A1 (5%) Submission due on 19th September 2025 (Week 6, Friday)

Given $\mathbf{Xw} = \mathbf{y}$ where $\mathbf{X} = \begin{bmatrix} 1 & 1 \\ 4 & 2 \\ 4 & 6 \\ 3 & -6 \\ 0 & -10 \end{bmatrix}$ and $\mathbf{y} = \begin{bmatrix} -3 \\ 2 \\ 1 \\ 5 \\ 4 \end{bmatrix}$ which constitute an exemplary problem. Write a Python routine to find the approximated solution **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 **X** and **y** as inputs and generate $(\mathbf{X}^{\mathbf{T}}\mathbf{X})^{-1}$ and **w** as outputs in a single file with filename "A1_StudentMatriculationNumber.py". Your Python routine should return one matrix $(\mathbf{X}^{\mathbf{T}}\mathbf{X})^{-1}$ and the least squares solution vector **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 **X** and **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 Friday of Week 6 sharp. No extensions will be entertained.)