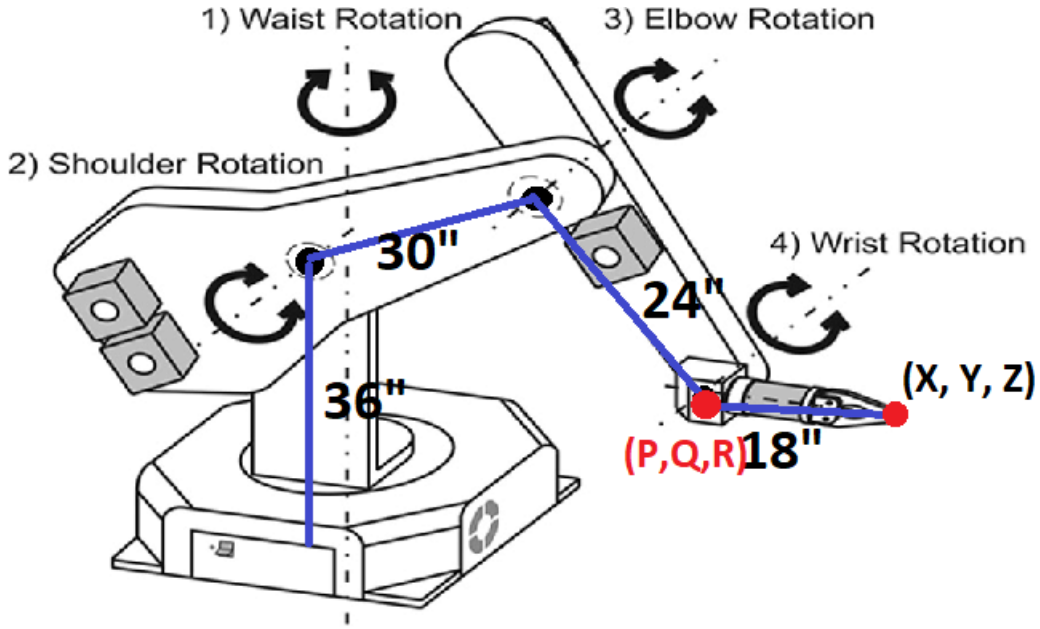
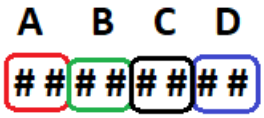
Considering following manipulator with four degree of freedom (4DOF) where height of shoulder from ground is 36”, Length from shoulder to elbow is 30”, Elbow to wrist is 24” and wrist to end point is 18”.



And if your ID is: **“# # # # # # # #”**



Question-1: Marks (10)

If we rotate waist **A*10** degree, shoulder **B*10** degree, elbow **C*10** degree and wrist **D*10** degree, what would be the value of X, Y and Z coordinate of the endpoint.

NB. Show every steps of calculation. If your answer is even correct but you do not show the calculation step you might get 0 mark.

Question-2: Marks (10)

If the coordinate value of the (P,Q,R) is (**D, C, B**)

What would be the rotating value of waist, shoulder and elbow?

NB. Show every steps of calculation. If your answer is even correct but you do not show the calculation step you might get 0 mark.

Question-3: Marks (2.5)

To move the end point of our arm from coordinate to another coordinate different motor will give different angle of movement. What is your idea, how can we achieve smooth movement?

Question-4: Marks (2.5)

Since the length of each arm is fixed, validity of X, Y, Z coordinate value sometime depend on the value of each other (that mean some time X is valid for a value of Y, Z but it will become invalid for some other value). How will we be able to handle it?