MATH 6767: DESIGN AND IMPLEMENTATION OF SYSTEMS TO SUPPORT COMPUTATIONAL FINACE

Instructor: Dr. Shijie Deng (deng@gatech.edu)
Course Prefix and Number: MATH 6767 A
Term: Fall 2026
Classroom: TBA.

Course Information

Introduction to large-scale system design to support computational finance for the pricing and hedging of options, stocks, or other financial instruments. Some programming experience and previous exposure to stocks, bonds, and options required. Cross-listed with ISYE 6767.

Prerequisites:

Both C++ and Python will be covered in the course. No prior programming knowledge in C++/Python is required; however, some exposure to a computer program language will be very helpful.

Textbooks:

1. **Accelerated C++: Practical Programming by Example** by Andrew Koenig and Barbara E. Moo, (2000) Addison-Wesley Professional, 1st Edition.
2. *Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython* (2nd Edition) by Wes McKinney

Course Objective

The primary objective of this course is to equip students with the ability to implement complex financial models using **C++** and **Python**, bridging the gap between theoretical quantitative finance and practical programming. The C++ portion focuses on progressing from simple programs to sophisticated **object-oriented designs**. Basic Python programming tools and the advanced packages for scientific computing, machine learning, and financial data analysis will be reviewed. By completing coding quizzes, interim projects, and a final project focused on portfolio trading strategy or derivative pricing, students are expected to develop a "scientific-like attitude" toward investigating financial problems and gain the self-study skills necessary to advance their programming expertise in future professional environments.

Course Outcomes:

At the end of this course, we hope to help students build the following skills.

- Develop good habits for elegant coding, insightful analysis, and rigorous verification of results.
- Gain the ability to progress from writing basic code to designing and implementing sophisticated object-oriented programs in C++/Python; become proficient in using C++/Python for scientific computing, financial data analysis, and the application of machine learning methods.

- Implement complex quantitative finance models, such as Binomial and Monte Carlo models, using both C++ and Python.
- Build technical expertise in pricing and hedging financial derivatives, as well as managing quantitative portfolio trading through comprehensive course projects.
- Develop he ability to independently advance one's programming skills beyond the classroom to meet future professional or academic needs.

Software:

Open-source tools: Gnu C++11 and Python 3.12 (Anaconda distribution); VS Code or Code::Blocks as IDE; Boost library, and QuantLib.

Grading Policy:

Course grades will be based on assessment of students' understanding of the material covered throughout the semester through course assignments, quizzes and projects. Homework, quizzes, and projects are graded for correctness, with partial credit awarded for partial answers (e.g. work shown) or to account for minor errors. Homework assignments, quizzes, projects, and their respective weights in the course grade are as follows:
Homework and Attendance (20%): homework is assigned approximately every 1-2 weeks.
Quizzes (20%): 5 in-class, timed coding-quizzes.
Interim projects (30%): two individual projects.
Final Project (30%): group project with each group containing no more than two students.

Thresholds for letter grades: A >= 90%; 90% > B >= 80%; 80% > C >= 65%; 65% > D >= 50%; F <50%. The right to adjust the thresholds to avoid certain extreme cases is reserved.

Course Policy:

Participation is important in this class. Class attendance is mandatory and recorded by signing Attendance Sheet. Unexcused absences may affect your final grade. Up to three non-excused absences are allowed without questions asked. Interviews, family trips, meetings for other courses are not excused.

Working together on course assignments is allowed, but your handed-in solutions should be personal and show individual effort (NOT identical to the others' assignments nor the previous solutions). For the regular assignments, the students need to submit their solutions on Canvas by the due date/time (usually 11PM). Penalty will be imposed on late submission of assignments as specified in Late Submission Policy. In addition, we ask students to type homework and project reports in Word or Latex format. Make-up tests are not permitted except in cases of serious illness, Institute Approved absences, Dean's office recommended absences, or GT Athletic Association conflicts with appropriate documentations. All course materials and grades will be posted on Canvas. You are responsible to check if your posted grades are correct. You have three days from the day we return assignment or tests on Canvas for considering re-grading. We reserve the right to re-grade the entire assignment or test. So, you may lose more points than

you gain when we re-grade your assignment or test. Please let us know any special situation you may have during the semester ASAP.

Late Submission Policy

1) No make-up assignments. 5% grade deduction if submission received within 24 hours passing the due time. 15% grade deduction if submission received within 48 hours passing the due time. 50% grade deduction if submission received later than 48 hours after the due time.

Academic Integrity

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review Georgia Tech's Honor Code and the student Code of Conduct. Any student suspected of cheating or plagiarism on a quiz, exam, or assignment will be reported to the Office of Student Integrity, who will investigate the incident and identify the appropriate penalty for violations.

Student-Faculty Expectations Agreement

At Georgia Tech, we believe that it is important to strive for an atmosphere of mutual respect, acknowledgement, and responsibility between faculty members and the student body. The Student-Faculty Expectations document (https://catalog.gatech.edu/rules/22/) articulates some basic expectations that you can have of me and that I have of you. In the end, simple respect for knowledge, hard work, and cordial interactions will help build the environment we seek.

Accommodations for Students with Disabilities:

Georgia Tech provides upon request appropriate academic accommodations for students with disabilities. https://disabilityservices.gatech.edu/. If you are a student with learning needs that require special accommodation, contact the Office of Disability Services (404-894-2563) as soon as possible to discuss the needs and to obtain an accommodations letter. Please also e-mail me as soon as possible to set up a time to discuss your learning needs.

Core IMPACTS

Not applicable. (https://www.usg.edu/curriculum/core-impacts/ is the University System of Georgia's General Education curriculum.)

Collaboration, Group Work, and Use of Generative AI

You are allowed to work in groups on all homework and out-of-class assignments, but any assignment you turn in must be written in your own hand. Homework, tests and exams are to be your own work.

In general, use of Generative AI as assistant for learning course materials is allowed. However, direct use of AI-generated solutions (without writing them in your own hand) and/or any previous semester course materials (such as homework solutions and project submissions) as submissions to course assignments are prohibited in this course. Using these materials will be considered a direct violation of academic policy and will be dealt with in accordance with the GT Academic Honor Code. When in doubt regarding what constitutes a violation, do not guess the answer and post on Piazza for clarifications.