International Islamic University Chittagong
Department of Computer Science and Engineering
B. Sc. Engineering in CSE
Final Exam, Autumn 2021

Course Code: CSE 4741 **Course Title: Computer Graphics**
Time: 2 hours 30 minutes **Full Marks: 50**

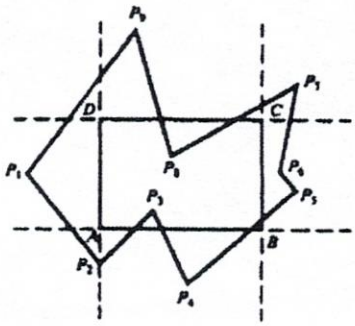
[The figures in the right-hand margin indicate full marks]

Part A

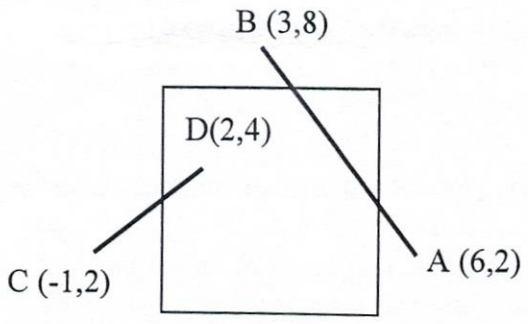
1(a) What is viewing transformation? Why is it so important in computer graphics? **CO1 Ap 2**

Find the workstation transformation with x extent 0 to 1 and y extent 0 to ¾ in the normalized device space into a workstation viewport whose lower left corner is at (5,5) with same aspect ratio.

1(b) Find the clipping polygon using Sutherland-Hodgman and Waler-Atherton algorithm of the following image. Show the steps including vertex output list and subject polygon and clipping polygon. **CO1 Ap 2**



1(c) **CO3 Ap 6**



Find the region codes for end point A(5,2); B(3,8); C(-1,2) and D(2,4). Then, Clip the line segments AB and CD using Cohen-Sutherland algorithm. *(Assume $X_{min}=1$, $X_{max}=5$, $Y_{min}=1$, $Y_{max}=7$)*

OR

Find the normalization transformation that maps a window whose lower left corner is at (0,0) and upper right corner is at (4,3) onto a viewport that is the entire normalized device screen. So that aspect ratios are preserved.

2(a) Find the transformation for mirror reflection with respect to xy plane. **CO2 U 2**

2(b)	Given a 3D object A(1,2,3), B(4,5,6), C(5,6,7) and D(7,8,4).Find the mirror reflection about xy-plane, yz-plane and zx-plane.	CO1	Ap	4
2(c)	Given a line AB in 3D space with coordinate points A (0, 0, 0) and B(3, 5, 3). Apply the rotation on AB, so that the line will completely align with Z axis (keeping the point A fixed). Find the new coordinates after rotation. **Or** Find the align matrix which aligns a given vector V with the vector K along the positive z-axis.	CO1	Ap	4

Part B

3(a)	The unit cube is projected onto the xy plane. Draw the projected image using the standard perspective transformation with (i) s = 4 (ii) s = 15 where s is distance from the view plane.	CO1	Ap	3
3(b)	Suppose you are an artist and want to draw a three dimensional picture, which projection you will use to make a realistic view. Describe the following states with necessary diagram. i) In what situation object represents upside down? ii) In what situation objects are appeared to meet a certain point? iii) In what situation the object will appear small than original? **Or** Briefly explain the anomalies on perspective projection.	CO1	An	3
3(c)	Find the transformation for a) Cavalier with $\theta=45^{\circ}$ b) Cabinet projection with $\theta=30^{\circ}$ c) Draw the projection of the unit cube for each transformation.	CO3	Ap	4
4(a)	Describe the different ways of representing a polygonal net model.	CO1	U	3
4(b)	What is the working principle of z-buffer algorithm? Demonstrate with an example. **Or** Describe Painters algorithm for hidden surface removal. Give necessary example.	CO3	U	3
4(c)	Given points $P_1(1,2,0)$, $P_2(3,6,20)$ and $P_3(2,4,6)$ and a viewpoint C(0,0,-1), determine which points obscure the others when viewed from C.	CO2	An	4
5(a)	What is pinhole camera? Write the working principle of basic pinhole camera. In which fields pinhole camera are important? Describe in brief.	CO1	R	3
5(b)	What is light? What are the basic characteristics of light? Describe the visible band of electromagnetic spectrum.	CO1	R	3
5(c)	If a point P_1 on line 5 has an RGB color (1, 0.5, 0) and point p_2 on line 15 has an RGB color (0.2, 0.5, 0.6), what is the color for line 8? **Or** Lines in two dimensional space can be represented by either the algebraic equation y= mx+b or the parametric vector equation L(t)= s+td ,where $-\infty<t<+\infty$. For s=I+J and d=I-J, find the equivalent algebraic representation.	CO3	Ap	4