

Université Paris-Dauphine
Exam Python for Finance

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This is an open book exam. You are allowed to use any course material and any other information on the internet.

At the end of the exam, send your solutions to `andras.niedermayer@dauphine.fr` as a Jupyter notebook containing the solutions.

1. Use the Cox-Ross-Rubinstein model to compute the value of an put option with time to maturity $T = 1/4$ years and strike price $K = 1000$. Assume that the current stock price is $S = 1000$, the risk-free rate $r = 0.05$, and the annual volatility $\sigma = 0.4$. Take $N = 29$ steps for the calculation.
 - Consider an American put option. Compute the value of the option.
 - Consider a European put option. Compute the value of the option.
 - Explain the difference in prices between the two types of options.

2. Consider two normally distributed random variable $X \sim N(5, 10)$ (that is, mean 5 and standard deviation 10) and $Y \sim N(4, 10)$. The random variable Z takes that value X with probability 0.5 and the value Y with probability 0.5, i.e.

$$Z = \begin{cases} X & \text{with probability 0.5,} \\ Y & \text{with probability 0.5.} \end{cases}$$

Run a monte carlo simulation with 10000 random draws from the distribution of Z .

- Plot a histogram of the draws of X , Y , and Z .
- Compute the value at risk for Z for $\alpha = 0.01$ based on the Monte Carlo simulation.
- Compute the expected shortfall for Z for $\alpha = 0.01$ based on the Monte Carlo simulation.