Graphics Midterm

Started: Feb 25 at 12:20pm

Quiz Instructions

This midterm test is open textbook and open notes. Using electronic versions of the textbook and your electronic notes is fine. You may also use a calculator, but please refrain from using a calculator app on a cell phone.

You may **not** use internet resources (e.g. other books, wikipedia) during this test.

Note: this is a timed quiz. You may check the remaining time you have at any point while taking the quiz by pressing the keyboard combination SHIFT, ALT, and T... Again: SHIFT, ALT, and T...

Question 1 1 pts

Most graphics cards (GPU's) use which algorithm that is built into their hardware to render triangles?

- (•) Rasterization and Z-Buffer
- ( ) Ray Tracing

Question 2 1 pts

What do we call different spectral distributions that have the same appearance to a human?

- ( ) Non-Spectral
- (•) Metamers
- ( ) Gamuts
- ( ) Fovea

Question 3 1 pts

Which of the following animal species has the largest number of photoreceptor types?

- ( ) Human
- ( ) Dog
- (•) Mantis Shrimp

Question 4 1 pts

Because magenta is a non-spectral color, it has no complementary color.

- ( ) True
- (•) False

Question 5 1 pts

In traditional ray tracing, the first rays that are shot have their origin at which location?

- (●) The eye
- ( ) The light source
- ( ) The object being rendered

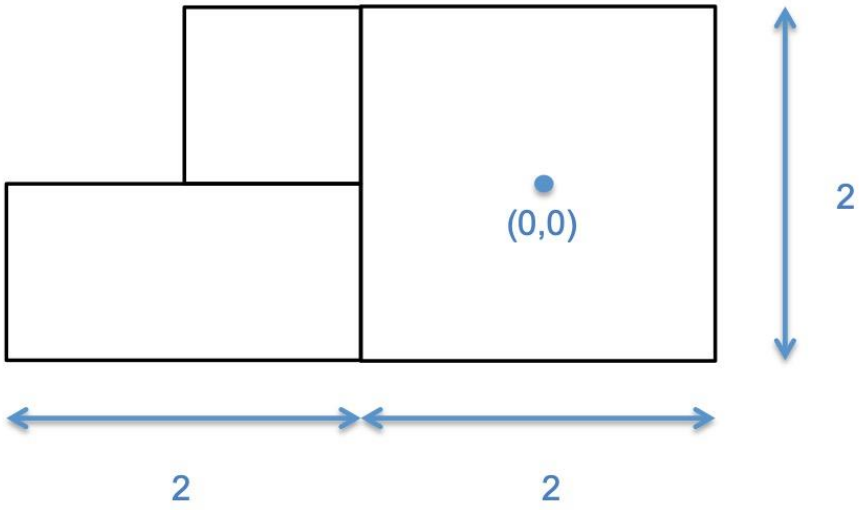
Question 6 1 pts

Why is **double-buffering** a popular technique to use for display devices?

- ( ) It reduces memory usage.
- ( ) It results in faster image synthesis.
- ( ) It allows the use of a wider amount of colors.
- (●) It helps avoid flickering or "tearing" of an animated image.

Question 7 3 pts

Assume that you have been provided with a routine "box()" that draws a square that is centered at the origin (0,0) and that has side lengths equal to 2. You are being given the task of drawing the following diagram that contains three black boxes:



Write a set of commands that would produce the above diagram. You should only draw the three boxes shown in black. The blue arrows and numbers are provided so that you know what sizes to make the boxes and where to place them with respect to the origin. Your code should use the provided box() command, as well as the standard matrix stack and transformation commands.

Question 82 pts

Assume that we are performing perspective projection, and that the center of projection (the eye position) is at the origin (0, 0, 0). Further assume that the view direction is down the negative z-axis, and that the view plane is at z = -1. Given a point with position P = (-16, 12, -4), at what point P' will it be projected to on the view plane? Note that we are not yet mapping this point into screen space, and that the point P' will have three-dimensional coordinates.

Question 91 pts

Which type of display device is easier to read in bright sunlight?

- ( ) LCD
- (●) E-Ink

Question 10 1 pts

Which of the following pairs of transformations always commute?

- non-uniform scale and translate
- translate and rotate
- uniform scale and rotate
- uniform scale and translate

Question 11 1 pts

The idea behind Phong interpolation during rasterization is to interpolate *which* quantity across the polygon, that will then be used for shading? The important quantity to interpolate is:

- Normal
- Color
- Eye position
- Light direction

Question 12 1 pts

What optical effect is used as the basis of liquid crystal displays (LCD's)?

- Interference
- Phosphor excitation
- Refraction
- Polarization

Question 13 1 pts

Assume you have been given two unit length vectors A and B. Which of the following statements is guaranteed to be true about the **cross-product** between any such pair of vectors?

- The resulting number will be zero.
- The resulting number will be one.
- The resulting vector will be perpendicular to both A and B.
- The resulting vector will be unit length.

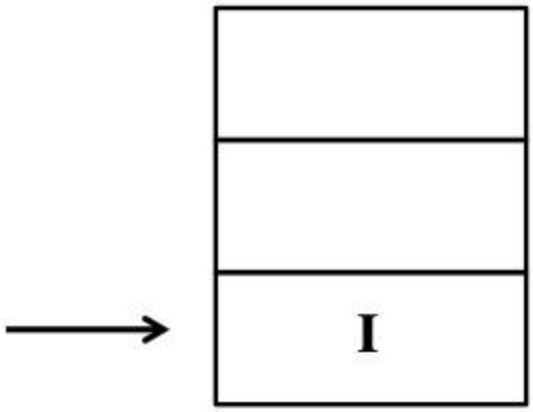
Question 14 1 pts

Most LCD displays use many small cyan, magenta and yellow filters to create colors.

- True
- False

Question 15 1 pts

This question is about the matrix stack. Assume that this is the status of the matrix stack:



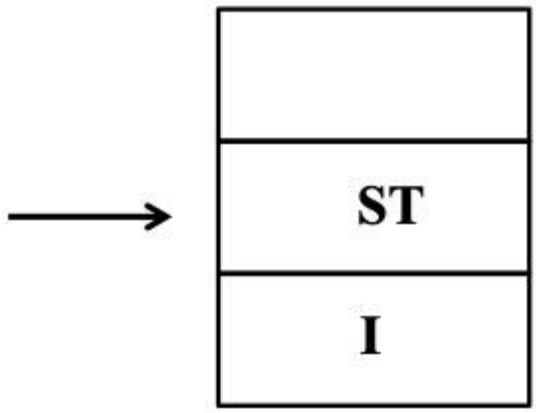
In this image of the stack, the arrow points to the current transformation matrix. The character **I** denotes the identity matrix. Assume that the following three commands are then executed:

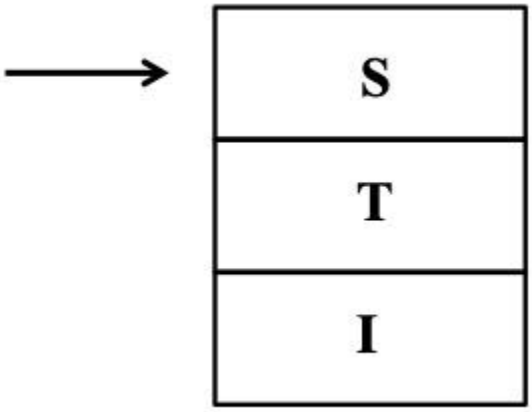
pushMatrix();

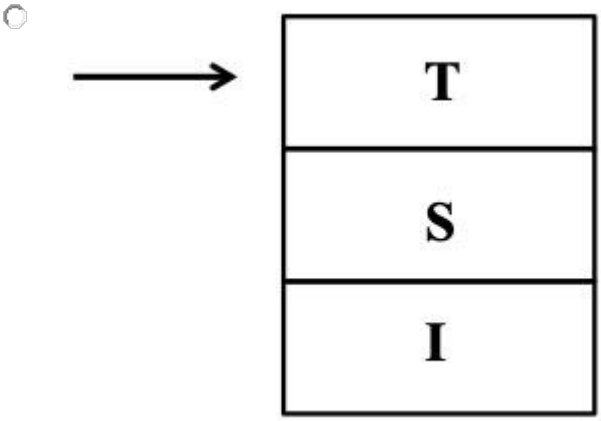
scale (1, 2, 1);

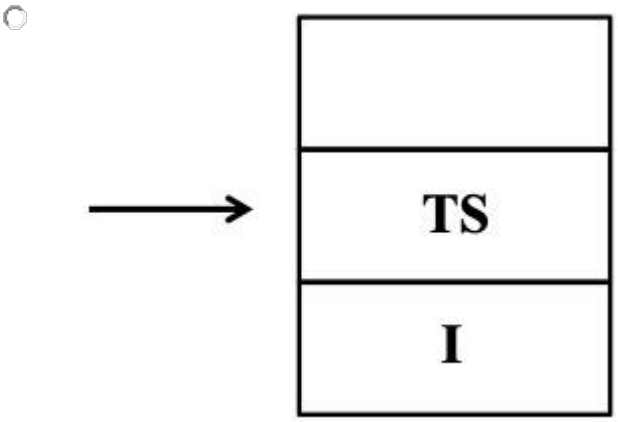
translate (0, 0, 5);

What will be the state of the stack after the above commands are executed?









Question 16 1 pts

You have been given a triangle that you are going to rasterize. Consider the edge given by two of the triangle vertices at (2,3) and (8,6). A key part to rasterizing this triangle is, for this edge, to determine the change in the x-coordinate (xdiff) of the intersection point of a scanline with the edge as you move from one scanline y to the next scanline y+1. What is the value of this change in x-coordinate between such intersection points for the edge in question?

- (●) 2
- ( ) 1.5
- ( ) 0.5
- ( ) 0.6666

Question 17 1 pts

Both the Painter's Algorithm and the Z-buffer Algorithm are designed to draw an image in which only the visible surfaces can be seen. Which of these algorithms always produce the correct visible surfaces?

- ( ) Both Algorithms
- (●) Z-Buffer Algorithm
- ( ) Painter's Algorithm

Question 18 1 pts

The Z-buffer Algorithm determines visibility by which method?

- Dividing the scene into a binary tree of polygon pieces and traversing the tree to draw the polygons.
- Casting a ray into the scene and finding the closest intersection point.
- Sorting the z-values by centroid and drawing polygons back-to-front.
- Store a per-pixel z-value, and potentially update this z-value during polygon rasterization.

Question 19 2 pts

After performing perspective projection, your task is to take locations on the view plane and map them into pixel coordinates in screen space. Assume that the field of view for the perspective transformation is 90 degrees, so that the x-coordinates of visible points on the view plane are in the range of -1 to 1. Give a single equation that will map these view plane values (x) in the range of -1 to 1 to screen coordinates (x') in the range of 0 to 400.

Your answer should start like this: x' =

Question 20 1 pts

The shading of a diffuse surface does **not** depend on which of these pieces of information?

- (•) The eye position
- The surface normal
- The light position

Question 21 1 pts

Which of the following color spaces was designed to help people select colors?

- CIE
- RGB
- (•) HSV
- CMY

Question 22 1 pts

Assume that you are drawing a 2D scene. You have been given a routine called hand() that draws a picture of a human hand that is pointing up. The center of the hand is at location (10, 5). You wish to rotate the hand 90 degrees counter-clockwise, but you want the hand to stay in its current position. Which of the following sequences of code will accomplish this?

- pushMatrix();

  translate (-10, -5);

  rotate (90);

  hand();

  popMatrix();

- pushMatrix();
  translate (-10, -5);
  rotate (90);
  translate (10, 5);
  hand();
  popMatrix();
- pushMatrix();
  rotate (90);
  hand();
  popMatrix();
- pushMatrix();
  translate (10, 5);
  rotate (90);
  translate (-10, -5);
  hand();
  popMatrix();

Question 23 2 pts

For this question, your answer will be a 4x4 matrix. Please format your answer on four different lines in the same manner as the following identity matrix:

[1 0 0 0]

[0 1 0 0]

[0 0 1 0]

[0 0 0 1]

First, assume that the current transformation matrix is the identity matrix. Then, the following two commands are executed:

scale (3, 3, 3)

translate (1, 2, 3)

What will be the value of the current transformation matrix after these two commands have been executed?