Chennai Mathematical Institute

Financial Modeling using Python

Jan - Apr 2021 Semester

Final Assignment

Total Point: 70

Instructions:

- There are seven questions in this assignment. Each assignment is worth 10 points.
- Write all your answers in a single Python script with non-executable comments.
- Save your file name as your ***firstname_lastname.py***. For example ***mousum_dutta.py***
- Explain your python code with the non-executable comment as much as possible

Copying is fatal

Deadline: May 10, 2021 (by 11:59 pm)

Requests for extension will not be entertained.

Problem 1

The following website contains information companies listed in NIFTY 50.

https://tradebrains.in/nifty-50-companies-list/

Choose any 2 companies from the list.

Assume both stocks follow the geometric Brownian motion.

1. For each stock, compute maximum loss can occur in a day that you are 95% confident.
2. Suppose you have created a portfolio with two stocks with equal quantity. What will be the maximum loss that can occur in a day that you are 95% confident?
3. Suppose you have X amount. How you will distribute the amount into two stocks so that the variance of the portfolio is minimum.

You have to submit all program/calculation along with the name of the stocks and historical data you used for calculation.

Problem 2

The stock price 6 months from the expiration of a European call option is INR 42. The exercise price of the option is INR 40. The Risk-free interest rate is 10% per anum and the volatility of 20% per anum. Find the instantaneous value (in INR) of the call option. You have to submit the program you used to calculate or calculation you used.

Problem 3

Consider a 20-years 8% bond with the coupon paid semi-annually. What will be the present value of the bond? Use the following spot rates tables to compute the present value. Also, compute duration and convexity.

Period	Spot Rate
6M	2.90%
1 Yr	4.40%
2 Yr	4.80%
3 Yr	5.00%
5 Yr	5.30%
10 Yr	5.40%
20 Yr	5.50%

Problem 4

Suppose that the time to expiration is 4 months, the strike price is INR 95, the call premium is INR 6, the put premium is INR 3, the current stock price is INR 94, and the continuously compounded annual interest rate is 10%.
Explain or give an example, how you can earn a riskless arbitrage profit.

Problem 5

Consider a 2-year European call with a strike price of 55 on a stock whose current price is 50. In each time step (of one year) the stock price either moves up by 20% or moves down by 20%. Let the risk-free interest rate be 5%.
Construct a 2 - step binomial tree model and compute the current price of the call options.

Problem 6

A stock price follows. Geometric Brownian motion with an expected return of 10% and a volatility of 25%. The current price is 38. What is the probability that a European call

option on the stock with an exercise price of 40 and a maturity date in 6 months will be exercised?

Problem 7

What is the price of a European put option on a non-dividend-paying stock when the stock price is 69, the strike price is 70, the risk-free interest rate is 5% per annum, the volatility is 25% per annum, and the time to maturity is 6 months?