Winter 2020
Sébastien Combéfis

NC301μ Introduction to Numerical Computing with SciPy

Mission 3: Time complexity of `ndarray` operations

This assessment evaluates the following competencies:

- *PP401 – Use Numpy to represent multidimensional arrays and perform operations with them (+2)*
- *PP411 – Draw a simple plot representing data with Matplotlib (+2)*

You may also be assessed on the following competencies:

- *PP431 – Select the appropriate algorithm of the Scipy module to solve a problem (+2)*
- *NC401 – Compare different numerical computing algorithms regarding performance and precision (+2)*

In this mission, you have to compare the time complexity of performing operations on a multidimensional arrays represented with Python list and with `ndarray` from the Scipy ecosystem. A program to show you how to measure the execution time of a function is available [1].

The operation that you have to compare is the matrix multiplication. You have to draw a plot showing the evolution of the execution time to multiply two square matrices with increasing size n. To succeed the mission, you have to:

1. Complete the provided program by implementing the matrix multiplication functions.
2. Use the method to measure the execution time to collect them for increasing size of matrices and plot it.
3. Choose another operation on `ndarray` (sum of elements, trace of matrix, finding the minimal value, etc.) and compare its execution time with the same operation done with Python lists.
4. Explain to the teacher the problem you selected, its mathematical description and the code you wrote to solve it.

Optionally, you may experiment with other features of the Scipy ecosystem. You may want to compare algorithms from the `scipy` module, for example.

[1] The code can be found here: https://github.com/ukonline/uCourse/blob/master/NC301%C2%B5/code/measuretime.py