

Assignment #4

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Advanced Quantitative Analysis in Finance

Exercise 1. Pricing an American Style Equity Derivative

Using the Binomial Asset Pricing Model, develop a Python-based American Style Equity Derivative pricing application. Input should be standard input to price a derivative via the black scholes equation, i.e. Underlying price, strike, risk free rate, time to maturity, and volatility. Also, your application should be able to compute the Greek sensitivities delta, gamma, and theta.

This will take time to understand, but also, there are many open-source versions of an application like this. Please understand any code that you might use and re-engineer it for your purpose.

Exercise 2. Pricing an Asian and Barrier Equity Derivative

Using the Monte Carlo simulation code developed in class, modify the code and price an Asian and also a Barrier (Knock-in and Knock-out) option. Remember that an Asian option's payoff is the average price realized by the diffusion path. A Barrier option will need an extra input which is the barrier price.

Barrier Knock-In Options (Up and In) or (Down and In)

- Up and In - If the diffusion **touches or exceeds** the barrier during the diffusion path, the payoff is valid. If the diffusion **never touches or exceeds** the barrier regardless of the diffusion path, the payoff is zero.
- Down and In - If the diffusion **touches or is less than** the barrier during the diffusion path, the payoff is valid. If the diffusion **never touches or is less than** the barrier regardless of the diffusion path, the payoff is zero.

Barrier Knock-Out Options (Up and Out) or (Down and Out)

- Up and Out - If the diffusion **touches or exceeds** the barrier during the diffusion path, the payoff is zero. If the diffusion **never touches or exceeds** the barrier regardless of the diffusion path, the payoff is valid.
- Down and Out - If the diffusion **touches or is less than** the barrier during the diffusion path, the payoff is zero. If the diffusion **never touches or is less than** the barrier regardless of the diffusion path, the payoff is valid.