Course outline: Data Science Capstone Course - YCBS 299 - 47

General information

Term and year: Fall 2025
Course pre-requisite(s):

- PDC in Data Science and Machine Learning: YCBS 255, YCBS 256, YCBS 257, and YCBS 258
- PDC in Data Analytics for Business: YCBS 256, YCBS 260, YCBS 261, and YCBS 262

Course co-requisite(s): No co-requisites
Course schedule (class day(s) and time): Wednesdays, 6:00 PM - 9:00 PM
Number of CEUs: 9 CEUs
Offering Domain: Technology and Innovation

Instructor information

Name and title: Assistant Professor Alejandro Gutiérrez López
E-mail: alejandro.gutierrezlopez@mcgill.ca
Office location/office hours: Online by appointment
Communication plan: Students may contact the instructor via email for course-related inquiries. Emails will typically receive a response within 36 hours, excluding weekends and statutory holidays. To support timely and effective communication, students are expected to use their McGill email address and to clearly state their question or request respectfully and concisely. Before reaching out by email, students should first make a reasonable effort to find the information by: (a) consulting the course syllabus or textbook, (b) reviewing materials posted on the course website (myCourses), or (c) discussing the matter with classmates.

Course overview

Integration and application of knowledge and skills gained during the program through hands-on projects supported by our industry partners to build a full data science pipeline from preparing, analyzing and visualizing data to building and testing models. Communication and presentation of insights and recommendations derived from data analysis using visualization and storytelling techniques.

Learning outcomes

At the end of this course, students should be able to:

- Apply essential data analysis tools to ingest, clean, process and analyze various large data sets
- Work through all the phases of a complete data problem science pipeline
- Apply different analysis and modelling techniques, such as descriptive statistics, regression analysis, machine learning, among others, to solve a business problem
- Formulate a business need or problem into a data science project and select the proper tools and algorithms needed

- Interpret and effectively communicate data insights by using data visualization and storytelling techniques and translate them into business-specific knowledge

Expectations for student participation

This course consists of a community of learners of which you are an integral member; your active participation is therefore essential to its success. This may include elements such as reviewing class content, visiting myCourses, carrying out readings and exercises, including group work and study groups, and engaging in discussions or other activities with the instructional team and/or the other participants, synchronously or asynchronously.

Required course materials

Materials

Readings and assignments provided through myCourses. Please note that any electronic materials available on the LMS will be accessible to students for six months after the conclusion of the course.

Hardware

Required computer hardware

- Minimum Disk Free Space: 100 GB
- Processor: 64-bit CPU: 4-core @ 2.5 GHz or Faster, System Memory: 16 GB

Recommended computer hardware

- Recommended Disk Free Space: 300 GB
- Processor: 64-bit CPU: 4-core @ 2.5 GHz or Faster, System Memory: 32 GB

Software

Required software and services

- Web browser to access the LMS myCourses
- Zoom
- Alteryx
- Tableau
- Students who prefer not to use Alteryx and Tableau can develop their projects in Python
- Operating System
  Windows 8/8.1 or Windows 10 for students using Tableau and Alteryx Designer
  Windows/ macOS/Linux for students using Python

Internet Connectivity

- 50 Mbps or above

Course content

Week	Date	Description	Assessment task
1	September 3rd, 2025	Introduction to the Course and team building activity	
2	September 10th, 2025	A journey into data science and analytics: The case of Ville de Montreal	
3	September 17th, 2025	Key technologies, tools, and techniques to develop the capstone project	
4	September 24th, 2025	Fundamental data analysis and modelling assessment	In-class individual assessment
5	October 1st, 2025	Presentation: Exploratory results, initial findings, and next steps	Team presentation
6	October 8th, 2025	Feature engineering	
7	October 15th, 2025	Data visualization and storytelling	
8	October 22nd, 2025	Presentation: Initial modelling results	Team presentation
9	October 29th, 2025	Visualization assessment	In-class individual assessment
10	November 5th, 2025	Presentation: Final presentation	Team presentation

Assessment

Name of Assessment Task *	Due Date	% of Final Grade	Assessment Criteria
Attendance and Active Participation	Integrated across all modules and sessions	10	Individual assessment. This aspect is evaluated throughout the course.
Fundamental Data Analysis and Modelling Assessment Activity	During session 4	10	Individual assessment. Complete an online activity to determine the level of understanding of fundamental data analysis and modelling techniques.
Visualization Assessment Activity	During session 9	10	Individual assessment. Complete an online activity to solve a data problem and prepare appropriate visualizations.

Project Reflections	One week after sessions 5 and 10	5	Individual assignment. Reflect on the accomplishments, work performed, challenges, and skills acquired in the project.
Business Problem Framing Report	Before session 3	10	Team assignment. Document the business problem that the team will try to solve. In this and all team assignments, the grade assigned to each team member could be adjusted depending on individual performance. The individual performance will be determined by the instructor based on the information collected from various sources such as surveys, learning journals, and class participation, among others.
Exploratory Results and Initial Findings	Before session 5	10	Team presentation. Present the initial findings and exploratory results discovered during the analysis process and evaluate your peers' presentations.
Initial Modelling Results	Before session 8	10	Team presentation. Present the first models developed and their areas for improvement, and evaluate your peers' presentations.
Final Report	November 3rd, 2025	20	Team assignment. Prepare a final executive report documenting the results obtained and the process followed.
Final Presentation	During session 10	15	Team presentation. Present the final results and recommendations based on the analysis performed and evaluate your peers' presentations. All team members must be present and participate.

**Electronic assessment tasks must be submitted via myCourses. FAQs for students using myCourses: Assignments.*

Land acknowledgment

McGill University is on land which long served as a site of meeting and exchange amongst Indigenous peoples, including the Haudenosaunee and Anishinabeg nations. We acknowledge and thank the diverse Indigenous people whose footsteps have marked this territory on which peoples of the world now gather.

L'Université McGill est située sur un territoire qui a longtemps servi de lieu de rencontre et d'échanges entre les peuples autochtones, notamment pour les Haudenosaunee et les Anishinaabeg. Nous saluons et remercions les divers peuples qui ont enrichi de leur présence ce territoire accueillant aujourd'hui des gens de partout dans le monde.

McGill policy statements

- Language of submission

  "In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French written work that is to be graded. This does not apply to courses in which acquiring proficiency in a language is one of the objectives." (Approved by Senate on 21 January 2009)

  « Conformément à la Charte des droits de l'étudiant de l'Université McGill, chaque étudiant a le droit de soumettre en français ou en anglais tout travail écrit devant être noté, sauf dans le cas des cours dont l'un des objets est la maîtrise d'une langue. » (Énoncé approuvé par le Sénat le 21 janvier 2009)

- Academic integrity

  "McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures" (Approved by Senate on 29 January 2003) (See McGill's guide to academic honesty for more information).

  « L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et procédures disciplinaires. » (Énoncé approuvé par le Sénat le 29 janvier 2003) (pour de plus amples renseignements, veuillez consulter le guide pour l'honnêteté académique de McGill.)

- Inclusive learning environment

  As the instructor of this course, I endeavor to provide an inclusive learning environment. However, if you experience barriers to learning in this course, do not hesitate to discuss them with me and/or Student Accessibility and Achievement.

Additional McGill policy statements

- Name/Pronouns

  Please inform your instructional team if you would like them to refer to you by a different name than the name indicated in your student record or to inform them of your pronouns.

- Recording privacy

  The instructor will notify you if part of a class is being recorded. By remaining in classes that are recorded, you agree to the recording, and you understand that your image, voice, and name may be

disclosed to classmates. You also understand that recordings will be made available in myCourses to students registered in the course. Please consult the instructor if you have concerns about privacy and we can discuss possible measures that can be taken.

- Sustainability

  McGill has policies on sustainability, paper use, and other initiatives to promote a culture of sustainability at McGill. See the Office of Sustainability https://www.mcgill.ca/sustainability.

- Respectful and professional communication

  This course is designed to help you learn to communicate professionally both during your time at McGill and in your future workplaces. In keeping with McGill's policies on student rights and responsibilities, it is expected that during class discussions and small group interactions, you will communicate constructively and respectfully. Sexist, racist, homophobic, ageist, and ableist expressions will not be tolerated in the classroom or during group meetings held outside of class.

- Artificial Intelligence (AI) tools

  Note that any use of AI tools (such as ChatGPT, Grok, Claude, etc.) in assessments must comply with the instructions of each specific assessment. In general, AI tool usage should be clearly cited and briefly explained, along with any other consulted sources. When in doubt, discuss with the instructor.

- Electronic data and intellectual property

  Students may not record any class proceedings or collect any electronic data (including photos and videos) from class activities without the express consent of the instructor. Instructor-generated course materials (e.g., handouts, notes, summaries, test questions, etc.) are protected by law and may not be copied or distributed in any form or in any medium without the explicit permission of the instructor. Note that infringements of copyright can be subject to follow-up by the University under the Code of Student Conduct and Disciplinary Procedures. Copyright extends to this document, which should not be shared beyond the classroom.