STA238H1-S: Probability, Statistics and Data Analysis II
Winter 2024
sta238@utoronto.ca

Lectures

Section	Instructor	Time	Location
Lec0101	Michael J. Moon	Mon 09-11 AM & Wed 09-10 AM	BR 200
Lec0201	Selvakkadunko Selvaratnam	Mon 01-03 PM & Wed 01-02 PM	AH 100
Lec0301	Michael J. Moon	Tue 03-05 PM & Thu 04-05 PM	AH 100
Lec5101	Luis E. Nieto-Barajas	Tue 07-08 PM & Thu 06-08 PM	PB B250

Tutorials

Section	Teaching Assistant	Time	Location
Tut0101	**Xiao** Wu		VC 212
Tut0102	**Barry** Lung	Wed 10-11 AM	AH 107
Tut0103	**Yushu** Zou		CR 406
Tut0104	**Lining** Wang		VC 206
Tut0201	**Henry** Lu		CR 406
Tut0202	**Rini** Perencsik	Wed 02-03 PM	CR 405
Tut0203	**Jack** Zhang		NF 113
Tut0204	**Shiyao** Ying		AH 107
Tut5101	**Fred** Song		HS 106
Tut5102	**Chen** Chen	Tue 06-07 PM	WB 219
Tut5103	**Arian** Hashemzadeh		WB 119
Tut5104	**Ruyi** Pan		HA 403
Tut5201	**Alex** Valencia Sanchez		CR 405
Tut5202	**Yuxin** Shi	Thu 05-06 PM	CR 406
Tut5203	**Mei** Dong		NF 113
Tut5204	**Sean** Feng		NF 119

*Office hours will be announced on Quercus.
**All times are in Toronto time (EST/EDT).

Course Description

This course will provide an introduction to statistical inference and practice. Topics covered include:

- statistical models and parameters;
- estimators of parameters and their statistical properties;
- methods of estimation;
- confidence intervals;
- hypothesis testing;
- likelihood function; and
- the linear model.

Data analysis and computer simulation in R will be taught and used for calculations and to guide the theoretical development.

Quercus Information

This Course uses the University's learning management system, Quercus, to post information about the course. This includes posting readings and other materials required to complete class activities and course assignments, as well as sharing important announcements and updates. New information and resources will be posted regularly as we move through the term. To access the course website, go to the U of T Quercus log-in page at `https://q.utoronto.ca`.

SPECIAL NOTE ABOUT GRADES POSTED ONLINE: Please also note that any grades posted are for your information only, so you can view and track your progress through the course. No grades are considered official, including any posted in Quercus at any point in the term, until they have been formally approved and posted on ACORN at the end of the course. Please contact the teaching team as soon as possible if you think there is an error in any grade posted on Quercus.

Course Structure

We will meet **in person** during the lecture times listed above. Tutorials will occur weekly in smaller groups in person. During each tutorial, you will have opportunities to review course materials. Bi-weekly quizzes will take place during tutorials in person. You are expected to attend all lectures and tutorials in person.

Grading Scheme

Item	Due	Weight	
Syllabus Scavenger Hunt (1%)			
Syllabus Scavenger Hunt	Jan 26, 2024	1%	
Weekly Reflections (7%) (Partial mark available after the due dates)			
Reflection 1	Week 3		
Reflection 2	Week 4		
Reflection 3	Week 5		
Reflection 4	Week 9	1% each	
Reflection 5	Week 10		
Reflection 6	Week 11		
Reflection 7	Week 12		
Tutorial Quizzes (27%) (Best 3 out of 4)			
Quiz 1	Week 3		
Quiz 2	Week 5	9% each	
Quiz 3	Week 9		
Quiz 4	Week 11		
Tests (65%)			
Term Test	Feb 16, 2024		25%
Final Exam	TBD		40%

Syllabus Scavenger Hunt will be available on Quercus. It will be a timed Quiz on Quercus based on this syllabus. You will have unlimited number of trials for the quiz and the latest trial will be used for your grade. The quiz will NOT reveal your mark between your attempts. Please ensure you have a clear understanding of this syllabus for the quiz.

Weekly Reflections will be available on Quercus. They are due for Lec0101, Lec0201, and Lec0301, at midnight on the day before, and for Lec5101 at noon on the day of the tutorial during the weeks indicated above. For each reflection, you will be asked a set of questions on a Quercus Quiz. You will have unlimited number of trials without time limits and the latest trial will be used for your grade. The quiz will reveal your mark after each attempt. **If you miss the due dates, you still have a chance to earn up to 0.5% out of 1% of the course grade assigned to each homework if you complete them by April 9, 2024.**

Tutorial Quizzes will take place in tutorial sessions during the weeks indicated above. The quizzes will consist of questions based on the previous lectures and weekly R worksheet, which will be available online. You may complete the quizzes collaboratively in groups of up to 3 or alone. All group members must be enrolled in the same TUT section, be present in person, and actively contribute to the tutorial quiz. No communication outside your group, nor use of unauthorized aids are permitted. You are allowed print completed weekly R worksheets and refer to them during quizzes. The printed worksheet must not contain any other materials. **You are responsible for completing and printing the R worksheets.** Quizzes must be written in the tutorial section in which your are officially enrolled, and you will be asked to show your student identification at tutorials. You will receive a grade of 0 if you are not present at your tutorial or if you write a tutorial quiz in another TUT section. Best 3 out of 4 the Quizzes will count towards your final course grade. There is no additional accommodation nor make-ups for missed tutorial quizzes.

Term Test & Final Exam will both be in person. The term test will take place from 5 PM to 7 PM on Friday, February 16, 2024, in Toronto time (EST). The location will be announced prior to the term test date. The final exam will be 3-hours long and will be scheduled by the Faculty of Arts and Science during the final assessment period in April.

Textbooks and Reference Materials

The following textbooks and reference materials are available online. The stud

- *A modern introduction to probability and statistics: Understanding why and how* (2005, First Edition) by Frederik M. Dekking, Cornelis Kraaikamp, Hendrik P. Lopuhaä, and Ludolf E. Meester. `https://librarysearch.library.utoronto.ca/permalink/01UTORONTO_INST/14bjeso/alma991106910545806196`

- *Probability and statistics: The science of uncertainty* (2023) by Michael J. Evans and Jeffrey S. Rosenthal. `https://www.utstat.toronto.edu/mikevans/jeffrosenthal/`

- *Chapters 1 & 2, Statistical rethinking: A Bayesian course with examples in R and Stan* (2020, Second Edition) by Richard McElreath. Link to the chapters are available at `https://xcelab.net/rm/statistical-rethinking/`

- *STA238 Supplementary material* (2021) by Alison Gibbs and Alex Stringer. `https://awstringer1.github.io/sta238-book/index.html`

Computing

We will use R for simulations and data analysis. You will learn to interpret simple outputs from R and write short R codes. While you will be able to complete all R worksheets online, you are encouraged to experiment with R beyond the provided online worksheets. R is freely available for download at `http://cran.r-project.org` for Windows, MacOS, and Linux operating systems. We strongly recommend using the University of Toronto JupyterHub `https://r.datatools.utoronto.ca/`, which doesn't require you to download the software, or RStudio Desktop `https://www.rstudio.com/products/rstudio/`.

Communication Policy

Please contact the teaching team at `sta238@utoronto.ca` for administrative inquiries. Emails sent from addresses other than *utoronto.ca* address will be ignored.

For questions on course materials, we encourage students to use Piazza. You can find our class signup link at: `https://piazza.com/utoronto.ca/winter2024/sta238h1f`. Be sure to read Piazza's Privacy Policy at `https://piazza.com/legal/privacy` and Terms of Use at `https://piazza.com/legal/terms` carefully. Take time to understand and be comfortable with what they say. They provide permissions for substantial sharing and disclosure of your personal information held by Piazza, which affect your privacy. If you decide to participate in Piazza, only provide content that you are comfortable sharing under the terms of the Privacy Policy and Terms of Use.

If you decide not to use Piazza, it will not disadvantage you in any way, and will not affect official University outcomes. If you choose not to opt-into Piazza then you can ask questions or discuss course materials with the teaching team during office hours and tutorials.

Regrading Policy

There will be no regrading for Syllabus Scavenger Hunt and the weekly reflections. For the term test and the tutorial quizzes, please fill out the *STA238 2024 Winter Regrading Request Form* no later than 1 week after receiving the grades at `https://forms.office.com/r/FxzcVwEWab` for each question. Any regrading requests made later or not using the form will be ignored without a notice. The course instructor may ask for a one-to-one meeting if more details are required. Keep in mind that it is possible for your assessment grade to go down if the regraded mark is lower.

Late Submissions and Extensions

There will be no extensions for Syllabus Scavenger Hunt. All late submissions for Syllabus Scavenger Hunt will receive a grade of 0. For the weekly reflections, you will receive up to 0.5% out of 1% of the course grade assigned if you complete them by April 9, 2024. Any missing weekly reflections after April 9, 2024 will receive a grade of 0.

Missing Work and Exceptions

You are given 3 weeks to complete Syllabus Scavenger Hunt. No exception will be granted for missing Syllabus Scavenger Hunt.

If you face exceptional circumstances including medical, personal, family, or other unavoidable reasons and miss a tutorial quiz or the term test, please fill our the *STA238 2024 Winter Request Form for an Exception* within 1 week following the assessment deadline at `https://forms.office.com/r/gRcFAZ5nOQ`. Each request will need **one** of the following supporting documents that covers the date(s) of your missed assessments:

- Absence Declaration form via ACORN in PDF — use "Print Absences" button (see `https://www.artsci.utoronto.ca/current/academics/student-absences`. Note that you can only use the Absence Declaration form once per term.)
- U of T Verification of Illness or Injury Form (VOI) (see `https://registrar.utoronto.ca/policies-and-guidelines/verification-of-illness-or-injury/`)
- College Registrar's letter
- Letter of Academic Accommodation from Accessibility Services

If you need to miss the term test due to a conflict with another course, you must submit the **both** of:

- 2024 Winter Timetable via ACORN in PDF – use "Print Timetable" button
- Syllabus of the course in conflict that the conflict

If you do not fill out the form within 1 week after the deadline, you will receive a 0 grade for the missed assessment and any further communications regarding the assessment may be ignored. If you are experiencing exceptional circumstances that will affect your performance in the course in the long term, it is your responsibility to contact your college registrar and the teaching team as early as possible.

For one documented missed tutorial quiz, the grade will be waived and the total tutorial quizzes grade will be based on the best 2 out of the remaining 3 tutorial quizzes. Because the tutorial quizzes are important to the course learning outcomes, **at most one tutorial quiz** will be accommodated. For any subsequent missed tutorial quizzes, you will receive a grade of 0.

For documented missed term test, there will be a make-up test from 5 PM to 7 PM on Friday, March 1, 2024 (EST). **If you miss the make-up test, you will receive a grade of 0 for the Term Test.**

For weekly reflections, you are given until April 9, 2024 if you miss the original due dates. You will be graded out of 0.5% instead of the full 1% of the course grade assigned to each reflection if you complete them by April 9, 2024. No exception will be made for missing the reflections after April 9, 2024.

Final exam conflicts and petitions for a deferred exam must be brought to the Faculty of Arts and Science, not your instructor. Information on how to request a deferred exam due to illness or another valid reason is available at `https://www.artsci.utoronto.ca/current/faculty-registrar/petitions/deferred-exams`.

Academic Integrity

The University of Toronto treats cases of academic misconduct very seriously. Academic integrity is a fundamental value of learning and scholarship at the university. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that your degree is valued and respected.

The University of Toronto's Code of Behaviour on Academic Matters `https://governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-matters-july-1-2019` outlines the behaviours that constitute academic misconduct, the processes for addressing academic offences, and the penalties that may be imposed. You are expected to be familiar with the contents of this document.

Specifically for this course, potential offences include, but are not limited to sharing answers on Weekly Reflections with anyone else, discussing your questions on Weekly Reflections with anyone other than the teaching team, sharing or discussing your questions or answers on Quizzes, Term Test, or Final Exam with others, and obtaining unauthorized assistance on Weekly Reflections, Quizzes, Term Test, or Final Exam from online sources, your peers or tutoring services. You are encouraged to seek assistance from your peers and the teaching team via Piazza or during office hours without sharing information that directly reveal answers to the assessment questions.

All suspected cases of academic dishonesty will be investigated following the procedures outlined in the Code of Behaviour on Academic Matters. If you have any questions about what is or is not permitted in this course, please do not hesitate to contact the teaching team.

Use of Generative AI

This course policy has been designed to promote your learning and intellectual development, and to help you achieve the course learning outcomes.

The use of generative artificial intelligence tools and apps is strictly prohibited in all course assessments (i.e., weekly reflections, tutorial quizzes, term test and final exam) unless explicitly stated otherwise by the course instructors on assessment instructions. This includes ChatGPT and other AI writing and coding assistants. Students may not copy or paraphrase from any generative artificial intelligence applications, including ChatGPT and other AI writing and coding assistants, for the purpose of completing assessments in this course. Use of generative AI in this course is considered use of an unauthorized aid, which is a form of cheating.

Religious Accommodations

As a student at the University of Toronto, you are part of a diverse community that welcomes and includes students and faculty from a wide range of cultural and religious traditions. If you anticipate being absent from class or missing a major course activity due to a religious observance, please let me know as early in the course as possible, and with sufficient notice (at least two weeks), so that we can work together to make alternate arrangements.

Accommodations for Disability

Students with diverse learning styles and needs are welcome in this course. If you have an acute or ongoing disability issue or accommodation need, you should register with Accessibility Services (AS) at the beginning of the academic year by visiting `https://studentlife.utoronto.ca/department/accessibility-services/`. Without registration, you will not be able to verify your situation with your instructors, and instructors will not be advised about your accommodation needs. AS will assess your situation, develop an accommodation plan with you, and support you in requesting accommodation for your course work. Remember that the process of accommodation is private: AS will not share details of your needs or condition with any instructor, and your instructors will not reveal that you are registered with AS.

Intellectual Property Statement

Course material - including but not limited to lecture slides, assessment questions, and other supplementary course material available on Quercus - is the intellectual property of the teaching team and is made available to you for your personal use in this course. Sharing, posting, selling, or using this material outside of your personal use in this course is **not** permitted under any circumstances and is considered an infringement of intellectual property rights.

Course Schedule

Below is a tentative weekly schedule by topic. The details may change during the term.

Week	Topic
Week 1	Introduction to data analysis
Week 2	Statistical modelling
Week 3	Estimators and their distributions
Week 4	Evaluating estimators
Week 5	Maximum likelihood estimation
Week 6	*Term test* / Bootstrapping
Week 7	*Reading week*
Week 8	Confidence intervals
Week 9	Statistical testing
Week 10	Goodness of fit
Week 11	Introduction to Bayesian inference
Week 12	Estimation in Bayesian inference
Week 13	Predictive modelling