McMaster University | DeGroote School of Business

Commerce 3DA3
Predictive Analytics
Fall 2024 Course Outline

Operations Management Area
DeGroote School of Business
McMaster University

COURSE OBJECTIVE

This course is designed to cover different aspects of predictive analytics using the Python programming language environment and packages. Students will learn how to use Python to perform data preprocessing, render visualization, conduct exploratory data analytics, build and evaluate statistical and machine learning models, etc., in business applications. Students will learn the concepts and methodologies by working on datasets from different resources, based on which they will generate insights that are helpful in making better data-driven business decisions. The course is aimed to help students interested in a career in business analytics. It offers hands-on experience in applying analytical models to generate managerial insight and requires no prior programming.

INSTRUCTOR AND CONTACT INFORMATION

Section 2: Thursdays, 2:30pm – 5:20pm

Dr. Berk Gorgulu
Instructor
gorgulub@mcmaster.ca
Office: DSB 414
Office Hours: TBA

Mehmet Kiraz
TA
kirazm@mcmaster.ca
Office Hours: TBA

Course sites:

- **Avenue to Learn:** https://avenue.mcmaster.ca/

    Please select the correct section of Commerce 3DA3: Predictive Analytics

- **TopHat:** https://app.tophat.com/e/609202/

COURSE ELEMENTS

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

COURSE DESCRIPTION

Predictive Analytics is an important step in most business analytics projects. Any analytics professional is expected to have some understanding of different aspects involved in predictive analytics. Producing "predictions" is an important part in the analytics project life cycle.

This course aims to equip students with the essential knowledge required to understand and conduct basic predictive modeling and evaluation. The material used in the course will use data from different sources, and will address business problems in various different industries and sectors.

The course takes an experiential-learning approach and will help students develop hands-on experience and gain a thorough understanding of the material through applying the concepts using the Python programming language. We will review data manipulation and aggregation, data visualization, statistical and machine learning algorithms along with statistical inference techniques and how their results can be used in predictive models.

COURSE LEARNING OUTCOMES

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

- Become familiar with key predictive analytics tools and techniques, develop and understanding on how and where each technique can be used to solve different business problems
- Demonstrate a working level of statistical data analysis knowledge to approach a data set and build a model based on it using software
- Acquire working knowledge of Python and Jupyter Notebooks.
- Learn different data manipulation, data exploration and aggregation techniques
- Learn different visualization techniques for both quantitative and categorical variables
- Understand statistical inference and how its results can be used to contribute to prediction
- Learn about different statistical and machine learning algorithms and gain hands-on experience in developing models and validating and interpreting results for the purpose of prediction.
- Learn to evaluate predictive model results
- Demonstrate ability to generate business insight based on results of predictive analytics models

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REQUIRED MATERIALS AND TEXTS

Required: Materials shared by the instructors (slides, handouts, etc.)

Referece Textbooks (optional):
- Python Data Analytics, Fabio Nelli (2nd edition, 2018)
  - An electronic version is available for free at McMaster University Library website. You can obtain a free electronic copy at http://library.mcmaster.ca by logging in using your MAC ID and password
- An Introduction to Statistical Learning with Applications in Python
  - An electronic version is available for free at https://www.statlearning.com.

Top Hat Platform: We will be using the Top Hat (www.tophat.com) classroom response system in class for enhanced learning experience. You will be able to submit answers to in-class questions using Apple or Android smartphones and tablets, laptops, or through text message. You can register by simply visiting our course website: https://app.tophat.com/e/609202/. If you need familiarity with the platform, you can visit the Top Hat Overview (https://support.tophat.com/s/article/Student-Top-Hat-Overview-and-Getting-Started-Guide) within the Top Hat Success Center. Should you require further assistance with Top Hat, please contact their support team directly through email (support@tophat.com), the in-app support button, or by calling 1-888-663-5491.

CLASS FORMAT

Lectures (In-Person): This is an in-person 3-hour course. The three hours will consist of lengthier discussions of the topics, and applied exercises (not necessarily always in this order).

COURSE EVALUATION

GRADE COMPONENT	WEIGHT	DESCRIPTION
In-Class Quizzes	8%	3 in-class Quizzes; best 2 will be used (4% each)
Assignments	12%	2 Assignments (6% each)
Midterm Exam	25%	
Group Project	25%	
Final Exam	30%	

COURSE DELIVERABLES

In-Class Quizzes (8%, individual work)

Quizzes are extensions of the classroom lectures and discussions. 3 quizzes will be conducted throughout the semester, and they will contain questions related to content covered in previous lectures. They take on average 15-20 minutes and <u>they can require coding and usage of personal laptops. Therefore, please do not forget to bring your personal laptops to the lectures.</u>

Assignments (12%, individual work)

The Assignments are carefully designed to help students keep up with the course material and prepare them for the midterm exam. There will be 2 assignments; weeks are posted below under the Course Outline section. The Assignments will be released through Avenue to Learn. You will need to log in to Avenue to Learn to see the assignments on the course webpage. The assignments will be submitted online. Assignments will strictly be due on the scheduled date and time. Please allow for sufficient time to start and finish the homework assignment on time.

Midterm Exam (25%, individual work)

Midterm exam is mandatory and individual assessment. The exact exam date/time and format will be announced on Avenue.

Group Project (25%, group work)

In this project, you will apply many of the topics learned in class to one or several datasets to conduct different tasks, build and evaluate models and produce insight. The project is a group work, and all group members be receiving the same mark. The project may involve other aspects (research, etc.) as well. The details of the requirements for the group project will be announced later in the term.

Final Exam (30%, individual work)

The Final Exam covers all the topics covered in the course (with higher weight on the topics covered after the midterm) and will be scheduled by the Office of Registrar.

LATE ASSIGNMENTS

Late assignments will be penalized by 4% per hour except under extraordinary circumstances. Please discuss any extenuating situation with your instructor at the earliest possible opportunity.

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 Level 2 courses, this feedback must equal a minimum of 20% of the final grade.

For Level 3 courses and above, this feedback must equal 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.

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

The instructor and university reserve the right to modify elements of the course during the term. The university may change 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.

ACADEMIC INTEGRITY

You are expected to exhibit honesty and use ethical behavior in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity. **It is your responsibility to understand what constitutes academic dishonesty.**

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 behavior 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. For information on the various types of academic dishonesty please refer to the [Academic Integrity Policy](.).

The following illustrates only three forms of academic dishonesty:

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

AUTHENTICITY/PLAGIARISM DETECTION

Some courses may use a web-based service (Turnitin.com) to reveal authenticity and ownership of student submitted work. For courses using such software, students will be expected to submit their work electronically either directly to Turnitin.com or via an online learning platform (e.g. Avenue to Learn, etc.) using plagiarism detection (a service supported by Turnitin.com) so it can be checked for academic dishonesty.

Students who do not wish their work to be submitted through the plagiarism detection software must inform the Instructor before the assignment is due. No penalty will be assigned to a student who does not submit work to the plagiarism detection software.

All submitted work is subject to normal verification that standards of academic integrity have been upheld (e.g., on-line search, other software, etc.). For more details about McMaster's use of Turnitin.com please go to [www.mcmaster.ca/academicintegrity](.).

GENERATIVE AI

This course will be guided by McMaster University's *Provisional Guidelines on AI* use. ([https://provost.mcmaster.ca/office-of-the-provost-2/generative-artificial-intelligence/task-force-on-generative-ai-in-teaching-and-learning/provisional-guidelines-on-the-use-of-generative-ai-in-teaching-and-learning/](.)).

Students may use generative AI in this course in accordance with the **guidelines outlined for each assessment**, and so long as the use of generative AI is referenced and cited following citation instructions given in the syllabus. **Use of generative AI outside assessment guidelines or without citation will constitute academic dishonesty.** It is the student's responsibility to be clear on the limitations for use for each assessment and to be clear on the expectations for citation and reference and to do so appropriately.

COURSES WITH AN ON-LINE 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.

ONLINE PROCTORING

Some courses may use online proctoring software for tests and exams. This software may require students to turn on their video camera, present identification, monitor and record their computer activities, and/or lock/restrict their browser or other applications/software during tests or exams. This software may be required to be installed before the test/exam begins.

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 Avenue 2 Learn, 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.

ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES

Student Accessibility Services (SAS) offers various support services for students with disabilities. Students with disabilities who require academic accommodation must contact [Student Accessibility Services](#) (SAS) at 905-525-9140 ext. 28652 or sas@mcmaster.ca to make arrangements with a Program Coordinator.

For further information, consult McMaster University's [Academic Accommodation of Students with Disabilities](#) policy.

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.

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. Please speak with the instructor if this is a concern for you.

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, Avenue to Learn and/or McMaster email.

RESEARCH USING HUMAN SUBJECTS

All researchers conducting research that involves human participants, their records or their biological material are required to receive approval from one of McMaster's Research Ethics Boards before (a) they can recruit participants and (b) collect or access their data. Failure to comply with relevant policies is a research misconduct matter. Contact these boards for further information about your requirements and the application process.

McMaster Research Ethics Board (General board): https://reo.mcmaster.ca/

Hamilton Integrated Research Ethics Board (Medical board): http://www.hireb.ca/

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ACKNOWLEDGEMENT OF COURSE POLICIES

Your enrolment in Commerce 3DA3 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

Commerce 3DA3 C02
Statistical Data Analysis
Fall 2024 Tentative Course Schedule

Week	Topics	Key Dates
1 (Sep. 3 – Sep. 6)	• Introduction to data analytics and Python	
2 (Sep. 9 – Sep. 13)	• Exploratory data analysis I	
3 (Sep. 16 – Sep. 20)	• Exploratory data analysis II • Data visualization I	
4 (Sep. 23 – Sep. 27)	• Data visualization II	
5 (Sep. 30 – Oct. 4)	• Introduction to statistical learning • Supervised learning – Linear regression	- Assignment 1
6 (Oct. 7 – Oct. 11)	• Supervised learning – Linear regression • Supervised learning – Classification	- Project information
7 (Oct. 14 – Oct. 18)	**MID-TERM RECESS**	
8 (Oct. 21 – Oct. 25)	**MIDTERM EXAM – No class this week!**	
9 (Oct. 28 – Nov. 1)	• Supervised learning – Classification • Supervised learning – Tree-based methods	
10 (Nov. 4 – Nov. 8)	• Supervised learning – Tree-based methods	

11 (Nov. 11 – Nov. 15)	• Evaluation methods • Cross validation and bias-variance trade-off	- Assignment 2
12 (Nov. 18 – Nov. 22)	• Unsupervised learning models	
13 (Nov. 25 – Nov. 29)	• Advanced topics in machine learning and data analytics	
14 (Dec. 2 – Dec. 5)	• Advanced topics in machine learning and data analytics	- Project submission