CSC 240
Computer Graphics

Fall 2015
Smith College
Outline: 11/2

• Recap Lighting and Lab 10

• Start hierarchical models

• Hierarchical models lab: robotic arm

White background slides from Eitan Mendelowitz
ambient_color = [ 0.2, 0, 0, 1]
diffuse_color = [1, 0, 0, 1]

.glLightfv(GL_LIGHT0, GL_AMBIENT, ambient_color)
.glLightfv(GL_LIGHT0, GL_DIFFUSE, diffuse_color)
.glLightfv(GL_LIGHT0, GL_POSITION, light_position)
Another way: material properties

ambient_color = [0.2, 0, 0, 1]
diffuse_color = [1, 0, 0, 1]

glMaterialfv(GL_FRONT, GL_AMBIENT, ambient_color)
glMaterialfv(GL_FRONT, GL_DIFFUSE, diffuse_color)

glLightfv(GL_LIGHT0, GL_POSITION, light_position)

**General form:**

```
glMaterialfv(face, type, color)
```
Ambient and Specular

mat_specular = [ 1, 1, 1, 1 ]
mat_shininess = [ 50 ]
mat_ambient = [ 1, 0, 0, 1 ]
light_position = [ 1, 1, 1, 0 ]
glClearColor(0, 0, 0, 0)
glShadeModel(GL_SMOOTH)

glMaterialfv(GL_FRONT, GL_SPECULAR, mat_specular)
glMaterialfv(GL_FRONT, GL_SHININESS, mat_shininess)
glMaterialfv(GL_FRONT, GL_AMBIENT, mat_ambient)
glLightfv(GL_LIGHT0, GL_POSITION, light_position)

.glEnable(GL_LIGHTING)
.glEnable(GL_LIGHT0)
.glEnable(GL_DEPTH_TEST)
Normal Vectors

Polygon Normals vs. True Normals

(OpenGL Redbook)
Lab 10 Demos

light_position = [math.cos(angle/360), 0, math.sin(angle/360), 0]

glutSolidSphere(1.0, 50, 50)
glRotate(angle,0,1,0)
gllightfv(GL_LIGHT0, GL_POSITION, light_position)

ambient_color = [0, abs(math.cos(radians)), abs(math.sin(radians)), .5]
diffuse_color = [0, abs(math.cos(radians)), abs(math.sin(radians)), .5]
Perspective in a different way

- Will see in Lab 11
gluFrustumum vs. gluPerspective

```
    gluPerspective(fovy, aspect, zNear, zFar)

    glFrustum(left, right, bottom, top, zNear, zFar)
```
Relationship

- \( \text{aspect} = \frac{w}{h} = \frac{\text{right-left}}{\text{top-bottom}} \)

- \( \text{fovy} = \text{field of view angle (y-direction)} \)

- \( \text{fovy} = \sin^{-1}\left[\frac{\text{top-bottom}}{2 \times z\text{Near}}\right] \)

- Example: `gluPerspective(65.0, w/h, 1.0, 20.0)`
gluLookAt

gluLookAt(eyeX, eyeY, eyeZ,
        centerX, centerY, centerZ,
        upX, upY, upZ)

- Example: gluLookAt(1, 2, 8, 0, 0, 0, 0, 1, 0)
- Camera/eye at (1, 2, 8)
- Look at origin (0, 0, 0)
- Y-axis (0, 1, 0) is “up”
Why Group?

- Scene Organization

Room
Floor
Table
Chair
Why Group?

• Scene Organization

Room
Floor
Plane
Table
Chair
Why Group?

- Scene Organization

Room
Floor
Plane
Table
Bowl
Sphere
Sphere
Box
Box
Box
Chair
Add Transforms to Group

```python
bowl = group()
bowl.addObject(Sphere(…))
bowl.addObject(Sphere(…))

```
Useful for animation
Hierarchical Models

- Lab 9 revisited
- Demo Lab 11
Lab 11: robotic arm

• Choose a partner for pair programming!

• (If you don’t pair program, at least check in with your partner and discuss what’s going on.)
HW 4 Demos