KATHMANDU UNIVERSITY
End Semester Examination [C]
April/May, 2023

Marks Scored:

Level : B.Sc.
Year : III

Course : COMP 342
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 30 APR 2023

SECTION "A"
[20Q. × 0.5 = 10 marks]

Tick (√) the correct answer(s) or fill in the blanks with most appropriate word/phrase.

1. Which application of computer graphics uses the technique to summarize the financial, statistical, mathematical, scientific and economic data?
[ ] Visualization [ ] Computer Art
[ ] Presentation Graphics [ ] Engineering and manufacturing

2. If you are drawing a circle with radius 7.5 and center at (100,100) using midpoint algorithm then the initial decision parameter P_0 is _____.
[ ] -6.5 [ ] -6.25 [ ] -6 [ ] 8.5

3. In Bresenham line drawing algorithm the initial decision parameter $\mathbf{P_0}$ for $\mathbf{|m|=1}$ can be calculated using _____.
a. $P_0 = 2\Delta y - \Delta x$ b. $P_0 = 2\Delta x - \Delta y$ c. $P_0 = 2\Delta y - 2\Delta x$
[ ] a or b [ ] a or c [ ] a only [ ] b only

4. The smallest size object that can be displayed on a monitor is called _____.
[ ] picture element [ ] dot pitch [ ] point [ ] aspect ratio

5. If we want to resize a 1024 × 768 image to one that is 640 pixels wide with the same aspect ratio, what would be the height of the resized image?
[ ] 853 [ ] 854 [ ] 480 [ ] 768

6. The architecture of Random display system consists of _____.
a. Display Processing Unit b. Pixmap c. System Memory
[ ] a & b [ ] a & c [ ] a only [ ] a, b &c

7. The Least Significant Bit of the region code of a point (X,Y) is '1' if _____
[ ] X > XWMIN [ ] X< XWMIN
[ ] X< XWMAX [ ] X>XWMAX

8. In **X-direction** shear relative to the line $\mathbf{y = y_{ref}}$, with shearing factor $\mathbf{Sh_x}$ and $\mathbf{Sh_y}$ in X and Y direction, the transformed **X- coordinate** will be _____.
[ ] $x + Sh_x * y$ [ ] x
[ ] $x + Sh_x (y - y_{ref})$ [ ] $sh_y*(y - y_{ref}) + y$

9. If you rotate the point (20, 30) by 90 degree, then translate it by (-20, 0) and then scale it by (2, 1), where will be the point?
[ ] (100,-20) [ ] (100, 10) [ ] (100, 20) [ ] (-100, 20)

10. Two successive translations are _____
[ ] additive [ ] multiplicative [ ] inverse [ ] subtractive

11. The process of mapping a world window in world coordinate system to viewport is called
[ ] Transformation viewing [ ] Viewport
[ ] Clipping window [ ] Screen coordinate system

12. Consider the matrix given by
$$\begin{bmatrix} a & 0 & 0 & 0 \\ 0 & b & 0 & 0 \\ 0 & 0 & c & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}.$$
Assuming that $a \neq b \neq c$, to what transformation does this 4x4 matrix correspond?
[ ] Shearing [ ] Non Uniform Scaling
[ ] Translation [ ] Uniform Scaling

13. The one point perspective projection occurs, when the projection plane is perpendicular to
[ ] X and Y axes [ ] X and Z axes [ ] Y and Z axes [ ] X, Y or Z axes

14. In cabinet projection, the lines perpendicular to the viewing surface are projected at _____ in their length.
[ ] no change [ ] 1/2 [ ] ¼ [ ] 3/4

15. What is the Maximum number of overlapping objects that can be handled by using the Z-buffer algorithm?
[ ] Single object [ ] Two object [ ] Multiple object [ ] Two opaque object

16. Which hidden surface removal method takes care of both opaque surfaces as well as transparent surfaces?
[ ] Back face removal method [ ] Z buffer method
[ ] Scan line method [ ] A buffer method

17. The total diffuse reflection $\mathbf{I}_{diff}$ is given by
[ ] $\mathbf{K_d I_a}$ [ ] $\mathbf{K_d I_l \cos \theta}$ [ ] $\mathbf{K_d I_l (N \cdot L)}$ [ ] $\mathbf{K_d I_a + K_d I_l (N \cdot L)}$

18. In Gouraud Shading, each polygon surface is rendered by performing the following calculations:
a. Determine all light sources incident on the object
b. Determine the average unit normal vector at each polygon vertex
c. Linearly interpolate the vertex intensities over the surface of the polygon
[ ] a & b [ ] a & c [ ] b & c [ ] a, b, & c

19. If the CMY color triplet is (0.5, 0.1, 0.2), what is its resulting RGB color triplet?
[ ] (0.5, 0.3,0.1) [ ] (0.5, 0.9,0.8) [ ] (0, 0.1,0.2) [ ] (0, 0,0)

20. Real-time animation requires
a. movement of whole object
b. movement of parts of the object
c. fluid coordination of the moving parts
[ ] a & b [ ] b & c [ ] a & c [ ] a, b & c

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SECTION "B"
[6Q. × 4 = 24 marks]

Attempt *ANY SIX* questions.

1. What is computer graphics? Describe the significance of computer graphics in the field of Image Processing and Computer Vision with relevant examples? [1+3]

2. Differentiate between Raster and Vector display? Consider a raster system with the resolution of 1024 x 768 pixels and the color palette calls for 65,536 colors. What is the minimum amount of video RAM that the computer must have to support the above-mentioned resolution and number of colors? [2+2]

3. What are the advantages of using homogeneous coordinate systems in compare to Cartesian system? Derive the necessary transformation equations for rotating a point $\mathbf{P(x, y)}$ by $\boldsymbol{\theta^o}$ with reference to $\mathbf{(X_r, Y_r)}$ geometrically? [1+3]

4. What is the relationship between clipping and windowing? Clip the line with end points A (3, 10) B (3, 7) against the clipping window with lower left corner (1, 2) and upper right corner (9, 8) using Liang-Barsky algorithm? [Show the entire step as per the algorithm] [1+3]

5. Why is it easier to locate hidden surfaces when parallel projection is used? Explain depth buffer algorithm with supporting mathematical relations and examples? [1+3]

6. Describe Constant Intensity Shading with relevant example? Differentiate between Specular Reflection and Gouraud reflection? [3+1]

7. Write Short notes on: [2+2]
   a. RGB Color model
   b. Morphing

SECTION "C"
[2Q × 8 = 16 marks]

Attempt *ALL* questions

8. Derive all the required decision parameters and write an algorithm for drawing a line with $\mathbf{|m| >= 1}$ using Bresenham algorithm. Digitize a first region of an ellipse with Center (20, 10) and $\mathbf{R_X = 8}$ $\mathbf{R_Y}$=6 using Midpoint ellipse drawing algorithm? [6+ 2]

9.

a. What are applications of Parallel Projection in Computer Graphics? Derive the composite transformation matrix for rotating any 3D object by **30°** about an axis parallel to X-axis using homogeneous coordinate system? [1+4]

b. Gokul sat in the car, and find the side mirror is 0.4m on his right and 0.3m in his front he started his car and drove 5m forward, turned 30 degrees to right, moved 5m forward again, and turned 45 degrees to the right, and stopped? What is the position of the side mirror now, relative to where Gokul was sitting in the beginning? [3]