Short Questions

1. What is the synthetic-camera model and how does it relate to OpenGL? **(5 points)**

2. Most interactive programs use event-driven programming. Describe how input is handled in such applications. **(5 points)**

3. What is a display list? Why would you want to use one and why wouldn't you want to use one? **(5 points)**

4. What is the difference between perspective and orthographic projection? Provide an example of how we would setup both types of projections. **(5 points)**

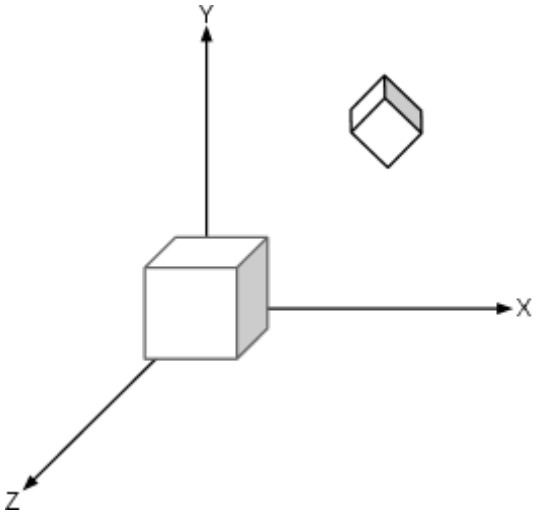
5. Suppose we are using **gluLookAt**. Describe how would we implement an arcball/orbital type camera? How would we implement a free camera? **(5 points)**

6. Describe how selection or picking works in OpenGL. **(5 points)**

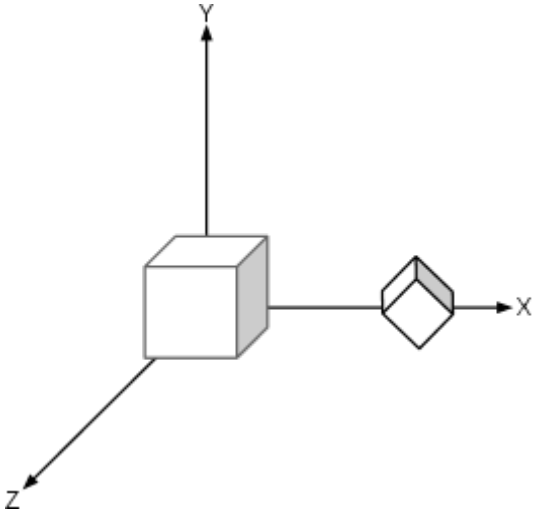
7. What are *homogenous coordinates* and why are they used in OpenGL? **(5 points)**

8. Suppose we have a unit block and want to transform it to match the figures below. Describe the transformations and the order they should occur should occur in OpenGL. Include the call to **draw_block** to actually render the block. **(4 points)**

a) (2 points)



b) (2 points)



9. What is color tracking and why would we use it? How would we enable it in OpenGL? **(5 points)**

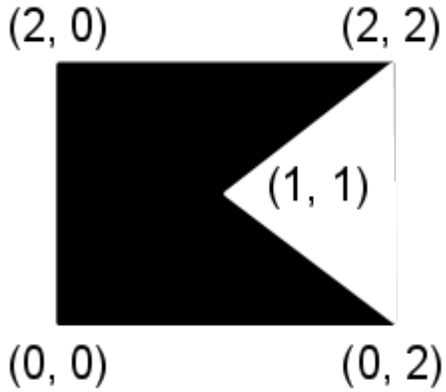
10. What do the functions **glMatrixMode**, **glLoadIdentity**, **glPushMatrix**, **glPopMatrix** do? Why would we use these functions?

11. If you want to allow the user to place an object directly onto a terrain, would you use picking or **gluUnProject**? Why?

Long Questions

1. Diagram the OpenGL rendering pipeline. Identify each phase and briefly describe what happens at each phase. **(10 points)**

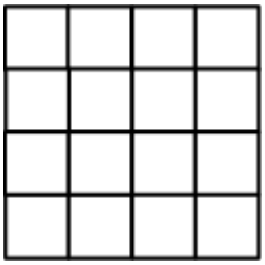
2. Suppose you wanted to draw the shape shown below.



a) Could you use **GL_POLYGON** to do this? Why or why not? **(3 points)**

b) Write some OpenGL code that could be used to draw the shape. **(7 points)**

3. Write the OpenGL code required to draw the grid of squares below:



a) Using **GL_LINE_STRIP (4 points)**
void draw_grid_lines() {

}
b) Using **GL_QUAD_STRIP (4 points)**
void draw_grid_quads() {

}
c) Using display lists composed of the functions defined above **(2 points)**

4. Diagram the vertex transformation pipeline and describe the matrices used at each phase and the coordinate transformations that result from each phase operation. **(10 points)**

5.

a) Describe the four lighting components used in the OpenGL light model. **(4 points)**

b) What extra piece of information must be supplied, with vertices, to enable proper lighting? (GLUT primitives and GLU quadrics provide this information automatically.) **(3 points)**

c) Using OpenGL**,** setup a point light source that emits only red light. **(3 points)**

d) Using OpenGL, create a metallic sphere that emits a green light. **(3 points)**

A. What do you enjoy the most and the least about the computer graphics course? What is the most useful part of the course: lecture, lab, homework? What can be improved (teaching style, course material, assignments, etc.)?