

Task 02 – Computational Hello World

When people start programming, it has become practically a meme that the first code test is printing 'Hello World' on the screen.

For numerical computing, I believe the best 'Hello World' equivalent could be related to Linear Algebra. The simplest operation in this field is the addition of two vectors.

- 1) Using an interpreted language of your choice, create a code that produces the following vector sum:

$$\vec{d} = a\vec{x} + \vec{y}$$

- a. a is a scalar and d, x, y are vectors of dimension N , with $N = 10, 10^6, 10^8$.
 - b. Choose the following values $a = 3$, $x = 0.1$ (for all the elements) and $y = 7.1$ (for all the elements).
 - c. Find a way to test that all the elements of d are equal to the sum of $a*x+y = 7.4$
- 2) Repeat point 1 using a compiled language of your choice
 - 3) Use both a compiled and interpreted language to solve the following matrix multiplication:

$$C = AB \rightarrow c_{ij} = \sum_{k=1}^N a_{ik} b_{kj}$$

- a. C, A, B are $N \times N$ matrices with $N = 10, 100, 10000$. A and B are matrices with values $A = \text{all } 3$ and $B = \text{all } 7.1$
 - b. Find a way to test that all the elements of C are equal to the product $AB = 21.3$
- 4) In the moodle page you will find the moodle application “Handout” with the title of this task, upload a single Markdown with the following items:
 - a. Source code for point 1, 2 and 3
 - b. Answer to the following questions

- i. Did you find any problems in running the codes for some N . If so, do you have an idea why?
- ii. Where you able to test correctly the sum and product of points 1-3? If so, how? If not, what was the problem?