Department of Mathematics & Statistics
Concordia University

MACF 402 (MAST 729/MAST 881), Sec. A

Mathematical & Computational Finance II

Fall 2024

Instructor: Prof. C. Hyndman, Office: LB 921-15 (SGW), Phone: (514) 848-2424, Ext. 5219
Email: cody.hyndman@concordia.ca

Office Hours: TBA.

Class Schedule: Tuesdays and Thursdays, 16:15-17:30. Regular in-class teaching.
Mid-term break: no class between October 15, 2024, and October 20, 2024.

Text: **There is no required text. Lecture notes, slides, and exercises are self-contained.**

Outline: This course focuses on computational aspects, implementation, continuous-time models, and advanced topics in Mathematical and Computational Finance. We shall cover the following topics:

- Overview of advanced probability theory, Brownian motion, and stochastic calculus;
- Continuous-time finance and the Black-Scholes model;
- Monte-Carlo simulation methods for option valuation, and variance reduction techniques;
- Partial Differential Equation (PDE) valuation methods: heat equation, numerical solution;
- Volatility: historical volatility, implied volatility surfaces and stylized facts, non-Gaussian option pricing models;
- Risk management, risk measures, Greek letters, hedging;
- American options valuation (PDEs, simulation & regression, dynamic programming);
- Interest rate models;
- Other topics (time permitting).

Course Evaluation: Assignments (35%), Midterm Examination (25%), Final Examination (40%). You are expected to work independently on all Assignments and Exams.

NOTE: It is the Department's policy that tests missed for any reason, **including illness**, cannot be made up. If you miss the midterm test **because of illness** ***(Short-Term Absence form or valid medical note required)*** the final exam will count for 65% of your final grade, and the assignments will count for the remaining 35%**.**

If the grading scheme for this course includes graded assignments, a reasonable and representative subset of each assignment may be graded. Students will not be told in advance which subset of the assigned problems will be marked and should therefore, attempt all assigned problems.

Programming: Multiple assignment problems will require programming in either R, Python, or an Object-Oriented programming language (C++/Java). If the University provides an appropriate online programming platform (such as Jupyter notebooks) students may be required to use this platform for programming exercises.

Academic Integrity and the Academic Code of Conduct
This course is governed by Concordia University's policies on Academic Integrity and the Academic Code of Conduct as set forth in the Undergraduate Calendar and the Graduate Calendar. Students are expected to familiarize themselves with these policies and conduct themselves accordingly. "Concordia University has several resources available to students to better understand and uphold academic integrity. Concordia's website on academic integrity can be found at the following address, which also includes links to each Faculty and the School of Graduate Studies: https://www.concordia.ca/conduct/academic-integrity.html" *[Undergraduate Calendar, Sec 17.10.2]*

Behaviour
All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications.

Concordia students are subject to the Code of Rights and Responsibilities which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

Intellectual Property
Content belonging to instructors shared in online courses, including, but not limited to, online lectures, course notes, and video recordings of classes remain the intellectual property of the faculty member. It may not be distributed, published or broadcast, in whole or in part, without the express permission of the faculty member. Students are also forbidden to use their own means of recording any elements of an online class or lecture without express permission of the instructor. Any unauthorized sharing of course content may constitute a breach of the Academic Code of Conduct and/or the Code of Rights and Responsibilities. As specified in the Policy on Intellectual Property, the University does not claim any ownership of or interest in any student IP. All university members retain copyright over their work.

Extraordinary circumstances
In the event of extraordinary circumstances and pursuant to the Academic Regulations the University may modify the delivery, content, structure, forum, location and/or evaluation scheme. In the event of such extraordinary circumstances, students will be informed of the change.