

## Midterm question 3

November 1, 2022

### Part A

For this question we simply need to compute a valid solution to these three equations,  $1.2 = c_1c_4s_5.2 - s_1c_5.2 - s_1d_3$ ,  $.8 = s_1c_4s_5.2 + c_1c_5.2 + c_1d_3$ ,  $.5 = -s_4s_5.2 + d_1 + d_2$ . For this we are considering  $d_1$  to be 0. First we will solve the most easy part, the z axis. If we hold  $\theta_4$  and  $\theta_5$  at their current values we get .3 for  $d_2$ . Conveniently if we keep  $\theta_4$  and  $\theta_5$  at their current position our other equations simplify nicely to  $1.2 = -\sin \theta_1 d_3$  and  $.8 = \cos \theta_1 d_3$ . I then used wolfram alpha to solve this system of equations, which gave me  $d = \frac{2\sqrt{13}}{5}$  and  $\theta_1 = 2.15$ .

### Part B

In part A the solution i found would result in a total of .1m of movement from  $d_2$ , 1.13m of movement from  $d_3$  and  $2.15^\circ$  in  $\theta_1$ . Comparing this to other solutions that include moving the "hand" part of the arm this is the lowest.