City College of New York
And
Graduate Center of City University of New York

G5501 Introduction to ROBOTICS

Homework #1

Due: Sep. 13, 2005

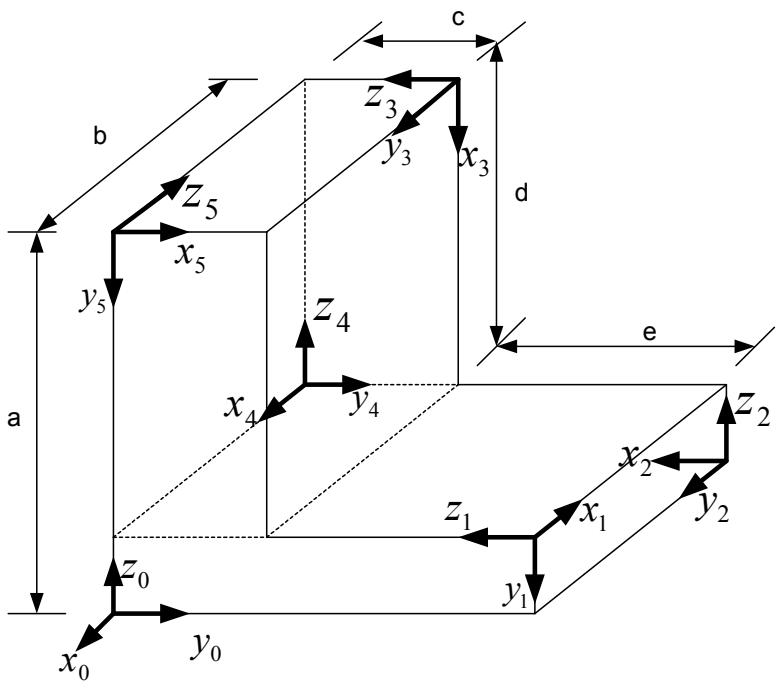
1. What is the rotation matrix for a rotation of 30º about the OZ axis, followed by a rotation of 60º about the OX axis, followed by a rotation of 90º about the OY axis? (10 points)

2. What is the rotation matrix for a rotation of ϕ angle about the OX axis, followed by a rotation of ψ angle about the OW axis, followed by a rotation of θ angle about the OY axis? (10 points)

3. Find another sequence of rotations that is different from Prob. 2, but which results in the same rotation matrix. (10 points)

4. Determine a T matrix that represents a rotation of α angle about the OX axis, followed by a translation of b unit of distance along the OZ axis, followed by a rotation of ϕ angle about the OV axis? (10 points)

5. For the figure shown below, find the 4x4 homogeneous transformation matrices ${}^{i-1}A_i$ and ${}^{0}A_i$ for i=1, 2, 3, 4, 5. (30 points)
   Note: can you find the answer by observation based on the geometric interpretation of homogeneous transformation matrix?



6. For the figure shown below, find the 4×4 homogeneous transformation matrices ${}^{i-1}A_i$ and ${}^{0}A_i$ for i=1, 2, 3, 4. (30 pints)

   Note: can you find the answer by observation based on the geometric interpretation of homogeneous transformation matrix?