

Worksheet 2: More Matrices & Transformations

CS770/870

Fall 2008

1. Suppose you want to create a 2D model for a small Ferris wheel with four cars. The model is composed of a Frame object plus 4 Car objects. A Car is composed of a Cage object a 2 Seat objects and a Door object. A Frame is composed of a Rim object and 8 Spoke objects.

Draw an object hierarchy tree with arcs labeled with a matrix designation (like the one for the Bicycle we did in class). For each leaf in the tree write the composite transformation matrix needed to make coordinates in the leaf to world coordinates. The Ferris wheel should be placed in the world with a matrix labeled F.

2. Consider the composite matrix: $M = R_x(\alpha)R_y(\beta)R_z(\gamma)S(s_x, s_y, s_z)T(d_x, d_y, d_z)$. Write the inverse of M. The components of your inverse should all be expressed without using the -1 (inverse) notation.

3. Describe how to create a rotation about an arbitrary axis defined by the point (p,q,r) and the vector (u,v,w) . Use a rotation about Y and then a rotation about Z (to align the axis of rotation with the X-axis), followed by a rotation about X of the desired amount, followed by appropriate inverse rotations.

4. Given the diagram on the right. what is the “handed-ness” of the following coordinate systems:

- a. pxa
- b. axp
- c. apx
- d. xap

