

Computational Finance

Course style: Independent Study

Moderator: Mr. Kramer

Prerequisites: Programming & Algorithms, Data Structures

Duration: 0.5 credits, ½ Year

Course Description

In computational finance, students will employ their financial and programming skills to create a semester-long project that integrates finance and computer science. The course gives students exposure to traditional financial theories, quantitative portfolio management, data science, and Java, C++, or Python programming

(<https://www.cmu.edu/mscf/academics/curriculum/index.html>). By the end of the course, students are expected to create a financial model that assesses the rate of growth of a portfolio value while simultaneously considering how much risk is involved (<https://youtu.be/DYbnbClvWNU>). Students must do so by coding a software that automatically measures the rate of growth of any portfolio. After that, students must make a presentation that illustrates how a specific real-world company (students may choose the company) can use the students' software to its advantage. The presentation must be presented to Mr. Kramer by the end of the semester.

Throughout the duration of the course, students progress will be monitored through the following checkpoints:

1. Students know what a portfolio is and how the amount of risk affects its growth.
2. Students have a rough draft of what their financial model will entail.
3. Students have coded the software that measures the rate of growth of a portfolio value while simultaneously considering how much risk is involved.
4. Students have made a presentation that depicts how a real-world company can use the students' software and why it would be beneficial to them.

Grading

Each checkpoint will be worth 150 points each. There may also be mini assignments as deemed necessary by Mr. Kramer. These assignments and projects will be worth 100 points each.

Assignments

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In order to prepare for the final project, students will complete assignments and mini projects throughout the course to enrich their understanding of core computational finance concepts. Here are the assignments and mini projects, along with how much time will be allocated for each and what the purpose of each is.

First Marking Period

1. Students will work on the Python course on Codecademy
 - a. **Purpose:** in order to make a financial model that can accurately interpret and predict the rate of growth of a portfolio (the final project), students must have a good understanding of Python. Therefore, this course will develop students' expertise with working with Python.
 - b. **Timings:** Since this is a complete Python course, it will take really long to complete; therefore, students need to do as much as they need to complete the Python assignments.
 - c. **Link:** <https://www.codecademy.com/learn/learn-python>
2. Python Assignments + projects
 - a. To demonstrate their understanding of Python, students will have to complete the following assignments + projects:
 - i. **Assignment:** Learning Python Syntax
 - ii. **Assignment:** Make a tip calculator
 - iii. **Assignment:** Strings & Console Output
 - iv. **Project:** Python Mad Libs
 - v. **Assignment:** Conditionals & Control Flow + PygLatin
 - vi. **Assignment:** Python Functions
 - vii. **Assignment:** Python Data Structures Lists and Dictionaries
 - viii. **Assignment:** Lists and Functions
 - ix. **Assignment:** Python Loops
 - x. **Assignment:** Bitwise Operators + Lambda Expressions
 - xi. **Project:** RGB-HEX Converter
 - xii. **Assignment:** Introduction to Classes
 - xiii. **Assignment:** File Input/Output

Second Marking Period

3. Over the course of the second marking period, students will learn core financial concepts so that they can create the final project (as outlined by the [Carnegie Mellon Computational Finance Course](#))
4. Using the Coursera Computational Finance Course, students will learn factors that affect the growth rate of a portfolio
 - a. <https://www.coursera.org/learn/financial-engineering-computationalmethods>

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5. After learning what a portfolio is, what factors affect the growth rate of a portfolio, and what a financial model entails, students will finally create their final project.
6. **Final Project:**
 - a. The final project will consist of 2 parts: the software and the presentation
 - i. **Software:** Make a financial model that can estimate the growth rate of a portfolio based on the factors that students learned previously
 1. The program must ask the user for details about the portfolio and certain factors that will affect how it grows (for example, ask about specific real-world economic situations, such as the inflation rate)
 2. Then, the program will analyze the factors and predict how much the portfolio will grow
 - ii. **Presentation:**
 1. Students choose any company they wish and make a presentation on how that company can use their software for its benefit.