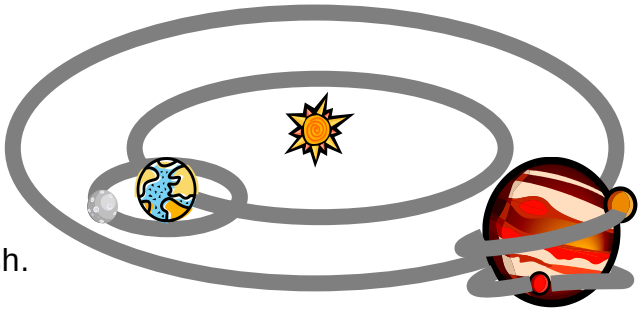
CS 418: Interactive Computer Graphics Spring 2019
In-class Worksheet 3

Viewing and Hierarchical Modeling

1. Modeling a (part of) a Solar System

Fix the following code so that it correctly models the Earth and Moon positions. You can insert Push/Pop commands and rearrange any lines of code you wish.



```
PushMatrix
Scale(7917,7917,7917)          // Set Earth diameter
Translate (AU,0,0)             // AU = distance from Earth to Sun
Rotate 360*days/365,(0,1,0)    // Rotation around sun
Scale (2159,2519,2519)         // Set moon diameter
Rotate 360*days/27,(0,1,0)     //  Moon rotation around Earth
Translate 238856,0,0           // Earth to moon distance
DrawMoon
DrawEarth
PopMatrix
```

PushMatrix
Rotate 360*days/365,(0,1,0)
Translate (AU,0,0)
PushMatrix
Rotate 360*days/27,(0,1,0)
Translate 238856,0,0
Scale (2159,2519,2519)
DrawMoon
PopMatrix
Scale(7917,7917,7917)
DrawEarth
PopMatrix

2. **Memory Layout of Matrices in WebGL**

Suppose we have the following transformation matrix:

$$\begin{bmatrix} a & b & c & t_x \\ d & e & f & t_y \\ g & h & i & t_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Write down the column-major layout of the matrix in memory:

a,d,g,0,b,e,h,0,c,f,l,0,tx,ty,tz,1

Write down the row-major layout of the matrix in memory:

a,b,c,tx,d,e,f,ty,g,h,i,tz,0,0,0,1

3. **View Transformation**

What viewing transformation matrix is produced by having the eyepoint at (1,0,0) with the lookat point at (4,0,0) and an up vector of <0,1,0>?

w=<-1,0,0>, u=<0,0,1>, v=<0,1,0>

$$\begin{bmatrix} 0 & 0 & -1 & 1 \\ 0 & 1 & 0 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}^{-1} = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ -1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$