## Homework 7

Ch En 263 – Numerical Tools

Due date: 12 May 2020

## Instructions

- For the problems in Excel, submit a workbook named "LastName\_FirstName\_HW7.xlsx" where each worksheet tab is named "Problem\_1", "Problem\_2", etc.
- For the problems in Python, submit a separate file for each problem named "Last-Name\_FirstName\_HW7\_ProblemXX.py" where XX is the problem number.
- For your convenience, optional Excel and Python template files are available on the course website.
- If needed, a supplementary handwritten or typed document can be submitted via pdf on Learning Suite with the name "LastName\_FirstName\_HW7.pdf".
- Please report how long it took you to complete the assignment (in hours) in the "Notes" section on Learning Suite.

## Problems

- 1. Do the following in a Python file.
  - (a) Define a Python list called my\_list, a Python tuple my\_tuple and a Numpy array my\_array with the values x = [4, 7, -2, 5, 13].
  - (b) Find the length of the list, and print it to the console.
  - (c) Print the value of the 3<sup>rd</sup> element of the tuple to the console.
  - (d) Print the value of the last element of the array to the console. *Hint: Remember that indices start counting at zero.*
- 2. Do the following in a Python file.
  - (a) Create a numpy array with the values in the matrix below.

$$\begin{bmatrix} 1 & -5 & 6 & -1 & 0 \\ 5 & 2 & 0 & 4 & -2 \\ -7 & -7 & 1 & -8 & 4 \\ -5 & 7 & 2 & -9 & 5 \\ 5 & 3 & 0 & 2 & 1 \\ 0 & 6 & 4 & 0 & 2 \end{bmatrix}$$

- (b) Use the numpy.shape function to print the shape of the array to the console.
- (c) Print the following values to the console: (3<sup>rd</sup> row, 4<sup>th</sup> column), (6<sup>th</sup> row, 1<sup>st</sup> column), (5<sup>th</sup> row, 2<sup>nd</sup> column)
- (d) Extract a  $2\times 2$  matrix that spans the  $4^{\rm th}\text{-}5^{\rm th}$  rows and  $1^{\rm st}\text{-}2^{\rm nd}$  columns. Print it to the console.
- 3. Do the following in a Python file.

- (a) Use a loop to fill an array with the sequence: 1, 4, 9, ..., 144. Print the array to the console.
- (b) Use a loop to find the average of the values in the array and print the value to the console.
- (c) Find the average of the values in the array using a function in the numpy module and print the value to the console. A list of the functions in the numpy module can be found here: https://docs.scipy.org/doc/numpy-1.13.0/reference/routines.html
- 4. Do the following in a Python file.
  - (a) Use loops to create a 2D numpy array to store the values in this  $10 \times 10$  matrix:

Γ2	-5	4	-1	0	0	0	0	0	[ 0
0	2	-5	4	-1	0	0	0	0	0
0	0	2	-5	4	-1	0	0	0	0
0	0	0	2	-5	4	-1	0	0	0
0	0	0	0	2	-5	4	-1	0	0
0	0	0	0	0	2	-5	4	-1	0
0	0	0	0	0	0	2	-5	4	-1
0	0	0	0	0	0	0	2	-5	4
0	0	0	0	0	0	0	0	2	-5
				~	~	~	0	0	~

Print the array to the console. *Hint: The main diagonal is where the row number equals the column number.* 

(b) Use slicing to assign the 3rd row of the matrix to the variable  $\boldsymbol{x}$ . Square each element in  $\boldsymbol{x}$  and print thier values to the console.