compute each successive **y** value as _____
   [ ] $y_{k+1} = y_K - m$ [ ] $y_{k+1} = y_K + 1/m$ [ ] $y_{k+1} = y_K + 1/m$ [ ] $y_{k+1} = y_K + m$

3. While drawing an Region-2 of an ellipse with $\mathbf{r_x}$ **=10** and $\mathbf{r_y}$ **= 6** and center (100, 100) using midpoint algorithm (Assume starting plotting coordinate as(106,100)), the initial decision parameter $\mathbf{P_{20}}$ will be _____
   [ ] -151 [ ] -244 [ ] 288 [ ] -2411

4. The purpose of the display processor or display coprocessor is / are:
   a. Digitizing picture definition
   b. Storing lookup table
   c. Interface with interactive input device
   [ ] a & b [ ] a & c [ ] b & c [ ] a only

5. In random scan system, the refresh display file is also referred as:
   a. Display list b. Display program c. Refresh buffer
   [ ] a & b [ ] b & c [ ] a & c [ ] a, b, & c

6. If an image has a height of 2 inches and an aspect ratio of 3, its width is _____
   [ ] 2 [ ] 3 [ ] 6 [ ] 2 / 3

7. Reflection of a point about **x-axis**, followed by a counterclockwise rotation of **90°**, is equivalent to reflection about the line:
   [ ] x = - y [ ] y = -x [ ] x = y [ ] x +y =1

8. In which transformation, the shape of an object can be modified in any direction depending upon the value assigned to them?
   [ ] Reflection [ ] Shearing [ ] Translation [ ] Rotation

9. Magnify the line with endpoints A (0, 0) and B (5, 2) to twice its size while keeping B (5, 2) fixed, the end points magnified line will be _____
[ ] (0, 0) (5, 2) [ ] (-5, -2) (5, 2) [ ] (0, 0) (10, 4) [ ] (2, 2) (10, 4)

10. What will be the value of r_4 for the line with endpoints (-1, 7, 11, 1) against rectangular clipping window (1, 2, 9, 8) in Liang- Barsky algorithm?
[ ] 1 / 6 [ ] 5 / 6 [ ] 7/6 [ ] -1 / 6

11. In Sutherland-Hodgeman Polygon clipping algorithm, if first vertex is inside the window boundary and second vertex is also inside the window boundary, what is added in the output vertex list?
[ ] Intersection point & second vertex [ ] First vertex
[ ] Second Vertex [ ] Nothing

12. Reflected homogeneous coordinates of the 3D Vertex A (5, 4, 3, 1) in the YZ plane is __
[ ] (-5, 4, 3, 1) [ ] (5, -4, 3, 1) [ ] (5, 4, -3, 1) [ ] (5, -4, -3, 1)

13. Which coordinate system in 3D viewing pipeline uses specifying the observer viewing position and position of the projection plane as a reference?
[ ] World Coordinates [ ] Viewing Coordinates
[ ] Projection Coordinates [ ] Device Coordinates

14. Which is **TRUE** for back-face detection?
a. The back-face detection algorithm is always working well for all polyhedron
b. The back-face detection algorithm always works for a concave polyhedron
c. The back-face detection algorithm always works for a convex polyhedron
[ ] a only [ ] b only [ ] c only [ ] b & c

15. In A-buffer Method, we can calculate the intensity of overlapped surface considering the following factors:
a. Percent of surface overlap b. Opacity c. Depth
[ ] a & b [ ] a & c [ ] b & c [ ] a, b & c

16. Diffuse reflection from a source are scattered with equal intensity in all directions, independent of the viewing direction such a surface are called:
a. Ideal diffuse reflector b. Phong reflector c. Lambertian reflector
[ ] a & b [ ] a & c [ ] b & c [ ] a, b & c

17. Which of the following characteristics hold **TRUE** for distributed light source?
a. Rays follow radially diverging paths
b. Light source is closer to the scene
c. Size of light source is small compared to the surfaces in the scene
[ ] a & b [ ] a & c [ ] b & c [ ] a, b &c

18. In which polygon rendering technique, we determine the average unit normal vector at each polygon vertex
a. Constant Intensity b. Gouraud c. Phong
[ ] a & b [ ] a & c [ ] b & c [ ] b only

19. Which color model use subtractive process?

[ ] XYZ color model
[ ] YIQ color model
[ ] RGB color model
[ ] CMY color model

20. Which steps of animation sequence defines the motion sequence as a set of basic events that are to take place?

[ ] Storyboard layout
[ ] Object definitions
[ ] Key-frame specifications
[ ] Generation of in-between frames