STA238H1-S: Probability, Statistics and Data Analysis II

Summer 2024

Instructor:	Fred Song	**Time:**	M,W 12:00 – 15:00 EST
Course Website:	Quercus	**Location:**	PB B250.

Tutorials:

Section	Teaching Assistant	Time	Location
TUT0101	Arian Hashemzadeh Amirkhizi	Mon 11-12 AM & Wed 11-12 AM	MS 2173
TUT0102	Yeonjoon Choi	Mon 11-12 AM & Wed 11-12 AM	MS 3278
TUT0103	Mei Dong	Mon 11-12 AM & Wed 11-12 AM	MS 4171
TUT0104	Yaqi Shi	Mon 11-12 AM & Wed 11-12 AM	MS 4279

Course Description: This course is an introduction to statistical inference and practice. Statistical models and parameters, estimators of parameters and their statistical properties, methods of estimation, confidence intervals, hypothesis testing, likelihood function, the linear model. Use of statistical computation for data analysis and simulation. Both statistics from frequentist (week 1- 5) and Bayesian (week 6-7) approach will be introduced.

Pre-requisities: A course in probability (STA237H1/STA247H1/STA257H1/STAB52H3/STA256H5). Comfort with the content of the calculus prerequisites of the probability prerequisite is also required. Please note that prerequisites for all STA courses fall outside the instructor's purview. Questions about prerequisites should be directed to ug.statistics@utoronto.ca.

Meetings: Lectures will introduce new material, including examples and applications, with blocks of time for questions. Tutorials will hold regular weekly quizzes (on Mondays) and in-class activities (on Wednesdays). Lectures begin on Wednesday, July 3, and end on Monday, August 12, with exceptions on Monday, August 5, for a provincial holiday. Note that the lecture on Wednesday, July 24, will only be 1.5 hours (the first 1.5 hours will be the Midterm), and the lecture on Wednesday, August 7, will be online due to conference traveling. Tutorials will begin on Monday, July 8, and end on Monday, August 12. Please note that lectures will not be recorded, but annotated slides will be uploaded to Quercus after each lecture. Anyone found recording the class will be asked to leave the classroom and may face further consequences. For information on Quizzes and In-class Activities, please refer to the subsequent sections.

Quizzes: There will be a total of 4 quizzes. Each quiz is worth 6% of the overall grade and will typically include two questions, *with one question specifically similar to the textbook's suggested questions.* The quizzes aim to test the understanding of the course content from previous weeks. The quizzes will take place on Mondays during the tutorial time, lasting about 40 minutes. They will be distributed at the beginning of the tutorial and will end at 11:55 AM to accommodate students arriving for the lecture at 12:10 PM.

In-class Activities: There will be a total of 4 in-class activities, each worth 1.5% of the overall grade. The in-class activities will be held regularly during the Wednesday tutorial time. The activities will be posted on Tuesday night for that week. TAs will walk through the activities, give hints to students, and answer their questions during the tutorial. The activities will normally consist of R coding questions, so a `.qmd`

file will be provided for the assignment. Students will have access to it until Friday of the same week. For submission, please turn in a knitted `.pdf` file along with the `.qmd` file by Friday. The in-class activities will be graded for completeness, with all answers sufficiently hinted at by the TAs, allowing students to practice the R coding learned in class.

Midterm: The midterm will be held during the tutorial and the first half of the lecture on Wednesday, July 24th, from 11:10 AM to 1:00 PM. The location is to be determined (TBD). The second half of the lecture will resume at its regular lecture room in PB B250, starting from 1:30 PM. Please make sure to bring your UofT student card and calculators.

The make-up midterm will take place the following week, on Monday, July 29th, from 5:10 PM to 7:00 PM, location TBD.

Course Schedule:

Table 1: STA 238 Summer 2024 Course Schdule

Week	Date	Tutorial Topic	Lecture Topic
Week 1	July 1st	Canada day no classes	
	July 3rd	No Tutorial	Syllabus + Introduction to data analysis
Week 2	July 8th	Quiz 1	Statistical modeling
	July 10th	In-class Activity 1	Estimators and their distributions
Week 3	July 15th	Quiz 2	Evaluating estimators
	July 17th	In-class Activity 2	Maximum likelihood
Week 4	July 22nd	Midterm Review	Bootstrapping and Confidence
	July 24th	No Tutorial, Midterm + Confidence interval	
Week 5	July 29th	Quiz 3	Statistical testing
	July 31st	In-class Activity 3	Goodness of fit
Week 6	August 5th	Civic Holiday no class	
	August 7th	In-class Activity 4	Online Lecture: Introduction to Bayesian Stats
Week 7	August 12th	Quiz 4	Estimation in Bayesian
	August 14th	Semester finished no class	

Communication: Administrative and logistical information and updates will be posted to Quercus, along with annotated notes, sample code, or other content. For questions beyond that, we have the following channels:

- **Piazza:** (sign-up link) Piazza is for discussions about course material, activities, and logistics. Out of respect for classmates, personal or individual matters should not be posted on Piazza. Posts that are off-topic may be removed. I encourage you to answer questions from fellow students. Teaching team members will check in regularly throughout the week to moderate the discussion and endorse posts, but may not respond to every post. Please be mindful about your classmates and fellow Teaching teams.
- **Office Hours:** Office hours will be held after class and weekly by Fred and other TAs (times to be posted on Quercus). Office hours are the best way to talk directly with the course instructor and TAs. There may be additional office hours from me before midterm and final exams based on demand. Any updates to availability will be discussed in lectures and posted on Quercus.

- **Email: sta238@course.utoronto.ca** Email is for private administrative inquiries and quiz/midterm re-grading only. We aim to return all emails within 48hrs, excluding weekends. Please start any email with "To the STA238 Teaching Team,. . . " and include your preferred name in closing. Emails that do not adhere to the guidelines may not receive a response. For guidelines on submitting re-grading requestion, please refer the subsequent **Marking Concerns** section. Please note that this email address will not be monitored after August 31, 2024.

Communication guidelines:

- Choose the appropriate context. *When* and *how* to communicate appropriately in this course is outlined in this syllabus. Note that appropriateness depends on the content of the message, that is, on what the message is about.
- Aim for clarity. All necessary details are included and delivered in as succinctly as possible.
- Show courtesy. Some ways of being courteous include: using a gentle tone, considering the perspective of your audience, and respecting boundaries expressed by others.
- Engage in good faith. Try to participate honestly and regularly, to the best of your abilities given your current situation. Everyone else (including the teaching team) will be trying too, although they have different abilities and situations, and these are private.

Policies for Absences:

- **Classes:** If you are unable to come to class, there is no need to report it to the instructor. You are responsible for the material covered in class—please make use of the annotated notes to find out what you missed.
- **In-class Activity** The tutorials on Wednesday will be hosted as in-class activity, where TAs will give hints to the posted materials and help students with questions that they might have. The deadline for each in-class activity will be the Friday of the week. There will be no late submission accepted for In-class activity.
- **Quizzes:** If you are unable to attend one of the four quizzes in the class, the percentage of that quiz will be evenly distributed among the remaining quizzes. There will be no make-up quizzes. If you miss two or more quizzes, the score for the second and any subsequent missed quizzes will be 0. To report an absence for the quizzes, please refer to the subsequent **Reporting Absences** section.
- **Midterm/Final Exam:** If you are unable to attend the Midterm on July 24th, a make-up midterm will be arranged for the following week (July 29th). If you miss both the midterm and the make-up midterm, a score of 0 will be given for the midterm. If you are unable to attend the Final exam during the Faculty of Arts & Science arranged times, you will need to take it in a subsequent course section. For both midterm and final exam absence declarations, please refer to the subsequent **Reporting Absences** section.

Reporting Absences: If you face exceptional circumstances including medical, personal, family, or other unavoidable reasons and miss a tutorial quiz or the midterm/final exam, please fill out the STA238 2024 Summer Request Form for an Exception within 1 week following the assessment deadline at `https://forms.office.com/r/G0aneqr0cG`. 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 the "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-guid verification-of-illness-or-injury/)
- College Registrar's letter
- Letter of Academic Accommodation from Accessibility Services

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.

Textbooks and Reference Materials: The following textbooks and reference materials are available online:

- **A Modern Introduction to Probability and Statistics: Understanding Why and How** (2005, First Edition) by Frederik M. Dekking, Cornelis Kraaikamp, Hendrik P. Lopuhaa, 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

Grading Scheme:

Quizzes	$4 \times 6\% = 24\%$
In-class Activities	$4 \times 1.5\% = 6\%$
Midterm Exam	30%
Final Exam	40%

Notice that there are following bonus points available, **they will be be calculated after the final exam period and added to the overall grade of the student:**

- A BONUS 1% is given for every 6 Piazza questions that students have answered. This means that, on average, students would need to answer 1 question per week. **Up to 2% can be obtained from answering questions on Piazza.**
- One survey will be sent to you via email during the semester, via Qualtrics. You will earn a 1% BONUS on your final grade for completing this survey in its entirety. Additional details will be provided via the course site on Quercus.

Practice problems: Practice problems from the textbooks will be assigned after each lecture. It is recommended that you complete all exercises in the reference material including the "quick exercises" in MIPS and the exercises provided in STA238supplement. All of the assigned practice problems are strongly recommended as preparation for the quizzes, the midterm and the final exam.

Marking Concerns (Re-grading requests): For the in-class activities, since the grading is for the completion of each question, there will be no re-grading for the work. For the term test and the tutorial

quizzes re-grading requests, please send out an email to the course email at **sta238@course.utoronto.ca** with the following format `https://tiny.cc/sta238regrading` **no later than 1 week after receiving the grades**. Any re-grading requests made later or not using the form will be ignored without 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 re-graded mark is lower.

Academic Integrity: Discussion about your work with classmates and the teaching team is encouraged, but you may not submit work completed by another student or group. You may use code provided by your instructors without providing a citation. If you use code from any other source, you must provide the source. It is expected that you understand any code that you use and that you are not sharing your completed work for this course. Academic offences can carry serious penalties. You are expected to be familiar with the University of Toronto's Code of Behaviour on Academic Matters, available at http://academicintegrity.utoronto.ca.

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 related assessment and communications (i.e., in-class activity, 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.