

**MATH 512**  
**Financial Informatics and Simulation**  
**SPRING 2017**

**Instructor:** Leonard Wong

**Time and Location:** MWF 11:00–11:50pm, VKC 152

**Email:** `tingkamw@usc.edu`

**Office Hours:** W 1–3pm, KAP 406H, or by appointment

**Teaching Assistant:** TBA

## Overview

This is an intensive course in computational finance with lots of coding and data analysis. We aim to give students hands-on experience in implementation of financial models, design and backtest of investment strategies, and the subtleties of dealing with simulated and empirical data. The course consists of two parts:

- I. Monte Carlo methods in financial engineering (about 60% of the semester): We will cover basic concepts of Monte Carlo simulation, and applications in finance such as derivative pricing and portfolio risk measures.
- II. Empirical finance and portfolio simulation (about 40% of the semester): We will use the free Quantopian platform (<https://www.quantopian.com/>) to study financial data and simulation of investment strategies.

## Prerequisites

Solid knowledge of basic probability theory and statistics, working knowledge of derivative pricing theory, and some familiarity with programming in C++.

## Required text

*Monte Carlo Methods in Financial Engineering*, by Paul Glasserman

## Coding

To give exposure to multiple languages, we will use C++ in Part I and Python in Part II. We will also use Python and R for plotting. We assume basic knowledge of C++, but will give brief reviews (e.g. STL vector) whenever needed. While previous experience in

Python (and/or other languages) is desired, we will start from the beginning. However, in the class we will focus more on the finance-related issues, and you are expected to learn the language along the way. A good source for Python is *Dive into Python* by Mark Pilgrim (<http://www.diveintopython3.net/>).

## Grading

There are no midterms and final exam.

- 70% Assignments
- 30% Project (presentation and written report)

Students will form groups of 1–2 to do the assignments, and groups of 2–3 for projects. You should keep the same group for the assignments, but may form different groups for the projects.

## Assignments

Assignments will be given roughly once in two weeks. A typical assignment consists of several questions featuring theoretical derivation/computation, coding and analysis of outputs. The submitted work should consist of a written (typed) report containing the analysis and numerical/graphical outputs as well as all source files (the codes). The TA and I may ask questions regarding the submitted materials, and small adjustments may be made to individual scores.

## Project

An end-of-semester project will be given to simulate the working environment: teamwork on real problems with deadlines, and communicating ideas and results with colleagues. The project has two parts:

- A financial application of Monte-Carlo
- Design and implementation of a trading strategy

In the last 2 weeks of the semester, each group will give a presentation (about 15 minutes) to explain the problem, the codes and the results. (One presentation for each part.) A written report will be collected at the end of the semester.

## Statement on Academic Conduct and Support Systems

### Academic Conduct

Plagiarism – presenting someone else’s ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in SCampus in Section 11, Behavior Violating University Standards <https://scampus.usc.edu/1100-behavior-violating-university-standards-and-appropriate-sanctions/>. Other forms of academic dishonesty are equally unacceptable. See additional information in SCampus and university policies on scientific misconduct, <http://policy.usc.edu/scientific-misconduct/>. Discrimination, sexual assault, and harassment are not tolerated by the university. You are encouraged to report any incidents to the Office of Equity and Diversity <http://equity.usc.edu/> or to the Department of Public Safety <http://capsnet.usc.edu/departement/departement-public-safety/online-forms/contact-us>. This is important for the safety whole USC community. Another member of the university community such as a friend, classmate, advisor, or faculty member can help initiate the report, or can initiate the report on behalf of another person. The Center for Women and Men <http://www.usc.edu/student-affairs/cwm/> provides 24/7 confidential support, and the sexual assault resource center webpage [sarc@usc.edu](mailto:sarc@usc.edu) describes reporting options and other resources.

### Support Systems

A number of USC’s schools provide support for students who need help with scholarly writing. Check with your advisor or program staff to find out more. Students whose primary language is not English should check with the American Language Institute <http://dornsife.usc.edu/ali>, which sponsors courses and workshops specifically for international graduate students. The Office of Disability Services and Programs [http://sait.usc.edu/academicsupport/centerprograms/dsp/home\\_index.html](http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html) provides certification for students with disabilities and helps arrange the relevant accommodations. If an officially declared emergency makes travel to campus infeasible, USC Emergency Information <http://emergency.usc.edu/> will provide safety and other updates, including ways in which instruction will be continued by means of blackboard, teleconferencing, and other technology.