Exercise #3 in Computer Graphics
Boxes worlds

Due: 3/28/02

In this exercise you'd be asked to practice transformations in OpenGL.

It consists of several cameras, from which you'd be asked to describe the view each one of these cameras sees.

There are several coordinate systems. The universe coordinate system and the ones as defined by each of the cameras.

The program is interactive. It waits for an input from the user, given as a command from the prompt, and it reacts to these commands.

The file "boxes.dat" consists of several lines. Each line describes a box. It consists of 9 numbers:

$$x_1, y_1, z_1,\ \ x_2, y_2, z_2,\ \ r, g, b$$

where x_1, y_1, z_1 and x_2, y_2, z_2 are the coordinates of the lower left closest corner of a box, and x_2, y_2, z_2. I.e. $x_1 < x_2,\ y_1 < y_2, z_1 < z_2$. r, g, b are numbers between 0 and 1, and describes the box's color. Later on, we refer to these boxes, as box i, which is the box described in line i of the file.

We also represent 1-4 cameras. Their location is described in the file "cameras.dat". Each line is of the format $(x_1, y_1, z_1, \{p|q\})$, describing the location of the camera, and the character 'p' or 'o' describes whether this camera uses orthogonal or prospective projection. The cameras always look at the origin $\mathbf{o}_{un}$ of the universe coordinate system. Their view should include at least a piece of each box. Each camera i defines its own coordinate system as follows: The origin o_i of the i-th coordinate system is in the center of the camera. The z-direction is the direction towards the center of the universe coordinate system. Define h_i as a plane passing thorough $\mathbf{o}_i$, and orthogonal

to the vector $\mathbf{o}_i - \mathbf{o}_{un}$. The y-direction is the projection on h_i of the z-direction of the universe. The x-direction is orthogonal to the x and z direction, so that x, y, z creates a right-hand coordinate system.

Commands:

view i Show the view of the boxes from the i'th camera

pick i In the following commands, use the coordinate system of the ith camera.

move j **z d** Move the jth box in the z direction by d units. A nice animation would be appreciated. Note that the z-direction is with respect to the camera which was picked. Note that boxes might overlap. This is a common phenomenon among boxes, and should not bother use. boxes are opaque.

move j **x d** -analogous to move in the x direction.

move j **y d** -analogous to move in the y direction.

reset — move all boxes to their original location, as specified.

Comments

- Note the different between "view" command and "pick" command — they might refer to different cameras.
- Make sure to print appropriate error messages if a command is invalid.
- The use of illumination and any other tricks for enhancing the three dimensional feeling is encouraged.
- Add a document describing the good things that your program are doing.
- Submitting in groups of two (at most).
- We will spent some time checking copying between projects.
- Example files would be available on the web. We would also published extra information, corrections, and FAQ if needed.