

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION, DECEMBER 2018

Course Code: CS401
Course Name: COMPUTER GRAPHICS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 4 marks.

Marks

- | | | |
|----|---|-----|
| 1 | What do you understand by the aspect ratio and resolution of a display screen in a raster scan display? | (4) |
| 2 | Write the flood fill algorithm for filling a polygon. | (4) |
| 3 | Write the methods used to plot a dashed line segment. | (4) |
| 4 | Given a triangle A(20,10) B(80,20) C(50,70). Find the co-ordinates of vertices after each of the following transformation.
(a) Reflection about the line $x=y$.
(b) Rotation of the triangle ABC about vertex A in clockwise direction for an angle 90 degree. | (4) |
| 5 | Write the different tables used for representing polygon surfaces. Illustrate with an example. | (4) |
| 6 | Describe the techniques that can be used to provide text clipping in a graphics package. | (4) |
| 7 | Explain about different types of parallel projections. | (4) |
| 8 | What do you understand by correlation and convolution operations in case of image processing? | (4) |
| 9 | Write the Z-buffer algorithm for hidden surface removal. | (4) |
| 10 | What do you understand by the following terms with respect to pixels. Neighbours, Adjacency, Connectivity. | (4) |

PART B

Answer any two full questions, each carries 9 marks.

- | | | |
|----|--|-----|
| 11 | a) Explain the working of a random scan display system with suitable diagram. | (6) |
| | b) Explain the working of a beam penetration CRT. | (3) |
| 12 | a) Write the midpoint circle drawing algorithm. | (4) |
| | b) Use midpoint circle drawing algorithm to plot a circle whose radius =20 units and center is (50, 30). | (5) |
| 13 | a) A mouse is picked up and placed in another position. Whether the position of the mouse pointer change. Justify your answer. | (2) |
| | b) Explain the working of a light pen. | (3) |
| | c) Write the scan line algorithm for filling a polygon. | (4) |

PART C

Answer any two full questions, each carries 9 marks.

- 14 a) Given a clipping window A(-20,-20), B(40,-20), C(40,30) and D(-20,30). (6)
Using Cohen Sutherland line clipping algorithm, find the visible portion of the line segment joining the points P(-30,20) and Q(60,-10).
- b) Derive an equation for window to viewport transformation by specifying the sequence of basic transformations involved. (3)
- 15 a) What are the steps for general 3D rotation if the rotation axis is not parallel to any one of the principal axis. The rotation axis is defined by the points P1(x1,y1,z1) and P2(x2,y2,z2). Write down the composite matrix representation. (9)
- 16 a) Explain Sutherland Hodgeman polygon clipping algorithm with illustrations. (5)
- b) Describe the transformation which reflects a 2-D object about a line L which has a y-intercept(0,b) and an angle of intersection theta degree w.r.t. to the x-axis. (4)

PART D

Answer any two full questions, each carries 12 marks.

- 17 a) Explain in detail the scan line algorithm for visible surface detection by pointing out the data structures used in this algorithm.. (7)
- b) How the cyclic overlaps of surfaces are eliminated in scan line algorithm? (2)
- c) In case of an A-buffer algorithm, what information is stored in a linked list. (3)
- 18 a) Explain the fundamental steps in Digital Image Processing with a neat diagram? (8)
- b) The gray levels in an image $g_1(x,y)$ range from **a** to **b**. It is decided to change it into an image $g_2(x,y)$ in which the gray levels range from **c** to **d** using a linear transformation of its gray levels. Derive the equation for $g_2(x,y)$ as a function of $g_1(x,y)$ by specifying the steps. (4)
- 19 a) Explain the Robert's, Prewitt's and Sobel's edge detectors. (6)
- b) Derive the transformation matrix for perspective projection with the projection reference point at position Z_{prp} along the Z_v axis and the view plane at Z_{vp} . Write the perspective transformation equations (i) if the view plane is taken to be the uv plane (ii) if the projection reference point is taken to be at the viewing co-ordinate origin. (6)

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(S), MAY 2019

Course Code: CS401
Course Name: COMPUTER GRAPHICS

Max. Marks: 100

Duration: 3 Hours

PART A*Answer all questions, each carries 4 marks.*

Marks

- | | | |
|---|--|-----|
| 1 | Differentiate between raster scan and random scan display systems. | (4) |
| 2 | How 8-way symmetry of circle can be used for writing circle drawing algorithms? Write the symmetric points if (x, y) is a point on the circle with centre at origin. | (4) |
| 3 | Write the DDA line drawing algorithm. | (4) |
| 4 | What do you mean by homogeneous coordinate system? What is its significance? | (4) |
| 5 | Define the terms window, viewport and windowing transformation in the context of 2D viewing with suitable diagrams. | (4) |
| 6 | Describe the steps involved in scaling a 3D object with respect to a fixed point (xf, yf, zf). Derive the composite transformation matrix. | (4) |
| 7 | Distinguish between parallel and perspective projections. | (4) |
| 8 | Explain the back face detection algorithm for hidden surface removal. | (4) |
| 9 | Consider the image segment shown. Let $V = \{1, 2\}$ and compute the lengths of the shortest 4-path, 8-path, and m-path between pixels p and q . | (4) |

3	1	2	1 (q)
2	2	0	2
1	2	1	1
(p) 1	0	1	2

- | | | |
|----|--|-----|
| 10 | Define the following terms related to pixel of an image:
i) pixel neighbourhood ii) digital path iii) connected set | (4) |
|----|--|-----|

PART B*Answer any two full questions, each carries 9 marks.*

- | | | |
|----|--|-----|
| 11 | a) Explain the architecture of raster graphics system with suitable diagrams. | (6) |
| | b) Explain the working of Direct View Storage Tube (DVST). | (3) |
| 12 | a) Explain the boundary fill algorithm using 4-connected approach. | (4) |
| | b) Rasterize the line segment from pixel coordinate (1, 1) to (8, 5) using Bresenham's line drawing algorithm. | (5) |

- 13 a) Consider a raster system with a resolution of 2560 x 2048. Determine the frame buffer size (in bytes) needed for the system to store 12-bits per pixel. How much storage is required if 24-bits per pixel are to be stored? (2)
- b) Explain the working of a delta-delta shadow mask CRT. (4)
- c) Explain the non-zero winding number rule to identify interior regions of a polygon. (3)

PART C

Answer any two full questions, each carries 9 marks.

- 14 a) Perform the following transformations on a point (6, 4). (4)
- i) Translate by $t_x = -2$ and $t_y = 4$
- ii) then, Scale by $s_x = 2$ and $s_y = 1$
- iii) and Rotate by 90° in clockwise direction. Determine the final coordinates of the transformed point.
- b) Prove that the multiplication of 2D transformation matrices for two successive rotations is commutative. (3)
- c) Explain the concept of point clipping in 2D. (2)
- 15 a) Explain Weiler Atherton polygon clipping algorithm with illustrations. (6)
- b) A rectangular parallelepiped is unit distance on Z-axis, 2 units on X-axis and 3 units on Y-axis. Determine the new coordinates of the parallelepiped when it is rotated counter clockwise about X-axis by an angle of 45° . (3)
- 16 a) What is a quadric surface? Explain about any one of the quadric surfaces. (3)
- b) Explain the Cohen Sutherland line clipping algorithm with suitable examples. (6)

PART D

Answer any two full questions, each carries 12 marks.

- 17 a) List out the differences between z-buffer method and A-buffer method for determining the visible surfaces. (4)
- b) Describe about the depth-sorting method to display the visible surfaces of any given object with plane faces. Also explain the tests to identify overlapping surfaces. (8)
- 18 a) Explain the components of a general purpose digital image processing system with a neat diagram. (6)
- b) How edge detection is performed in digital images using (i) Sobel operator (ii) Prewitt operator. (6)
- What are the advantages of Sobel operator over Prewitt operator?
- 19 a) Derive the transformation matrix for oblique parallel projection with the help of a neat diagram. (6)
- b) Discuss the role of histogram equalization in a digital image. (2)
- c) What do you mean by histogram of a digital image? Discuss on the histogram of four basic image types. (4)

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SEVENTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), DECEMBER 2019

Course Code: CS401
Course Name: COMPUTER GRAPHICS

Max. Marks: 100

Duration: 3 Hours

PART A

Answer all questions, each carries 4 marks.

Marks

- | | | |
|----|---|-----|
| 1 | Suppose you have a raster system designed using an 8 inches × 10 inches screen with a resolution of 100 pixels per inch in each direction. What frame buffer size is required if 6 bits are stored per pixel in the buffer? | (4) |
| 2 | Write the midpoint circle drawing algorithm. | (4) |
| 3 | a) List the advantages of using Bresenham's line drawing algorithm. | (2) |
| | b) What is the purpose of a frame buffer in a display system? | (2) |
| 4 | How does Cohen Sutherland algorithm determine whether a line is visible, invisible or a candidate for clipping based on the region codes assigned to the end points of the line? | (4) |
| 5 | A triangle ABC with coordinates A(0,0), B(6,5), C(6,0) is scaled with scaling factors $S_x=2$ and $S_y=3$ about the vertex C(6,0). Find the transformed coordinate points. | (4) |
| 6 | Write the 3D translation matrix for moving an object by -2 units, -4 units and -6 units respectively in x, y and z directions. | (4) |
| 7 | Describe Histogram and also the type of information which obtained from a gray level histogram | (4) |
| 8 | Briefly describe the various classification of the visible-surface detection algorithms. | (4) |
| 9 | Is there any point at which a set of projected parallel lines appears to converge? Justify your answer. | (4) |
| 10 | What is edge detection? Explain any one edge detection technique in digital image processing. | (4) |

PART B

Answer any two full questions, each carries 9 marks.

- | | | |
|----|--|-----|
| 11 | a) Describe in detail about emissive and non-emissive flat panel displays. | (5) |
|----|--|-----|

- b) Explain the working principle of a Refresh CRT monitor with suitable diagrams. (4)
- 12 a) Write the boundary fill algorithm for filling a polygon using eight connected approach. (4)
- b) Use mid-point circle drawing algorithm to plot a circle whose radius =20 units and centre at (50,30). (5)
- 13 a) Write a note on any two interactive graphics input devices. (3)
- b) Scan convert the line segment with end points (30,20) and (15,10) using DDA line drawing algorithm (4)
- c) What are the advantages and disadvantages of DDA line drawing algorithm (2)

PART C

Answer any two full questions, each carries 9 marks.

- 14 a) Perform a 45 degree rotation of a triangle ABC having the vertices at A(0,0) B(10,10) and C(50,20) (6)
- i. About the origin
- ii. About an arbitrary point P(-10,-10)
- b) Describe the tables used to represent a polygon surface. (3)
- 15 a) Explain the window to viewport coordinate transformation and also derive the scaling factors during the transformation. (5)
- b) Show that the composition of two rotation is additive by concatenating the matrix representation for $R(\Theta_1)$ and $R(\Theta_2)$ (4)
- 16 a) Show that transformation matrix for a reflection about the line $y=x$ is equivalent to a reflection relative to the x axis followed by a counter clockwise rotation of 90 degree. (4)
- b) Write Weiler – Atherton polygon clipping algorithm with suitable example. (5)

PART D

Answer any two full questions, each carries 12 marks.

- 17 a) Compare object space and image space method of visible surface detection technique. (3)
- b) Describe in detail the depth buffer visible surface detection technique. Derive the equation to find the depth values for a surface position (x, y). (9)
- 18 a) What is mean by convolution? Give applications of 2D convolution in the field of image processing. (4)
- b) Distinguish between cavalier and cabinet projection. (4)
- c) Explain scan line algorithm with suitable example. (4)

- 19 a) What is parallel projection? Describe orthographic and oblique parallel projection in detail. (6)
- b) Consider the image segment shown below. (6)

	3	1	2	<u>1</u> (q)
	2	2	0	2
	1	2	1	1
(p)	<u>1</u>	0	1	2

- i) Compute the lengths of shortest 4, shortest 8 and shortest m paths between pixels p and q where $V=\{0,1\}$. If a particular path does not exist between these two points, explain why.

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

B.Tech S7 (S) Examination Sept 2020

Course Code: CS401**Course Name: COMPUTER GRAPHICS**

Max. Marks: 100

Duration: 3 Hours

PART A*Answer all questions, each carries 4 marks.*

Marks

- | | | |
|----|--|-----|
| 1 | Describe simple random scan display system and draw its architecture. | (4) |
| 2 | Describe Flat Panel Display and explain its different categories. | (4) |
| 3 | Which are the steps involved in window to viewport coordinate transformation in 2D? | (4) |
| 4 | Magnify the triangle ABC with A(0, 0), B(1, 1) and C(5, 2) to twice its size while keeping C(5, 2) fixed. | (4) |
| 5 | Show that the composition of two successive rotations are additive i.e. $R(\Theta_1) \cdot R(\Theta_2) = R(\Theta_1 + \Theta_2)$. | (4) |
| 6 | Derive the linear equation for a 3D object and test whether the coordinates are inside or outside the plane. | (4) |
| 7 | Define the terms (i) Centre of projection (ii) Principal vanishing point | (4) |
| 8 | Differentiate between the object space and image space method for the hidden surface removal of an image. | (4) |
| 9 | Describe the basic concepts of sampling and quantization with a neat sketch. | (4) |
| 10 | Write any six differences between perspective projection and parallel projection | (4) |

PART B*Answer any two full questions, each carries 9 marks.*

- | | | |
|----|--|-----|
| 11 | a) Generate the points between the end points of a line viz.(2,2) and (9,6) by using Bresenham's line drawing algorithm. | (5) |
| | b) Scan convert the line segment with end points (30,20) and (15,10) using DDA line drawing algorithm. | (4) |
| 12 | a) With a suitable figure, describe the shadow masking techniques in CRT. | (5) |
| | b) Write a note on any two interactive graphics input devices. | (4) |
| 13 | a) Derive the Initial decision parameter of midpoint circle drawing algorithm. | (6) |
| | b) Describe the relevance and various methods of inside-outside test used in polygon filling. | (3) |

PART C*Answer any two full questions, each carries 9 marks.*

- 14 Explain the Sutherland Hodgeman algorithm for polygon clipping with an example. (9)
- 15 Consider a triangle at (2,2), (10,2), (2,10). Perform the following 2D transformations in succession and find the resultant vertices (9)
- (i) Scale with respect to (2,2) by scaling factors (2,2) respectively along x and y directions.
- (ii) Rotate by 90^0 counter clockwise direction
- 16 a) Briefly explain the steps involved in clipping a line using Mid point Subdivision algorithm. (5)
- b) Explain how polygon meshes are used for 3D modelling. (4)

PART D*Answer any two full questions, each carries 12 marks.*

- 17 a) Differentiate between oblique and orthogonal projection. (4)
- b) Explain histogram matching with an example. (8)
- 18 a) Describe in detail the depth buffer visible surface detection technique. Derive the equation to find the depth values for a surface position (x, y). (9)
- b) Explain the terms adjacency and connectivity in the context of digital images. (3)
- 19 a) Explain the scan –line method used in visible surface detection with an example. (4)
- b) Consider the image segment and compute the length of the shortest 4- , 8- and m-path between p and q by considering two set of values for V: (8)
- (i) $V=\{0,1,2\}$
- (ii) $V=\{1,2\}$.

If a particular path does not exist explain the reason for the above two cases of

V .	3	4	1	2	0
	0	1	0	4	2(q)
	2	2	3	1	4
(q)3	0	4	2	1	
	1	2	0	3	4

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Seventh Semester B.Tech Degree Examination (Regular and Supplementary), December 2020

Course Code: CS401**Course Name: COMPUTER GRAPHICS**

Max. Marks: 100

Duration: 3 Hours

PART A*Answer all questions, each carries 4 marks.*

Marks

- | | | |
|----|--|-----|
| 1 | Describe simple raster scan system and draw its architecture. | (4) |
| 2 | Generate 4 pixel positions of a circle in the first quadrant with radius $r=10$ centered on the origin, using the midpoint circle algorithm. | (4) |
| 3 | (a) Which algorithm is better for line drawing – DDA or Bresenham's? Defend your view. | (2) |
| | (b) Write a note on any two interactive graphics input devices. | (2) |
| 4 | Write 2D transformation matrix for reflection and rotation of an object about x-axis. | (4) |
| 5 | Write the A-buffer algorithm for visible surface detection. | (4) |
| 6 | Describe the various classifications of the visible–surface detection algorithms with example. | (4) |
| 7 | Describe the concept of vanishing point with relevant figures. | (4) |
| 8 | Distinguish between one point perspective projection and two point perspective projection with suitable diagram. | (4) |
| 9 | Illustrate scaling with respect to a selected fixed position (X_f, Y_f, Z_f) | (4) |
| 10 | Describe the concept of spatial convolution. | (4) |

PART B*Answer any two full questions, each carries 9 marks.*

- | | | |
|----|---|-----|
| 11 | a) Consider three different raster systems with resolutions of 640 by 480, 1280 by 1024 and 2560 by 2048. What size frame buffer (in bytes) is needed for each of these systems to store 12 bits per pixel? How much storage is required for each system if 24 bits per pixel are to be stored? | (5) |
| | b) Compare Boundary and flood fill algorithm. | (4) |
| 12 | a) Explain the components and working of colour CRT with suitable diagrams. | (6) |
| | b) Indicate what raster locations would be chosen by Bresenham's algorithm while scan converting a line from (5, 5) to (13, 9). | (3) |
| 13 | a) Mention the steps involved in the rotation of a 2D object about a selected pivot point. | (5) |
| | b) Cohen Sutherland algorithm can totally reject a line in the first step itself. Justify | (4) |

PART C

Answer any two full questions, each carries 9 marks.

- 14 a) Use Cohen Sutherland algorithm to clip the line segment joining the points P(40,80) and Q(120,30) against a clipping window with corners at A(20,20), B(60,20), C(60,40) and D(20,40). (6)
- b) Draw and explain the two dimensional viewing pipeline. (3)
- 15 a) A point (4,3) is rotated counter clockwise by an angle of 45° . Find the rotation matrix and resultant point. (4)
- b) Explain how polygon meshes are used for 3D modelling. (5)
- 16 a) Explain Weiler-Atherton polygon clipping with an example. (5)
- b) Describe the methods to model quadric surfaces in 3D. (4)

PART D

Answer any two full questions, each carries 12 marks.

- 17 a) Derive the linear equation for a 3D object and test whether the coordinates are inside or outside the plane. (4)
- b) Derive the transformation matrix for perspective projection with suitable diagram. (8)
- 18 a) Describe histogram equalisation and discuss the role of histogram equalisation in a digital image. (4)
- b) With a suitable example explain the depth buffer algorithm for hidden surface elimination. (8)
- 19 a) Explain how edge detection is done using Robert, Prewitt, Sobel operators. (6)
- b) Explain any 3 visible surface detection methods. (6)
