

A1 (5%) Submission due on 16th Sept. 2022 (Week 6 Friday)

Given $\mathbf{X}\mathbf{w} = \mathbf{y}$ where $\mathbf{X} = \begin{bmatrix} 1 & 4 \\ 4 & 2 \\ 5 & 6 \\ 3 & -3 \\ 9 & -10 \end{bmatrix}$ and $\mathbf{y} = \begin{bmatrix} -1 \\ 2 \\ 1 \\ 0 \\ 4 \end{bmatrix}$ which constitute an exemplary problem. Write a Python routine

to find the least squares solution for \mathbf{w} given arbitrary $\mathbf{X} \in \mathcal{R}^{5 \times 2}$ and $\mathbf{y} \in \mathcal{R}^{5 \times 1}$. Submit your Python codes as a function routine (“def A1_MatricNumber(X,y)”) that takes in \mathbf{X} and \mathbf{y} as inputs and generate $(\mathbf{X}^T\mathbf{X})^{-1}$ and \mathbf{w} as outputs in a single file with filename “A1_StudentMatriculationNumber.py”. Your Python routine should return one matrix $(\mathbf{X}^T\mathbf{X})^{-1}$ and the least squares solution vector \mathbf{w} (as numpy array). Hint: you will need “import numpy as np” and its matrix manipulation functions.

Instructions:

- Please use the python template provided to you. Do not comment out any lines. Remember to rename both “A1_StudentMatriculationNumber.py” and “A1_MatricNumber” using your student matriculation number. For example, if your matriculation ID is A1234567R, then you should submit “A1_A1234567R.py” that contains the function “A1_A1234567R”.
- Please do NOT zip/compress your file. Please do not redefine \mathbf{X} and \mathbf{y} inside your function. The function will take in inputs $\mathbf{X} \in \mathcal{R}^{5 \times 2}$ and $\mathbf{y} \in \mathcal{R}^{5 \times 1}$.
- Please test your code at least once. Python is case sensitive.
- Note that only non-singular matrix will be given.
- Because of the large class size, **points will be deducted if instructions are not followed**. The way we would run your code might be something like this

```
>> import A1_A1234567R as grading
>> InvXTX, w = grading.A1_A1234567R(X,y)
```

Marks allocation is based on the two outputs: InvXTX (2%), w (3%)

Please make sure you replace “StudentMatriculationNumber” and “MatricNumber” with your matriculation number!

Submission folder: LumiNUS >> files >> A1

(The submission folder in LumiNUS will be closed at 2359 hour)