Calcolo Numerico - Esercitazione 1

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1 Machine precision

Exercise 1.1. Machine epsilon or machine precision is an upper bound on the relative approximation error due to rounding in floating point arithmetic. Execute the following code

```
import sys
help(sys.float_info)
print(sys.float_info)
```

- understand the meaning of `max`, `max_exp` and `max_10_exp`.
- Write a code to compute the machine precision ϵ in (float) default precision with a `while` construct. Compute also the mantissa digits number.
- Use NumPy and exploit the functions `float16` and `float31` in the while statement and see the differences. Check the result of `np.finfo(float).eps`.

2 Plot of a function

Exercise 2.1. Matplotlib is a plotting library for the Python programming language and its numerical mathematics extension NumPy. Create a figure combining together the cosine and sine curves, on the domain $[0, 10]$:

- add a legend
- add a title
- change the default colors

Exercise 2.2. The Fibonacci sequence is a sequence in which each number is the sum of the two preceding ones and it is formally defined as:

$$\begin{cases} F_1 = F_2 = 1 \\ F_n = F_{n-1} + F_{n-2} \qquad n > 2 \end{cases}$$

- Write a script that, given an input number n, computes the number F_n of the Fibonacci sequence.
- Write a code computing, for a natural number k, the ratio $r_k = \frac{F_{k+1}}{F_k}$, where F_k are the Fibonacci numbers.
- Verify that, for a large k, $\{r_k\}_k$ converges to the value $\varphi = \frac{1+\sqrt{5}}{2}$
- Create a plot of the error (with respect to φ)