Mathematical Skills for Data Scientists
Lab Exercises 2 – 3 Marks (Due: 17/10/22, 11 am)

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Once the scripts are ready, use `diary` to log what happens in your command window when you run them. Save the log in a `.txt` file. Submit the `.m` files and the log.

A Matlab script is stored in a `.m` file. Learn about them here: `https://uk.mathworks.com/help/matlab/learn_matlab/scripts.html` When you write a script, terminate a line with a semicolon `;` to prevent the output being printed to the command window and cluttering everything. A function can also be stored in a `.m` file. Learn more here `https://uk.mathworks.com/help/matlab/matlab_prog/create-functions-in-files.html` See Introductory Matlab materials for further information.

Exercise 1 (For loops)**.** Write a Matlab script which uses a for loop to calculate the L^2 norm of $v = (3, 2, -1, -2)^{\mathrm{t}}$.

The script should begin with the line `v = [ 3; 2; -1; -2]` and then iterate over the entries of v to carry out the calculation. The correct answer is approximately 4.24.

Once this is working, amend your script to create a function `mynorm` which can calculate the norm of any vector of any length.

Input: `v`, a vector.

Output: `mynorm(v)`, the norm of `v`.

In the command window, use your function to calculate the norm of `w = [ 2; 9; -4; -6; 7; 0; 1]`.

Exercise 2 (Linear dependence)**.** Consider the equation $Ax = v$ where

$$A := \begin{pmatrix} 1 & 1 & 3 \\ 1 & 0 & 2 \\ 0 & 1 & 1 \end{pmatrix}, v := \begin{pmatrix} 2 \\ 2 \\ 6 \end{pmatrix}.$$

Try `x = A \ v`.

Now consider a matrix

$$H := \begin{pmatrix} 0 & 0 & h \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}.$$

Write a script with a for loop that solves $(A + H)x = v$. Start with $h = 1$ and divide h by 2 with each iteration of the loop. Run ten iterations. Calculate the norm of each solution vector x using `mynorm`.

Input: None – this is just a script, not a function. A, H and v should be hard-coded.

Output: A vector containing the norms of each solution `x` from each iteration.

Run your script from the command window.