**ME192 Quiz 1**

**9/10/14**

Name \_\_\_\_\_\_\_KEY\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Score \_\_\_24/20\_\_(4 points for each problem)\_\_\_

1. A finer breakdown of the robot joint types (*revolute and prismatic*) is Linear (L), Orthogonal (O), Rotational (R), Revolving (V), and Twisting (T). Starting from the base, sequentially list the joint type of each axis of the below robot. Example: L-O-R-V-T

Cartesian \_\_\_\_\_\_\_L-L-O-T\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

SCARA \_\_\_\_\_\_\_V-R/V-O-T (/ for or)

Six Axes \_\_\_\_\_\_\_R/V-R/V-R/V-R-R-R (/ for or)

2. Indicate the differences, by “zero” or “non-zero”, between the revolute joint types in view of the D-H parameters, *ai* (link length) and *di* (link offset). Strictly, the two X axes intersect at a rotational joint.

Link Length Link Offset

Rotational non-zero \_\_ Zero\_\_\_\_\_

Revolving non-zero\_\_ Non-zero\_

Twisting Zero\_\_\_\_\_\_ Non-zero\_

3. Using the orthonormal properties of a 3x3 robot rotation matrix, answer the following:

 

4. Frame {B} is constructed by rotating frame {A} about its Y axis by θ and by shifting its origin by Δx, Δy, Δz.



 Construct a transformation matrix describing the operation below:



 



θ

θ















 5. From , show that  [*Hint: *].





 



6. EXTRA Credit: Given the element positions of the joint-to-joint transformation matrix of a robot, indicate

 where the terms αi-1, a i-1, θi, and di will appear. *Hint: Columns for joint I, rows for joint i-1*.

 