COLLEGE OF STATEN ISLAND

DEPARTMENT OF COMPUTER SCIENCE

CSC 470 COMPUTER GRAPHICS

MIDTERM EXAM

Due not later than Monday, 24 October 2016 at the beginning of the class.
You can put it under my door (1N 205) before the due date.

No exceptions. No Makeup. No resubmission.

24 October 2016

Name, Surname : .....

Question	maxPoints	Your Points
1	10	
2	10	
3	10	
4	10	
5	15	
6	10	
7	10	
8	10	
9	15	

Max Points Midterm: 100

Note: You can attach additional pages but, please, do not remove any of my pages. You can also write your answers on the back of my pages.

All answers must be very detailed. Providing only a final answer will carry zero points.

1. What combination of non-uniform scaling and translation will map points P_1 and P_2 to Q_1 and Q_2 respectively given the following:

(10 points)

$$P_1 = \begin{vmatrix} 0 \\ 0 \\ 1 \end{vmatrix}, Q_1 = \begin{vmatrix} 2 \\ 2 \\ 1 \end{vmatrix}, P_2 = \begin{vmatrix} 1 \\ 3 \\ 1 \end{vmatrix}, Q_2 = \begin{vmatrix} 4 \\ 11 \\ 1 \end{vmatrix}$$

$$Q_1 = M_T \cdot M_S \cdot P_1$$

$$Q_2 = M_T \cdot M_S \cdot P_2$$

Specifically, what values are in the 3x3 matrices M_s and M_t?

2. Clipping Line Segments (10 Points)

Consider the following 2 line segments.

	x1	y1	x2	y2
Line 1	5	20	15	10
Line 2	2	2	18	10

Clip each of these segments to the box defined by:

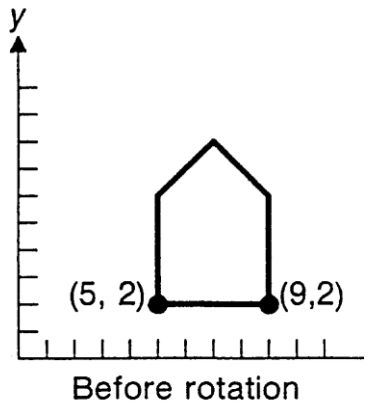
	xmin	ymin	xmax	ymax
Box	0	0	10	30

Present your answer in the following table. Show how you determine the new end points of the clip segments in the table below.

	x1	y1	x2	y2
Line 1				
Line 2				

3. Where are the points (5, 2) and (9, 2) after rotation of the house by 30^0 **about the origin** followed by a reflection **about the origin.**

(10 points)



4. Find values of *A*, *B*, *C*, and *D* for the case of a world window (0.0, 10.0, -6.0, 6.0) and a viewport (0, 600, 0, 400). **(10 points)**

5. a) Consider the following four points A = (0, 0), B = (4, -5), C = (2, -2), D = (-2, 0)

a. Are the points C and D on the line determined by A & B? Show your calculations.

(5 points)

b) Consider the four points A = (-2, -3), B = (2, 17), C = (4, 27), D = (9, 52)

What is the intersection of the line segment AB with the segment CD? Show your calculations.

(5 points)

c) Find a vector through the point (3, 4, 5) that is normal to the plane determined by points A, B, and C.

A = (0, 0, 0), B = (4, -5, 2), C = (2, -2, 4)

(5 points)

6. Suppose the camera has a focal point at (0,0,0), and you cast a ray through a pixel whose center is at (1/2, 0, 1). Does this ray intersect a sphere centered at (3, 2, 12) with a radius of 3? Find the points of intersection, if they exist.

(10 points)

7. Consider a camera with *eye*= (4, 3, 3) that looks down on a look-at point *look* = (0, 1, 0). Suppose further that **up** is set to **up** = (2, 1, 0). Find **u**, **v**, and **n**. Check that the three vectors **u**, **v**, and **n** are mutually perpendicular.

(10 points)

8. For the three vertices (6, 1, 4), (2, 0, 5), and (7, 0, 9), compare the normal found using the Newell method with that found using the usual cross product. Then use the Newell method to find the components of the normal vector $\boldsymbol{n}$ (n_x,n_y,n_z) for the polygon having the vertices $V_0 = (1, 1, 2)$, $V_1 = (2, 0, 5)$, $V_2 = (6, 0, 7)$, $V_3 = (5, 1, 4)$. Is the polygon planar? If so, find its true normal using the cross product, and compare it with the result of the Newell method.

(10 points)

9. What kind of geometry is best described using the following OpenGL primitive types? Be specific about the relation between vertices and edges in your answer. Include them into small program (including colors and color interpolation), print the source code, and the output. Store the source code, the colored output and the exe file on my pen drive during the first 15 minutes of the class.

(i) GL_TRIANGLE_STRIP
(ii) GL_QUAD_STRIP

(iii) GL_TRIANGLE_FAN

(15 points)

GL_TRIANGLE_STRIP —

GL_QUAD_STRIP —

GL_TRIANGLE_FAN —