Marks scored:

KATHMANDU UNIVERSITY
End Semester Examination
March/April, 2017

Level : B. Sc.
Year : III
Course : COMP 342
Semester : I

Exam Roll No. :
Time: 30 mins.
F. M. : 10

Registration No. :
Date :

SECTION "A"
[20 Q × 0.5 =10 marks]

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

1. What is/are principle applications of image-processing methods:
   a. Improving picture quality
   b. Testing performance of system
   c. Machine perception of visual information
   d. Transformation of one object into another
   [ ] a & b [ ] b & c [ ] c & d [ ] a &c

2. In Bresenham line drawing algorithm the initial decision parameter $\mathbf{P_0}$ for $|\mathbf{m}|=\mathbf{1}$ 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 & b [ ] a & c [ ] a only [ ] b only

3. While drawing an ellipse with $\mathbf{r_x = 6}$ and $\mathbf{r_y = 8}$ using Mid point algorithm, the initial decision parameter $\mathbf{P1_0}$ for region-1 is _____
   [ ] 151 [ ] -332 [ ] -215 [ ] -151

4. What will be the aspect ratio of monitor if the horizontal line plotted with 3 points has the same length as vertical line plotted with 2 points?
   [ ] 3/ 4 [ ] 3/2 [ ] 1 [ ] 2/3

5. 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

6. RLE is a technique for _____
   [ ] Scan conversion
   [ ] storing lookup table
   [ ] mixing frame buffer image with an input image from camera
   [ ] image compression

7. Magnify the line with vertices A (1, 1) and B (5, 2) to twice its size while keeping B (5, 2) fixed. The coordinates of magnified line are _____
   [ ] (2, 2) and (5, 2) [ ] (-5,-2) and (5, 2)
   [ ] (-3, 0) and (5, 2) [ ] (5, 2) and (5, 2)

8. In x-direction shear relative to the x-axis. The transformed x coordinate position is obtained by _____
   [ ] $x * sh_x + y$ [ ] $x + y * sh_x$
   [ ] $x + sh_x (y - y_{ref})$ [ ] $x + sh_x (x - x_{ref})$

9. Find the condition under which we have $S_{SX, SY}$. R (α) = R (α). $S_{SX, SY}$
[ ] SX ≠ SY [ ] SX = SY [ ] α = 45^0 [ ] α = 90^0

10. What will be the value of r_l edge, for the line with endpoints (-1, 7, 11, 1) using Liang-Barsky line clipping algorithm?
[ ] 1/6 [ ] 5/6 [ ] -5/6 [ ] -1/6

11. The rectangular region of the screen which is selected for displaying the object is _____
[ ] window port [ ] viewport [ ] clip window [ ] clipping

12. Which of the following 3D transformation technique doesn't consider view plane while undergoing transformation?
a. Reflection b. Rotation c. Scaling
[ ] a only [ ] b only [ ] c only [ ] a, b & c

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 right handed viewing system with viewing direction along the negative z axis, the polygon is a back face, if _____, where C is a z component of surface normal vector.
[ ] C = 0 [ ] C >0 [ ] C < 0 [ ] C ≤ 0

15. In A buffer method, if an object is transparent then the value of depth will be _____
[ ] depth < 0 [ ] depth > 0 [ ] depth ≤ 0 [ ] depth ≥ 0

16. Which of the following characteristics hold true for point source of light?
a. Rays follow radially diverging paths
b. Size of light source is not small compared to object in the scene
c. Light source is sufficiently far from the scene
[ ] a & b [ ] a & c [ ] b & c [ ] a, b & c

17. What value of $\mathbf{n_s}$ (Specular reflection parameter), results illuminated intensity from the 3D surface similar to diffuse reflection while simulating specular reflection?
[ ] 100 [ ] 50 [ ] 2 [ ] 1

18. In Gouraud Shading, each polygon surface is rendered by performing the following calculations:
a. Determine all light sources illuminating 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. Find the RGB coordinates of a color at (0.15, 0.75, 0), in the CMY space.
[ ] (0.85, 0.25, 1) [ ] (-0.85, 0.25, 0)
[ ] (-0.85, -0.25, 0) [ ] (0, 0, 0)

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

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F. M. : 40

SECTION "B"

[6Q × 4 = 24 marks]

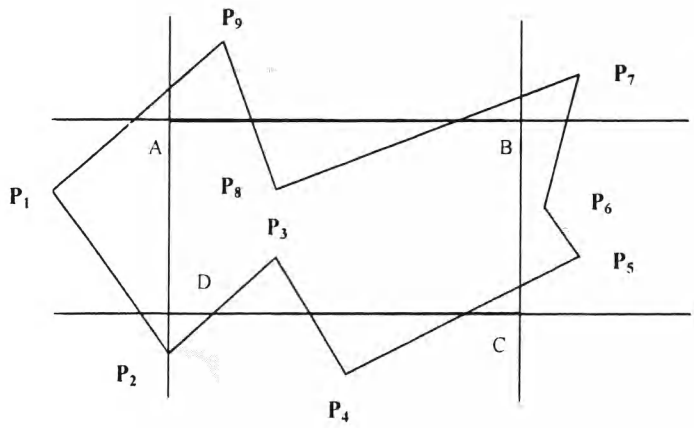
Attempt *ANY SIX* questions.

1. How Computer Graphics differ from Image Processing? Wikipedia refers 3D printing, also known as additive manufacturing (AM) as, "a processes used to synthesize a three-dimensional object in which successive layers of material are formed under computer control to create an object. Objects can be of almost any shape or geometry and are produced using digital model data from a 3D model or another electronic data source such as an Additive Manufacturing File (AMF) file." Describe the roles that computer graphic plays in this emerging field of 3D printing? [1+3=4]

2. In architecture of advanced raster display system, display processor (DP) is introduced, does this DP has a direct access to system memory and what was the main purpose of introducing DP? Assuming that a certain full-color (24-bit per pixel) RGB raster system has a 512-by-512 frame buffer, how many distinct color choices (intensity levels) would we have available? How many different colors could we display at any one time? [2+2=4]

3. Differentiate between Geometric transformations and composite transformations? Derive the transformation that rotates an object point α^0 about the origin geometrically. Write the matrix representations for this rotation in homogeneous coordinate system? [1+3=4]

4. Clip the polygon with vertex $P_1,\ldots,P_9$ in figure below against the rectangular clipping window ***ABCD*** using the Sutherland-Hodgman algorithm(***all intermediate and final results must be shown along with the vertex table***)? Clip the line ***L1 (1, -2, 3, 3)*** against the rectangular window ***R (-3, 1, 2, 6)*** using Cohen-Sutherland line clipping algorithm? [2+2=4]



5. Differentiate between object space method and image space method? What were the advantages of introducing Scan Line method after Z-buffer method? Write the algorithm for depth buffer hidden surface detection method assuming the background depth as ***1*** and background intensity as $I_{backgnd}$? [1+1+2=4]

6. Write a general equation to model the combined diffuse and specular reflections from a point on an illuminated surface with multiple light sources? Explain diffuse reflection with supporting mathematical calculations? [1+3=4]

7. Write Short notes on: [2+2=4]
   a. HSV Color model
   b. Morphing

SECTION "C"

[2Q × 8 =16 marks]

Attempt *ANY TWO* questions.

8. What are advantages of Bresenham algorithm in compare to DDA while drawing a line? Derive all the required decision parameters and write an algorithm to draw a Semi-Circle using Mid-point algorithm? [1+ 5+2=8]

9. Derive a transformation matrix for producing any parallel projection onto the (X_v, Y_v) plane and write a condition for getting orthographic, cabinet and cavalier projection from the derived transformation matrix? Derive the composite transformation matrix for rotating a 3D object about an axis i.e parallel to ***X-axis*** (***make necessary assumptions***)? [4+1+3=8]

10. a. What are the drawbacks of Flat surface rendering techniques in compare to Gouraud technique? Explain Gouraud rendering technique with supporting mathematical calculation? [1+4=5]

    b. Perform a 45^0 rotation of triangle ***A (0, 0), B (1, 1), C (5, 2)*** about a point ***P(-1, -1)***? [3]