Algorithm 5 Sceneview

Introduction to Computer Graphics, Fall 2015

Due Sunday, October 25 at 4pm

Instructions: Write or type all of your answers on a separate sheet of paper and hand in to the cs123 hand-in bin. Late hand-ins will receive no credit. Respect the CS123 collaboration policy. Do not ask a friend to hand in the assignment for you. Wikipedia is neither a trusted nor an authorized resource.

This assignment is worth 6% of your Sceneview grade.

1. Consider the following excerpt from a scenefile:

```
<transblock>
  <scale x=".05" y="1.0" z=".05"/>
  <translate x="0" y=".5" z="0"/>
  <rotate x="1" y="0" z="0" angle="45"/>
  <object type="primitive" name="cylinder">
    <diffuse r="1" g="1" b="1"/>
  </object>
</transblock>
```

[1 point] To transform the cylinder $C$ into the desired cylinder $C'$, in which order would you multiply the three transformations: translate ($T$), rotate ($R$), and scale ($S$) for your Sceneview project? You should consult the Sceneview project handout and the scene file reference on the course website.

[1 point] Describe each step in the multiplication you gave above. Is the order you described above how you would want to organize transforms in a scenefile? Propose a better (more logical) order for how you would generally order transformations in a trans block.

2. When coding Sceneview, you will have to compose transformations whenever there is an object tree block contained within a trans block. Consider the following contrived excerpt from a scenefile:

```
<transblock>
  <rotate x="0" y="1" z="0" angle="60"/>
  <scale x=".5" y=".5" z=".5"/>
  <object type="tree">
    <transblock>
      <translate x="0" y="2" z="0"/>
      <scale x="1" y=".5" z="1"/>
      <object type="primitive" name="sphere">
        <diffuse r="1" g="1" b="0"/>
      </object>
    </transblock>
  </object>
</transblock>
```

[1 point] Suppose you composed the two transformations in the outer trans block (the rotate and scale), calling the resultant matrix $CTM_1$, and then composed the transformations in the inner trans block (the translate and scale), calling the result $CTM_2$. In what order must you multiply these matrices to obtain a single composite matrix with the desired effect on the primitive sphere object?

3. Being sure of the order in which matrices must be multiplied puts you well on your way to completing Sceneview. The other major hurdle is deciding how you will efficiently traverse the objects from the parse tree provided by CS123ISceneParser.

a. [1 point] When drawing a static scene, is there a more efficient way to draw objects than traversing scene graph every time? What feature(s) of a scene graph would make it slow to traverse multiple times for drawing?

b. [1 point] What type of data structure will you use for drawing that can store your more efficient version of the tree?

c. [1 point] What information will you store at each of the nodes in your data structure? Please give valid types and descriptions of any types you are defining yourself.