CHEM-E7140/2019: Assignment I, part 1

Exercise 1. Use Matlab (or else) to create i) two random matrixes A of size (3×4) and B of size (4×3) and, ii) a random vector x of size (3×1). Use function `rand` to generate the needed random numbers.

Write down A, B and x and perform by hand the following operations

- $y = Bx$

- $z = Ay$

- $C = AB$

- $w = Cx$

Show your calculations and indicate the dimensions of y, z, C and w.

Validate your calculations by writing a piece of Matlab (or else) code that performs the aforementioned operations and displays the results. Show your code with comments that explain your implementation and comment the results.

Exercise 2. Given C from the previous exercise, write Matlab (or else) code to compute

- The rank of C, $\text{rank}(C)$

- The determinant of C, $\det(C)$

- The dimensions of the null space of C, $\text{null}(C)$

- The eigenvalues $\{\lambda_i\}$ and associated eigenvectors $\{\nu(\lambda_i)\}$ of C and their dimensions

Then, let T be a matrix whose columns are the eigenvectors of C and compute the following

- $D = T^{-1}CT$ and its dimensions

- $v = Dx$ or $v = T^{-1}CTx$ and its dimensions

Show your code with comments that explain your implementation. Comment on the results.