

# HW Setup and Grading

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CURLY  
Explore the Unknown

# Overview

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1. Homework Setup
2. Homework Files
3. Homework Submission
4. Debugging Process








# Homework Setup

# Homework Files

- Each homework assignment contains Python (.py) files and notebook (.ipynb) files
- The notebook contains instructions for each problem
- Implement solutions in the .py files

 hw1_code_template.zip	Jan 9, 2024	Jan 9, 2024	Junzhe Wu	13 KB	✓
 hw1_student.ipynb	Jan 9, 2024	Jan 9, 2024	Junzhe Wu	28 KB	✓



 target_tracking.py
 probability_basics.py
 hw1_student.ipynb
 estimation.py
 covariance_propagation.py
 bayes_filter_b.py
 bayes_filter_a.py

# Notebook Setup

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- Minimal packages required, and only CPU
- Can run locally or using Google Colab
  - If local, you need a local Python environment installed.

# Local Notebook

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1. Install Jupyter: <https://jupyter.org/install>
2. Download homework files, navigate to folder
3. Run jupyter notebook `tigeriv@psyched:~/Data/MobileRobotics/Hw1$ jupyter notebook`
4. Open link in a browser

To access the notebook, open this file in a browser:

`file:///home/tigeriv/.local/share/jupyter/runtime/nbserver-8805-open.html`

Or copy and paste one of these URLs:

`http://localhost:8888/?token=8ee34607959e46913b3dc70f135d05f6bdced89d20109328`

or `http://127.0.0.1:8888/?token=8ee34607959e46913b3dc70f135d05f6bdced89d20109328`

# Local Notebook

[Quit](#)[Logout](#)[Files](#)[Running](#)[Clusters](#)

Select items to perform actions on them.

[Upload](#)[New ▾](#)

<input type="checkbox"/> 0 ▾	/	Name ▾	Last Modified	File size
<input type="checkbox"/>	hw1_student.ipynb		20 minutes ago	27.8 kB
<input type="checkbox"/>	bayes_filter_a.py		8 days ago	1.91 kB
<input type="checkbox"/>	bayes_filter_b.py		8 days ago	2.1 kB
<input type="checkbox"/>	covariance_propagation.py		8 days ago	11.9 kB
<input type="checkbox"/>	estimation.py		7 days ago	3.65 kB
<input type="checkbox"/>	probability_basics.py		8 days ago	1.38 kB
<input type="checkbox"/>	target_tracking.py		8 days ago	1.21 kB



















# Colab Setup

## 1. Place Files in Google Drive

My Drive > MobileRobotics > hw1 ▾

✓ ☰ ⓘ

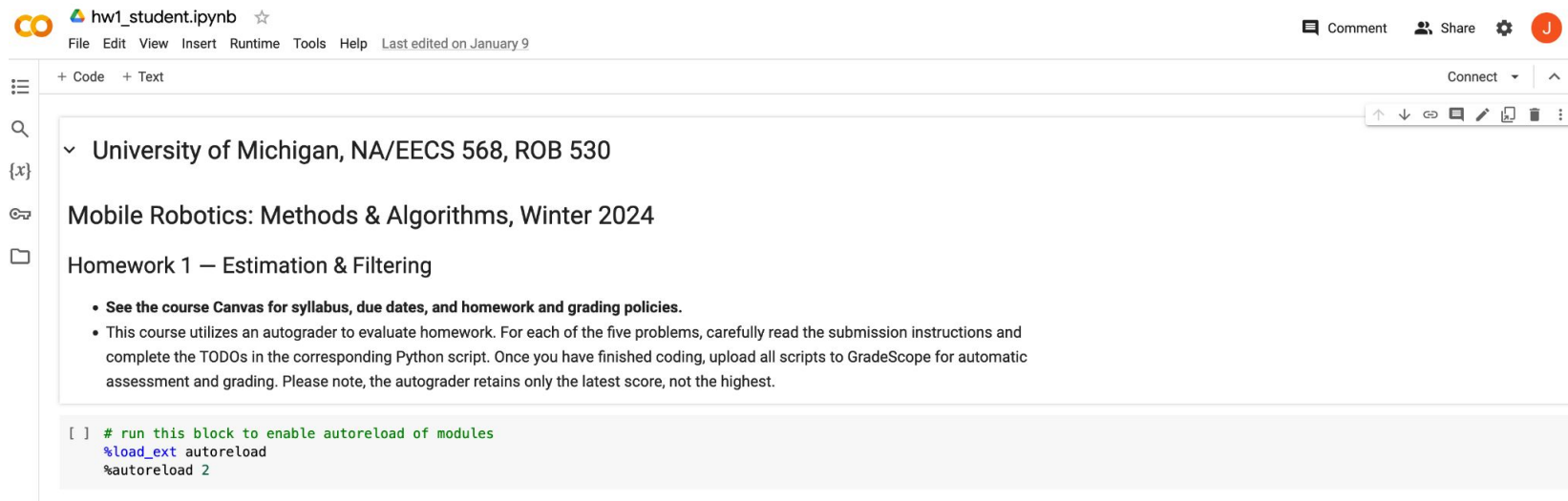
Type ▾ People ▾ Modified ▾

Name ▾	Owner	Last modified ▾	File size	
 target_tracking.py	 me	Jan 8, 2024 me	1 KB	⋮
 probability_basics.py	 me	Jan 8, 2024 me	1 KB	⋮
 hw1_student.ipynb	 me	Jan 9, 2024 me	27 KB	    ⋮
 estimation.py	 me	Jan 9, 2024 me	4 KB	⋮
 covariance_propagation.py	 me	Jan 8, 2024 me	12 KB	⋮
 bayes_filter_b.py	 me	Jan 8, 2024 me	2 KB	⋮
 bayes_filter_a.py	 me	Jan 8, 2024 me	2 KB	⋮



# Colab Setup

## 2. Open ipynb

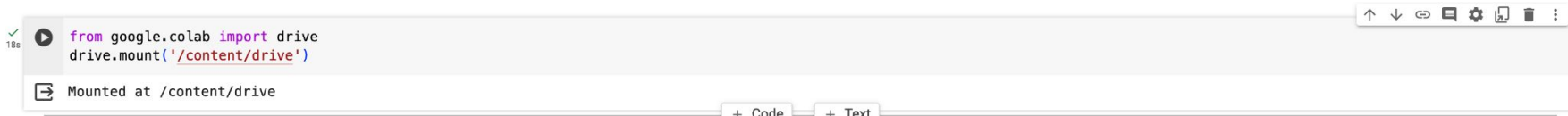


The screenshot shows a Google Colab notebook titled "hw1\_student.ipynb". The interface includes a top menu bar with options like File, Edit, View, Insert, Runtime, Tools, and Help. On the right, there are buttons for Comment, Share, and a user profile icon. Below the menu bar, there are tabs for "+ Code" and "+ Text". The main content area displays a document titled "University of Michigan, NA/EECS 568, ROB 530" with a subtitle "Mobile Robotics: Methods & Algorithms, Winter 2024". The document content includes "Homework 1 — Estimation & Filtering" and a list of instructions: "See the course Canvas for syllabus, due dates, and homework and grading policies." and "This course utilizes an autograder to evaluate homework. For each of the five problems, carefully read the submission instructions and complete the TODOs in the corresponding Python script. Once you have finished coding, upload all scripts to GradeScope for automatic assessment and grading. Please note, the autograder retains only the latest score, not the highest." At the bottom of the notebook, there is a code cell with the following text: 

```
[ ] # run this block to enable autoreload of modules
%load_ext autoreload
%autoreload 2
```

# Colab Setup

3. Add the following cell and run to mount your drive

A screenshot of a Google Colab code cell. The code is: 

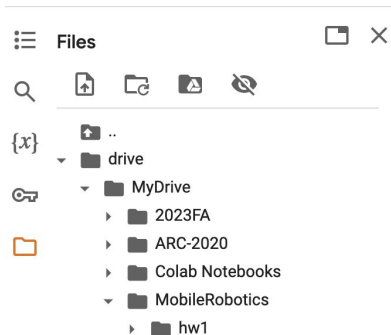
```
from google.colab import drive
drive.mount('/content/drive')
```

 Below the code, it says "Mounted at /content/drive". The cell has a toolbar with icons for undo, redo, insert, settings, and others. At the bottom, there are tabs for "+ Code" and "+ Text".

```
from google.colab import drive
drive.mount('/content/drive')
```

Mounted at /content/drive

4. Add a cell with your drive path (can be found to the left)



```
import os
GOOGLE_DRIVE_PATH_AFTER_MYDRIVE = "MobileRobotics/hw1"
GOOGLE_DRIVE_PATH = os.path.join('drive', 'My Drive', GOOGLE_DRIVE_PATH_AFTER_MYDRIVE)
print(os.listdir(GOOGLE_DRIVE_PATH))
```

# Colab Setup

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5. Add the .py files to your path (make sure to keep the autoreload block)

```
import sys
sys.path.append(GOOGLE_DRIVE_PATH)

import time, os
os.environ["TZ"] = "US/Eastern"
time.tzset()
```

**Demo**

# Homework Files

# Workflow

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- Notebook contains all problems with a point total, and point distribution

## Problem 1. Probability Basics (20 points)

Rick has collected four points (in 2D space); let's call this set  $r$ . He has computed their mean and (biased) sample covariance to be:

$$\mu_r = \begin{bmatrix} 2 \\ 3 \end{bmatrix} \quad \Sigma_{rr} = \begin{bmatrix} 5 & 3 \\ 3 & 7 \end{bmatrix}$$

And Morty has collected six points (from the same 2D space); let's call it set  $m$ , finding their mean and (biased) sample covariance to be:

$$\mu_m = \begin{bmatrix} -2 \\ 2 \end{bmatrix} \quad \Sigma_{mm} = \begin{bmatrix} 8 & 4 \\ 4 & 3 \end{bmatrix}$$

### 1.a (5 points)

If Rick computed the sum (over all  $r$  points) of  $xx^T$ , what value would he have computed? (Show work and provide a numerical answer.)

# Workflow

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- For each problem, implement solution in corresponding Python file
- This implementation is what we will call to check your work!
  - Do not change file names

## Submission

Please fill the **TODOs** in the function contained in **probability\_basics.py** and submit the file to gradescope.

```
from probability_basics import *

mu_r = np.array([[2], [3]])
sigma_rr = np.array([[5, 3], [3, 7]])
mu_m = np.array([[-2], [2]])
sigma_mm = np.array([[8, 4], [4, 3]])
ans_1a, ans_1b, ans_1c, ans_1d = probability_basics(mu_r, sigma_rr, mu_m, sigma_mm)
print('Answer for problem 1a:\n', ans_1a)
print('Answer for problem 1b:\n', ans_1b)
print('Answer for problem 1c:\n', ans_1c)
print('Answer for problem 1d:\n', ans_1d)
```

```
Answer for problem 1a:
0
Answer for problem 1b:
0
Answer for problem 1c:
0
Answer for problem 1d:
0
```

# Homework Submission



# Submission

- Upload all Python files to Gradescope (separate or as a .zip)
- Each sub-problem will be graded, can be a discrete or continuous scale

## Submit Programming Assignment

Upload all files for your submission

Submission Method

☒ Upload ☐ GitHub ☐ Bitbucket

Drag & Drop

Any file(s) including .zip. Click to browse.

## Homework 1 -- Estimation & Filtering

● Graded

Student

Unknown Student (removed from roster?)

Total Points

90 / 100 pts

Autograder Score

90.0 / 100.0

Failed Tests

1b) test\_q1b (test\_score.TestProblem1) (0/5)

5a) test\_q5a (test\_score.TestProblem5) (0/5)

Passed Tests

Check submitted files (0/0)

1a) test\_q1a (test\_score.TestProblem1) (5/5)

1c) test\_q1c (test\_score.TestProblem1) (5/5)

# Debugging

# Steps to Debug

Encountering Bugs is normal, try these steps

1. Locate the error message in your code
  - a. Think about what the error message is telling you, what might be breaking
2. Check Piazza
  - a. People may have already encountered the same issue
3. Copy and search for **key phrases** of the error on the internet

Programmers. Everyday.



<https://about.gitlab.com/blog/2021/03/31/3-debugging-tips-we-learned-from-you/>

# Example

```
-----  
ValueError                                Traceback (most recent call last)  
/tmp/ipykernel_9242/818448814.py in <module>  
    1 mat_1 = np.random.rand(4, 2)  
    2 mat_2 = np.random.rand(3, 2)  
----> 3 mat_3 = mat_1 @ mat_2  
  
ValueError: matmul: Input operand 1 has a mismatch in its core dimension 0, with gufunc signature (n?,k),(k,m?)->  
(n?,m?) (size 3 is different from 2)
```

The error message indicates the line, and issue (incorrect shape in matrix multiplication when computing `mat_3`). We can also find similar problems with solutions on sites like StackOverflow (can ask ChatGPT as well).



13



You are transposing a Matrix with 3 rows and 1 column to a Matrix with 3 columns and 1 row. Then you are multiplying it with a similar Matrix (also 3 columns 1 row) which is incorrect mathematically. So you can either remove the transpose function or define your R Matrix as 1 row 3 columns and then transpose it. Check [this](#) for further information.

Share Improve this answer Follow

edited Oct 6, 2021 at 8:22

answered Dec 13, 2019 at 6:36



IcesHay

359 ● 2 ● 13

# Still Stuck?

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1. Make a **public** post on Piazza
  - a. First, state what you are working on and where the error is occurring.
  - b. Next, indicate what you have tried and what you think.
  - c. Include the error message, but do not share your answer.

If you are unable to solve the problem through the previous methods

2. Come to **office hours**, and tell us what you are working on, what you have tried, and what you think may be occurring. We will try our best to help.
3. If you are unable to make it to office hours, as a last resort make a private Piazza post with your code and all previous information.