MFIN 706
Computational Finance
Fall 2018 Course Outline

DeGroote School of Business
McMaster University

Course Objective

The objective of the course is to examine the construction of computational algorithms in solving financial problems, such as risk-aware decision-making, asset pricing, portfolio optimization and hedging. Considerable attention is devoted to the application of computational and programming techniques to financial, investment and risk management problems. Materials in this course are quantitative and computational in nature as well as analytical.

Instructor and Contact Information

Instructor Name: Oleksandr Romanko, Ph.D.
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Phone: TBA
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Course Description

Topics of study include mean-variance portfolio optimization, simulation (Monte Carlo) methods, scenario-based risk optimization, hedging, uncertainty modeling, asset pricing,

simulating stochastic processes, and numerical solutions of differential equations. Matlab is the primary computational and modeling software used in this course, we also briefly describe other programming environments such as R, Python and C/C++ used in financial modeling. Practical aspects of financial and risk modeling, which are used by industry practitioners, are emphasized.

COURSE MATERIALS AND READINGS

Required:

Simulation and Optimization in Finance: Modeling with MATLAB, @Risk, or VBA by D. Pachamanova and F. Fabozzi, 2010
http://www.amazon.com/Simulation-Optimization-Finance-Website-Modeling/dp/0470371897/.

Optional:

Risk Management and Financial Institutions (3rd Edition) by J. Hull, 2012
http://www.amazon.com/Management-Financial-Institutions-Wiley-Finance/dp/1118269039/.

Numerical Methods in Finance and Economics: A MATLAB-Based Introduction (2nd Edition) by P. Brandimarte, 2006
http://www.amazon.com/Numerical-Methods-Finance-Economics-MATLAB-Based/dp/0471745030/.

Introduction to Computational Finance and Financial Econometrics by E. Zivot, 2012
http://faculty.washington.edu/ezivot/econ424/424notes.htm.

EVALUATION

Notes about the types of assessments used as well as notes regarding how group work will be evaluated.

Missed tests/exams will receive a grade of zero unless the student has submitted and been approved for a Notification of Absence or MSAF. Late assignments will be penalized xxxxx% for each day they are late. Your final grade will be calculated as follows:

Components and Weights

Assignment #1	20%
Assignment #2	20%
Assignment #3	20%
Midterm Test	10%
Final Exam	20%
In-Class Participation/Presentation	10%
Total	100%

If a student gets less than 50% mark at the Final Exam, her/his course mark will be reduced one letter grade down. E.g., a student got 18 points (Assignment 1) + 18 points (Assignment 2) + 19 points (Assignment 3) + 9 points (Midterm Test) + 8 points (In-Class Presentation) + 9 poimts (Final Exam) = 81 points that corresponds to A- course mark, but because a student got 9 pts out of 20 pts at the Final Exam (less than 50%), the course mark will be reduced from A- to B+.

Conversion

At the end of the course your overall percentage grade will be converted to your letter grade in accordance with the following conversion scheme.

Letter Grade	Percent	Points
A+	90-100	12
A	85-89	11
A-	80-84	10
B+	75-79	9
B	70-74	8
B-	60-69	7
F	00-59	0

Communication and Feedback

Students who wish to correspond with instructors or TAs directly via email must send messages that originate from their official McMaster University email account. This protects the confidentiality and sensitivity of information as well as confirms the identity of the student. Emails regarding course issues

should NOT be sent to the Area Administrative Assistants. Instructors are required to provide evaluation feedback for at least 10% of the final grade to students prior to Week #9 in the term. Instructors may solicit feedback via an informal course review with students by Week #4 to allow time for modifications in curriculum delivery.

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at:

www.mcmaster.ca/academicintegrity

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations

REQUESTING RELIEF FOR MISSED ACADEMIC WORK

Students may request relief from a regularly scheduled midterm, test, assignment or other course components. Please refer to the policy and procedure on the DeGroote website at the link below;

http://ug.degroote.mcmaster.ca/forms-and-resources/missed-course-work-policy/

STUDENT ACCESSIBILITY SERVICES

Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca.

For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities:

http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicAccommodation-StudentsWithDisabilities.pdf

ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request, including the dates/times needing to be accommodated and the courses which will be impacted, to their Faculty Office normally within 10 days of the beginning of term or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

POTENTIAL MODIFICATION TO THE COURSE

The instructor reserves the right to modify elements of the course during the term. There may be changes to the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

ACKNOWLEDGEMENT OF COURSE POLICIES

Your enrolment in MFIN 706 will be considered to be an implicit acknowledgement of the course policies outlined above, or of any other that may be announced during lecture and/or on A2L. **It is your responsibility to read this course outline, to familiarize yourself with the course policies and to act accordingly.**

Lack of awareness of the course policies **cannot be invoked** at any point during this course for failure to meet them. It is your responsibility to ask for clarification on any policies that you do not understand

COURSE SCHEDULE

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Topics	Concepts
Introduction	1. Important finance and statistics concepts 2. Computational finance with Matlab
Simulation Modelling	1. Introduction to simulation modelling 2. Generating random numbers 3. Monte Carlo simulations 4. Introduction to asset pricing by simulation 5. Factor models
Quantitative Risk Management	1. Risk measures, moment-based and tail-based risk 2. Market, credit, liquidity and operational risks 3. Economic and regulatory capital, capital requirements under Basel II-III accord 4. Capital budgeting under uncertainty
Optimization Modelling	1. Portfolio selection and portfolio optimization in practice a) mean-variance optimization b) multi-objective optimization, computing efficient frontiers c) benchmarks, tracking error minimization d) incorporating transaction costs and taxes 2. Risk budgeting 3. Scenario-based risk optimization 4. Liability-driven investment strategies and portfolio replication

	5. Optimization under uncertainty a) robust parameter estimation b) portfolio resampling c) regularized optimization d) robust portfolio optimization
Asset Pricing	1. Modelling dynamics of asset prices 2. Binomial lattices 3. Random walk models 4. Stochastic processes 5. Derivatives pricing a) Black-Scholes model b) option pricing by Monte Carlo methods