FIN 4770: Programming for FinTech

Prof. Matthew G. Son

E-mail: gson@usf.edu
Office Hours: by appointment
Office: BSN 3127

Web: USF Canvas / GitHub Classroom (TBA)
Class Hours: 12:30pm-01:45pm
Class Room: BSN 2205

Course Description

The objective of this course is to establish a fundamental understanding of programming in the field of finance, FinTech, and broader business applications. Students will start with basic programming concepts and methods, progress to practical applications in financial analysis, and advance to understanding concepts such as object-oriented programming, virtual environments and version control. The course will introduce popular programming language in finance, including R, Python, and Unix Shell. Additionally, students will learn how to leverage Generative AIs to enhance programming efficiency. Students will learn technical skills in financial modeling, quantitative analysis and technical documentation for business communications, which are essential in the rapidly expanding technology-intensive field of finance.

Prerequisites

Introductory level finance courses. No previous programming experience is required. It is anticipated that students have a general proficiency with computers.

Course Objective

This course aims to equip students with a comprehensive understanding of programming for applications in the financial technology sector. The objectives include mastering fundamentals in programming and developing proficiency in reading and writing code for financial applications. Through hands-on practices and real-world applications, the course seeks to enhance students' capabilities in solving financial analytics problems and communicate effectively with technology. The course strives to make programming enjoyable.

Learning Outcomes

Upon completion of this financial technology course, students will be able to:

1. **Recall** the basics of data manipulation, financial modeling, and data visualization.
2. **Explain** fundamental programming concepts and methods applicable to finance, FinTech, and business contexts.
3. **Apply** programming skills to financial data analysis tasks, utilizing popular data science languages to manipulate data, create financial models, and generate visualizations.
4. **Analyze** financial datasets to identify patterns, trends, and insights using advanced analytical methods and tools.
5. **Prepare** comprehensive technical reports to eectively communicate the results of financial data analysis to a business audience.
6. **Implement** hands-on practices and real-world applications to enhance problem-solving capabilities in financial analytics.

Course Materials

Textbook

Required

No textbook is required for this course; my lecture notes will provide everything you need.

Recommended

1. Hadley Wickham & Garrett Grolemund, R for Data Science, 2nd edition, 2023, OReilly. ISBN-13: *"978-1491910399". Electronic copies are available for free.*
2. Hadley Wickham, *Advanced R, 2nd edition*, 2019, CRC Press. ISBN-13: *"978-0815384571". Electronic copies are available for free.*
3. Marek Gagolewski, Deep R Programming, 2023, Marek Gagloewski. ISBN-13: *"978-0645571929". Electronic copies are available for free.*
4. Marek Gagolewski, Minimalist Data Wranigling with Python, 2022, Marek Gagloewski. ISBN-13: *"978-0645571912". Electronic copies are available for free.*
5. Jaren Jansses, Data Science at the Command Line, 2023, OReilly. ISBN-13: *"978-1491947852". Electronic copies are available for free.*

For additional reference, please look at the external sources section.

Computer & Software

Intalling R and Positron IDE will be sufficient for the earlier part of the class. Guidance on installation will be provided in class if necessary.

- The latest stable version of R, Python, Quarto, Unix Shell (Bash, Zsh, etc.)
- Positron IDE

Please bring a laptop (macOS/Windows/Linux). A step-by-step installation guide will be provided on the Canvas.

Grading Scale

Grades will be curbed with target average B~B+.

Grade	Grade Percentage
A	94% - 100%
A-	90% - 93%
B+	87% - 89%
B	84% - 86%
B-	80% - 83%
C+	77% - 79%
C	74% - 76%
C-	70% - 73%
D+	67% - 69%
D	64% - 66%
D-	60% - 63%
F	0% - 59%

Grading Categories and Weights

Graded Items	Percent of Final Grade
Participation	10%
Quizzes	20%
Assignments	15%
Midterm	25%
Final Exam	30%

Grading Policy

Quizzes

Quizzes will consist of conceptual questions, multiple-choice questions, and True/False questions based on the previous lectures and lab problems. A short (20 min) in-class exam administered through Canvas. Open book.

Midterm / Final

Exams will be administered through Canvas and Honorlock screen monitoring systems. They will consist of basic conceptual questions, coding problems with numerical answers, multiple-choice questions, and True/False questions based on the lectures, lab problems, and homework assignments. Close book exam. A letter-size, single-sided (double-sided for the final) cheat sheet will be allowed.

Engaging in communication with others using electronic devices, internet search engines, or generative language models such as ChatGPT, Gemini, Claude, etc., and any AI-augmented coding engine tools (Copilot, etc) is strictly prohibited.

Homework Assignments

Assignments will be graded based on below criteria:

1. Accuracy (70%): Getting the desirable outcome, without encountering any errors.
2. Replicability (20%): Making sure that others achieve identical outcomes using the provided code, without encountering any errors.
3. Readability (10%): The clarity of code without redundancy, and helpful comments that explains the code.

No late submissions will be accepted.

Peer Evaluation[1]

At the end of the semester, students will be required to submit an anonymous team-peer evaluation for each team assignments. This evaluation will assess the contributions of team members. If it is determined that a team member did not significantly contribute to the assignment or project, their grade will be adjusted accordingly.

Class Participation

Attendance at all lecture and lab sessions is mandatory. Absence from every two classes will also lead to a downgrade in your overall grade. For further information, please refer to the course policies section.

[1] Only applicable when team assignments were given in the class.

Course Outlines

The topics of the course are subject to change.

Week		Topics	Finance Applications
1 ~ 10	R	• Course Intro, Installation • Objects, Symbols, Values, Attributes • Class of object, vectors, lists, subsetting • Functions and loops • Pipe chaining • Control structure • Logical / Integer / Numerics • Date and Times • Characters and String manipulation • Regular expressions / Wordcloud • File systems and Paths • Data import and export • Data frames and manipulations	• Cash flows • Time value of money • Free cash flow / ratio analysis • Bond pricing • Capital Asset Pricing Model • Portfolio analysis • Portfolio sorting • Textual analysis • Options pricing • Crypto analysis
11 ~ 12	Python & LLMs	• Using AI for programming • Jupyter systems • Control structure • Functions, loops, comprehensions • Data frames and manipulations • Debugging and programming workflows	• Prompt engineering • AI Code generation and translation • Debugging
13 ~ 14	Unix Shell	• Basic command line tools • Calling web APIs	
15	Special Topic	• Virtual Environments • Version control: Git/Github • Object-oriented programming	

Further resources

Other references (Advanced)

- Tidy Finance with R
- Automated Trading with R
- Mastering Spark with R

Unix Shell

- Tutorial: How to use Bash on Windows

Python

- University of Waterloo Python Tutorial
- University of Waterloo Computer Science Circles

Course Policies

During Class

Please refrain from using computers for anything but activities related to the class. Phones are prohibited as they are rarely useful for anything in the course. Eating and drinking are allowed in class but please refrain from it affecting the course. Students who habitually disturb the class by talking, arriving late, etc., and have been warned may suffer a reduction in participation.

Attendance Policy

Please arrive on time for all class meetings. Attendance is expected in all lecture and lab sections. Valid excuses for absence will be accepted before class. In extenuating circumstances, valid excuses with proof will be accepted after class.

Policies on Late Submissions

Late submissions will be accepted for no penalty if a valid excuse is communicated to the instructor before the deadline. In extenuating circumstances, valid excuses with proof will be accepted later. Otherwise, no late submissions will be accepted.

Missing exams or quizzes

A valid excuse must be communicated to the instructor before the exam/quiz. In extenuating circumstances, valid excuses with proof will be accepted later. A make-up exam/quiz will be scheduled **earlier** than the original exam/quiz date.

Request for Re-grading

Students may request re-grading exams and assignments **within one week** (seven calendar days) following the day the graded work was returned to them. Requests made after this period will not be considered. All regrading requests must be submitted in writing, clearly stating the reasons for the request.

In the case of a regrading request after the final exam, all previous submissions for the course will be thoroughly reevaluated to ensure consistent grading standards. Students should be aware that this comprehensive review may affect grades on earlier submissions, leading to downward grade adjustments.

Online Exam Proctoring

Final exam will be in-person and will use a software (Honorlock) for monitoring students screens and testing environments. Students are strictly responsible for ensuring that they take all exams using a reliable computer and high-speed internet connection. To use Honorlock, students are required to download and install the Honolock Chrome Extension. For additional information please visit the USF online proctoring student FAQ and Honorlock student resources.

Academic Integrity and Honesty

Students are required to comply with the university policy on academic integrity found in USF Regulation 3.027. **I will not tolerate any kind of dishonesty.** Academic integrity is the foundation of the University of South Florida's commitment to the academic honesty and personal integrity of its university community. Academic integrity is grounded in certain fundamental values, which include honesty, respect, and fairness. Broadly defined, academic honesty is the completion of all academic endeavors and claims of scholarly knowledge as representative of one's own efforts.

Acceptable Use of Generative AI Tools

Definition of Generative AI Tools: Generative AI tools refer to any artificial intelligence-powered software, program or application that can generate content, including but not limited to text, visuals, music, and other creative outputs. Examples of these tools include AI text generators, AI content rewriters, AI graphic generators, etc.

Permitted Use: The use of generative AI tools is permitted for course-related submissions, including assignments, projects, presentations, examinations, and other forms of assessment. However, students must responsibly use these tools, adhering to the guidelines outlined in this policy.

Student Responsibility: Students are responsible for appropriately using generative AI tools in their work. This includes:

1. Citing all AI-generated content used in their submissions.
2. Demonstrating a deep understanding of the subject matter, not solely relying on AI-generated content.
3. Using AI tools as a supplemental resource (i.e., as an editor), not as the primary means of completing assignments.
4. Understanding that generative AI tools, while powerful, are not infallible and can produce misinformation or inaccurate results. Students are responsible for the accuracy of their submissions.

Violation Consequences: Misuse of AI tools, including use of AI that undermines the student learning objectives of the course or assignment, failing to cite AI-generated content, relying too heavily on AI for work completion or submitting inaccurate information generated by AI tools, will be subject to academic penalties. Consequences may range from a reduction in an individual assignment grade to larger academic sanctions per USF policy, depending on the severity of the violation (USF Regulation 3.027).

End of Semester Student Evaluations

All classes at USF make use of an online system for students to provide feedback to the University regarding the course. These surveys will be made available at the end of the semester, and the University will notify you by email when the response window opens. Your participation is highly encouraged and valued.

Disability Access

Students with disabilities are responsible for registering with Students Accessibility Services (SAS) (SVC 1133) in order to receive academic accommodations. SAS encourages students to notify instructors of accommodation needs at least five (5) business days prior to needing the accommodation. A letter from SAS must accompany this request. Please visit the Student Accessibility Services for more information.

Academic Grievance Procedure

The purpose of these procedures is to provide all undergraduate and graduate students taking courses at the University of South Florida an opportunity for objective review of facts and events pertinent to the cause of the academic grievance. An "academic grievance" is a claim that a specific academic decision or action that affects that student's academic record or status has violated

published policies and procedures, or has been applied to the grievant in a manner different from that used for other students.

Disruption to Academic Progress

Disruptive students in the academic setting hinder the educational process. Disruption of the academic process (USF Regulation 3.025) is defined as the act, words, or general conduct of a student in a classroom or other academic environment which in the reasonable estimation of the instructor: (a) directs attention away from the academic matters at hand, such as noisy distractions, persistent, disrespectful or abusive interruption of lecture, exam, academic discussion, or general University operations, or (b) presents a danger to the health, safety, or well-being of self or other persons.

Intellectual Freedom and Viewpoint Diversity Act (House Bill 233)

Preliminary Guidance Document Students may, without prior notice, record video or audio of a class lecture for a class in which the student is enrolled for their own personal, educational use. A class lecture is defined as a formal or methodical oral presentation as part of a university course intended to present information or teach enrolled students about a particular subject. Recording class activities other than class lectures, including but not limited to lab sessions, student presentations (whether individually or part of a group), class discussion, clinical presentations such as patient history, academic exercises involving student participation, test or examination administrations, field trips, private conversations between students in the class or between a student and the faculty member is prohibited. Recordings may not be used as a substitute for class participation and class attendance and may not be published or shared without the written consent of the faculty member. Failure to adhere to these requirements may constitute a violation of the USF Student Conduct Code.

Religious Observances

All students have a right to expect that the University will reasonably accommodate their religious observances, practices and beliefs (USF Policy 10-045). The University of South Florida, through its faculty, will make every attempt to schedule required classes and examinations in view of customarily observed religious holidays of those religious groups or communities comprising USF's constituency. Students are expected to attend classes and take examinations as determined by the university. No student shall be compelled to attend class or sit for an examination at a day or time prohibited by his or her religious belief. However, students should review the course requirements and meeting days and times to avoid foreseeable conflicts, as excessive absences in a given term may prevent a student from completing the academic requirements of a specific course. Students are expected to notify their instructors at the beginning of each academic term if they intend to be absent for a class or announced examination, in accordance with this Policy.

Sexual Misconduct / Sexual Harassment

USF is committed to providing an environment free from sex discrimination, including sexual harassment and sexual violence (USF Policy 0-004). The USF Center for Victim Advocacy is a confidential resource where you can talk about incidents of sexual harassment and gender-based crimes including sexual assault, stalking, and domestic/relationship violence. This confidential resource can help you without having to report your situation to the Title IX Office unless you request that they make a report. Contact the USF Center for Victim Advocacy: 813-974-5757. Please be aware that in compliance with Title IX and under the USF Policy, educators must report

incidents of sexual harassment and gender-based crimes including sexual assault, stalking, and domestic/relationship violence. If you disclose any of these situations personally to an educator, he or she is required to report it to the Title IX Office. For more information about Title IX, a full list of resources, or to report incidents of sexual harassment, sexual violence, relationship violence or stalking visit: usf.edu/title-ix

Statement of Academic Continuity

In the event of an emergency, it may be necessary for USF to suspend normal operations. During this time, USF may opt to continue delivery of instruction through methods that include, but are not limited to: Canvas, Teams, email messaging, and/or an alternate schedule. It is the responsibility of the student to monitor the Canvas for each class for course-specific communication, and the USF, College, and Department websites, emails, and ALERTUSF messages for important general information (USF Policy 6-010).