KATHMANDU UNIVERSITY
End Semester Examination
June/July, 2023

Marks Scored:

Level : B.E.
Year : III

Course : COMP 342
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 10

17 JUL 2023

Registration No.:

Date :

SECTION "A"
[20Q. × 0.5 = 10 marks]

Encircle the most appropriate option among the given choices.

1. Which application of computer graphics provides a feature of graphical symbol that is designed to look like the processing option it represents?
[ ] Image Processing [ ] Visualization
[ ] Computer Art [ ] Graphical user interfaces

2. While drawing a line using BLA, which factor/s is/are considered while selecting the sampling position?
a. Y intercept value of the line
b. Slope of the line
c. Starting point of the line
[ ] a only [ ] b only [ ] a & b [ ] a & c

3. While drawing a Region-2 of an ellipse with $\mathbf{r_x = 8}$ and $\mathbf{r_y = 6}$, center (200, 300) and the plotted end point of Region-1 (207, 303) using midpoint algorithm, the initial decision parameter $\mathbf{P2_0}$ is _____.
[ ] -151 [ ] -23 [ ] 4585 [ ] -332

4. 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

5. Which of the following holds true for Random Scan Display System?
a. Uses interlacing
b. Refresh rate depends directly on picture complexity
c. Scan conversion is not required
[ ] a & b [ ] a & c [ ] b & c [ ] a, b &c

6. How much memory is needed for the frame buffer to store a 640 × 400 display with 16 different color levels?
[ ] 4096000 bits [ ] 512000 bits [ ] 1024000 bits [ ] 2048000 bits

7. Which of the following are rigid body transformations?
a. Translation b. Rotation c. Reflection d. Scaling
[ ] a, b & c [ ] b, c & d [ ] a, c, & d [ ] a, b, & d

8. In a 2D fixed point scaling coordinate $\mathbf{(x_f, y_f)}$. For a vertex with coordinates **(x, y)**, the scaled coordinates **y'** with scaling factor **sx, sy** is calculated as _____.
[ ] $y. sx + x_f . (1-sx)$ [ ] $x. sx + x_f .(1-sx)$
[ ] $y. sx + y_f . (1-sy)$ [ ] $y. sx + x_f . (1-sy)$

9. The coordinates after the rotation of a line A (0, 0), B (1, 0) by $\mathbf{45^0}$ about the origin is ___
[ ] (0,0) $(\sqrt{2}/2, \sqrt{2}/2)$ [ ] (0,0) $(0, \sqrt{2})$
[ ] (0,0) $(-\sqrt{2}/2, \sqrt{2}/2)$ [ ] (0,0) $(\sqrt{2}/2, \sqrt{2}/2)$

10. In Cohen-Sutherland line clipping algorithm a line with endpoints codes as 0000 and 0100 is:
[ ] No intersection point across the boundary needs to be calculated
[ ] One intersection points across the boundary needs to be calculated
[ ] Two intersection points across the boundary needs to be calculated
[ ] Line is completely outside the clipping boundary

11. In which transformation step of 2D viewing transformation pipeline, all parts of the picture that lie outside the viewport are clipped?
[ ] MC to WC [ ] WC to VC [ ] VC to NVC [ ] NVC to DC

12. What will be the final coordinates after 3D rotation of the point P (10, 10, 10, 1) represented in homogenous coordinate at 90° about Z-axis?
[ ] (10, -10, -10, 1) [ ] (-10, -10, -10, 1)
[ ] (-10, 10, 10, 1) [ ] (10, -10, 10, 1)

13. Which type of 3D projection is used to create the illusion of depth in a 2D image?
[ ] Parallel projection [ ] Perspective projection
[ ] Oblique projection [ ] Isometric projection

14. How does the depth buffer method work?
a. It stores the depth of each pixel in the depth buffer
b. It compares the depth of each new pixel to the depth of the pixel in the depth buffer
c. If the new pixel is closer to the viewer, then its depth is stored in the depth buffer and the old pixel is overwritten
[ ] a & b [ ] b &c [ ] a & c [ ] a, b & c

15. What are the different factors that are considered in A- buffer method, while calculating the intensity of each pixel in transparent overlapping surfaces?
a. Depth values b. Opacity factors c. Percent of surface overlap
[ ] a & b [ ] b & c [ ] a & c [ ] a only

16. Which of the following is **NOT** a factor that affects the intensity of light reflected from a surface?
[ ] The angle of incidence [ ] The intensity of the light source
[ ] The color of the surface [ ] The roughness of the surface

17. What is the main assumption of constant intensity shading?
[ ] The surface is smooth and curved
[ ] The surface is flat and planar
[ ] The surface is illuminated by a single light source
[ ] The surface is reflective

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 normal over the surface of the polygon
[ ] a & b [ ] a & c [ ] b & c [ ] a, b, & c

19. In HLS color model, at L=1, we observe _____ color.
[ ] Yellow [ ] Blue [ ] Magenta [ ] White

20. _____ techniques are often used to specify the animation paths between key frames.
[ ] Simulating acceleration [ ] Curve-fitting
[ ] Key-frame specifications [ ] Motion specifications

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Semester : II
F. M. : 40

SECTION "B"
[6Q. × 4= 24 marks]

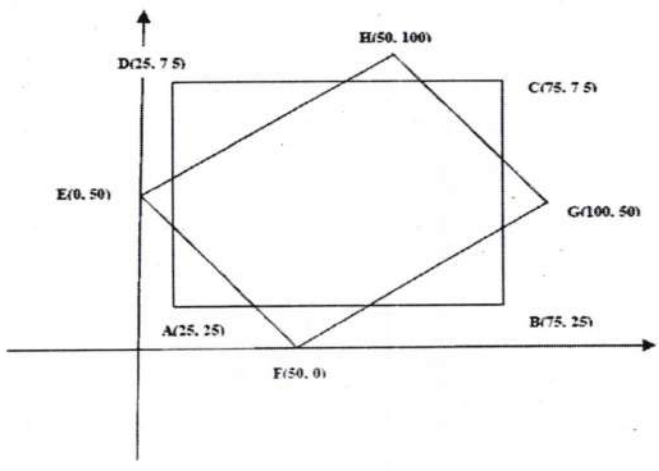
Attempt *ANY SIX* questions. ***Question number 1 is compulsory.***

1. Health Informatics research team is looking for solution to represent the obtained data collected in different regions of Kathmandu valley which shows the distribution of diseases or health conditions in a population, they are struggling to present the collected data in more appropriate way, you as a student of computer graphics which applications of Computer graphics will you use and what will be your approach for solving the given issues? (Make assumptions as needed)

2. A laser printer is capable of printing two pages (size 9 ×11 inch) per second at resolution of 600 pixels per inch. How many bits per second does such device require? Describe the basic video-controller refresh operations in raster display system with suitable block diagram? [2+2]

3. If you are developing a game snake and ladders, what are the different transformation technique you are going to use, and write their purpose, and also describe do we require any composite transformations? Find the equation of the circle $(x')^2 + (y')^2 = 1$ in terms of xy coordinates, assuming that the $x'y'$ coordinate system results from a scaling of a units in the x direction and b units in the y direction. [2+2]

4. Using the Sutherland-Hodgeman algorithm, clip the following polygons against the rectangle. [Show the entire steps as per the algorithm]



5. Why is it easier to locate hidden surfaces when parallel projection is used? Describe Scan line method for hidden surface detection technique with suitable example and also list its advantage and similarity with depth buffer algorithm? [1.5+2.5]

6. Describe specular reflection with supporting mathematical calculations and also write the equation that shows the surface lighting effects, if we place more than one source of a light in a scene? [1.5+2.5]

7. Write Short notes on: [2+2]
   a. RGB Color model
   b. Design of Animation Sequences

SECTION "C"
[2 Q. × 8 = 16 marks]

Attempt *ANY TWO* questions.

8. Derive all the required decision parameters and write an algorithm for drawing a circle with Radius R, starting from **(-R, 0)** using Midpoint algorithm? Digitize a line with end points A (10, 10) and B (16, 14) using Bresenham line drawing algorithm? [6+2]

9. Calculate the transformation coordinates of a unit cube for a cavalier projection with $\phi = 45^{o}$ (use homogeneous coordinate)? Derive 3D composite transformation matrix for rotating a 3D object about an arbitrary axis by an angle θ^{o} using homogeneous coordinate? (***Make necessary assumptions) (Actual rotation*** θ^{o} ***should be performed on y-axis)*** [Matrix multiplication not needed] [3+5]

10.
   a. Explain Phong rendering technique with supporting mathematical calculation and also write its advantages over Gouraud rendering technique? [4]

   b. Find the instance transformation which places a half-size copy of a square P(0, 0), Q(1, 0), R(1, 1), S(0, 1) into a master picture coordinate system so that the center of the square is at (-1, -1). [4]