

CS559 Midterm Exam – November 2, 2000 – 9:30 AM

This exam is meant to take 1 hour, however, you will be given the entire class time slot.

Name: _____ **KEY** _____

CS Login: _____

Before beginning, please write your name and CS login on each sheet of paper in the exam as things have a habit of coming unstapled. Please also check to make sure that you have all of the pages of the exam.

		Mean Scores
Question 1:	___ / 3	1.75
Question 2:	___ / 3	1.9
Question 3:	___ / 4	3.3
Question 4:	___ / 4	2
Question 5:	___ / 7	3.7
Question 6:	___ / 4	3.4
Question 7:	___ / 12	10.5
Question 8:	___ / 3	1.6
Question 9:	___ / 8	4.5
Total:	___ / 48	69.5

Please be sure to read the instructions carefully.

With the short answer questions, please be brief.

If you feel as though a question is ambiguous, please make a reasonable set of assumptions and interpretations. You may want to state any assumptions that you make. (hint: This is almost always a sign that you aren't really understanding the question.)

Question 1: (3 points)

A symptom of excessive amounts of graphics hacking is that the blue-sensitive photo-receptors in your eye temporarily fail, causing a temporary form of color blindness. As a public service, we want to make sure that 559 students know how to test themselves. Assuming that you weren't color blind to begin with, cross out the pairs of colors on a standard CRT that you would NOT be able to distinguish.

- 1.A Blue and Green
- 1.B Blue and Cyan
- 1.C Blue and White
- 1.D Magenta and Yellow
- 1.E Magenta and Red**
- 1.F Yellow and White**

1 pt for each of E and F, 1 pt for nothing else

Question 2: (3 points)

An inkjet printer uses 3 colors of ink and can combine them to show all primary colors. Suppose a printer runs out of one color of ink. You find that it cannot print yellow. Which of the other 5 primary colors could it not print?

Red and Green

1 pt for R & G, 1 pt for nothing else

2.5 pts given for the answer "R,G and Black" since black isn't a primary

Question 3: (4 points)

Alice and Bob are two students in a digital camera design class. For their class project, they each make cameras that can capture the same number of pixels. The professor tests their cameras by taking pictures of a black-and-white checkerboard. Alice's camera takes a blurrier picture. The professor gives Alice a better grade than Bob. Explain why Alice's picture is more correct than Bob's.

Sharp edges are actually aliasing artifacts since you cannot be sure that the sharp edges were there (or exactly where they were)

Question 4: (4 points)

Explain why a line drawn with Bresenham's algorithm (or the midpoint algorithm described in the book) looks dimmer if it is drawn at a 45 degree angle.

Because the same amount of pixels are lit, even though the line is longer

Question 5: (7 points) 1 point each

For each task on the left, pick the method on the right that is most appropriate. Note: methods might apply to more than one task, and some methods may not apply to any.

- | | |
|-------------------------------------------------------------------------------|------------------------------------|
| <input type="checkbox"/> D Draw a line using floating point arithmetic | A. Median-Cut Algorithm |
| <input type="checkbox"/> E Draw a circle | B. Super-Sampling |
| <input type="checkbox"/> A Choose a palette of colors | C. Flood Fill |
| <input type="checkbox"/> H Shrink an image | D. DDA Algorithm |
| <input type="checkbox"/> F Quantize an image to 8 known colors | E. Mid-point (or Bresenham's) Alg. |
| <input type="checkbox"/> C Fill an irregularly shaped region | F. Floyd-Steinberg Algorithm |
| <input type="checkbox"/> I Fill a convex polygon | G. Ordered Dithering |
| | H. Re-Sampling |
| | I. Scan-Conversion |
| | J. Low-Pass filtering |
| | K. High-Pass Filtering |

Question 6: (4 points)

Name 2 display devices that take advantage of the persistence of vision to create the stability of their image:

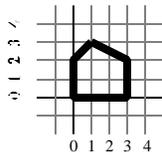
Standard CRT, Movie, flip books

Name 2 display devices that do not:

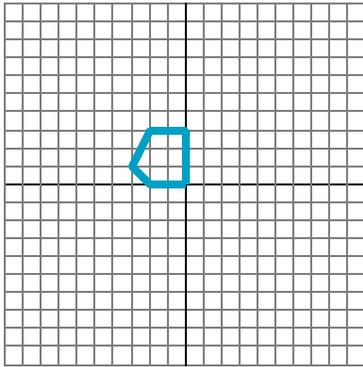
Printed page, calligraphic (vector) display, plotter
1 point each

Question 7: Transformations (12 pts)

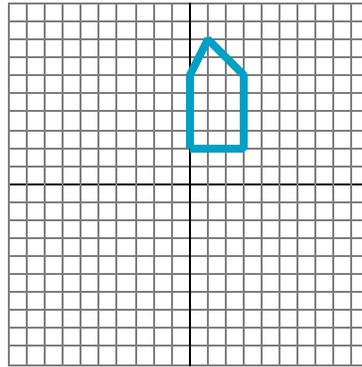
Given the following picture of a house: (note that it is NOT symmetric)



Sketch the house after applying the following transformations to the house in the given order: (remember, in a right-handed coordinate system, positive rotation is counter-clockwise).

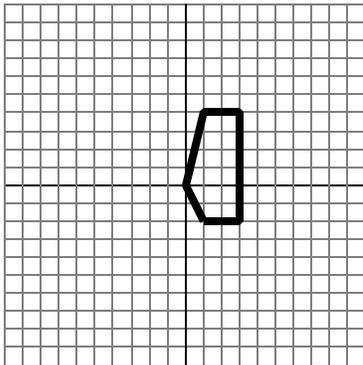


1. Translate(2,0) **1 pt size**
2. Rotate(90) **1 pt position**
3. Translate(0,-2) **1 pt orientation**

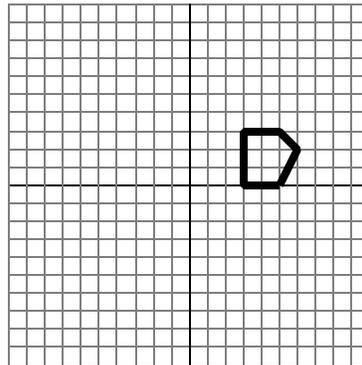


1. Rotate(-90)
2. Scale(2,1)
3. Translate(2,0)
4. Rotate(90)

Write a sequence of Rotate, Scale, and Translate transformations that when applied to the house in the given order put it into this configuration. You should not need to use all of the lines given.



1. trans -1, -3
2. rot 90
3. scale 1,2



1. rot -90
2. trans 3,3

Question 8: (3 points)

A program draws a picture of a person in 3D. The right hand is described in the coordinate system of the right forearm. The right forearm is described in the coordinate system of the right upper arm. The right upper arm is described in the coordinate system of the right shoulder. The right shoulder is described in terms of the torso. The torso is described in relation to the world coordinate system.

A standard projective camera transformation is described in the world coordinate system and transforms points from locations in the world to locations in the camera's image plane.

The program is implemented using a standard graphics toolkit that uses homogeneous transformation (4x4 matrices) using floating point numbers. All of the 6 transformations described above are realized by such matrices. All positions are always represented using floating-point numbers.

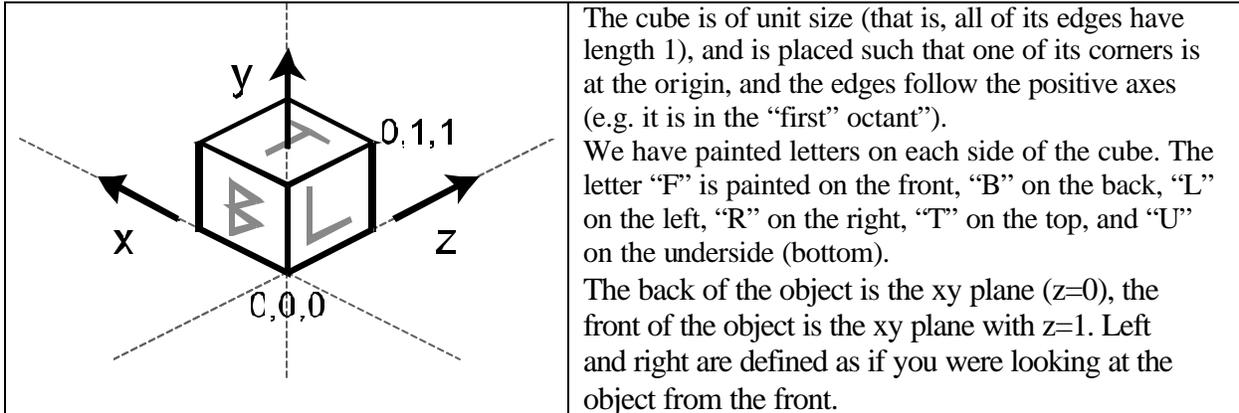
The program draws several points on the right hand. After it draws the first few, how many floating point multiplication operations are required?

12 (or 16) since it's 1 4x4 matrix multiply by a vector. (12 operations since we don't care about the Z row of the matrix). 9 is possible if you assume that w is always 1, so you don't need to multiply by it.

2 points for recognizing that its 1 matrix multiply, 3 points for entire right answer

Question 9 (8 points)

In this picture, we will be making pictures of a cube.



The cube is of unit size (that is, all of its edges have length 1), and is placed such that one of its corners is at the origin, and the edges follow the positive axes (e.g. it is in the “first” octant”).

We have painted letters on each side of the cube. The letter “F” is painted on the front, “B” on the back, “L” on the left, “R” on the right, “T” on the top, and “U” on the underside (bottom).

The back of the object is the xy plane ($z=0$), the front of the object is the xy plane with $z=1$. Left and right are defined as if you were looking at the object from the front.

Title:
(559-3d-q-box.eps)
Creator:
Adobe Illustrator(R) 8.0
Preview:
This EPS picture was not saved
with a preview included in it.
Comment:
This EPS picture will print to a
PostScript printer, but not to a

Assume some reasonable field of view big enough to fit the entire cube in the view.

Assume that the aspect is 1:1 (e.g. that the viewport is square).

Sketch the view of the cube as seen by the cameras specified. You need not get the view exactly (in fact, you can't since we didn't tell you what the field of view is).

A. Look from 6,0,0. Look at 0,0,0. VUP 0,1,0. B. Look from 6,6,6. Look at 0,0,0. VUP 0,1,0.

	<ol style="list-style-type: none"> 1. Corner of cube at origin 2. Only R visible 3. R oriented correctly 4. All in upper left 		<ol style="list-style-type: none"> 1. corner at origin 2. see F R and T in right order 3. orientations of letters 4. shape
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C. Look from -6,6,6. Look at: 0,0,0. VUP 0,0,1. D. Look from 6,1,1. Look at 1,1,1. VUP 0,0,1.

	<ol style="list-style-type: none"> 1. only in upper left 2. L, F, T visible 3. L&T orientation 4. F orientation 		<ol style="list-style-type: none"> 1. only in lower left 2. R oriented correctly 3. R is only thing visible 4. corner at origin
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