

CG ECSE-4750 Computer Graphics Midterm, RPI, Thurs 2017-10-12

(2 min)

W Randolph Franklin, RPI — 2017-10-14 00:00

Name, RCSID:

WRF SOLUTION

Rules:

1. You have 60 minutes.
2. You may bring in one 2-sided 8.5"x11" paper with notes.
3. You may not share material with each other during the exam.
4. No collaboration or communication (except with the staff) is allowed.
5. There are 18 questions. Check that your copy of this test has all the pages.

1. (4 pts) Suppose that we have a plane in 3-D thru the points A(4,2,0), B(2,2,0), and C(3,1,0).

1. What is its equation, in the form $ax+by+cz+d=0$?
2. Consider the line L thru the points O(0,0,0) and P(1,1,1). Where does this line intersect the plane?

$$0x + 0y + z + 0 = 0$$

$$(0, 0, 0)$$

2. (2) Which RPI grad was the technical person in the founding group of NVidia?

CURTIS PRIGBY

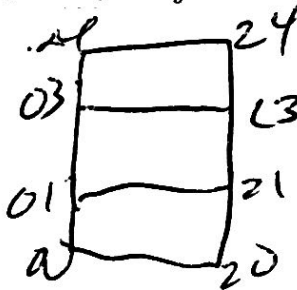
3. (2) What hardware component had to get much cheaper in order to make frame buffers possible?

DRAM

4. (5) Part of changing from one coordinate system to another is scaling and making things fit. E.g., suppose that you had a square with lower left corner (llc) (0,0) and upper right corner (urc) (2,2). You want to scale and center it to just fit into a rectangle with llc (0,0) and urc (2,4). Find s , d_x , d_y in these formulae:

$$x' = sx + d_x$$

$$y' = sy + d_y$$



$$s = 1$$

$$d_x = 0$$

$$d_y = 1$$

5. (2) Putting certain corkscrew-shaped molecules in an electric field stretches them out. What widely used graphics device exploits this?

LCD

6. (2) Which of the following types of GLSL variables can be stored in constant memory in the GPU?

uniform varying, attribute.

7. (2) If you do not tell OpenGL to do hidden surface removal, and two objects overlap the same pixel, then what color is that pixel?

1. OpenGL throws an error.
2. the closer object
3. the farther object
4. the first object to be drawn there
5. the last object to be drawn there

8. (5) Use the vector rotation formula to rotate the point $(1,0,0)$ by 180 degrees about the axis $(12,4,3)$.

$$p' = p \cos \theta + (1 - \cos \theta) a \cdot p a + a \times p \sin \theta$$

NORMALIZE AXIS TO $(\frac{12}{13}, \frac{4}{13}, \frac{3}{13})$

$$\cos 180 = -1$$

$$\sin 180 = 0$$

$$a \cdot p = \frac{12}{13}$$

$$a \times p = (0, \frac{3}{13}, -\frac{4}{13})$$

$$p' = -p + \frac{24}{13} (\frac{12}{13}, \frac{4}{13}, \frac{3}{13})$$

$$= \frac{24}{169} (\frac{12}{13}, \frac{4}{13}, \frac{3}{13})$$

$$p' = \frac{24}{169} (-12, 4, 3)$$

1243
100

9. (2) In 2D, what is the complex number that corresponds to a rotation by 270 degrees?

$$\theta = \frac{3}{2} \pi$$

$$c = e^{i\theta} = e^{\frac{3}{2} i \pi} = -i$$

10. (2) What is gimbal lock?

WITH EULER ANGLES, CANNOT DO SMOOTH ROTATIONS WITH SMOOTH ANGLE CHANGES

OTHER ANSWERS ALSO OK.

11. (2) What tool maps spectral colors into a human perceptual coordinate system? You use it to determine what one color a mixture of colors will appear.

CIE CHROMATICITY DIAGRAM

12. (2) What's a disadvantage of using a widely standardized API compared to a proprietary API?

EXCLUDES RECENT HI PERFORMANCE HW

13. (2) This is a rotation matrix

$$\begin{pmatrix} 0.07142857142 & -0.6589265829 & 0.7488081981 \\ 0.9446408685 & 0.2857142857 & 0.1613101866 \\ -0.3202367695 & 0.6958326704 & 0.6428571428 \end{pmatrix}$$

What's its determinant?

/

14. (5) If θ is the angle of rotation, what's $\cos \theta$?

$$M_{11} + M_{22} + M_{33} = 1 + 2 \cos \theta$$

$$.07 + .29 + .64 = 1 \quad \cos \theta = 0$$

15. (2) What does `gl.bindBuffer` do?

SETS WHICH BUFFER FUTURE ROUTINES WILL USE.

16. (2) What does `gl.uniform1f` do?

WRITES A FLOAT UNIFORM SCALAR TO GPU

17. (5) Many programs we've studied have a line like this:

```
var y = 2*(canvas.height-event.clientY)/canvas.height-1;
```

This is necessitated because of something messy in the various coordinate systems these programs use.

What?

EVENT'S ORIGIN IS TOP LEFT, UNIT IS PIXELS
Y COUNTS DOWN.
OTHERWISE ORIGIN USUALLY CENTER, Y COUNTS
UP, SIZE IS OFTEN 2x2, NOT PIXELS.

18. (2) What is GLSL used for?

LANGUAGE FOR SHADERS

End of midterm, total 50 points.

misc

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