Quiz #3 (CSE4190.410)

October 15, 2012 (Monday)

Name: _____ **Dept:** _____ **ID No:** _____

1. (10 points) Fill in the blanks in the following OpenGL program.

```
#include <math.h>
#include <gl/freeglut.h>

#define PI 3.141592f

int type = 0;

typedef struct {
    float r1, r2, a1, a2, p1, p2, w0, q, e, m;
    int n;
} Tree;

Tree trees[10];

void draw_cylinder() {
    int vnum = 16, unum = 16;

    float r = 0.5;
    float length = 1;

    for(int i = 0; i < vnum; ++i) {
        float v = (float)i/vnum;
        float vnext = (float)(i+1)/vnum;

        glBegin(__GL_QUAD_STRIP__);
        for(int j = 0; j <= unum; ++j) {
            float u = (float)j/unum;
            float t = u*2*PI;

            __glVertex3f__(r*sin(t), v*length, r*cos(t));
            __glVertex3f__(r*sin(t), vnext*length, r*cos(t));
        }
        glEnd();
    }
}

void init() {
    glClearColor(1.0f, 1.0f, 1.0f, 1.0f);
    glClearDepth(1.0f);
    glEnable(GL_DEPTH_TEST);
    glDepthFunc(GL_LEQUAL);
    glHint(GL_PERSPECTIVE_CORRECTION_HINT, GL_NICEST);
```

```
    trees[0].r1 = 0.75, trees[0].r2 = 0.77, trees[0].a1 = 35, trees[0].a2 = -35;
    trees[0].p1 = 0, trees[0].p2 = 0, trees[0].w0 = 30;
    trees[0].q = 0.50, trees[0].e = 0.40, trees[0].m = 0.0, trees[0].n = 10;
    .......
    trees[8].r1 = 0.55, trees[8].r2 = 0.95, trees[8].a1 = -5, trees[8].a2 = 30;
    trees[8].p1 = 137, trees[8].p2 = 137, trees[8].w0 = 5;
    trees[8].q = 0.40, trees[8].e = 0.00, trees[8].m = 5.0, trees[8].n = 12;
}

void forward(float length, float width) {

    glPushMatrix();

    __glScalef__(width, length, width);
    draw_cylinder();

    glPopMatrix();

    __glTranslatef__(0, length, 0);
}

void draw_tree(float length, float width, float r1, float r2, float a1, float a2,
               float p1, float p2, float q, float e, float m, int n, int depth) {
    if(length >= m && depth < n) {
        forward(length, width);

        // left branch
        glPushMatrix();
            glRotatef(a1, 0, 0, 1);
            glRotatef(-p1, 0, 1, 0);

            draw_tree(__length*r1__,

                      __width*pow(q,e)__,
                      r1, r2, a1, a2, p1, p2, q, e, m, n,

                      __depth+1__);
        glPopMatrix();

        // right branch
        glPushMatrix();
            glRotatef(a2, 0, 0, 1);
            glRotatef(-p2, 0, 1, 0);

            draw_tree(__length*r2__,

                      __width*pow(1-q,e)__,
                      r1, r2, a1, a2, p1, p2, q, e, m, n,

                      __depth+1__);
        glPopMatrix();
    }
}
```

```
void display() {
    glClear(GL_COLOR_BUFFER_BIT | GL_DEPTH_BUFFER_BIT);

    glLoadIdentity();
    glTranslatef(0, -4, -10);
    glScalef(0.007,0.007,0.007);

    glColor3f(0,0,0);
    draw_tree(100, trees[type].w0,
              trees[type].r1, trees[type].r2,
              trees[type].a1, trees[type].a2,
              trees[type].p1, trees[type].p2,
              trees[type].q, trees[type].e,
              trees[type].m, trees[type].n, 0);

    glutSwapBuffers();
}

void reshape(int w, int h) {
    glViewport(0, 0, w, h);
    //projection matrix
    glMatrixMode(GL_PROJECTION);
    glLoadIdentity();
    gluPerspective(45.0f,(GLfloat)w/(GLfloat)h,.1f,100.0f);
    //modelview matrix
    glMatrixMode(GL_MODELVIEW);
    glLoadIdentity();
}

void keyboard(unsigned char key, int x, int y) {
   if(key >= '1' && key <= '9')
        type = key - 49;
    else if(key == 27)
        exit(0);
}

void idle(){
    glutPostRedisplay();
}

int main(int argc, char **argv) {
    glutInit(&argc, argv);
    glutInitDisplayMode(GLUT_DOUBLE | GLUT_RGB);
    glutInitWindowSize(700, 700);
    glutInitWindowPosition(250, 250);
    glutCreateWindow(argv[0]);
    init();
    glutDisplayFunc(display);
    glutReshapeFunc(reshape);
    glutKeyboardFunc(keyboard);
    glutIdleFunc(idle);
    glutMainLoop();
    return 0;
}
```