CSE 581 Midterm I

Spring 2005

Instructions: Answer each question thoroughly, showing your work and how you reached the answer. Correct responses will not receive credit without a proper derivation or explanation.

Format: Four questions, each worth 25 points.

1. (Four parts) Using the grids below and the following list of points, draw the resulting OpenGL output using large points, lines or a diagonal hatch pattern for front-facing polygons and a cross hatch pattern for back-facing polygons. Show the connectivity, and assume we are drawing in GL_FILL mode:

```c
float vertices[7][2] = { (0,0), (10,0), (0,10), (10,10), (20,10), (20,10), (30,10)};
glBegin( GL_LINES );
    for( int i=0; i < 7; i++ )
        glVertex2fv( vertices[i] );
glEnd();
```

![Grid with points](image-url)
float vertices[7][2] = { (0,0), (10,0), (0,10), (10,10), (20,10), (20,10), (30,10)};
glBegin( GL_TRIANGLE_STRIP );
    for( int i=0; i < 7; i++ )
        glVertex2fv( vertices[i] );
glEnd();
float vertices[7][2] = { (0,0), (10,0), (0,10), (10,10), (20,10), (20,10), (30,10)};

glBegin( GL_TRIANGLES );
for( int i=0; i < 7; i++ )
    glVertex2fv( vertices[i] );

glEnd();
2. Give the transformation matrix that will transform points in world space to the camera’s coordinate frame. The camera is defined in world space as having a position (0.3, 0.2, 0.4). It is focused on an object at world location (0.8, 0.7, -0.1), and is tilted up-right, with the y-axis as the view-up.
3. (2 parts) Consider our campus, with West being the x-axis, North the y-axis and z the up direction. Give a set of transformations that will take a unit cube (1 foot by 1 foot by 1 foot) and transform it into a crude Dreese Labs (a rectangle). Dreese labs is situated 100 feet east of our reference point or origin and 30 feet north. It is approximately 150 feet tall and 50 feet on each side. Give the transformations in an order that allows multiplying the vertices on the right-hand side.

Give the sequence of OpenGL calls that will accomplish this transformation, assuming that the current modelview matrix sets the coordinate frame as outlined above and the current matrix mode is undefined.
4. Give the resulting 4x4 modelview matrix from the following sequence of OpenGL code and give the resulting vertex positions:

```c
glViewport( 0,0, 100, 200 );
glMatrixMode( GL_MODELVIEW );
glLoadIdentity( );
glRotatef( 30.0, 0.0, 1.0, 0.0 );
glPushMatrix();
glTranslatef( 1, 1, 1);
glMatrixMode( GL_PERSPECTIVE );
glScale( 3, 3, 3 );
glLoadIdentity();
glMatrixMode( GL_MODELVIEW );
glScale( 0, 0, -1 );
glPopMatrix() ;
glBegin( GL_LINES ) ;
glVertex3f( 0, 0, 0 ) ;
glVertex3f( 1, 0, 0 ) ;
glEnd() ;
```