

Graded Assignment 2

Math Basics for Machine Learning

Fall 2022

Instructions

This is the second graded assignment for the Math Basics for Machine Learning course. It contains two tasks. The instructions, as well as links to supplementary material, are given in the task descriptions below.

You should submit the **detailed solutions** to the tasks, as well as your code by filling in [the corresponding Google form](#).

You can earn 12 points for this assignment. This score will contribute to your final score for this course.

You must submit your answers by **Monday, October 24, 23:59** [Anywhere on Earth](#). *Late submissions will **not** be accepted.*

It is the idea that you complete this assignment individually. Do not collaborate or copy answers of somebody else.

Have fun!

1 System of linear equations (2.5 points)

This task is supposed to be solved by hand. Please attach your solutions to the submission form as a .pdf file. Always show how you arrive to the solution and provide reasonably detailed explanations. Answers stated without any comments won't be accepted.

In Lecture 3, we (very briefly) reviewed how to solve a system of linear equations (SLE) via Gaussian elimination. At that point, we were focusing more on determining how many solutions to a given system are there. In this exercise, you will also need to find the solutions themselves.

Before you start, you can see a more detailed example of finding *general* and a *particular* solution of an SLE [here](#) or [here](#).

Now, consider the following SLE:

$$\begin{cases} x_1 + 2x_2 + x_3 = 1 \\ -x_1 - 2x_2 + x_3 = 2 \\ 2x_1 + 4x_2 + 2x_3 = 2 \end{cases}$$

1.1 (0.5 points) Matrix notation

Re-write this system as $Ax = b$. What are A , x and b ?

1.2 (0.5 points) Number of solutions

How many solutions does the system above have? Answer using ranks of the matrix A and $[A|b]$.

1.3 (1 points) General solution

Find a *general* solution to this system.

1.4 (0.5 points) Particular solution

Give an example of a *particular* solution.

2 Method of least squares (9.5 points)

This is a programming task dedicated to the method of least squares. You can find the assignment in the [Google Colab notebook](#).

First, make your own copy of the notebook (*File* \rightarrow *Save a copy in Drive*) or download the notebook to your machine if you prefer to work locally (*File* \rightarrow *Download*).

Then, implement your solutions to the tasks formulated in the notebook. You can add **code cells** to write some code and **text cells** in case you want to include additional explanations to your answers in plain English.

Finally, save your notebook as a .pdf file and attach it to the submission form. **Make sure that all the cells are executed and all relevant outputs are being printed out.**