CSE4421: Assignment 2

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Complete the full inverse kinematics of either the A150 or A255 arm. Matlab implementations of the full forward kinematics can be found here:

```
/cs/dept/www/course/4421/src/matlab/forwardA150.m
/cs/dept/www/course/4421/src/matlab/forwardA255.m
```

The inverse kinematics for the Lab 4 problem (up to joint 3 actuated) can be found here:

```
/cs/dept/www/course/4421/src/matlab/inverseA150_lab4.m
/cs/dept/www/course/4421/src/matlab/inverseA255_lab4.m
```

Note that the DH-parameters for joint 4 are different than those for Lab 4 because of the presence of joint 5. Also note that the origin for frame 5 is located on the plate that attaches to the gripper (for your project you will probably want to move the origin of frame 5 to somewhere between the gripper fingers).

Undergrads may choose to attempt either of two variations of this problem; *graduate students must attempt variation 2*:

1. Solve the inverse kinematics given the location of the origin of frame 5 relative to frame 0 *and* assuming that the z-axis of frame 5 is pointing exactly downwards in the world (in the $-z$-direction of frame 0). In this case you do not care about orientation of frame 5 (ie. you can choose the solution with $\theta_5 = 0$) and you can apply the planar 3R solution discussed in class. There is only one valid solution for the joint angles given the physical constraints on the joint angles.

2. Solve the inverse kinematics given the full pose of frame 5 relative to frame 0. In this case, there is only one valid solution but you must find the full set of 5 joint angles.

Your solution should return 5 joint angles in degrees measured relative to the horizon (ie. a set of joint angles that can be passed directly to the robot). You should submit electronically your documented source code (in Matlab, C, C++, or Java); if you submit anything other than Matlab it must be compilable and executable by me on a Linux workstation in Prism. You should not use symbolic mathematical solvers in your source code.

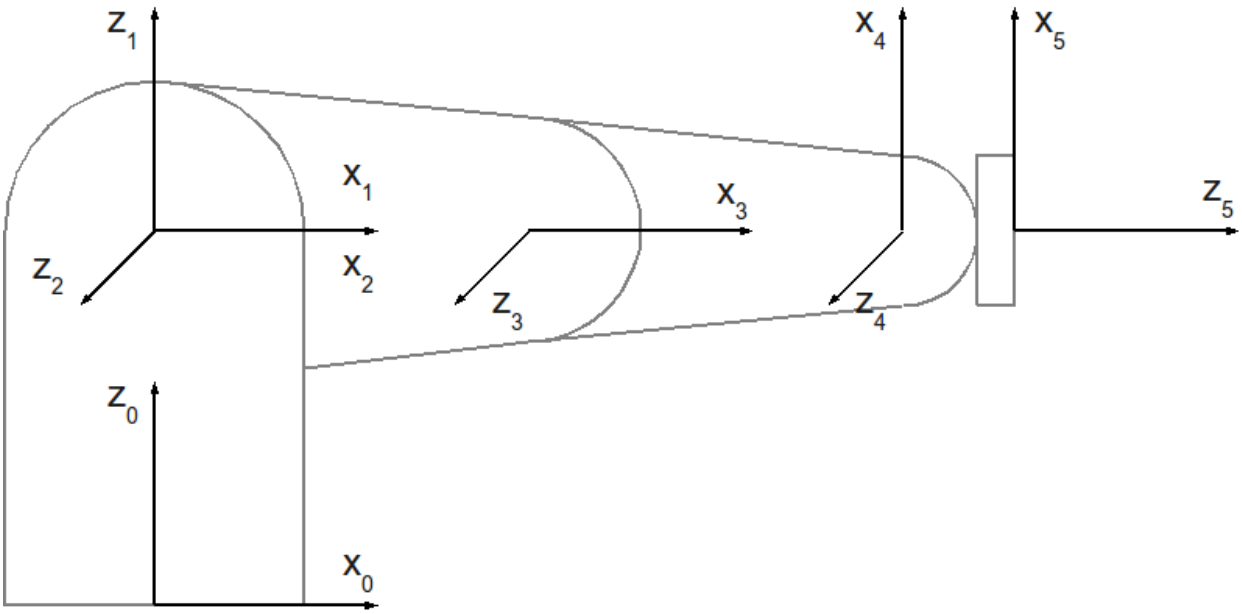

Table 1: A150 Denavit-Hartenberg parameters in inches and degrees.

i	a_{i-1}	α_{i-1}	d_i	θ_{i-1}
1	0	0	10	θ_1
2	0	90	0	θ_2
3	10	0	0	θ_3
4	10	0	0	$90 + \theta_4$
5	0	90	2	θ_5