

CS289 Mobile Manipulation

Fall 2026

Assignment 1

Submit your solutions to GitLab in folder called hw1

Dear students,

This semester, we will be using the rvc3python package for practical assignments. We will be utilizing its Python version. As there is relatively limited online information available about the rvc3python package, we encourage all of you to carefully read the literature and dedicate time and effort to learning this library.

This assignment is related to our textbook “Fundamental Algorithms in Python” Chapter I Foundations – 2 Representing Position and Orientation, starting from page 23). There is an installing tutorial at page 716 or you can go to its github website for reference:

<https://github.com/petercorke/RVC3-python/tree/main>

For the first two tasks, you need to finish them in the given jupyter notebook file. The last one we prefer you to use latex/markdown to give your answer, but handwritten answers are also acceptable.

A tutorial on using AI models:

We encourage you to use AI to help you finish the homework and learn new knowledge. Here, we will provide a simple tutorial on using AI.

First, the university offers an agent platform service: <https://genai.shanghaitech.edu.cn/dashboard/analysis>. You can log in to the website and use local models without limits and a small quota for closed-source models. You can apply for API access to enable agentic development support, but you must follow the rules of the platform, and the experience may vary depending on resource availability.

Besides, you can use multiple models and clients such as Claude code and Codex, or use plugins for the corresponding models in Vscode. A relatively cost-effective option is to purchase DeepSeek credits and integrate them into client tools via API key. You can refer to <https://github.com/deepseek-ai/awesome-deepseek-agent/tree/main> for more details.

If you have any questions about how to access AI services or how to use them including prompting engineering, you are welcome to ask on Piazza or through WeChat.

Please fill out the survey on using AI: <https://wj.qq.com/s2/27940326/7ilv/>.

Problem 1:

Create a 2D rotation matrix. Visualize the rotation using trplot2 . Use it to transform a vector. Invert it and multiply it by the original matrix; what is the result? Reverse the order of multiplication; what is the result? What is the determinant of the matrix and its inverse?

Problem 2:

Now we have a robot which is at the position (4,5,6) in world coordinate. The rotation sequence from the robot coordinate system to the world coordinate system is as follows: first, rotate 45 degrees around the X-axis, and then rotate 30 degrees around the Y-axis.

Now we have a point P at the position (1,2,3) in world coordinate. Now you need to find out the position of P in robot coordinate.

Problem 3:

Write down the rotation matrices that correspond to a coordinate frame rotation of θ about the x-, y- and z-axes separately.

Then calculate and write down the rotation matrix that corresponds to a coordinate frame rotation of α about the x-axes, β about the y-axes and γ about z-axes.

Submit as *problem3.pdf*.

Problem 4:

AI usage: Submit a PDF document (named *AI_usage.pdf*) where you detail how you used AI in this HW (for the previous problems):

- Which AI did you use (if any)
- What did you use it for (any use is allowed!)
- Include some prompts you used (In the original language you used)