

Computational Physics II

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Project 2, due March 10, 2021 at 11:55 pm

to be uploaded to <https://moodle.jacobs-university.de>



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2. Two-dimensional numerical integration [10 points]

- a) Write a program to implement the midpoint approximation in two dimensions and integrate the function $f(x, y) = 2x^2 + 3xy + y^2$ over the region defined by the condition $x^2 + y^2 \leq 0.5$. Use $h = 0.1, 0.05, 0.025$, and 0.0125 .
- b) Repeat part a) using a Monte Carlo method and the same number of points n . For each value of n , repeat the calculation several times to obtain a crude estimate of the random error.
- c) Discuss the differences in the errors of the results in part a) and b).

General remarks for all Projects

You will have to (i) analyze the problem, (ii) select an algorithm (if not specified), (iii) write a Python program, (iv) run the program, (v) visualize the data numerical data, and (vi) extract an answer to the physics question from the data.

Which checks did you perform to validate the code? State the results you got for these tests.

For each project you will submit a short report describing the physics problem, your way of attacking it, and the results you obtained. Provide the documented Python code in such a form that we can run the code. A Jupyter Notebook including the code and report is fine but not necessary.