BRAC UNIVERSITY

Department of Computer Science and Engineering

A

Examination: Semester Final Exam
Duration: 1 hour 30 minutes

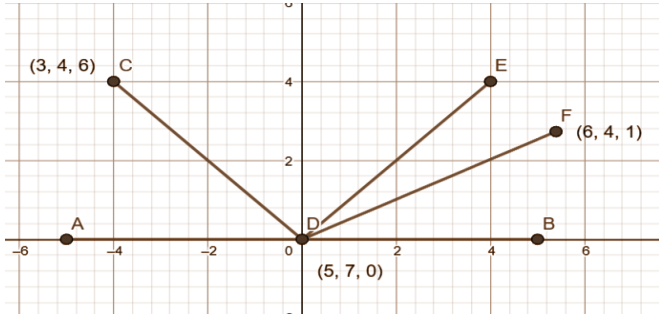Semester: Summer 2022
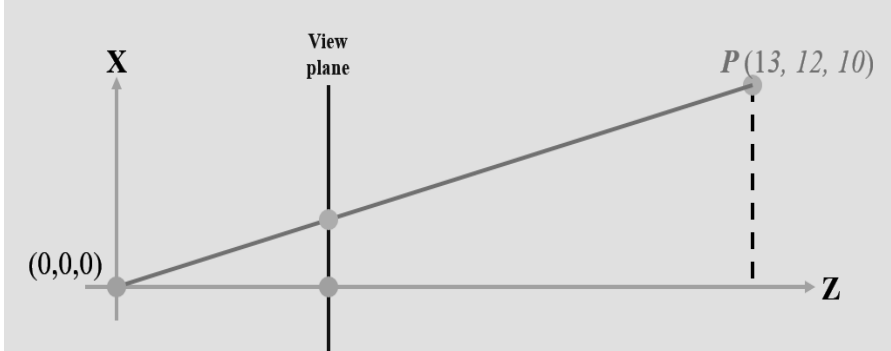Full Marks: 30

CSE 423: Computer Graphics

Name:	ID:	Section:

Instructions:
1. Answer all of the following questions.
2. Figures in the right margin indicate marks.
3. Non programmable calculators are allowed.

Questions:

1		Asuna is a computer graphics student and recently she is trying to simulate a new variation of coronavirus and its phylogenetic characteristics for better understanding its mutations. One of its simulated models, situated at point (5,6) drew her attention. For better visibility, she rotated the model 60 degrees clockwise with respect to the point (6,6). Finding some interesting results, she focused her attention to a very similar model which was situated at reflected coordinates of the previous model with respect to the line $y=\sqrt{3}x+3$	
CO3	a.	Between shell and solid modeling, which do you think best fits the above scenario and why?	**2**
CO1	b.	Show the composite transformation matrix in the homogeneous form for the mentioned rotation of the first model.	**4**
CO2	c.	Show the coordinates of the second model Asuna was interested in.	**4**

2		A light source with intensity 6 and radius of the sphere of influence 25 is located at a point **C**(3, 4, 6) from which you are supposed to calculate the illumination of a point on the xy plane. The camera is set at a point **F**(6, 4, 1) and the light is reflected back from the point **D**(5, 7) of the plane. The ambient, diffuse and specular coefficient is given as 0.3, 0.1, 0.5.	
CO1	a.	Theoretically Phong's model should follow the inverse square law ($f_{att}= 1/d^2$) for calculating attenuation but it does not follow the same formula in practical terms. State the formula that Phong's model uses to calculate attenuation and point out the reasons why it is changed.	**2**

	CO1	b.	For the above phenomenon, show the reflected ray **E** in the unit vector format.	3
	CO1	c.	State the equation to calculate total reflected light intensity for ambient, diffuse and specular reflection using Phong's model.	1
	CO2	d.	Measure the total reflected light intensity at the given point according to Phong's model (with attenuation factor) where shininess factor is 8 and ambient light intensity is 2. *Note: Consider attenuation only from light source to surface.*	4
3	CO3	a.	A Mechanical Engineer, Soulcas wants to draw the top view, front view projection of BRAC University building no-1. As a Computer Science engineer, which projection would you suggest him to use? State your reasons.	2
	CO2	b.	Your friend Jampii wants you to click some pictures of him. While clicking pictures for Jampii you saw that when Jampii is 2 meters away from camera you cannot take his full body but when he is 5 meters away from camera his full body projects properly in camera. Due to which projection mechanism this scenario happened? State your reasons.	2
	CO1	c.	Write the Orthographic Projection Matrix if we project the (x, y, z) point on the ZX plane where y = -13. [No Derivation required just write the matrix of 4*4 shape] Using the matrix find out the position of point (13, 17, 10) after the projection.	2
	CO2	d.	Suppose a Perspective Projection where the eye/camera is on (0, 0, 0) point , the projection plane is on the xy plane and where the view plane is 5 units far on the z axis from camera/eye that means z'=5. Input point is P (13, 12, 10) Find out the new coordinate of point **P** after projection. [Use Perspective Projection Matrix to solve the math.] 	4

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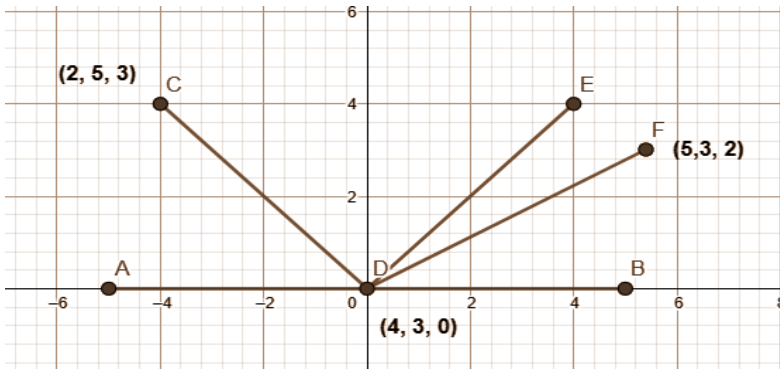
<u>CSE 423: Computer Graphics</u>
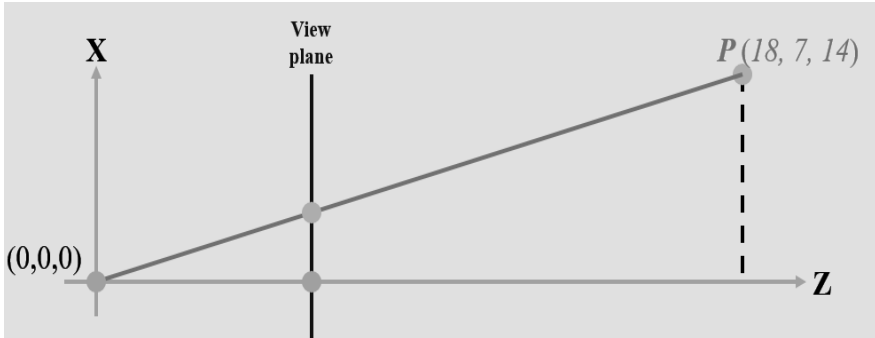
Name:	ID:	Section:

Instructions:
1. Answer all of the following questions.
2. Figures in the right margin indicate marks.
3. Non programmable calculators are allowed.

Questions:

1		Mitsuha is a computer graphics student and recently she is trying to simulate a new variation of coronavirus and its phylogenetic characteristics for better understanding its mutations. One of its simulated models, situated at point (2,5) drew her attention. For better visibility, she rotated the model 60 degrees counterclockwise with respect to the point (5,5). Finding some interesting results, she focused her attention to a very similar model which was situated at reflected coordinates of the previous model with respect to the line $y=\sqrt{3}x+5$	
CO3	a.	Between shell and solid modeling, which do you think best fits the above scenario and why?	**2**
CO1	b.	Show the composite transformation matrix in the homogeneous form for the mentioned rotation of the first model.	**4**
CO2	c.	Show the coordinates of the second model Mitsuha was interested in.	**4**

2		A light source with intensity 5 and radius of the sphere of influence 21 is located at a point **C**(2, 5, 3) from which you are supposed to calculate the illumination of a point on the xy plane. The camera is set at a point **F**(5, 3, 2) and the light is reflected back from the point **D**(4, 3) of the plane. The ambient, diffuse and specular coefficient is given as 0.3, 0.1, 0.5.	

	CO1	a.	Theoretically Phong's model should follow the inverse square law ($f_{att}= 1/d^2$) for calculating attenuation but it does not follow the same formula in practical terms. State the formula that Phong's model uses to calculate attenuation and point out the reasons why it is changed.	2
	CO1	b.	For the above phenomenon, show the reflected ray **E** in the unit vector format.	3
	CO1	c.	State the equation to calculate total reflected light intensity for ambient, diffuse and specular reflection using Phong's model.	1
	CO2	d.	Measure the total reflected light intensity at the given point according to Phong's model (with attenuation factor) where shininess factor is 6 and ambient light intensity is 2. *Note: Consider attenuation only from light source to surface.*	4
3	CO3	a.	A Mechanical Engineer, Soulcas wants to draw the top view, front view projection of BRAC University building no-1. As a Computer Science engineer, which projection would you suggest him to use? State your reasons.	2
	CO2	b.	Your friend Jampii wants you to click some pictures of him. While clicking pictures for Jampii you saw that when Jampii is 2 meters away from camera you cannot take his full body but when he is 5 meters away from camera his full body projects properly in camera. Due to which projection mechanism this scenario happened? State your reasons.	2
	CO1	c.	Write the Orthographic Projection Matrix if we project the (x, y, z) point on the YZ plane where x = 16. [No Derivation required just write the matrix of 4*4 shape] Using the matrix find out the position of point (7, 9, 4) after the projection.	2
	CO2	d.	Suppose a Perspective Projection where the eye/camera is on (0, 0, 0) point , the projection plane is on the xy plane and where the view plane is 9 units far on the z axis from camera/eye that means z'=9. Input point is P (18, 7, 14) Find out the new coordinate of point **P** after projection. [Use Perspective Projection Matrix to solve the math.]	4