Numerical Software Lab
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Spring term 2023
Project 1, due March 2, 2023 at 11:59 pm
to be uploaded to https://elearning.jacobs-university.de

CONSTRUCTOR UNIVERSITY

1. Project [100 points]

Write scripts which fulfill the following functions:

a) [40 points] Generate 201 points for x from -10 and 10 (both values included) and then determine $y = \cos(x)$. Moreover, calculate

$$f_N(x) = \sum_{n=0}^{N} (-1)^n \frac{x^{2n}}{(2n)!}.$$

for N=1, 3, 5, 7, 9, and 11, i.e., create six arrays with 201 elements containing the respective results. Later we will learn how to define functions, but that is not necessary here.

b) [40 points] Prepare a 2D plot of the seven arrays as a function of x, each in a different color and (partially) different line style. Please restrict the plotting along the y axis to (-10, 10). Lable the axes as "x" and "cos(x)" as well as put a title "Taylor expansion of cos(x)". Finally, add a legend. The plot shall be displayed on the screen and be exported as a pdf file.

c) [20 points] DNA consists of base-pairs denoted by the letters A, G, C and T. Write a piece of code that from a given string determines the number of C and A bases in this sequence. Test it on at least three different arbitrary sequences of A, G, C and T.

Happy coding!