

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

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|--------------|--|----------|--------------|----------|--------------|----------|----------|----------|----------|----------|----------|----------|----------|--------------|----------|----------|----------|--|
| 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 (x_f, y_f, z_f) . 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) | | | | | | | | | | | | | | | | |
| | <table style="margin: auto; border-collapse: collapse;"> <tbody> <tr> <td style="padding: 5px;">3</td> <td style="padding: 5px;">1</td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">1 (q)</td> </tr> <tr> <td style="padding: 5px;">2</td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">2</td> </tr> <tr> <td style="padding: 5px;">1</td> <td style="padding: 5px;">2</td> <td style="padding: 5px;">1</td> <td style="padding: 5px;">1</td> </tr> <tr> <td style="padding: 5px;">(p) 1</td> <td style="padding: 5px;">0</td> <td style="padding: 5px;">1</td> <td style="padding: 5px;">2</td> </tr> </tbody> </table> | 3 | 1 | 2 | 1 (q) | 2 | 2 | 0 | 2 | 1 | 2 | 1 | 1 | (p) 1 | 0 | 1 | 2 | |
| 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.*

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| 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)
