

# CS 432 – Interactive Computer Graphics

## Assignment 5 – 3D Objects, Cameras, and Projection

### Objectives:

1. Render 3D objects
2. Implement a WASD camera interface

### Assignment

#### The Scene

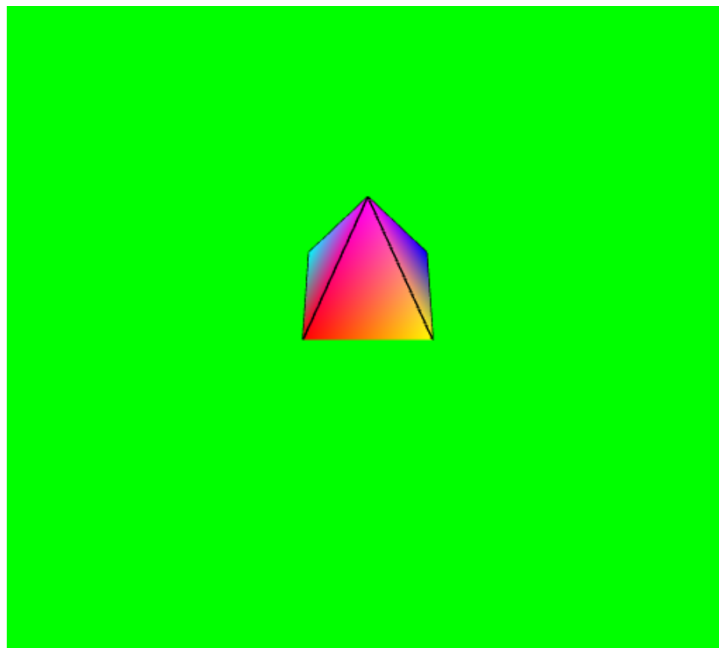
The background should be white.

The ground plane should be a  $5 \times 5$  plane on the  $xz$  plane with  $y = 0$ .

The pyramid should be situated so that it is on top of the ground plane and located at  $(0,0,0)$  in the world.

The camera should be placed at  $eye = (0,5,5)$ , looking in the negative  $z$  direction, but pointed down by  $45^\circ$ .

Your view volume will be a perspective view volume with a  $45^\circ$  field of view, a near clipping plane at a distance of 0.1, and a far clipping distance of 100.0. The aspect ratio of your viewport and projection view volume should be the same to avoid distortion.



On the next page is a description of how the objects are to be drawn.

### 3D Objects

Using the code show in lecture, you'll create two objects:

1. Green "ground plane"
2. A pyramid.

Each of these objects, their vertex locations should be defined in their own model coordinate system and then transformed into world coordinates via their model matrices. Below is more details on each of these objects:

#### *Green Plane*

The green ground plane should be in the  $xz$  plane at  $y = 0$ .

#### *Pyramid*

The pyramid will have a base with four vertices and an apex vertex. In addition, it should have a black wireframe. We will draw the pyramid using indices, so place the 5 unique vertices, and their associated colors, in array buffers. Then define the indices for the triangles that form the pyramid, and the indices that form the frame, and place these in element buffers. Finally draw the body and the frame by element.

**Hint:** Drawing 3D locations by hand to figure out how to assemble your polygon can be a pain. In the past students have found the following website useful in helping them visualize their vertices:

<https://technology.cpm.org/general/3dgraph/>

### Interaction

Hitting the spacebar toggles between flat and interpolated shading of the triangles that make up the sides of your pyramid.

We will also implement a WASD camera interface. The behavior is as follows:

- **W/w key:** Moves the camera forwards, in the direction opposite the  $n$  vector.
- **S/s key:** Moves the camera backwards, in the direction of the  $n$  vector.
- **A/a key:** Moves the camera left, in the direction opposite the  $u$  vector.
- **D/d key:** Moves the camera right, in the direction of the  $u$  vector.

### What to submit?

Submit a single zip file containing all the files needed to run your code.

We should be able to extract your file, navigate to your directory, run an http server there and run your code in a browser.

### Grading:

1. Draw 3D shapes: 3pts
2. Correct color (w/ wireframe): 3pts
3. Toggling color mode: 2pt
4. Camera interface: 2pts