

Computational Finance

In-Tutorial Exercises

In-Tutorial Exercise 03

We want to evaluate definite integrals using Monte-Carlo integration. Write a function

`MC_integration (N, f, a, b)`

which computes the MC-estimator of a definite integral of a function f on $[a, b]$, i.e.

$$\frac{(b-a)}{N} \sum_{i=1}^N f(x_i)$$

where x_i is uniformly distributed on $[a, b]$. Test your function by computing the integral

$$\int_0^1 \sqrt{1-x^2} dx$$

with $N = 10, 100, 1000, 10000$ samples.

Useful Python commands: `np.random.uniform`

In-Tutorial Exercise 04

Write a Python function

`Pi_approx(N)`

that approximates π by sampling $N \in \mathbb{N}$ random variables which are iid. $U([0, 1]^2)$ -distributed. Use the fact that the area of a circle with radius 1 is π . Display the result of your approximation in the console. Test your function with $N = 10, 100, 1000, 10000$. Plot each sampling process in an own subplot of the same plotting window. Plot only the samples that are inside of the circle sector.

Discussion in tutorial: Monday, 06.05.2024 and Tuesday, 07.05.2024
