MBA O712
Data Analytics with Python
Fall 2023 Course Outline

Operations Management Area
DeGroote School of Business
McMaster University

COURSE OBJECTIVE

This course is designed to cover different aspects of data analytics using the Python programming language environmentand packages. In this course you will learn how to use Python to perform data manipulation, render visualization, conduct tests, build,validate and evaluate statistical and machine learning models, and perform Natural Language Processing analysis. The course provides hands-on experience and you will learn the concepts by working on datasets from different resources and using Python to produce insight that can be used to make better data-driven business decisions. No prior programming experience is required for this course. The course is aimed to help students interested in a career in analytics with hands-on experience in using analytical models to generate managerial insight.

INSTRUCTOR AND CONTACT INFORMATION

Instructor	**Teaching Assistant**
Apoorv Thawani	**Maryam Mashayekhi**
thawania@outlook.com	masham3@mcmaster.ca
Tel: (289) 880-6607	

Instructor Office Hour:	**TA Office Hour:**
Timing: Thursdays 5:30PM – 6:30PM	TBA
Location: MS Team (click here to attend)	

COURSE ELEMENTS

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

COURSE DESCRIPTION

This course is a hands-on learning experience to learn about different techniques use in data analytics using Python. Python has become one of the most important tools used by practitioners to perform data analysis and analytics tasks. We will learn required aspects of using Python for different aspects of an analytics project. This includes data manipulation and wrangling, visualization, statistical inference and inferential data analysis, statistical and machine learning algorithms for different scenarios, etc. We will also learn about how machine learning models could be evaluated and how models can be used to help the decision maker make better data-driven decisions. We will use various relevant packages that are popular in the Python data analytics world.

LEARNING OUTCOMES

The following learning outcomes are expected upon completion of this course:

➢ Acquire working knowledge of Jupyter Notebooks, creating notebooks, editing and sharing notebooks, etc.
➢ Conduct basic data manipulation, data wrangling and visualization in Jupyter Notebooks. Visualization for both categorical and numerical variables.
➢ Learn different data manipulation, data exploration and aggregation techniques
➢ Create aggregate reports based on data.
➢ Become familiar with feature engineering ideas.
➢ Conduct different ideas in statistical inferences. This includes hypothesis testing and confidence intervals.
➢ Learn about different supervised statistical and machine learning algorithms used for classification and regression. Learn different scenarios appropriate for each method and learn about the evaluation techniques used in each method.
➢ Build, validate and evaluate different models and apply them to datasets to produce data-driven intelligence.
➢ Learn about different techniques common to data cleaning, pre-processing. This includes data transformation and variable encoding.

COURSE MATERIALS AND READINGS

Avenue registration for course content (slides, readings, materials, etc.)
➢ http://avenue.mcmaster.ca

Suggested textbook: 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.

EVALUATION

Components and Weights

Assignment 1	Individual	15%
Assignment 2	Individual	15%
Group Project	Group	30%
Final Exam	Individual	40%
Total		**100%**

NOTE: The use of a McMaster standard calculator is allowed during examinations in this course. See McMaster calculator policy at the following URL:

www.mcmaster.ca/policy/Students-AcademicStudies/UndergraduateExaminationsPolicy.pdf

Grade 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

Course Deliverables

Assignment 1 and 2 (15% + 15%)
These two assignments combined are worth 30% of your overall marks. You will be provided with a sample business problem that you would be required to solve using the tools and techniques learnt in the class. For each assignment, you will have a whole week to solve the provided problem and write a short report on your descriptions, observations, and recommendations. Both the assignments are individual.

Group Project (30%)
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 will be receiving the same mark. The details of the requirements for the group project will be announced in class.

Final Exam (40%)
Final exam is mandatory and will be schedule by the Office of Registrar. You will be provided with a set of questions and task that you will be required to complete by using the tools and techniques learnt in the classes. You will be able to use your notes from the class and the textbook. Final exam is individual.

COMMUNICATION AND FEEDBACK

Students that are uncomfortable in directly approaching an instructor regarding a course concern may send a confidential and anonymous email to the respective Area Chair or Associate Dean:

http://mbastudent.degroote.mcmaster.ca/contact/anonymous/

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 Administrative Assistant.

Instructors are encouraged to conduct an informal course review with students by Week #4 to allow time for modifications in curriculum delivery. Instructors should provide evaluation feedback for at least 10% of the final grade to students prior to Week #8 in the term.

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

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. A2L, 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.

COURSES WITH AN ON-LINE ELEMENT

Some courses may use on-line elements (e.g. e-mail, Avenue to Learn (A2L), 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.

ON-LINE 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.

MISSED ACADEMIC WORK

Missed Mid-Term Examinations / Tests / Class Participation

Where students miss a regularly scheduled mid-term or class participation for legitimate reasons as determined by the Student Experience – Academic (MBA) 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 Student Experience – Academic (MBA) office within five (5) working days upon returning to school.

To document absences for health related reasons, please provide to Student Experience – Academic (MBA) office the Petition for Relief for MBA Missed Term Work and the McMaster University Student Health Certificate which can be found on the DeGroote website at http://mbastudent.degroote.mcmaster.ca/forms-and-applications/. 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 Director of the program.

To document absences for reasons other than health related, please provide Student Experience – Academic (MBA) office the Petition for Relief for MBA Missed Term Work 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; work-related (for part-time students only); representing university at an academic or varsity athletic 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 Student Experience – Academic (MBA) 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 Student Experience – Academic (MBA).

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 Student Experience – Academic (MBA) 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 MBA Final Examination and a statement from a doctor certifying illness on the date of the examination. The Application for Deferred MBA Final Examination and the McMaster University Student Health Certificate can be found on the DeGroote website at http://mbastudent.degroote.mcmaster.ca/forms-and-applications/ Please do not use the online McMaster Student Absence Form as this is for Undergraduate students only. 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 Student Experience – Academic (MBA) 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 (for example religious, or for part-time students only, work-related reasons):

- 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.
- Part-time students who have business commitments which make it impossible to write examinations at the times posted are required to produce a letter on company letterhead from the student's immediate supervisor stating that they are unable to be present owing to a specific job commitment.

In such cases, applications must be made in writing to the Student Experience – Academic (MBA) office at least ten business days before the scheduled examination date and acceptable documentation must be supplied.

If a student is representing the University at an academic or athletic 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 Student Experience – Academic (MBA) office.

In such cases, the request for a deferred examination privilege must be made in writing to the Student Experience – Academic (MBA) 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 Graduate Admissions and Study Committee may require that the student with one or more deferred examination privileges refrain from re-registering until the examination(s) have been cleared.

ACADEMIC ACCOMMODATION FOR STUDENTS WITH DISABILITIES

Student Accessibility Services (SAS) offers various support services for students with disabilities. Students are required to inform SAS of accommodation needs for course work at the outset of term. Students must forward a

copy of such SAS accommodation to the instructor normally, within the first three (3) weeks of classes by setting up an appointment with the instructor. If a student with a disability chooses NOT to take advantage of an SAS accommodation and chooses to sit for a regular exam, a petition for relief may not be filed after the examination is complete. The SAS website is:

http://sas.mcmaster.ca

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.

POTENTIAL MODIFICATION TO THE COURSE

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.

ACKNOWLEDGEMENT OF COURSE POLICIES

Your registration and continuous participation (e.g. on A2L, in the classroom, etc.) to the various learning activities of MBA O712 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

MBA O712
Data Analytics with Python
Fall 2023 Course Schedule

Week	Date	Topics	Deliverables
1	Sep. 13	Introduction Jupyter Notebooks, Data manipulation, Data types	
2	Sep. 20	Data exploration and manipulation, Data aggregation	
3	Sep. 27	Visualization - Part 1	
4	Oct. 04	Visualization - Part 2	Assignment 1 release
5	Oct. 11	Supervised machine learning methods - Part 1 Introduction + linear Regression	Assignment 1 Due
6	Oct. 18	Supervised machine learning methods - Part 2 Multi-linear regression	
7	Oct. 25	Supervised machine learning methods - Part 3 Classification - logistic regression + KNN	
8	Nov. 01	Supervised machine learning methods - Part 4 Decision Trees	Assignment 2 release
9	Nov. 08	Supervised machine learning methods - Part 5 Supplementary Class (Option: GLM)	Assignment 2 Due
10	Nov. 15	Unsupervised machine learning models K-mean	Group Assignment Release
11	Nov. 22	NLP - Part 1	
12	Nov. 29	NLP - Part 2	
13	Dec. 06	Group presentations	Group Assignment submission

Note: Depending on class progress, the above schedule may slightly change