

**A1 (5%) Submission due on 28 February, 2024 (Week 7, Wednesday)**

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

to find the approximated solution  $\mathbf{w}$  for this over-determined system 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: Canvas/EE2211/Assignments/A1**

**(The submission folder in Canvas will be closed at 23:59 on February 28, 2023 (Wednesday) sharp. No extensions will be entertained.)**