

Herramientas Computacionales para Ciencias

Homework 7b

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How hard it is to calculate π ?

There are several strategies to do it, we are going to explore some of them.

Hint: just to compare!, an approximate value of π can be used on python as `numpy.pi`

Leibniz' way

Around 1676, Leibniz published a method to calculate π which was based on the integral of a geometric series or the $\arctan(\theta)$ series expansion.

$$\frac{\pi}{4} = \sum_{n=0}^{\infty} \frac{(-1)^n}{2n+1} \quad (1)$$

that means, that if you take the inverse of all the positive odd numbers and sum the even positions and subtract the odds, you get $\pi/4!!!$

$$\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} \dots$$

On this assignment, we are going to see if we can use this as an approximation to the value of π by using `numpy`.

Doing the code

We are going to study how this sum becomes π , to do so,

- Create a function `Leib` such that, return the n th element of the sum.
- Create two arrays, first `x` with the integers from 0 to 10 (Including the limits), and the second `y` with the value of the function `Leib` for every value on `x`.
- Create a new array `y2` by using the function `numpy.cumsum(y)`. This function creates an array where each value has the information of the cumulative sum of the parameter. So that,

$$y2[i] = \sum_0^i y[i] \quad (2)$$

- plot `y2` vs `x` by using the following line

```
import matplotlib.pyplot as plt
plt.plot(x,y2)
plt.show()
```

- Repeat for `x` from 0 to 100 and write some conclusions on a Markdown cell.

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