MATH*4440 - Case Studies in Mathematics and Statistics

Winter 2024 Course Outline
Section: 01
Credits: 0.50

Land Acknowledgement: Guelph

The University of Guelph resides on the ancestral lands of the Attawandaron people and the treaty lands and territory of the Mississaugas of the Credit. We recognize the significance of the Dish with One Spoon Covenant to this land and offer respect to our Anishinaabe, Haudenosaunee and Métis neighbours. Today, this gathering place is home to many First Nations, Inuit, and Métis peoples and acknowledging them reminds us of our important connection to this land where we work and learn.

Calendar Description

This capstone course for the Mathematical Science major provides students with an opportunity to synthesize knowledge and utilize problem-solving skills accumulated over the course of their studies. The course will focus on case studies drawn from engineering, computer science, biology, life and physical sciences, medicine, and/or economics.
Prerequisite(s): At least 3.0 mathematics and/or statistics credits at the 3000 level or above.
Restriction(s): Restricted to students in the Mathematical Science major.
Department(s): Department of Mathematics and Statistics

Course Description

Course Content Description:

Week 1: Students will be divided in several teams (no more than 4 per team), blending mathematics and statistics majors. Each team will choose among specific projects in math modelling (such as: game theory, population health, operations research, differential equations, markov chains, data science, etc).

- All teams will have to use a collaborative platform to contribute slides/presentations, to brief project updates writing and to coding and scientific paper writing. All teams will have to incorporate some mathematical modelling with coding and data studies in their respective projects.
- All team members will evaluate their members' contributions, alongside the Instructor.
- The aim for each team is to write a "paper" (in the format of a short journal contribution) on the project they have been assigned to work on.
- All teams will be able to give feedback on all other teams' writings and presentations.

If a team's work is judged sufficiently original and thoroughly correct, the winning team(s) will be encouraged to submit their work to the Canadian Journal of Undergraduate Research (https://cjur.ca/).

Course Evaluation and Term grades/assignments:

For clarity, the below table refers to:
Week 1 of classes = Week of Jan. 8, 2024
READING WEEK: Feb 16-26, 2024
Week 12 of classes = Week of April 1st, 2024 (last day: April 8)

Week 1: Possible projects and their respective backgrounds will be discussed in the 1st week of classes, in lectures, with the Instructor providing an overview of the problems, some guidance, on current methods used in the literature; all students are asked to participate in the ensuing discussions.

Weeks 2 - 5 (5% of the final grade each week, each student = total of 20% final mark for each
student): Lectures of Wednesdays are for in-class discussions with select teams, instructor and TA (see table below); Mondays lectures are to be used by teams on independent project work. Each team will have an equal time window to discuss their work, as follows:

1) Present an update on their current work - in class, as a team; in writing, in a personal journal submitted weekly via Dropbox.

2) Ask questions related to their work and ask for help/ideas from other teams and Instructor.

A possible guide as to what work a team may undertake in these weeks:
literature review – where to find relevant material, how to read and pick the most relevant;
how to find free data for their specific needs; how to look for a computational platform; how best to assign skills in each team;
how to discern between good journals and not so good.
How to start the modelling process; what constitutes a good model for their project?
How to make use of data in their models: what others have been doing, what could/would you do?
If no data is available, can you design a survey? If so, how can you gather answers?
Is there a role for public policy in your model?
What will be the "core references" for their proposed work?
Etc.....

Week 6 (Feb 12-Feb 16, 2024): Mid-semester presentations (20% - all slides will be uploaded on Courselink in a Teams folder - this is a one common grade to the entire team)
1) Each team summarizes their work in a slide presentation (5% - up to 5 slides)
2) Each team highlights: their found data sources, their collaborative platform, their coding platform/software (5% up to 5 slides)
3) Each team summarizes their current model building, numerical implementation stage(s) and open questions (10% up to 10 slides)

Mid-semester Instructor evaluation (10% per student): Each team answers Q&A from class and Instructor after presentation and each team member submits their evaluation scores on their teammates and other teams – score sheets will be provided by Instructor (students submit their eval scores on Courselink, in their respective Dropbox folder)

Week 7- 10 (5% of the final grade each week, each student = total of 20% final mark for each student): Lectures of Wednesdays are for in-class discussions with select teams, instructor and TA (see table below); Mon lectures are to be used by teams on independent project work. Each team will have an equal time window to discuss their work, as follows:

1) Present an update on their current work, as a team; in writing, in a personal journal submitted weekly via Dropbox.
2) Ask questions related to their work and ask for help/ideas from other teams and Instructor.

These are the weeks that contain the most intense modelling and data use for each team, as well as numerical implementation issues, results visualization, etc.

Week 11: Teams are supposed to start writing their discovery in paper format – lectures this week will focus on writing styles and presentation of results: theoretical, numerical and data analyses results, etc. All teams are to prepare their drafts in Overleaf using LaTeX (no WORD usage is allowed, nor any other software). The Instructor will be generating the project folders for each team, ensuring direct access for comments as the writing process progresses.

Week 12 (20%): Teams should bring their writing to a close **before** the lectures of this week. A PDF file of each team's written work will be circulated to all students in class. All students can give feedback and ask questions on each of the written works, alongside the Instructor. The written works will be graded based on these extensive Q&A and feedback from class and Instructor (2nd scores sheet for written work will be circulated and students will submit it online for their team, using Dropbox anytime within the first week of exams).

Online personal questionnaire (10%): this will be open for students through the first week of the exam period to complete via the Courselink Quiz facility, online. It will be a series of 10 questions with a "free format" answer regarding the student's experience in the course and if/how their specific knowledge base has expanded.

Lecture Schedule

MonWed 2:30pm-3:50pm in ALEX*117 (1/8 to 4/23)

Weekly Lecture Schedule

UNLESS YOUR TEAM IS LISTED SPECIFICALLY HERE (in which case it is mandatory you participate), YOU ARE EXPECTED TO:

1) ATTEND CLASS AT THE USUAL SCHEDULED TIME, EITHER WITH INSTRUCTOR (in ALEX 117) OR
2) Teams can use the class time to work on their projects as a study group - please note you can reserve space for group work in the Library.

EVERYTHING LISTED HERE HAPPENS AT THE REGULAR SCHEDULED CLASS-TIME: 2.30 - 3:50 pm.

Day	Time	Location	Teams weekly work meetings
Jan. 15		M. Kreitzer MACN 556B	Teams 3,4,5
Jan 17		M. Cojocaru -ALEX 117	Teams 1, 2
Jan. 22		M. Kreitzer MACN 556B & ***Library support***	Teams 3,4,5 ***Any Teams - see details in last row***
Jan 24		M. Cojocaru - ALEX 117	Teams 1,2;
Jan 29		M. Kreitzer MACN 556B & ***Library Support***	Teams 3,4,5 ***Any Teams - see details in last row***
Jan 31		M. Cojocaru - Alex 117	Teams 1,2;
Feb 5		M. Kreitzer MACN 556B	Teams 3,4,5
Feb 7		M. Cojocaru - Alex 117	Teams 1,2
Week 6 (Mo&Wed)		class in-person ALEX 117	mid-semester presentations - all required to be present
Feb 26		M. Kreitzer - MACN 556B	Teams 1,2
Feb 28		M. Cojocaru - ALEX 117	Teams 3,4,5
Mar 4		M. Kreitzer - MACN 556B	Teams 1,2
Mar 6		M. Cojocaru - ALEX 117	Teams 3,4,5
Mar 11		M. Kreitzer - MACN 556B	Teams 1,2
Mar 13		M. Cojocaru - ALEX 117	Teams 3,4,5
Mar 18		M. Kreitzer - MACN 556B	Teams 1,2
MAr 20		M. Cojocaru - AEX 117	Teams 3,4,5
Week 11 (Mo&Wed)		class in-person ALEX 117	all in-class project discussion help
Week 12 (Mo&Wed)		class in-person ALEX 117	Projects discussions and Q&A
Mondays: Jan. 22 & 29	***class time***	***Specialized Library Help: Jacqueline Kreller-Vanderkooy McLaughlin Library room 277***	***Literature review help***

Instructor Information

Monica Cojocaru
Email: mcojocar@uoguelph.ca

Additional Support

TA information: Matthew Kreitzer, Ph.D. Candidate, Mathematics

Course site: please see Courselink for all course content, information, grades, and instructor's notes throughout the semester.

Library Support for our teams w.r.t. data, writing and literature review questions:

- Link to the form to request writing support for your course (https://uoguelph.eu.qualtrics.com/jfe/form/SV_4YCz2jIeryHFTox/).
- Writing in the Sciences online module (https://writinginthesciences.uoguelph.ca/)
- Link to book a data appointment (https://www.lib.uoguelph.ca/using-library/book-appointments/working-data-request/) They can help students both find and work with data.
- Link to book a research assistance appointment (https://www.lib.uoguelph.ca/using-library/book-appointments/research-assistance-request/) Students can use this link to book an appointment.

Learning Resources

Some Instructor's Notes and major literature references for each topic will be provided via the
Courselink site of the course. They are not completely self-contained, but they can be used in conjunction with any textbook treating the same topics. All teams are expected to bring a lot of independent work and reading to their projects during the course.

Required Resources

Posted on the course website: Course link (Website) (https://courselink.uoguelph.ca/)

Course Resources

Library support for scientific literature reviews, data search and scientific writing will be provided throughout the semester (see this Outline, under Additional Support).

Campus Resources

If you are concerned about any aspect of your academic program: Make an appointment with a Program Counsellor (https://www.uoguelph.ca/uaic/programcounsellors/) in your degree program. If you are struggling to succeed academically: There are numerous academic resources offered by the Learning Commons (https://www.lib.uoguelph.ca/using-library/spaces/learning-commons/) including, Supported Learning Groups for a variety of courses, workshops related to time management, taking multiple choice exams, and general study skills.

Course Learning Outcomes

Course Level Learning Outcomes

Specific Learning Outcomes:
1. Critically review and summarize articles from the literature.
2. Properly cite sources and practice academic integrity.
3. Find and evaluate background, primary and secondary sources of information.
4. Collaborate effectively in small groups and provide effective feedback.
5. Select, implement, and interpret appropriate mathematical or statistical models and demonstrate an understanding of the limitations and uncertainties associated with these models.
6. Synthesize and integrate mathematical sciences knowledge with subject area knowledge.
7. Communicate results accurately and effectively in graphical, oral, mathematical, statistical and written form.
8. Critical reflection on topic(s); scientific paper writing skills.

Assessment Breakdown

{NOTE: instructor can add another row by hitting "TAB" button when they are at the end of the row}

Description	Weighting (%)	Due Date
Personal journal + team class discussions	20%	Week 5 (Wed)
Mid-semester presentation	20%	Week 6 (M/W)
Mid-semester Instructor evaluation	10%	Week 6 (Wed)
Personal journal 2 + team class discussions	20%	Week 10 (Wed)
Written project + team class discussions	20%	Week 12 (M/W)
Online questionnaire	10%	1st week of exam period

Last Day to Drop Course

The final day to drop Winter 2024 courses without academic penalty is the last day of classes: April 08

After this date, a mark will be recorded, whether course work is completed or not (a zero is assigned for missed tests/assignments). This mark will show on the student's transcript and will be calculated into their average.

Course Grading Policies

Submission of Assignments

See it under Course Description. Peer review sheets will be distributed via Courselink for mid-semester presentations and project Q&A at end of semester.

Late Assignment

If required, please ask for extensions no later than 24 hrs before a deadline. Extensions will be maximum 24hrs past the deadline.

Course Standard Statements

<Course Policies

Email communication with Instructor:
Student emails will be replied to on a first-come basis, within regular working hours, in accordance with provincial regulations. If multiple emails concern an issue for the entire class, the Instructor will email the class list and/or post relevant info on the Courselink site under "Announcements". Students should use their University of Guelph emails to communicate.

Should a student need to communicate 1-1 with the Instructor on specific/personal concerns, they can submit a request to the Instructor at any time. Meetings will be set online on Teams.

Course Technology Requirements

Some courses have statements about specific technology needed in the course.

Standard Statements for Undergraduate Courses

Academic Integrity

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community – faculty, staff, and students – to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection.

Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor.

The Academic Misconduct Policy (https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-misconduct/) is outlined in the Undergraduate Calendar.

Accessibility

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student.

When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required; however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability. Use of the SAS Exam Centre requires students to make a booking at least 10 days in advance, and no later than the first business day in November, March or July as appropriate for the semester. Similarly, new or changed accommodations for online quizzes, tests and exams must be approved at least a week ahead of time. For students at the Guelph campus, information can be found on the SAS website. (https://www.uoguelph.ca/sas/)

Accommodation of Religious Obligations

If you are unable to meet an in-course requirement due to religious obligations, please email the course instructor within two weeks of the start of the semester to make alternate arrangements.

See the Academic calendar for information on regulations and procedures for Academic Accommodations of Religious Obligations (https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-accommodation-religious-obligations/).

Copies of Out-of-class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Drop Date

Students will have until the last day of classes to drop courses without academic penalty. The deadline to drop two-semester courses will be the last day of classes in the second semester. This applies to all undergraduate students except for Doctor of Veterinary Medicine and Associate Diploma in Veterinary Technology (conventional and alternative delivery) students. The regulations and procedures for course registration are available in the Undergraduate Calendar - Dropping Courses (https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/dropping-courses/).

Email Communication

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

Health and Wellbeing

The University of Guelph provides a wide range of health and wellbeing services at the Vaccarino Centre for Student Wellness (https://wellness.uoguelph.ca/). If you are concerned about your mental health and not sure where to start, connect with a Student Wellness Navigator (https://wellness.uoguelph.ca/navigators/) who can help develop a plan to manage and support your mental health or check out our mental wellbeing resources (https://wellness.uoguelph.ca/shine-this-year/). The Student Wellness team are here to help and welcome the opportunity to connect with you.

Illness

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).

Recording of Materials

Presentations that are made in relation to course work—including lectures—cannot be recorded or copied without the permission of the presenter, whether the instructor, a student, or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted.

Resources

The Academic Calendars (http://www.uoguelph.ca/registrar/calendars/?index) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

When You Cannot Meet a Course Requirement

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the Undergraduate Calendar for information

on regulations and procedures for Academic Consideration. (https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-consideration-appeals-petitions/)