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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

Sixth Semester B.Tech Degree Regular and Supplementary Examination June 2023 (2019 Scheme)

Course Code: AIT322

Course Name: CONCEPTS IN COMPUTER GRAPHICS AND IMAGE PROCESSING

Max. Marks: 100 Duration: 3 Hours

PART A

Answer all questions, each carries 3 marks. Marks

1	How many bits are required for 1024×1024 raster with each pixel being represented by 24 bits?	(3)
2	Calculate the intermediate points in the generation of the line segment with end points (5,6) and (8,12) using DDA line drawing algorithm.	(3)
3	Write the boundary fill algorithm for filling a polygon using four connected approach.	(3)
4	Write the steps in the rotation of a 3D object about an arbitrary line.	(3)
5	Distinguish between parallel and perspective projections.	(3)
6	Illustrate with suitable example how a line segment is clipped using Cohen Sutherland line clipping algorithm.	(3)
7	Compare sampling and quantization in digital image processing.	(3)
8	Find the number of bits required to store a 128 x 128 image with 256 gray levels.	(3)
9	Describe spatial filtering in image processing.	(3)
10	What do you mean by histogram of a digital image? How the histogram varies in the cases of grayscale, binary and colour images?	(3)

PART B

Answer one question from each module, each carries 14 marks.

Module I

11	a)	Illustrate the generation of a circle with radius 10 units and centre at (20,30), using Bresenham's circle drawing algorithm	(7)
	b)	Use the Mid-Point circle drawing algorithm to plot a circle whose radius is 8 units and centre at (6,5).	(7)

OR

12 a) Describe the working principle of a Random Scan display system with a suitable diagram. (6)

b) Apply the Bresenham's line drawing algorithm to rasterize a line segment with endpoints (2,8) and (12,18) (8)

Module II

13 a) Do the following transformations to a triangle with vertices A(10,20), B(10,10), C(20,10) (8)

(i) Translation with factors tx=5, ty=10

(ii) Magnify triangle ABC w.r.t the vertex A, with factors Sx=3, Sy=2

(iii) Rotate triangle ABC w.r.t. the vertex C for an angle 90 degree in clockwise direction.

b) What do you understand by the homogeneous representation of a point? What is the advantage of using homogeneous representation? Write the homogenous representation of two-dimensional transformations. (6)

OR

14 a) Given a triangle with vertices P(30,20), Q(70,40) and R(50,60). Do the following reflection transformations on the triangle PQR. (7)

(i) About x-axis

(ii) About y-axis

(iii) About origin

(iv) About the line y=x

(v) About the line y=-x

b) Explain the scan line polygon filling algorithm. (7)

Module III

15 a) Derive an expression for window to viewport transformation. Determine the viewport coordinates corresponding to the point (20, 15) on the window. The window and viewport are defined as follows. The bottom left corner of the window is at (0, 0) and top right corner is at (100, 100). The bottom left corner of the viewport is at (5, 5) and top right corner is at (20, 20). (7)

b) Explain in detail the scan line algorithm for visible surface detection by listing the tables used in this algorithm. (7)

OR

16 a) Explain the Sutherland – Hodgeman polygon clipping algorithm with an example. (6)

b) Make use of Cohen Sutherland line clipping algorithm, find the visible portion of the line segment joining the points P1(10,30), P2(80,90) and Q1(20,10), Q2(70,60). Clipping window is defined as : A(20,20), B(90,20), C(90,70), D(20,70). (8)

Module IV

17 a) Define **4**-adjacency, **8**-adjacency and **m**-adjacency between pixels of an image. Explain using an example for each. (8)

b) Explain Spatial Resolution and Gray Level Resolution in image processing. (6)

OR

18 a) Consider the image segment shown below. Compute length of shortest-4, shortest-8 and shortest–m paths between the pixels p & q where v= {1, 2}. If no path exists give the reason. (7)

4	3	5	2 (q)
3	4	1	4
1	5	2	3
(p) 2	1	1	4

b) With a neat diagram, explain the fundamental steps in Digital Image Processing. (7)

Module V

19 a) Explain the following region-based segmentation methods. (6)

i) Region Growing

ii) Region Splitting and Merging

b) Perform histogram stretching so that the new image has a dynamic range of [0,7] (8)

Gray Level	0	1	2	3	4	5	6	7
No. of pixels	100	90	85	70	0	0	0	0

OR

20 a) Apply the histogram equalization method on the following 4x4 image with gray scale [0,9] (8)

2	3	3	2
4	2	4	3
3	2	3	5
2	4	2	4

b) Explain the Prewitt and Sobel Edge detectors. (6)

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