Chennai Mathematical Institute
Financial Modelling using Python
January 2025 Semester

Instructions:

- Save your file name as your rollnumber_Assignmentno_name_lastname.extension.
- For example MDS202101_assignment1_mousum_dutta.pdf
- If you write a program, explain your python code with the non-executable comment as much as possible
- Deadline: 27 April 2025 (by 11:59 pm)
- Requests for extension will not be entertained.

1. Suppose a student has taken an education load of size Rs 0.8 million. The interest rate is 12%. Write a python program that generates the schedule of repayment of the loan in 5 years (or 'n' number of years). Assume the first payment date is 01 January 2026. Also, show the breakup of each payment is principal and interest.

2. 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%

3. Complete the following tasks under this assignment.
    a. Download one-year INFY, and RIL stock prices from National Stock Exchange
    b. Compute the daily returns for both.
    c. Fit the return series separately to Generalized Gaussian distribution if you can or fit the normal distribution.
    d. Fit the T-Copula with the return series. You may use the `copulae` package for the same or your own.
    e. Construct a portfolio with equal units from both.
    f. Simulate 10,000 or more random returns of your portfolio using copula

g. And calculate the maximum loss you may have in a day that you can say with 95% confidence.

4. The following website contains information companies listed in NIFTY 50.
   https://tradebrains.in/nifty-50-companies-list/
   Choose the first 3 companies from the list.
   What will be the prices for both Call Option and Put Option derived from each of three companies' stocks? Assume,
   a. Risk free interest rate is 6% annually compounded.
   b. You are computing the prices on your last birthday.
   c. The Stock price is the last closing price prior to the computing date.
   d. Expiration date is exactly 3 months from the computing date.
   e. The Strike price is the1.2 times of last closing price one month prior to the computing date.
   f. Compute volatility based last 3 years data from computing date.
   g. Additionally:
      a. Compute the Delta, Gamma, Vega and Theta for each of the derivatives.
      b. Also – Construct a portfolio of consists of These three stocks and their derivatives such that the portfolio is Delta, Gamma and Vega neutral.
      c. Explain if such a portfolio cannot be constructed.

5. Assume you are assigned the task of evaluating the stock of Infosys (INFY). To evaluate the stock, you calculate required return using the CAPM. You can assume that the price of Infosys is fairly valued. The following information is available:
   - Expected Annual Nifty return is 10%
   - beta of INFY is 0.55
   - Risk free rate is 5.3%
   - The annualised volatility of market return is 15%

   Answer the following questions:
   a. Using CAPM, calculate the annual expected return of INFY
   b. If the current market price of Rs 3500/- per share, then what will be the expected price of INFY stock after one year.2.
   c. Find the annualised volatility of the return of INFY
   d. Assuming INFY return follows Gaussian distribution, what is the probability that after one year the INFY price will be less than Rs. 3500/-?