COMPUTER GRAPHICS AND MULTIMEDIA
(MCAP 3102)

Time Allotted : 3 hrs   **Full Marks : 70**

Figures out of the right margin indicate full marks.

*Candidates are required to answer Group A and
<u>any 5 (five)</u> from Group B to E, taking <u>at least one</u> from each group.*

Candidates are required to give answer in their own words as far as practicable.

Group – A
(Multiple Choice Type Questions)

1.   Choose the correct alternative for the following: **10 × 1 = 10**

   (i)   Two successive translations are
            (a) Multiplicative   (b) Inverse   (c) Subtractive   (d) Additive.

   (ii)   Consider the point (2, 5) in the XY plane. Assume that the point is rotated
            counter-clockwise in the plane by 90 degrees about the origin. What are the
            coordinates of the resulting point?
            (a) (-2, 5)   (b) (2, -5)   (c) (-2,-5)   (d) (-5, -2)

   (iii)   If the axis of rotation is Z-axis, then direction of positive rotation is
            (a) Y to Z   (b) Z to X   (c) X to Y   (d) Y to X.

   (iv)   Let the maximum number of pixels in a line be M. The number of subdivisions at
            most necessary for using the mid-point subdivision method of clipping is
            (a) $\log_2 M$ (b) 2^M (c) M / 2   (d) $(M / 2)^2$.

   (v)   Which of the following is not an object-space hidden surface removal method?
            (a) Painter's Algorithm   (b) Z-Buffer Algorithm
            (c) Back face Culling   (d) Warnock's Algorithm.

   (vi)   In Cohen-Sutherland line clipping, a line with end point codes 0000 & 0100 is
            (a) partially visible   (b) completely visible
            (c) completely invisible   (d) cannot be determined.

   (vii)   Consider two points A (0, 1) and B (5, 6). Let P (u) =(x (u), y (u)) be a parametric
            line function. What is a parametric equation of the line segment joining the
            points A and B?
            (a) x(u)=u, y(u)=5u+1   (b) x(u)=5u, y(u)=5u+1
   (c) x(u)=5u, y(u)=u+1   (d) x(u)=5u, y(u)=5u.

(viii) If we want to cut a 512 X 512 sub-image out from the center of an 800 X 600 image, what are the coordinates of the of the pixel in the large image that is at the lower left corner of the small image?
(a) (144, 144)   (b) (150, 150)
(c) (800, 512)   (d) (512, 600).

(ix) The format for storing digital audio in multimedia application is
(a) JPEG   (b) MPEG   (c) WAV   (d) BMP.

(x) Consider a raster system with a resolution of 640 by 480. If the display controller refreshes the screen at a rate of 60 frames per second, what is the access time per pixel?
(a) 54.25 ns   (b) 64.25 ns   (c) 50.45 ns   (d) 48.55 ns.

Group – B

2. (a) Summarize the procedure for Bresenham line drawing algorithm. [(CO2)(Summarize/LOCQ)]
   (b) Applying midpoint ellipse drawing algorithm find the pixel positions on the first quadrant for the ellipse $\frac{x^2}{64} + \frac{y^2}{36} = 1$. [(CO2)(Finding/IOCQ)]
   (c) Using the mid-point algorithm find the pixel positions of a circle of radius 10 units in the first quadrant. [(CO2) (Analyze/IOCQ)]

   4 + 5 + 3 =12

3. (a) Explain the meaning of 'interlaced' video and the reason for using interlaced video formats. [(CO2)(Analyze/IOCQ)]
   (b) Differentiate between Direct Coding & Colour Lookup Table Implementation with suitable example. [(CO2)(Analyze/IOCQ)]
   (c) Identify two applications of Computer Graphics in the Entertainment Industry and describe about them. [(CO1)(Remember/LOCQ)]

   3 + 3 + 6 = 12

Group – C

4. (a) Explian the term 'Affine Transformation' mathematically? [(CO3) (Analyze/IOCQ)]
   (b) Implement the reflection of a point (x, y) about an arbitrary line with equation y = mx + c. Derive itstransformation matrix. [(CO3) (Apply/IOCQ)]
   (c) Interprete the term 'positively oriented convex polygon'. [(CO3) (Understand/LOCQ)]

   4 + 5 + 3 = 12

5. (a) Detect the clipped portion applying Sutherland-Hodgman clipping algorithm to the following 2D polygon $P_1P_2P_3P_4P_5P_6$ with respect to the clipping window ABCD. What is the 'extra edge' with regards to the result here? Use the clipping order Top->Bottom->Left->Right and give the full list of vertices produced after each step. [(CO4) (Evaluate/HOCQ)]
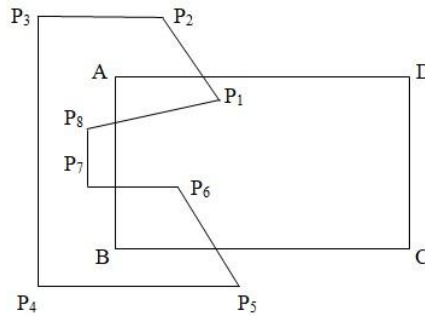
(b)   Find the normalization transformation which uses the rectangle A(1, 1), B(5, 3), C(4, 5) and D(0, 3) as a window and the normalized device screen as a viewport. [(CO4) (Apply/IOCQ)]

(c)   Consider a line (-2, -2) to (10, 9). Find its visibility against a rectangle with principle diagonal (0, 6) to (8, 0) using Cyrus-Beck algorithm? [(CO4)(Apply/IOCQ)]
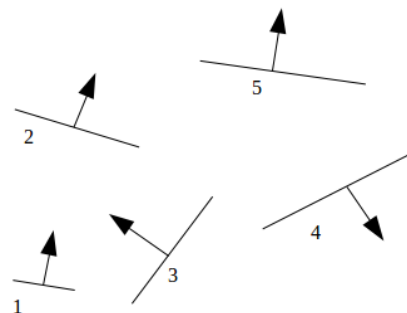
                                                                        5 + 3 + 4 = 12

Group – D

6. (a)   Differentiate between Phong Shading and Gouraud Shading. [(CO4) (Analyze/IOCQ)]

    (b)   Describe piecewise spline curve for (n+1) control points. Differentiate between geometric Continuity and parametric continuity. [(CO4) (Analyze/IOCQ)]

    (c)   Generate a Bezier curve passing through the points $P_1(40,40), P_2(10,40)$ and controlled by the points $P_3(60,60), P_4(60,0)$. Also calculate the coordinate of the points on the curve corresponding to the parameter t = 0.2; 0.4; 0.6. Calculate a rough sketch of the graph. [(CO4)(Create/HOCQ)]

                                                                        4 + 4 + 4 = 12

7. (a)   Generate the BSP Tree according to the given Planes in the following diagram with indicated surface normals. Then do the traversal of the tree according to the eye position. [(CO4) (Create/HOCQ)]

    (b)   Explain the type of reflection that creates whitish shiny surface. [(CO4)(Understand/LOCQ)]

    (c)   Explain the Back Face culling algorithm with suitable diagram. [(CO4) (Analyze/IOCQ)]

                                                                        5 + 3 + 4 = 12

Group – E

8. (a)   Explain the term 'authoring' in the context of multimedia. [(CO5) (Analyze/IOCQ)]

    (b)   Mention the usgae of Multimedia in two different industries. [(CO5) (Understand/LOCQ)]

    (c)   What will be the ideal sampling rate of an analog signal which has a juxtaposition of 1.5 – 3KHz. Explain your answer. [(CO5) (Analyze/IOCQ)]

3 + 6 + 3 = 12

9.   (a)   Outline the steps how MIDI sound is synthesized. [(CO6) (Analyze/IOCQ)]
     (b)   Outline the JPEG compression process. [(CO6) (Analyze/IOCQ)]
     (c)   Explain one Entropy coding scheme. [(CO5) (Analyze/IOCQ)]

4 + 5 + 3 = 12

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Cognition Level	LOCQ	IOCQ	HOCQ
Percentage distribution	22.92%	62.5%	14.58%

Course Outcome (CO):
After the completion of the course students will be able to:
1. Visualize the application areas of computer graphics concepts in the development of real world applications.
2. Understand the basics of color model and image representation.
3. Develop the concept of affine transformation in 2D & 3D.
4. Analyze the steps to map from real world coordinates to device specific coordinates.
5. Understand Multimedia document architecture, importance of synchronization and specific applications of Multimedia.
6. Identify the individual media ingredients to develop an integrated multimedia project.

*LOCQ: Lower Order Cognitive Question; IOCQ: Intermediate Order Cognitive Question; HOCQ: Higher Order Cognitive Question

Department & Section	Submission Link
MCA	https://classroom.google.com/c/NDA0ODA0NTIxNDk4/a/NDU3OTg2ODE4MDUy/details