Hierarchical Models

1. Robot with two arms: Draw the hierarchical tree for the model below, with two arms attached at a “shoulder”. Where should push and pop be placed on the tree?

![Hierarchical Tree for Robot with Two Arms](image)

2. Robotic arm, Lab 11: Draw the hierarchical tree for this lab, based on the code below. Use one node for each transformation and each object.

```c
gluLookAt(1,2,8, 0,0,0, 0,1,0)
glPushMatrix()
glRotate(shoulderAngle, 0, 0, 1)
glTranslatef(1, 0, 0)
glPushMatrix()
glScale(2, 0.4, 1)
glutWireCube(1.0)
glPopMatrix()
glTranslate(1, 0, 0)
glRotatef(elbowAngle, 0, 0, 1)
glTranslatef(1, 0, 0)
glPushMatrix()
glScale(2, 0.4, 1)
glutWireCube(1)
glPopMatrix()
glPopMatrix()
```

![Hierarchical Tree for Robotic Arm](image)
3. **Robot**: Draw a hierarchical tree for the robot below, assuming the shoulder is at the origin. Use objects as nodes first, then add transformations.

![Robot Diagram]

4. **Lamp**: Design a model for a lamp (maybe like the Pixar lamp below). How could you make it jump? How could you locate a light source at the end of the lamp?

![Lamp Diagram]