McMaster University

DeGroote SCHOOL OF BUSINESS

COMMERCE 3FN3
Big Data in Finance
Fall 2025 Course Outline

Finance and Business Economics Area
DeGroote School of Business
McMaster University

COURSE DESCRIPTION

This course introduces business students to the applications of data science, its key statistical tools, and the underlying technology in the finance area. Students gain a deeper understanding of how finance, technology, and statistics intersect in an applied setting to solve tough problems in innovative ways. The course is intended to equip students with skills in solving problems requiring acquisition, management, and analysis of very large datasets.

INSTRUCTOR AND CONTACT INFORMATION

Class Timing: **Wednesdays at 2.30 PM** or **Thursdays at 2.30 PM**
All times referenced in this document are Eastern.

Adeel Mahmood
Instructor
Office Hours: Before or after class, or by appointment

COURSE ELEMENTS

Credit Value:	3	Leadership:	Yes	IT skills:	Yes	Global view:	Yes
Avenue:	Yes	Ethics:	No	Numeracy:	Yes	Written skills:	Yes
Participation:	Yes	Innovation:	Yes	Group Work:	Yes	Oral skills:	Yes

COURSE PREREQUISITES AND COMPLEMENTS

COMMERCE 2FB3 (or 3FA3) or IBH 3AC3; and registration in any Bachelor of Commerce or Engineering and Management program or relevant minor

COURSE OVERVIEW

"*The world is swimming in data.*"

According to an IBM estimate, the world is generating more than 2.5 quintillion bytes of data every day, and the pace continues to rise as more technology reaches farther corners of the planet. Financial services data is of particular interest and value because of the high quality quotient of its content. Deeper and more effective analysis of the financial services data can result in improvement in such high-value decisions as economic policy, capital markets investments, credit scores and lending, and financial fraud, among others.

The course is divided into two segments: (1) skills and (2) applications.

The **skills** segment focuses on lectures, lab work, out-of-class research, and self-directed content to deliver the requisite learning. This section is designed to equip a business student with key data science skills. We begin with framing the problem and soon move into acquiring and managing the underlying data. The statistical tools and the technology infrastructure needed to analyse this data are discussed next. The higher cognitive business (esp. finance) insights are then applied to the problem.

The **applications** segment is centred around a real-life big data project that students complete in teams. The project allows students to work on an actual problem being faced by an institution in North America and apply the skills learned in the first segment to help solve the problem. This segment uses group work, instructor-to-group meetings, institution-to-group meetings, continued lab work, and periodic progress reports with feedback to deliver the learning components.

LEARNING OUTCOMES

Upon completion of the course, students will be able to:

➢ Identify and articulate big data challenges in finance, including trading, portfolio optimization, risk management, fraud detection, credit scoring, and fintech.

➢ Acquire, clean, manage, and visualize large financial datasets from Bloomberg, APIs, and public sources using Python and modern data tools.

➢ Apply descriptive and inferential statistics to analyze financial data and support decision-making.

➢ Implement supervised and unsupervised machine learning methods (e.g., regression, classification, clustering, dimension reduction) for financial applications.

➢ Build and evaluate predictive models in Python using Scikit Learn and related libraries.

➢ Apply deep learning methods, including neural networks, to areas such as fraud detection, algorithmic trading, and sentiment analysis.

➢ Analyze unstructured text data (e.g., news, filings, social media) with natural language processing and apply prompt engineering to enhance financial insights.

> ➢ Utilize modern big data infrastructure, including cloud platforms, distributed computing frameworks, and data pipelines, for large-scale financial analysis.

> ➢ Integrate Python programming with Bloomberg analytics to design and execute data-driven financial solutions.

> ➢ Critically evaluate the opportunities, limitations, and ethical considerations of big data and AI in financial services, and recommend value-adding strategies.

REQUIRED COURSE MATERIALS AND READINGS

Course content and class communication available on Avenue:
- http://avenue.mcmaster.ca

EVALUATION

This course will be delivered using a variety of tools, including pre-recorded and live lectures, office hours, group work, and online activities. The final student grade will be calculated as follows:

Components and Weights

Quizzes	Completed online (individual)	5%
Practice Assignments	Completed online (individual)	10%
Term Tests	Written in class (individual)	50%
Big Data Project	Due at the end of the term (group)	35%
Total		**100%**

Quizzes

There are eight (8) **quizzes** in total, of which each student's **best five (5) marks** are used to compute their grade for this component. The quizzes are written online and can be completed from anywhere using a computer and an Internet connection. The quizzes are due by the end of the Sunday of the week for which they are assigned.

Each quiz has a limited duration but can be written anytime during a longer window of time. The quiz questions are multiple-choice in format. The content covered is the lecture topic in the week immediately preceding the quiz deadline. Students can use books, notes, and computing devices but must write each quiz on own without assistance from any other person.

The first three missed quizzes are dropped from the grade - such that the student's marks on the remaining quizzes are used to calculate the overall grade for this component. Any additional missed quizzes can only be accommodated for documented, valid reasons. (Students can also use available MSAF submissions to obtain accommodations.) The weight of such additional missed quizzes (with approved accommodations) is reallocated to that of the remaining quizzes.

Practice Assignments

The purpose of the *Practice Assignments* is to provide students an opportunity to learn basic programming concepts on a self-guided basis. A bit like tutorials, these assignments are designed to help learn by 'doing' it - i.e. by writing actual code.

There are **eight (8) available assignments in total**, of which each student's **best five (5) marks** are used to compute grade for this component. The assignments are worked on out of class and submitted online using a computer and an Internet connection.

Each assignment is **due by the end of the Sunday** of the week for which it is assigned. (See specific dates in the schedule.) This assessment component is submitted by and graded for each student individually. Assignments generally cover the technical content being discussed in the respective work using software tools and services identified in the assignment.

The **first three (3) missed assignments are dropped from the grade** - such that the student's marks on the remaining assignments are used to calculate the overall grade for this component. Any additional missed assignment can only be accommodated for documented, valid reasons. The weight of such missed assignment (with approved accommodations) is reallocated to that of the remaining lab assignments.

Term Tests

Three (3) term tests – *open-book*, *open-notes* tests – will be written during the term. For each student, the two highest percentage scores of the three tests (i.e. **best two out of three**) will be considered in the determination of the final grade.   More details of the format, structure, and content coverage will be provided on the course website.

If a student *misses a term test*, the missed test's weight will become zero, and the student's overall *Term Tests* grade will be calculated using the two tests that are written. A student *missing a term test* is required to contact the 'Student Experience – Academic Office' and obtain an official approval of relief to avoid getting a zero (0) grade for the missed test.

For MSAF purposes, the weight of each test is considered to be 25%.

Big Data Project

The project allows students to work on a data analytics problem faced by an institution and apply key skills such as the analysis of large datasets, application of modern machine learning, and use of the necessary technology infrastructure. The project will culminate in presenting a management-level solution to the proposed problem.

Examples of projects include:
- *Predictive analytics in ecommerce and retail*: Which products or categories to market to a customer given the customer profile?
- *Predictive analytics in investments and trading*: Which stocks or securities to purchase following a sequence of events?
- *Pricing for new technology products or services*: How to price a new tech product given competitive, customer, and transactional data?
- *Credit scores and ratings*: How to assess the credit risk of a borrower given the borrower profile and meta data?
- *Financial fraud*: What is the likelihood of fraud for a user attempting to access your personal finance solution?
- *Customer segmentation and targeting*: What value to assign to a customer based on the past purchase and/or transactional data and customer profile?

The group members will be assigned individual grades relative to the group grade based on the peer assessments completed towards the end of the course. More details of the format, structure, and length of the project will be provided during the term.

Any student missing the submission deadline will be subject to a marks deduction equal to 25% of the project grade for every 24 hours that the submission is late.

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. All students must receive feedback regarding their progress prior to the final date by which a student may cancel the course without failure by default.
- For Level 1 and 2 courses, this feedback must be a minimum of 20% of the final grade.
- For Level 3 courses and above, this feedback must be a minimum of 10% of the final grade.

Instructors may solicit feedback via an informal course review with students by Week #4 to allow time for modifications in curriculum delivery.

Students who have concerns about the course content, evaluation methods, or delivery should first reach out to the course instructor. If your concern remains unresolved after speaking with the instructor, you may then reach out to the relevant Area Chair for further consideration.

COURSES WITH AN ONLINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn, LearnLink, web pages, capa, Moodle, ThinkingCap, etc.). Students should be aware that, when they access the electronic components of a course using these elements, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in a course that uses on-line elements will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

CONDUCT EXPECTATIONS

As a McMaster student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the *Code of Student Rights & Responsibilities* (the "Code"). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online**.

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of A2L, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students' access to these platforms.

EXTREME CIRCUMSTANCES

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

COPYRIGHT AND RECORDING

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors.

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a

student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Speak with the instructor if this is a concern for you.

REQUESTING RELIEF FOR MISSED ACADEMIC WORK

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar, *Requests for Relief for Missed Academic Term Work*, and the link below:
http://ug.degroote.mcmaster.ca/forms-and-resources/missed-course-work-policy/

* Non-Commerce students must follow the Missed Course Work protocols outlined by their home faculty and Program Office.

COURSE MODIFICATION

From time to time, there may be a need to add and/or remove topics or to change the schedule or delivery format. If these are necessary, you will be given as much advance notice as possible.

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 at:

www.mcmaster.ca/academicintegrity

Students are responsible for being aware of and demonstrating behaviour that is honest and ethical in their academic work. Such behaviour includes:

- following the expectations articulated by instructors for referencing sources of information and for group work;
- asking for clarification of expectations as necessary;
- identifying testing situations that may allow copying;
- preventing their work from being used by others (e.g., protecting access to computer files); and
- adhering to the principles of academic integrity when conducting and reporting research.

GENERATIVE AI

Students may use generative AI for editing, translating, and revising their work throughout the course so long as the use of generative AI is referenced and cited. Use of generative AI outside the stated use of editing, translating, and revising without citation will constitute academic dishonesty. It is the student's responsibility to be clear on the limitations for use and to be clear on the expectations for citation and reference and to do so appropriately.

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 should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation 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.

ACKNOWLEDGEMENT OF COURSE POLICIES

Your enrolment in this course 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

CL.	WEEK OF	CONTENT	DUE*
1	Sep 3 / 4	**Introduction to Big Data, AI, and Finance** Course overview, Programming setup	-
2	Sep 10 / 11	**Programming for Business Students** Python basics, Using Bloomberg terminals	• **PA 1** • **Quiz 1**
3	Sep 17 / 18	**Programming for Big Data** Big data libraries, data management + visualization	• **PA 2** • **Quiz 2**
4	Sep 26	**Term Test 1** at 7.00 PM on Sep 26	
5	Oct 1 / 2	**Machine Learning for Business Students** Statistical background, regression/classification algorithms	• **PA 3** • **Quiz 3**
6	Oct 8 / 9	**Machine Learning for Big Data I** Clustering and dimension reduction for big datasets	• **PA 4** • **Quiz 4**
-	Oct 13 to 19	**Study Break** (No class)	
7	Oct 22 / 23	**Machine Learning for Big Data II** Regression and time series, Pipelines	• **PA 5** • **Quiz 5**
8	Nov 1	**Term Test 2** at 12.00 PM on Nov 1	
9	Nov 5 / 6	**Deep Learning with Big Data I** Logistic regression, neural networks, deep networks	• **PA 6** • **Quiz 6**
10	Nov 12 / 13	**Deep Learning with Big Data II** Natural language processing, CNNs, RNNs, Transformers	• **PA 7** • **Quiz 7**
11	Nov 19 / 20	**Big Data Infrastructure** Cloud computing, Distributed computing	• **PA 8** • **Quiz 8**
-	Nov 21	**Term Test 3** at 7.00 PM on Nov 21	
12	Nov 26 / 27	**Applications in Trading, Risk, and Fintech** Algorithmic trading, robo-advisors, blockchains	-
13	Dec 3 / 4	**Capstone and Integration** Ethics and governance, Project discussion	-
-	Sun. Dec 7	**Big Data Project** – Due online by end of day	

*** Practice Assignments** are numbered **PA 1** to **PA 8**. Each assignment is due online by the end of the day on the Sunday <u>following</u> the listed date of the respective week.*