MFIN 704
Numerical Methods
Winter 2020 Course Outline

Finance and Business Economics
DeGroote School of Business
McMaster University

COURSE OBJECTIVE

This course will introduce students to common numerical methods and their applications in finance.

INSTRUCTOR AND CONTACT INFORMATION

Instructor(s):
Michael Milewski – milewsmr@mcmaster.ca

Teaching Assistants:
TBD

Office Hours – By Appointment

COURSE ELEMENTS

Credit Value:	3	Leadership:	No	IT skills:	Yes	Global view:	No
A2L:	Yes	Ethics:	Yes	Numeracy:	Yes	Written skills:	Yes
Participation:	Yes	Innovation:	Yes	Group work:	Yes	Oral skills:	Yes
Evidence-based:	Yes	Experiential:	Yes	Final Exam:	Yes	Guest speaker(s):	No

COURSE DESCRIPTION

This course covers various numerical techniques to solve quantitative problems. Its primary objective is to develop a basic understanding of the construction of numerical algorithms and the applicability and limits of their use. An important component of this course is the learning of relevant computer programs such as MATLAB. The main topics include standard algorithms for numerical computations, such as root finding for nonlinear equations, numerical differentiation, and numerical solutions of ordinary differential equations.

LEARNING OUTCOMES

Upon successful completion of this course, students will be able to complete the following key tasks:

- Learn common numerical methods and their applications in finance
- Attain a level of comfort in programming with MATLAB in the financial industry
- Identifying numerical approaches to solve real world financial problems
- Learn the limitations and common issues with numerical solutions and potential ethical problems that may arise
- Practice solving problems in a team environment, and practice communicating technical materials in written and oral manner

COURSE MATERIALS AND READINGS

Required:
Paolo Brandimarte, Numerical Methods in Finance and Economics: A MATLAB- Based Introduction, 2nd Edition, by Wiley, 2006.

Optional:
(none)

EVALUATION

Missed tests/exams not approved by the MFIN Program Office will receive a grade of zero. Late assignments will be penalized 10% for each day they are late. Your final grade will be calculated as follows:

Components and Weights

Assignment #1	10%
Assignment #2	10%
Mid-Term	20%
Term Project	30%
Final Exam	20%
Participation	10%
Total	100%

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
A+	90 - 100
A	85 - 89
A-	80 - 84
B+	75 - 79
B	70 - 74
B-	60 - 69
F	00 - 59

Course Deliverables

Assignment #1
This assignment is worth **10%** of your final grade and will be marked in groups of 2.

Assignment #2
This assignment is worth **10%** of your final grade and will be marked in groups of 2.

Term Project
This assignment is worth **30%** of your final grade and will be marked in groups of 4-5.

Participation/Topic Presentation
This is worth **10%** of your final grade. The grade is comprised of your 10-minute algorithm topic presentation (5%) and class involvement throughout the term (5%).

Midterm
This midterm is worth **20%** of your final grade.

Final Exam
This exam is worth **20%** of your final grade.
Non-Cumulative

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.

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

MISSED EXAMINATIONS/TESTS/CLASS PARTICIPATION

Where students miss a regularly scheduled mid-term or class participation for legitimate reasons as determined by the MFIN Program Office, the weight for that test/participation will be distributed across other evaluative components of the course at the discretion of the instructor.

Documentation explaining such an absence must be provided to the MFIN Program Office within five (5) working days upon returning to school.

To document absences for health-related reasons, please provide the Petition for Relief for MFIN Missed Term Work and the McMaster University Student Health Certificate which can be found on the DeGroote website at https://mfin.degroote.mcmaster.ca/current-students/forms/.

Please do not use the online McMaster Student Absence Form as this is for Undergraduate students only.

University policy states that a student may submit a maximum of three (3) Medical certificates per year after which the student must meet with the Program Director.

To document absences for reasons other than health related, please provide the Petition for Relief for MFIN Missed Term Work which can be found on the DeGroote website at https://mfin.degroote.mcmaster.ca/current-students/forms/ and documentation supporting the reason for the absence.

Students unable to write a mid-term at the posted exam time due to the following reasons: religious; representing university at an academic event; conflicts between two overlapping scheduled mid-term exams; or other extenuating circumstances have the option of applying for special exam arrangements. Such requests must be made to the MFIN Program Office at least ten (10) working days before the scheduled exam along with acceptable documentation. Instructors cannot themselves allow students to unofficially write make-up exams/tests.

Adjudication of the request must be handled by the MFIN Program Office.

If a mid-term exam is missed without a valid reason, students will receive a grade of zero (0) for that component.

Missed Final Examinations

A student who misses a final examination without good reason will receive a mark of 0 on the Examination.

All applications for deferred and special examination arrangements must be made to the MFIN Program Office. Failure to meet the stated deadlines may result in the denial of these arrangements. Deferred examination privileges, if granted, must be satisfied during the examination period at the end of the following term. There will be one common sitting for all deferred exams.

Failure to write an approved deferred examination at the pre-scheduled time will result in a failure for that examination, except in the case of exceptional circumstances where documentation has been provided and approved. Upon approval, no credit will be given for the course, and the notation N.C. (no credit) will be placed on the student's transcript. Students receiving no credit for a required course must repeat the course. Optional or elective courses for which no credit is given may be repeated or replaced with another course of equal credit value.

Requests for a second deferral or rescheduling of a deferred examination will not be considered.

Any student who is unable to write a final examination because of illness is required to submit the Application for Deferred MFIN Final Examination and a statement from a doctor certifying illness on the date of the examination. The Application for Deferred MFIN Final Examination and the McMaster University Student Health Certificate can be found on the DeGroote website at https://mfin.degroote.mcmaster.ca/current-students/forms/

Students who write examinations while ill will not be given special consideration after the fact. In such cases, the request for a deferred examination privilege must be made in writing to the MFIN Program Office within five business days of the missed examination.

Special examination arrangements may be made for students unable to write at the posted exam time due to compelling reasons such as religious or representing the University at an academic event.

Students who have religious obligations which make it impossible to write examinations at the times posted are required to produce a letter from their religious leader stating that they are unable to be present owing to a religious obligation.

If a student is representing the University at an academic event and is available at an overlapping scheduled time of the test/examination, the student may write the test/examination at an approved location with an approved invigilator, as determined by the MFIN Program Office. In such cases, the request for a deferred examination privilege must be made in writing to the MFIN Program Office within ten business days of the end of the examination period.

Note: A fee of $50 will be charged for a deferred exam written on campus and a fee of $100 for deferred exams written elsewhere.

In cases where the student's standing is in doubt, the MFIN Program Office may require that the student with one or more deferred examination privileges refrain from re-registering until the examination(s) have been cleared.

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

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 704 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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Winter 2020 Course Schedule

WEEK	DATE	TOPIC*	READINGS*	DUE DATES	PRESENTATION
1	January 8	Introduction, Coding and MATLAB	Chapter 1 Chapter 2 (Optional)		
2	January 15	Computer Numbers and Sources of Errors	Chapter 4 – Section 4.3 Chapter 3 – Section 3.1		
3	January 22	Numerical Instability and Ill conditioning	Chapter 3 – Section 3.1		Linear Regression
4	January 29	Solving systems of linear equations, solving non-linear equations	Chapter 3 – Section 3.2 Section 3.4	Assignment 1 - Jan 31st 12:00	ARIMA
5	February 5	Finite Difference Methods	Chapter 5 – Section 5.1 Section 5.2		Logistic Regression
6	February 12	Finite Difference Methods	Chapter 5 – Section 5.3 Section 5.4	Assignment 2 – Feb 14th 12:00	Ridge Regression
7	February 19	Reading Week			
8	February 26	Midterm		TBD	
9	March 4	Simulation	Chapter 8 – Section 8.1		LASSO Regression
10	March 11	Introduction to Optimization in Finance	Chapter 6 – Section 6.1		SVM
11	March 18	Unconstrained Optimization	Chapter 6 – Section 6.2		Gradient Boosting
12	March 25	Heuristic Methods	Chapter 12 - Section 12.4		Naïve Bayes
13	April 1	Machine Learning			Decision Tree
14	April 8	Presentations		Term Project – Apr 9th 12:00	

*Any changes to the reading list or topics will be posted on Avenue in advance