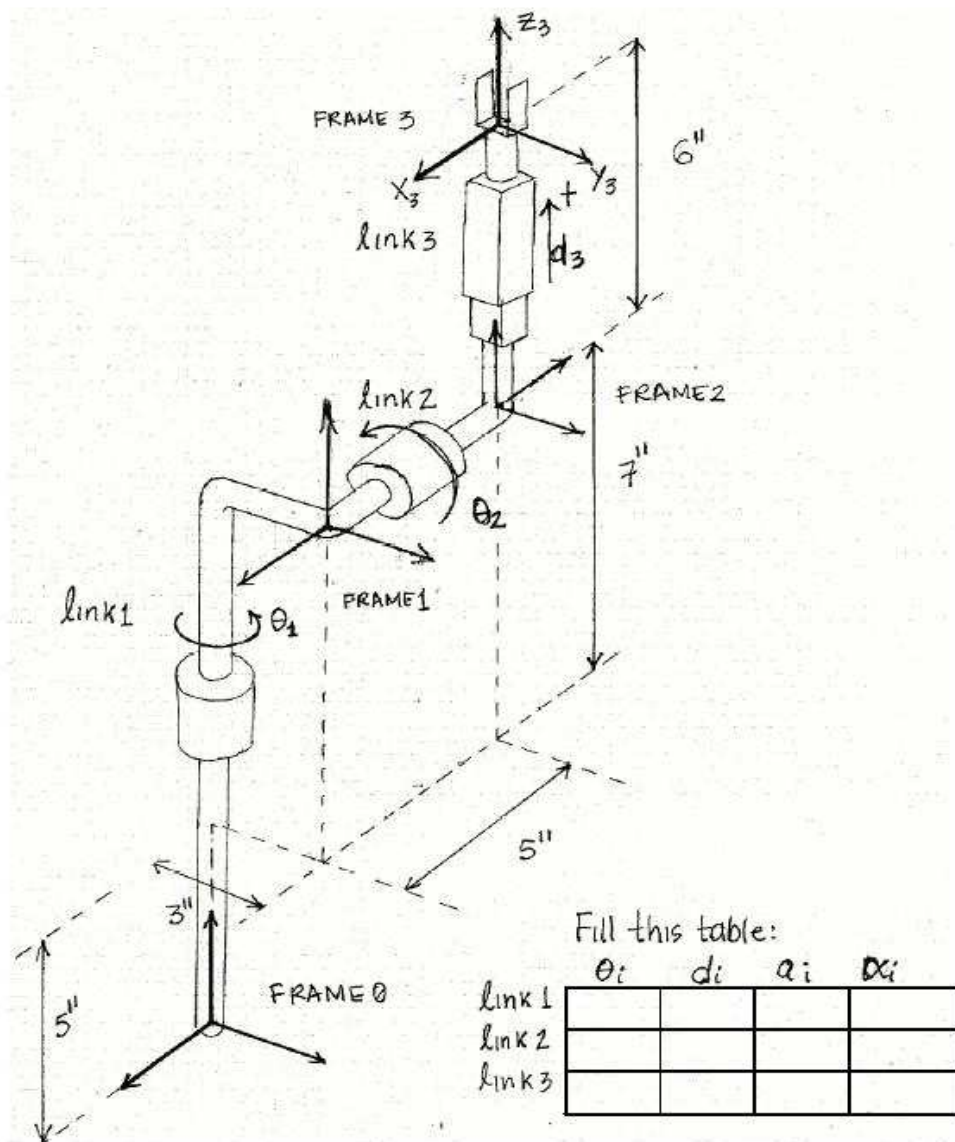


CS545 Homework #2

Question 1: (15 points)

- a) (5 points) Do you think the assigned reference frames to the joints are correct for the following robot? If not, draw the correct assignment (justify your answer). If yes, specify x, y and z axes for all the given frames.



b) (5 pts) Fill out the DH parameters in the given table.

Each item 0.5pts

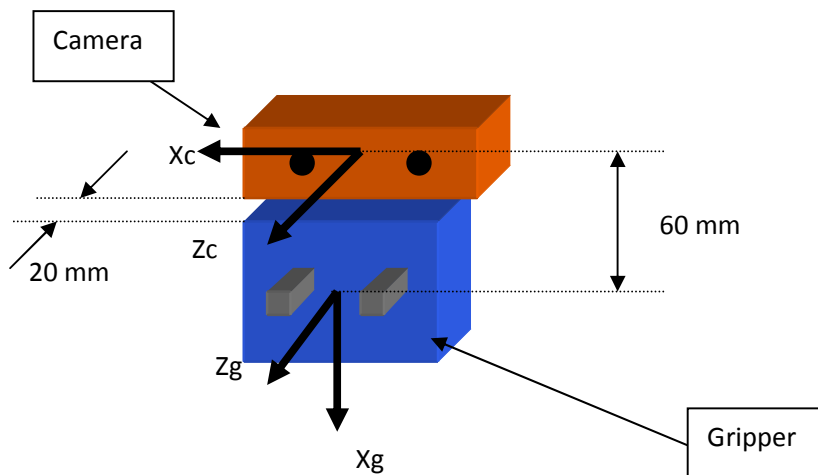
	$\theta(i)$	$\alpha(i)$	$a(i)$	$d(i)$
1				
2				
3				

c) (5 pts) Calculate the homogeneous transformation matrix from frame 3 to 0 (H_3^0) (you need to show the intermediate steps).

Question 2: (10 points) Transformations

A robot is equipped with a stereo camera on its gripper. The camera returns the pose of an object with respect to its own coordinate frame shown as X_c , Y_c , and Z_c in the image. Also the gripper's coordinate frame is shown as X_g , and Z_g . If the homogeneous transformation matrix of the gripper to frame zero is given as follows, calculate the homogeneous transformation matrix from the camera to frame zero (in other words, give the transformation which can be used to calculate the pose of an object in frame zero rather than camera frame).

$${}^0_g T = \begin{bmatrix} r_{11} & r_{12} & r_{13} & p_x \\ r_{21} & r_{22} & r_{23} & p_y \\ r_{31} & r_{32} & r_{33} & p_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$



Q3. (5 points) Problem 2-39 in the textbook

Q4. (5 points) Problem 3-10 in the textbook

Q5. (5 points) Problem 3-14 in the textbook

Q6. (5 points) Problem 3-16 in the textbook

Q7. (5 points) Problem 3-21 in the textbook