

**WESTMINSTER BUSINESS SCHOOL**

**Module Title: Computational methods for Finance**

**Module Code: 7FNCE041W**

**Host School of the Module: School of Finance and Accounting**

Deadline: 10th Jan 2024 13:00

**Note: The coursework is currently undergoing external examination. This is the provisional coursework, which may be subject to changes.**

**Individual Authentic Assessment**

**(Weighted 50%)**

**Assignment**

**Note:**

**Word Limit:** 2400 words excluding Title Page, Bibliography and Appendices. Except for quantitative answers, your word total for each answer should be approximately in proportion to the marks awarded to the question.

Q1. Python

Critique the following libraries in Python: numpy, pandas, matplotlib, and yfinance.

(1). Please explain what ‘library’ in Python is, how to use it, and what will happen without it when executing the relevant command. (5 marks)

(2). Compare four libraries: explain the features of each of them. Are there any similarities between some or all of them? Are there any differences between some or all of them? (10 marks)

(3). Show an application for each library in Jupyter notebook or Spyder by inserting and explaining a screenshot of the results. Please also include formula when needed. (10 marks)

**(Total: 25 marks)**

Q2. Implied volatility

1. Compare historical volatility and implied volatility: what are they? How to measure? Are there any similarities between them? Are there any differences between them? Please show formula when needed.

(4 marks)

b) Explain the Newton-Raphson iteration to estimate the implied volatility of a non-dividend European call option. Please show formula when needed.

1. marks)
2. Use Python to show the process in b). Please show the screenshots of codes in Jupyter notebook or Spyder and explain your codes step-by-step.
3. marks)
4. Estimate the implied volatility of Amazon’s Option. The Strike price K= $165, Expire Date is 19th January 2024. The three-month T-bill rate is 5.47% (the risk-free rate). Please show the screenshot of the spot price and call price via Yahoo finance. Please show the calculations step by step.

(12 marks)

1. Calculate the annual historical volatility of Amazon’s stock return. Compare the value of implied volatility with the value of historical volatility of the stock return and discuss whether the option price is under or overestimated.

(7 marks)

**(Total: 35 marks)**

Q3. Binomial Tree Option Pricing

Consider a non-dividend-paying stock where the spot price is $100, and its volatility is 20%, the risk-free rate is 5% per annum, the time to maturity is one year with four 3-month periods.

a) Calculate *u, d*, and the risk-neutral probability *p* for a four-step tree.

(3 marks)

b) Value the European call option with the strike is $100 with the four-step tree and risk-neutral probability you calculated in a).

1. marks)
2. Implement the above process in the Python. Please show the screenshot of Jupyter notebook or Spyder and the code should be explained step-by-step.

(12 marks)

1. Compare the results in b) and c) and explain why they are different/same.

(5 marks)

**(Total: 30 marks)**

**Assessment Criteria**

In addition to the marks above you will be awarded 10 marks based on report writing and presentation.

This is an individual coursework assignment, and Assessment Weighting for this individual assessment is weighted at 50%.

**Marking criteria:**

* Your marks will be based on your ability to:

- undertake critical financial analysis

- work independently, utilising your own initiative to undertake

the work e.g., finding sources of information, analysing different information

sources in different contexts etc.

-structure, organise, as well as general presentation of your report

-present a clear and concise report

* You are encouraged to make full use of all material available in the University and other sources, such as journals, newspapers, books etc. Any use of any data, reports, etc. should be correctly referenced by using Cite Them Right Harvard.
* In order to answer these questions, you will need to conduct independent research, learn, and show an understanding of financial analysis. You should apply concepts that you have learnt in the module, and on finance courses in general, when answering these questions.

**Submission Instructions**

Student must submit the assignment via Blackboard by 10th Jan 2024.

To submit your assignment:

• Log on to Blackboard at http://learning.westminster.ac.uk;

• Go to the relevant module Blackboard site;

• Click on the ‘Submit Coursework’ link in the navigation menu on the left-hand side, as advised by the module teaching team;

• Click on the link for the relevant assignment;

• Follow the instructions.

• You must submit in Word document.

Please note that your submission will be automatically be scanned by an automated plagiarism detection software. The University reserves the right to investigate plagiarism and this may affect your marks and studies.

If you submit later than an agreed submission deadline then your submission will be marked in accordance with the current University regulations (if they apply); you may apply for ‘Mitigating Circumstances’ if necessary.