

MACF 401 (MAST 729/MAST 881), Sec. F
Mathematical & Computational Finance I
Winter 2021

- Instructor:** Dr. C. Hyndman
Email: cody.hyndman@concordia.ca
- Preface:** **Due to exceptional circumstances, this course will be taught and all assessments will be done completely ONLINE.**
- 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 changes.
- Office Hours:** TBA via Zoom (accessible through the course Moodle page).
- Class Schedule:** Tuesdays and Thursdays, 16:15-17:30 via Zoom (accessible through the course Moodle page).
- Use of Zoom:** Some lectures will be conducted live using Zoom and the recordings posted following the lecture for offline viewing. In other cases all or part of a lecture may be prerecorded and the remaining scheduled class time will be available for guided discussion and problem solving, which will not be recorded. If you have concerns about your image or voice being recorded during the lectures please inform the instructor.
- Please note that you may not share recordings of your classes and that the instructor will only share class recordings for the purpose of course delivery and development. Any other sharing may be in violation of the law and applicable University policies, and may be subject to penalties.
- 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.

Text: *Stochastic Calculus for Finance I: The Binomial Asset Pricing Model*, by Steven Shreve, Springer, 2005. (Required)

The textbook will be available at:

<https://www.bkstr.com/concordiastore/home>

Note: Students should order textbooks as early as possible, especially for printed versions in case books are backordered or there are any shipping delays.

Outline: This course is an introduction to mathematical and computational finance. The focus is on the general theory through a thorough study of Binomial Models. The topics covered include:

- The binomial no-arbitrage price model: one-period, multi-period;
- State prices: change of measure, Radon-Nikodym derivatives, capital asset pricing model; utility maximization and optimal investment.
- European and American derivative securities: call and put options, stopping times; exotic derivative securities.
- Random walks: first passage times, reflection principal; perpetual American put option.
- Interest-rate derivatives: binomial model for interest rates, bonds, fixed income derivatives, forward measure; Ho-Lee and Black-Derman-Toy models.
- Forward and Futures contracts.
- Hedging: the Greeks, Delta hedging.
- Convergence of the Binomial Model to the Black-Scholes model. The Black-Scholes Formula.
- Numerical methods.
- Other topics (time permitting).

Evaluation: Weighted average of Assignments (35%), Midterm Examination (25%), and the Final Examination (40%).

All assignments and examinations will be conducted through Moodle using the Assignment and Quiz features. You are expected to work independently on all Assignments and Exams.

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: Some assignment and exam problems will require programming for computational and numerical exercises. Students are encouraged to use an object oriented programming language such as C++ or Java for programming, as these are the industry standards for Quantitative Finance. Python or R are also acceptable languages if students do not have previous

experience in object oriented programming. If the University provides an appropriate online programming platform (such as Jupyter notebooks) students may be required to use this platform for programming exercises.

**Intellectual
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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: concordia.ca/students/academic-integrity." [*Undergraduate Calendar, Sec 17.10.2*]