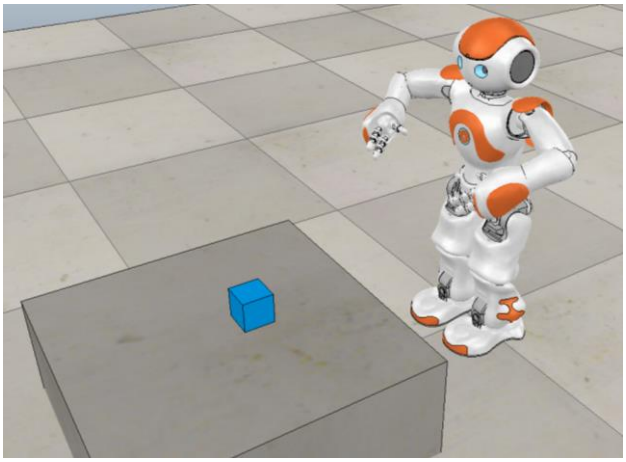
Problem

In the figure below, a setup including a NAO robot and an object is shown. The initial configuration is shown in figure (a) to (c). The robot rotates θ as it is shown in figure (d). Suppose that the transformation matrices between the hand frame and the arm frame (A_{RH}^{RA} and A_{LH}^{LA}) are given.

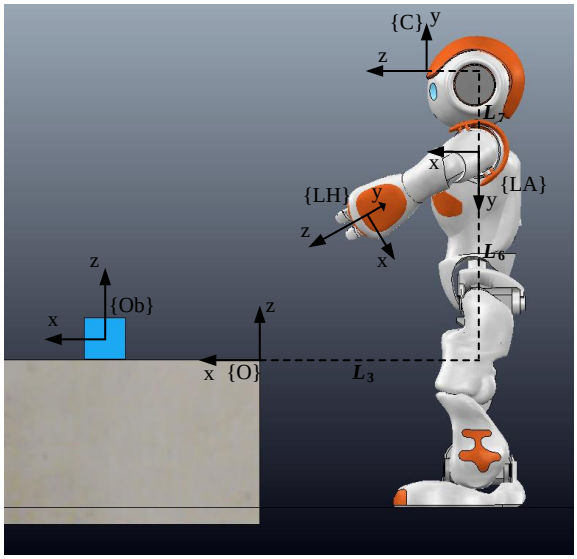
a) Derive the transformation matrices of all the frames with respect to {O}. (1 point)

b) Suppose the coordinate of the object is $[x_{ob} \quad y_{ob} \quad z_{ob}]$ in {O}. What is the object coordinate in {RA}? (1 point)

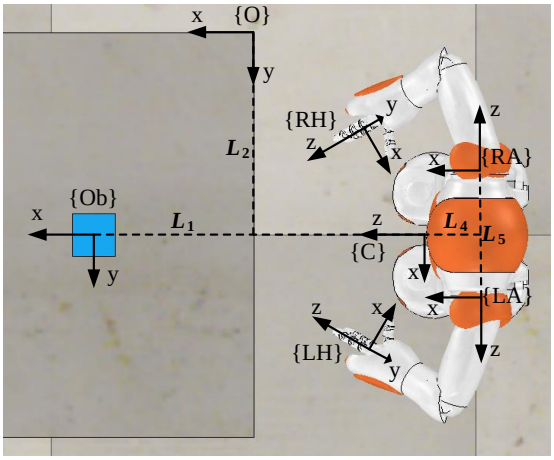
c) Assume $L_1 = L_3 = L_5 = L_6 = 1$ m and $\theta = 0$. Write down the orientation of {LA} with respect to {Ob} using quaternion with the help of rotation matrix between two frames. (1 point)



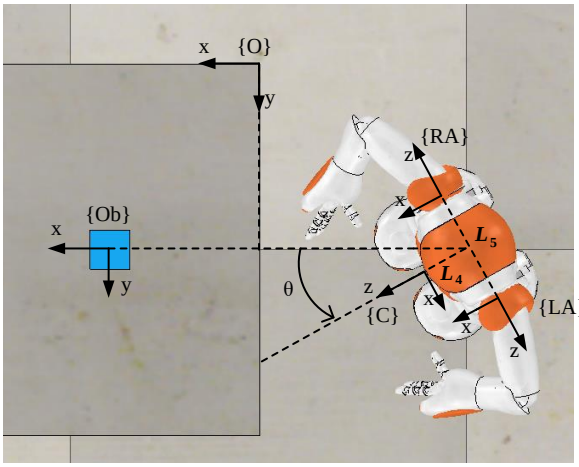
(a)



(b)



(c)



(d)