MFIN 706 Computational Finance

Fall 2019 Course Outline

DeGroote School of Business McMaster University

COURSE OBJECTIVE: To introduce some key computational methods and practical resources that are widely used to solve quantitative problems in investment and risk management.

Method and Scope: The course is designed to guide the students through a set of practical problems and projects to be worked on a computer programming environment. There is no requirement for prior coding experience, however students are expected to dedicate time to build programming and data analysis skills throughout the term. Mathematical and financial concepts will be briefly discussed and explained in class. Related programming and data resources will be presented.

Students are expected to employ computational tools to deliver solutions to issues encountered in areas such as risk analysis, portfolio construction, strategy back-testing, optimization, derivative pricing and asset pricing models. Students are expected to dedicate out-of-class time for assignments and projects.

INSTRUCTOR AND CONTACT INFORMATION

Instructor Name: Mehmet Beceren, Ph.D.

Email: becerenm@mcmaster.ca

Office Address: TBA, Office Hours: After class or by appointment Phone: TBA Class

TA Name: xxxxxxx

TA Email: xxxxxxx TA Office: TBA TA Office Hours: TBA Phone: TBA COURSE DESCRIPTION

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Topics of study will cover some common quantitative methods used in portfolio construction, optimization, numerical simulation methods, measures of risk, derivative pricing, factor-based risk models, quantitative strategy back-testing, yield curve fitting, interest rate models, and credit risk models.

The course is designed to improve students' skills and perspectives in solving problems encountered in investment and risk management. The course is a continuation from MFIN 704 with more focus on practical applications. The students will have an opportunity to use their theoretical knowledge and

computer skills to work on various projects. Timely, neat, and coherent work will be rewarded in a 'business-like' setting.

The main programming tool will be R. It provides a free, open-source development environment with many powerful tools. MS Excel will also be handy. Bloomberg will be used heavily as a data source, as a pricing tool and a risk analysis platform. An account for WRDS database through the library will be needed to access historical financial data.

COURSE MATERIALS AND READINGS

There is no required textbook. Some suggested reference text books are as follows.

- Portfolio Construction and Analysis*, by D. Pachamanova and F.J. Fabozzi*
https://onlinelibrary.wiley.com/doi/book/10.1002/9781118656747
- Computational Finance – An Introductory Course with R, *by Argimiro Arratia, Atlantis Press*
- Bernhard Pfaff (2013),"Financial risk modelling and portfolio optimization with R", Wiley
https://www.academia.edu/22287157/Financial_Risk_Modelling_and_Portfolio_Optimization_with_R
**See online/downloadable sources before purchasing*

Additional references:

- Active Portfolio Management*, by Richard Grinold and Ronald Kahn, MCGraw Hill*
- Paul Wilmott Introduces Quantitative Finance*, by P. Wilmott*
- Quantitative Equity Portfolio Management, *by L.B.Chincarini and D.Kim, McGrawHill*
- Reproducible Finance with R*, by J. Regenstein*
- Numerical Methods in Finance and Economics: A MATLAB-Based Introduction, *by P. Brandimarte*

COURSE SCHEDULE MFIN 706

Computational Finance Fall 2018

Course Program*:

Broad Topic and Approximate Week	**Specific Topics of Discussion**
Introduction: *Week # 1*	Programming and Data Logistics, Fields of Computational Finance, Recap of Statistics and Stochastic Process Basics RStudio IDE tips and examples
Portfolio Selection & Risk Analysis ---Equities--- *Week # ~ 2, 3*	Portfolio Decisions based on Thematic Views, Styles, Risk Factors - Back-testing Views and Strategies: Common issues and fallacies - Optimization with Constraints - Risk Factor Exposures- ERP, Country, Sector, Style, FX etc.
Portfolio Selection & Risk Analysis ---Fixed Income--- *Week # ~4, 5*	Stochastic Interest Rate Models & Parametric Yield Curve Models Credit Risk Models (KMV etc.) Optimization with Constraints Risk Reports and Scenario Analysis
Numerical Risk Simulation Examples *Week #: ~ 6,7*	Monte-Carlo techniques, Var-Cov Assumptions Examples with Equity/Credit/Bond Portfolios
Derivatives Pricing *Week #: ~ 8, 9, 10*	Numerical Methods in Equity Option Pricing, Delta Hedging Examples, Binomial tree models etc. Interest Rate Derivatives Examples Exotic Options, Structured Products Volatility Models
Recap & Discussion *Week #: ~11*	Project Presentations and Recap
Index Tracking Problem *Week # ~ 12*	Numerical Challenges and Solutions
If time permits: Recent Advances in Information Processing *Week # ~ 13*	Basic discussion on the concepts behind Machine Learning and Deep Learning Techniques Introduction to programming tools & resources Dangers of using ML techniques in finance: Artificial Intelligence or Computerized Ignorance?

(*) The program is an approximate plan subject to change according to specific needs and priorities that may emerge throughout the term.

EVALUATION GUIDELINE

Assignments	**50%**
Term Project	**25%**
Final Exam*	**25%**
Participation**	**10% Bonus**
	110%

Late assignments will not be able to receive full mark.

(*) The Final Exam will test the comprehension of the assignments in addition to the understanding of the material taught in class. It is crucial to work on assignments diligently to be able to achieve a high score in the final exam.

(**) Participation in online forum discussions and class discussions is strongly encouraged.

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 email sas@mcmaster.ca. For further information, consult McMaster University's Policy for Academic Accommodation of Students with Disabilities:

http://www.mcmaster.ca/policy/StudentsAcademicStudies/AcademicAccommodationStudentsWithDisabilities.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 as 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.