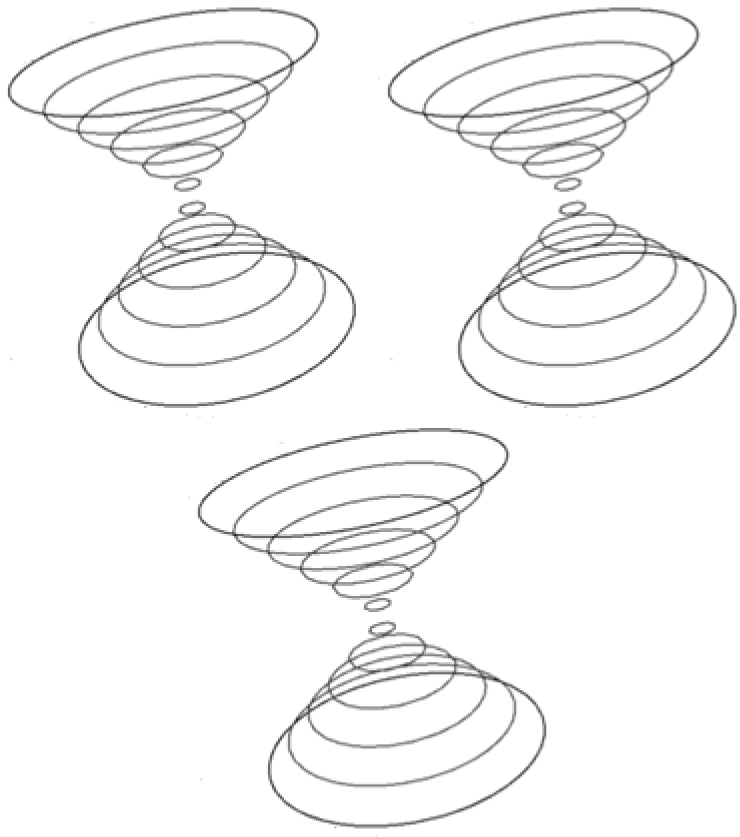
Faculty of Computers and Information
Assiut University

Course: Computer Graphics
Code: CS351

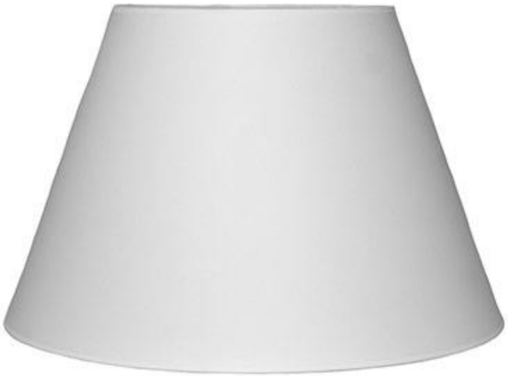
Assignement#2

1. Write OpenGL functions to draw the following figures. Assume any missing data

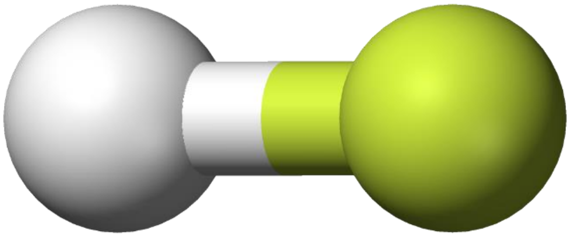
   a)



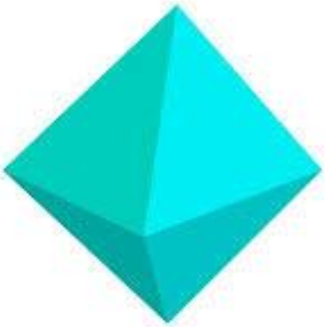
b)



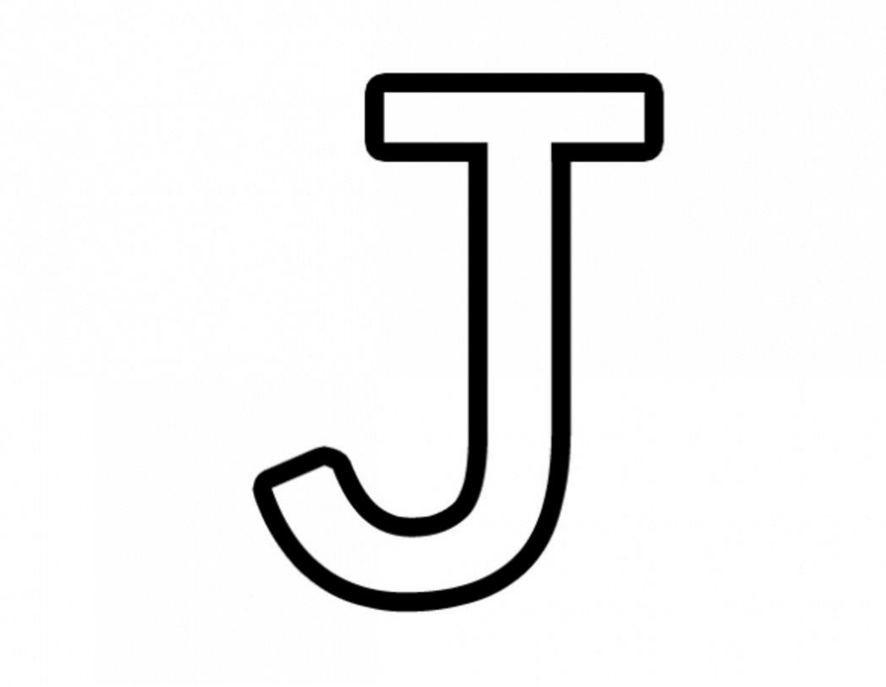
c)



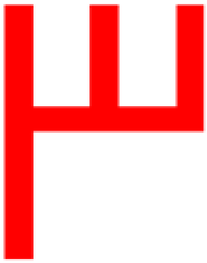
d)



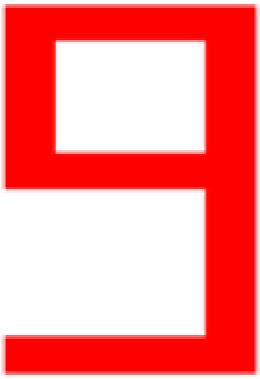
e)



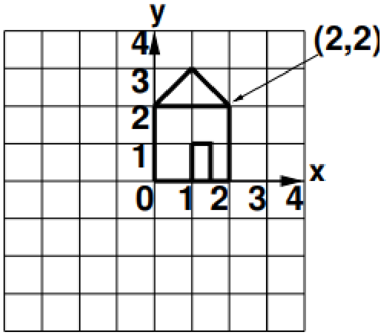
f)



g)



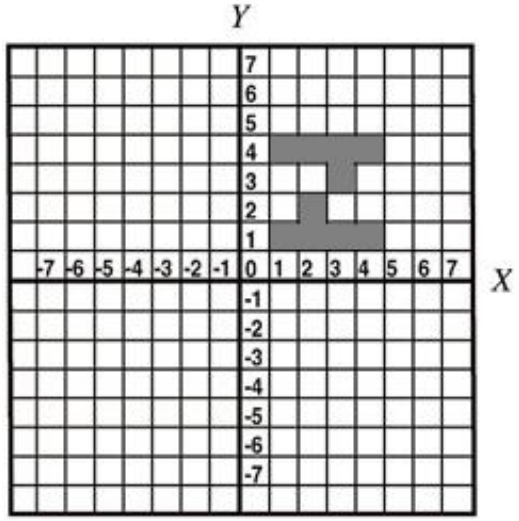
2. Assume that drawHouse function draws the following house.



Draw the output of executing the following OpenGL code segments **independently**.

<table>
<tr><td colspan="2">glMatrixMode (GL_PROJECTION); glLoadIdentity();
glOrtho (-10.0, 10.0, -10.0, 10.0, -2.0, 2.0); glMatrixMode(GL_MODELVIEW); glLoadIdentity();</td></tr>
<tr><td>(a)
glTranslate(-1,2,0);
glScale(1,-1,1);
drawHouse();</td><td>(b)
glTranslate(2, 2, 0);
glRotate(-90, 0, 0, 1);
glTranslate(-2, -2, 0);
drawHouse();</td></tr>
<tr><td colspan="2">(c)
glTranslate(1, -1, 0);
glRotate(-90, 0, 0, 1);
drawHouse();
glRotate(90, 0, 0, 1);
glTranslate(-2, 1, 0);
drawHouse();</td></tr>
</table>

3. The output of executing the following OpenGL code segment is shown in figure below.
   {glLoadIdentity(); drawShape1();}



Draw the output of executing the following OpenGL code segments **<u>independently</u>**.

<table>
<tr><td colspan="3">glMatrixMode (GL_PROJECTION); glLoadIdentity();
glOrtho (-7.0, 7.0, -7.0, 7.0, -2.0, 2.0); glMatrixMode(GL_MODELVIEW); glLoadIdentity();</td></tr>
<tr><td>(a)
glScalef(-1.0, 1.0,1.0);
drawShape1();</td><td>(b)
glRotatef(90.0, 0, 0, 1.0);
drawShape1();</td><td>(c)
glRotatef(90.0, 0, 0, 1.0);
glTranslatef(1.0, 0, 0);
drawShape1();</td></tr>
<tr><td>(d)
glRotatef(-90.0, 0, 0, 1.0);
glPushMatrix();
glTranslatef(1.0, 0, 0);
glScalef(1.0, 2.0, 1.0).
glTranslatef(1.0, -2.0, 0.0);
glTranslatef(-2.0, -2.0, 0.0);
glRotatef(90.0, 0, 0, 1.0);
glTranslatef(-1.0, -1.0, 0.0);
glScalef(1.0, 0.5, 1.0).
glRotatef(90.0, 0, 0, 1.0);
glPopMatrix();
glTranslatef(-1.0, 1.0, 0.0);
drawShape1 ();</td><td>(e)
glPushMatrix();
glRotatef(-90.0, 0, 0, 1.0);
glTranslatef(-1.0, -2.0, 0.0);
drawLShape ();
glPushMatrix();
glTranslatef(2.0, 0.0, 0.0);
glRotatef(-90, 0, 0, 1);
glPopMatrix();
glPopMatrix();
glScalef(1.0,-1.0, 1.0).
drawShape1 ();</td><td>(f)
glScalef(-1.0, 1.0,1.0);
drawShape1 ();
glScalef(-1.0, 1.0,1.0);
glBegin(GL_TRIANGLES);
    glVertex2f(1.0, 3.0);
    glVertex2f(3.0, 3.0);
    glVertex2f(3.0, 5.0);
    glVertex2f(3.0, 3.0);
    glVertex2f(3.0, 5.0);
    glVertex2f(5.0, 3.0);
glEnd();</td></tr>
</table>

4. Write the transformation matrix that makes the following transformations:
    a) Figure A to Figure B
    b) Figure B to Figure C
    c) Figure A to Figure C

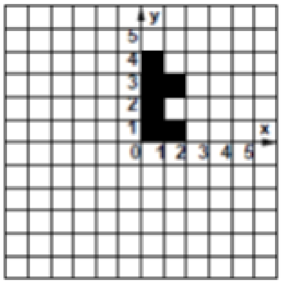


Figure: **A**

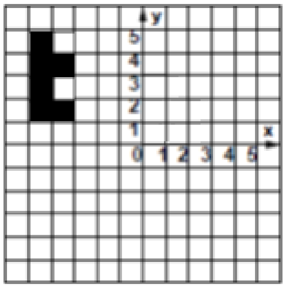


Figure: **B**

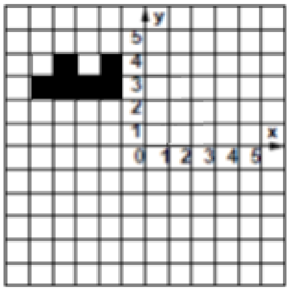


Figure: **C**

5. Write down the transformation matrix that corresponds to the following OpenGL code segments:

a)

```
glRotatef(90.0, 0, 0, 1.0);
glScalef(-1.0, 2.0,-1.0);
glTranslatef(-2.0,-1.0, 2.0);
```

b)

```
glTranslatef(2.0,1.0,4.0);
glScalef(1.0, 1.0,0.5);
glRotatef(90.0, 0, 1.0, 0.0);
```

6. Suppose we have the following sequence of transformations:

```
glRotatef(90, 0, 0, 1);
glTranslatef(1,1,0);
glRotatef(180, 0, 0, 1);
glTranslatef(2,1,0);
Draw_Unit_Square();
```

Assume that Draw_Unit_Square function draws a unit square (extending from 0 to 1 in x and y). Draw out the intermediate four positions of the square as each transformation is applied.

7. Give the sequence of OpenGL transformations that would produce the following transformation matrix. Write the transformation matrix of each OpenGL command.

$$\begin{bmatrix} 0 & -1 & 0 & 4 \\ 1 & 0 & 0 & -3 \\ 0 & 0 & 1 & 2 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

8. Given the following transformation

   rot(z,90) trans(4,1,0)

   Determine the values for x,y, and theta if the following transformation is to be identical:

   trans(x,y,0) rot(z, theta)

   Express the above transformations in terms of OpenGL commands.

9. Write down the transformation matrix that corresponds to the following OpenGL code segment in two ways:
   a) The standard 4 × 4 matrix notation
   b) As a one dimensional 16-entry array used in OpenGL.
   c) Write one OpenGL statement that corresponds to the three OpenGL statements using the one dimensional matrix in (b).

```
glRotatef(90.0, 1.0, 0.0, 0.0);
glTranslatef(-2.0,1.0,-3.0);
glScalef(1.0, 2.0,2.0);
```

10. Triangles are a common primitive for surfaces in OpenGL. Given three vertices P1=(2, 1, 0), P2=(0.5, 2, 0.5), P3=(1, 1, 1) on a plane, calculate the equation of the plane . What is the z value of the point in the plane with x=0.5, y=0.5?