**Carlos Hernandez**

**CSCI 4250/5250 Homework 5 (Due beginning of class, Tuesday Oct 31st)**

***You are required to type your answers. Submit to the D2L Dropbox labeled “homework 5”***

1. Given the 3D cube example in programs: ortho.js and ortho.html (available on the course web page), if the view position and the orthographic viewing volume is changed into each of the following situations, how will the final 2D image change from its original image? Justify your answer.

|  |  |  |
| --- | --- | --- |
| a. | mvMatrix=lookAt(vec3(-4, 0, 0), at, up); | // pMatrix does not change |
|  | **It is now only looking at the yellow side because the eye has moved to the left only (-4 on the x-axis).** |  |
| b. | mvMatrix=lookAt(vec3(3, 3, 3), at, up); | // pMatrix does not change |
|  | **It is now looking at the top, right, and front faces of the cube. Because it was moved to the right 3 (3 on the x-axis), up 3 (3 on the y-axis), and closer 3 (3 on z-axis).** |  |

1. mvMatrix=lookAt(vec3(3, 3, 3, at, up); pMatrix=ortho(-3, 3, -3, 3, -1, 1);

**Nothing is shown because the near**

**and are out of the view volume.**

* 1. pMatrix= ortho(-6, 6, -3, 3, 2, 10); // mvMatrix does not change

**It will shrink because the view volume was increased.**

* 1. pMatrix=ortho(0, 4, 0, 3, 2, 10); // mvMatrix does not change

**It will only show a small part of the cube because the left and right were adjusted**

**to be partly out of the view volume.**

1. Given: mvMatrix=lookAt(vec3(4, 4, - 4), at, up);

pMatrix=ortho(-2, 2, -4, 4, -10, 10);

show:

* + the mvMatrix

n = (4, 4, -4)

u = (-4, 0, -4)

v = (-16, 32, -16)

normalize n = (4/6.928, 4/6.928, -4/6.928) = (-.577, .577, -.577)

normalize u = (4/5.656, 0/5.656, -4/5.656) = (-.707, 0, -.707)

normalize v = (-16/22.627, 32/22.627, -16/22.627) = (-.408, .816, .408)

dx = -(4, 4, -4).(-.0707, 0, -.707) = 0

dy = -(4, 4, -4).(-.408, .816, .408) = 0

dz = -(4, 4, -4).(-.577, .577, -.577) = -6.928

|  |  |  |  |
| --- | --- | --- | --- |
| -0.707 | 0 | -0.707 | 0 |
| -0.408 | 0.816 | 0.408 | 0 |
| 0.577 | 0.577 | -0.577 | 0 |
| 0 | 0 | 0 | 1 |

* + the pMatrix

|  |  |  |  |
| --- | --- | --- | --- |
| 0.5 | 0 | 0 | 0 |
| 0 | 0.25 | 0 | 0 |
| 0 | 0 | -0.1 | 0 |
| 0 | 0 | 0 | 1 |

* + the coordinates of a point F(1, 1, -1) when converted into the final clip coordinates. (show intermediate steps in deriving the results)

1. Changing the orthographic viewing volume in problem 2) to a frustum with left=-2, right=2, bottom=-4, top=4 for the near plane, and the near plane at distance 4 and far plane at distance 10 from the eye/camera. How would you call the perspective function to set up the corresponding pMatrix in the .js program?

**perspective( 90, 1, 4, 10);**

1. With the perspective viewing volume defined in problem 3), what will be the x and y coordinates of the two points F(1, 1, -1) and B(1, 1, 1) when projected onto the near plane?

**F(-4,-4)**

**B(4,4)**