Write C++ program to draw 3-D cube and perform following transformations on it using OpenGL i)Translation ii)Scaling iii)Rotation about an axix (X/Y/Z)

Code :

```
#include<iostream>
#include<math.h>
#include<GL/glut.h>
using namespace std;
typedef float Matrix4 [4][4];
Matrix4 theMatrix;
static GLfloat input[8][3]=
{
 {40,40,-50},{90,40,-50},{90,90,-50},{40,90,-50},
 {30,30,0},{80,30,0},{80,80,0},{30,80,0}
};
float output[8][3];
float tx,ty,tz;
float sx,sy,sz;
float angle;
int choice,choiceRot;
void setIdentityM(Matrix4 m)
{
for(int i=0;i<4;i++)
 for(int j=0;j<4;j++)
 m[i][j]=(i==j);
}
void translate(int tx,int ty,int tz)
{
for(int i=0;i<8;i++)
{
output[i][0]=input[i][0]+tx;
output[i][1]=input[i][1]+ty;
output[i][2]=input[i][2]+tz;
}
}
void scale(int sx,int sy,int sz)
{
 theMatrix[0][0]=sx;
 theMatrix[1][1]=sy;
 theMatrix[2][2]=sz;
}
void RotateX(float angle) //Parallel to x
{
angle = angle*3.142/180;
```

```
 theMatrix[1][1] = cos(angle);
theMatrix[1][2] = -sin(angle);
theMatrix[2][1] = sin(angle);
theMatrix[2][2] = cos(angle);
}
void RotateY(float angle) //parallel to y
{
angle = angle*3.14/180;
theMatrix[0][0] = cos(angle);
theMatrix[0][2] = -sin(angle);
theMatrix[2][0] = sin(angle);
theMatrix[2][2] = cos(angle);
}
void RotateZ(float angle) //parallel to z
{
angle = angle*3.14/180;
theMatrix[0][0] = cos(angle);
theMatrix[0][1] = sin(angle);
theMatrix[1][0] = -sin(angle);
theMatrix[1][1] = cos(angle);
}
void multiplyM()
{
//We Don't require 4th row and column in scaling and rotation
//[8][3]=[8][3]*[3][3] //4th not used
for(int i=0;i<8;i++)
{
 for(int j=0;j<3;j++)
 {
 output[i][j]=0;
 for(int k=0;k<3;k++)
 {
 output[i][j]=output[i][j]+input[i][k]*theMatrix[k][j];
 }
 }
}
}
void Axes(void)
{
glColor3f (0.0, 0.0, 0.0); // Set the color to BLACK
glBegin(GL_LINES); // Plotting X-Axis
glVertex2s(-1000 ,0);
glVertex2s( 1000 ,0);
glEnd();
glBegin(GL_LINES); // Plotting Y-Axis
glVertex2s(0 ,-1000);
glVertex2s(0 , 1000);
glEnd();
}
```

```
void draw(float a[8][3])
{
 glBegin(GL_QUADS);
 glColor3f(0.7,0.4,0.5); //behind
 glVertex3fv(a[0]);
 glVertex3fv(a[1]);
 glVertex3fv(a[2]);
 glVertex3fv(a[3]);
 glColor3f(0.8,0.2,0.4); //bottom
 glVertex3fv(a[0]);
 glVertex3fv(a[1]);
 glVertex3fv(a[5]);
 glVertex3fv(a[4]);
 glColor3f(0.3,0.6,0.7); //left
 glVertex3fv(a[0]);
 glVertex3fv(a[4]);
 glVertex3fv(a[7]);
 glVertex3fv(a[3]);
 glColor3f(0.2,0.8,0.2); //right
glVertex3fv(a[1]);
glVertex3fv(a[2]);
glVertex3fv(a[6]);
glVertex3fv(a[5]);
glColor3f(0.7,0.7,0.2); //up
glVertex3fv(a[2]);
glVertex3fv(a[3]);
glVertex3fv(a[7]);
glVertex3fv(a[6]);
glColor3f(1.0,0.1,0.1);
glVertex3fv(a[4]);
glVertex3fv(a[5]);
glVertex3fv(a[6]);
glVertex3fv(a[7]);
glEnd();
}
void init()
{
 glClearColor(1.0,1.0,1.0,1.0); //set backgrond color to white
 glOrtho(-454.0,454.0,-250.0,250.0,-250.0,250.0);
 // Set the no. of Co-ordinates along X & Y axes and their gappings
 glEnable(GL_DEPTH_TEST);
 // To Render the surfaces Properly according to their depths
}
void display()
{
glClear(GL_COLOR_BUFFER_BIT|GL_DEPTH_BUFFER_BIT);
Axes();
glColor3f(1.0,0.0,0.0);
draw(input);
```

```
setIdentityM(theMatrix);
switch(choice)
{
case 1:
 translate(tx,ty,tz);
 break;
case 2:
 scale(sx,sy,sz);
multiplyM();
 break;
case 3:
 switch (choiceRot) {
 case 1:
 RotateX(angle);
 break;
 case 2: RotateY(angle);
 break;
 case 3:
 RotateZ(angle);
 break;
 default:
 break;
 }
multiplyM();
 break;
}
draw(output);
glFlush();
}
int main(int argc, char** argv)
{
 glutInit(&argc,argv);
 glutInitDisplayMode(GLUT_SINGLE|GLUT_RGB|GLUT_DEPTH);
 glutInitWindowSize(1362,750);
 glutInitWindowPosition(0,0);
 glutCreateWindow("3D TRANSFORMATIONS");
 init();
 cout<<"Enter your choice number:\n1.Translation\n2.Scaling\n3.Rotation\n=>";
 cin>>choice;
 switch (choice) {
 case 1:
 cout<<"\nEnter Tx,Ty &Tz: \n";
 cin>>tx>>ty>>tz;
 break;
 case 2:
 cout<<"\nEnter Sx,Sy & Sz: \n";
 cin>>sx>>sy>>sz;
 break;
 case 3:
```

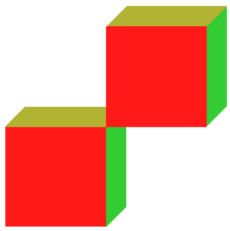
```
 cout<<"Enter your choice for Rotation about axis:\n1.parallel to X-axis."
 <<"(y& z)\n2.parallel to Y-axis.(x& z)\n3.parallel to Z-axis."
 <<"(x& y)\n =>";
 cin>>choiceRot;
 switch (choiceRot) {
 case 1:
 cout<<"\nENter Rotation angle: ";
 cin>>angle;
 break;
 case 2:
 cout<<"\nENter Rotation angle: ";
 cin>>angle;
 break;
 case 3:
 cout<<"\nENter Rotation angle: ";
 cin>>angle;
 break;
 default:
 break;
 }
 break;
 default:
 break;
 }
 glutDisplayFunc(display);
 glutMainLoop();
return 0;
}
```

Output :

1. Translation :

```
Enter your choice number:
1.Translation
2.Scaling
3.Rotation
=>1

Enter Tx,Ty &Tz:
50
50
150
```

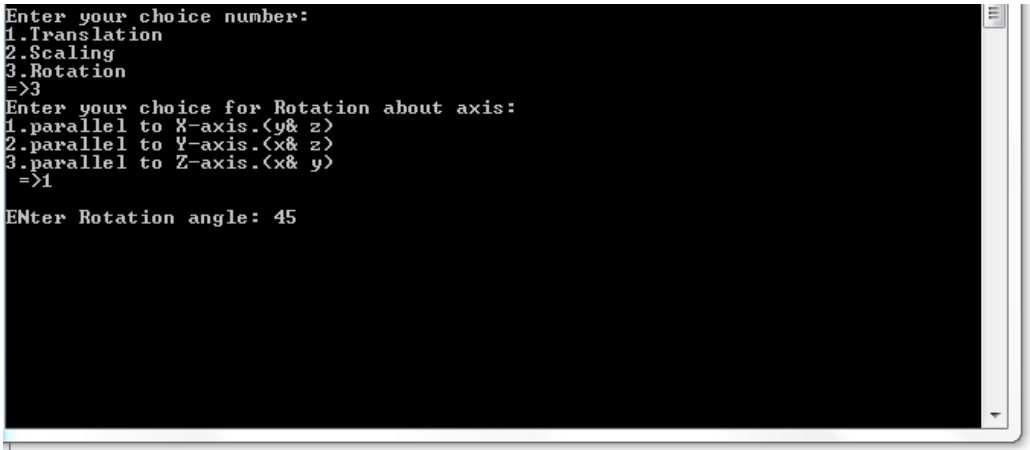


2. Scaling :

```
Enter your choice number:
1.Translation
2.Scaling
3.Rotation
=>2

Enter Sx,Sy & Sz:
3
2
1
```

3. Rotation:


Enter your choice number:
1.Translation
2.Scaling
3.Rotation
=>3
Enter your choice for Rotation about axis:
1.parallel to X-axis.(y& z)
2.parallel to Y-axis.(x& z)
3.parallel to Z-axis.(x& y)
=>1
ENter Rotation angle: 45