Practice Set 6

Robotics & Automation
Dylan Losey, Virginia Tech

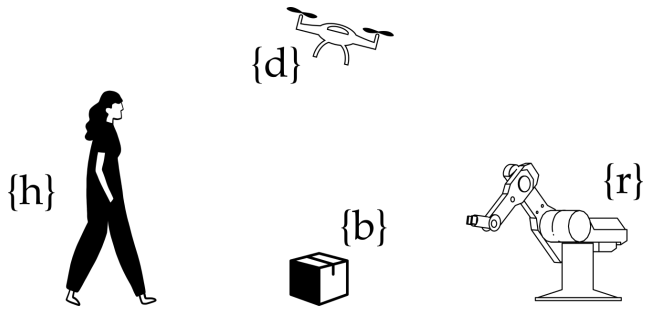
Using your textbook and what we covered in lecture, try solving the following problems. For some problems you may find it convenient to use Matlab (or another programming language of your choice). The solutions are on the next page.

Problem 1

In the following examples we try to multiply transformation matrices. Write the output. If the multiplication is incorrect, explain why.

- $T_{ab}T_{bc}T_{cd} = ?$
- $T_{hr}T_{hb}T_{bd} = ?$
- $T_{sb}T_{cb}^{-1}p_{cd} = ?$

Problem 2



We have a human, a drone, a box, and a robot arm. You know the transformations T_{hb}, T_{db}, and T_{rb}. Write an equation using these transformations to find T_{rh}.

Problem 1

In the following examples we try to multiply transformation matrices. Write the output. If the multiplication is incorrect, explain why.

- $T_{ab}T_{bc}T_{cd} = ?$

  > Use the subscript cancellation rule. Here: $T_{ab}T_{bc}T_{cd} = T_{ad}$

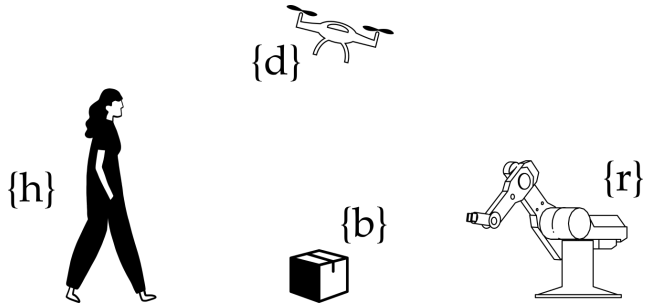
- $T_{hr}T_{hb}T_{bd} = ?$

  > Notice that we have $T_{hr}T_{hb}$. Multiplying these matrices does not follow the subscript cancellation rule, so the setup here is incorrect.

- $T_{sb}T_{cb}^{-1}p_{cd} = ?$

  > Use the subscript cancellation rule while remembering that $T_{cb}^{-1} = T_{bc}$. Here: $T_{sb}T_{cb}^{-1}p_{cd} = T_{sb}T_{bc}p_{cd} = p_{sd}$

Problem 2



We have a human, a drone, a box, and a robot arm. You know the transformations T_{hb}, T_{db}, and T_{rb}. Write an equation using these transformations to find T_{rh}.

> Using the subscript cancellation rule:
>
> $$T_{rh} = T_{rb}T_{hb}^{-1} \tag{1}$$
>
> To find this, try drawing a path from the start $\{r\}$ to your goal $\{h\}$. Then figure out what transformations you can leverage to move through that path.