Algorithm 3: Sceneview

Comp175: Introduction to Computer Graphics – Spring 2020

Algorithm due: Friday February 28th at 11:59am
Project due: Monday March 9th at 11:59pm

Your Names: _____________________________
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Your CS Logins: _________________________
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1 Instructions

Complete this assignment only with your teammate. You may use a calculator or computer algebra system. All your answers should be given in simplest form. When a numerical answer is required, provide a reduced fraction (i.e. 1/3) or at least three decimal places (i.e. 0.333). Show all work; write your answers on this sheet. This algorithm handout is worth 3% of your final grade for the class.

2 OpenGL Commands

[1½ point each] Suppose you want to apply a transformation matrix to some vertices. In what order should you use the following five OpenGL commands?

```c
    glEnd()
    glMatrixMode(GL_MODELVIEW)
    glBegin()
    glLoadMatrix()
    glVertex4fv()
```

[1½ points] Suppose your program contained a block of code which sent vertices to OpenGL, delimited by `glBegin()` and `glEnd()`. What would be the effect of a call to `glLoadMatrix()` within this block?

3 Scenefiles

Consider the following excerpt from a scenefile.

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

[1½ points] To transform a point on the cylinder $C$ into the desired cylinder $C'$, in which order would you multiply the three transformations: translate ($T$), rotate ($R$), and scale ($S$) to achieve the desired effect?

$$C' = \underline{\text{__________________________}} * C$$
In a previous question you described how to compose transformations within a single transformation block (trans block). When coding Sceneview, you will also have to compose transformations whenever there is an object tree block contained within a trans block. Consider the following contrived excerpt from a scene file:

```xml
<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>
```

Suppose you composed the two transformations in the outer trans block, calling the result CTM1, and composed the transformations in the inner trans block, calling the result CTM2. Show the order in which you must multiply these matrices to obtain a single composite matrix with the desired effect on the sphere.

### 4 Parse Tree

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 traverse the parse tree provided by SceneParser.

### 5 How to Submit

Hand in a PDF version of your solutions using the following command:

```
provide comp175 a3-alg
```