

International Islamic University Chittagong

Department of Computer Science and Engineering

B. Sc. in CSE; 8th Semester Final Term Examination, Spring 2023

Course Code: CSE 4741

Course Title: Computer Graphics

Total marks: 50

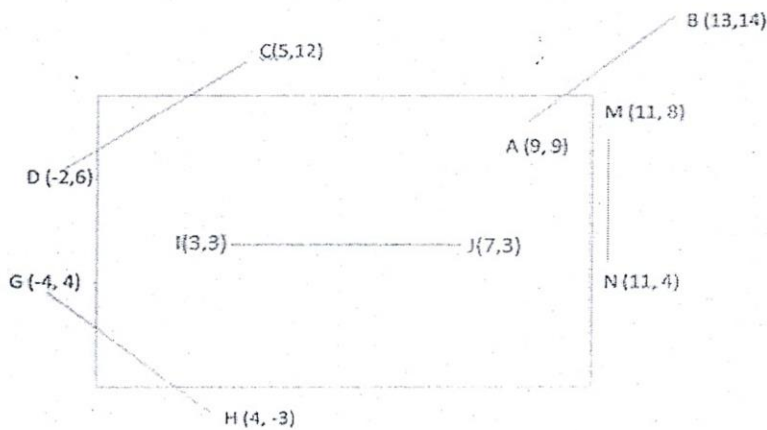
Time: 2 hours 30 minutes

[Answer all the questions; Separate answer scripts must be used for Group A and Group B]

GROUP A

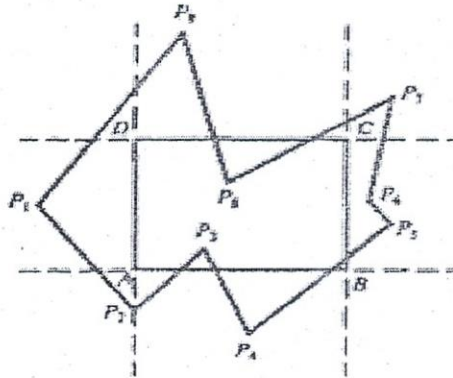
CO DL
5 CO3 C2

1. a) Let R be the rectangle window whose lower left-hand corner is at L(1,1) and upper right corner is at R (10,10). Find the region codes for the endpoints. Find the category of the lines. Find the intersection points also using Cohen-Sutherland algorithm



OR

- i. Describe the Sutherland Hodgeman Polygon Clipping Algorithm.
- ii. Clip the polygon P_1, \dots, P_9 in Fig. 1 against the window ABCD using the Sutherland Hodgeman algorithm.



- b) Find the clipping coordinates for a line P_1P_2 using Liang Barsky algorithm where $P_1=(-1,7)$ and $P_2=(11,1)$ against window with $(x_{wmin}, y_{wmin})=(1,2)$ and $(x_{wmax}, y_{wmax})=(9, 8)$.

5 CO3 C2

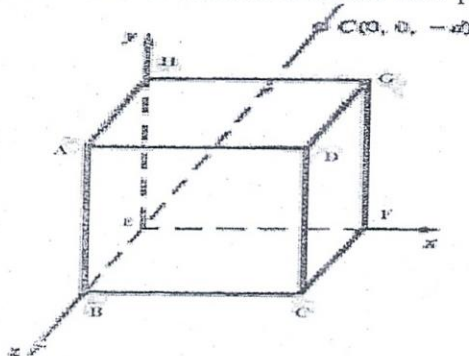
OR

Find the complete viewing transformation that maps a window in world coordinates with x extent 1 to 10 and y extent 1 to 10 onto a viewport with x extent $2/4$ to $3/4$ and y extent 0 to $1/2$ in normalized device space, and then maps a workstation window with x extent 1 to \backslash and y extent 1 to \backslash in the normalized device space into a workstation viewport with x extent 1 to 5 and y extent 1 to 5 on the physical display device.

2. a) Find the transformation for - 4 CO4 C3
(i) cavalier with $\theta = 60^\circ$
(ii) cabinet projections with $\theta = 45^\circ$
(iii) Draw the projection of the unit cube for each transformation
- b) Tilting is defined as a rotation about the y axis followed by a rotation about the x axis. 4 CO4 C3
(a) Find the tilting matrix.
(b) What will be the output of the tilting matrix if the tilting angle is 30° about the x axis and 45° about the y axis
- c) Given a 3D unit cube. Find the mirror reflection of the object about zx plane. 2 CO1 C2

GROUP B

3. a) What do you mean by Parallel projection? Give the mathematical description of a parallel projection. 3 CO1 C1
- b) The unit cube is projected onto the xy plane. Note the position of the x , y and z axes. Draw the projected image using the standard perspective transformation with CO2 C3
(a) $d = 2$ and (b) $d = 8$, where d is the distance from the view plane.



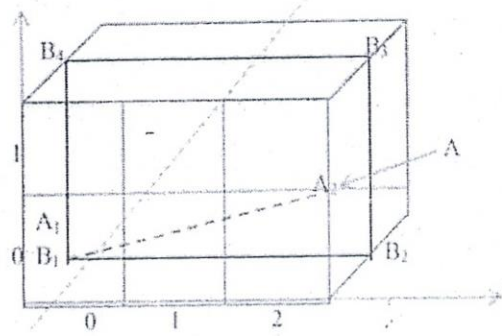
- c) Define Wireframe model. What are the advantages and disadvantages of Wireframe model? 3 CO2 C1
- 4.a) Describe Scan Line algorithm for hidden surface removal. 3 CO2 C1
- b) Why hidden surface removal is so important in computer graphics? What steps are required to determine whether any given point $p_1(x_1, y_1, z_1)$ obscures another point $p_2(x_2, y_2, z_2)$? 3 CO2 C2
- c) Give a suitable example of z buffer algorithm and describe it. 4 CO2 C3

Or,

Give a suitable example of painter's Hidden Surface Removal algorithm and describe it.

5.a) What is light? What are the basic characteristics of light? Describe the visible band of electromagnetic spectrum. 4 CO2 C2

b) Using a 3*2 pixel display, show how the Z-buffer algorithm would determine the color of each pixel for the given objects A and B in figure below:- 3 CO4 C3



Where for object B $Z = \frac{3}{4}$, $B_1(\frac{1}{2}, \frac{1}{2})$, $B_2(3, \frac{1}{2})$, $B_3(3, 2)$, $B_4(\frac{1}{2}, 2)$ and for object A: $Z = 0$, $A_1(\frac{1}{2}, \frac{1}{2})$, $A_2 = (3, 1)$

Or

What is the difference between vector and ray? Describe the recursive ray tracer algorithm.

c) Describe the Phong model. 3 CO2 C1

OR

Identify the differences among Constant shading, Gouraud shading and Phong shading.