STA 238 L5101 - Probability, Statistics, and Data Analysis II
MW @ 6-9 PM EST, TUT: MW @ 5 PM EST on Bb Collaborate

Instructor: Karen H. Wong - karen.huynhwong@utoronto.ca

TA and Instructor Office Hours: Will be posted on Quercus

Course Description: 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.

Prerequisites: STA237/STA247/STA257/STAB52/STA256

Textbooks:

1. *A Modern Introduction to Probability* by *Dekking et. al.*, available through the library here
2. *Modern Mathematical Statistics with Applications*, 2nd ed. by *Devore and Berk* available through the library here
3. *R for Data Science* by *Grolemund and Wickham* is a recommended reference text for students new to using R. Chapters 3-9 is recommended reading to reinforce skills in R. Available here

We will be referencing mostly from MIPS in our course, and occasionally from MMSA.

Course Structure: During these unprecedented and challenging times, this course will be operate differently from the regular sitting. Our course will be a combination of synchronous and asynchronous lectures with weekly tutorial sessions. Synchronous lectures *will be recorded* and made available on our Quercus page, but tutorial attendance is **mandatory**. See if online learning is right for you HERE.

Suggested Weekly Routine

Friday	Saturday	Sunday	Monday	Tuesday	Wednesday	Thursday
Do suggested textbook problems. Post Q&A to discussion board. Video lecture part A posted.	*Video lecture part B posted. Watch video lectures, take your own notes. Flag anything you find unclear. Post your questions and answers on discussion board. Complete pre-tutorial.*		***(Tutorial),*** *Synchronous lecture. Do suggested textbook problems. Post Q&A on discussion board*	REST DAY	***(Tutorial), Quiz.*** *Synchronous lecture.*	*Review this week's topics, in-class problems, activities. Experiment with R. Start pre-tutorial if applicable.*

Everyone learns at a different pace. In addition to our course times (∼8 hours per week), students should expect to commit *at least 2-3 hours per lecture* as self-study, or 4-6 hours per week. Self-study includes: creating course notes for yourself, working on suggested problems, reviewing class material, and posting on the discussion board.

Quercus Page: All lecture slides, video recordings, weekly quizzes, and other course material will be posted on Quercus under Modules. Course materials provided on Quercus are for the use of students *currently enrolled in this course only. Distributing course materials to anyone outside of the course is considered unauthorized use.*

Course Assessments:

Discussion Board	5%	All term
Tutorial Assessments (best 5 out of 6)	8% each	Due: Weekly
Weekly Quizzes (best 5 out of 6)	6% each	Every Wednesday + August 17 @ 8 PM
Final Assessment Part 1	10%	August 17
Final Assessment Part 2	15%	Scheduled by Faculty of Arts and Science

Discussion Board: There will be weekly topic threads on the Quercus Discussion Board as a space for students to discuss textbook problems, course topics, and as peer support. The instructor and TAs will be monitoring and contributing regularly to keep the discussions going, guide students back on track, or answer any lingering questions. The expectation is that students contribute by working collaboratively with each other and build on your understanding of concepts by answering each others' questions. The grading scheme will be posted and discussed during our first class.

Tutorials: Tutorials will run weekly. All tutorials will be graded, but tasks will differ from week to week. You should expect to complete and submit some preparatory work (e.g. your own data analysis) before attending tutorial, as well as some final reporting work to be submitted during your tutorial or by the end of the next day, depending on the tutorial.

> **(Mandatory) Tutorial Dates:** July: 13, 20, 27 — August: 5, 10, 17.
> Supplementary Tutorial Dates (tentative): July 22, 29, August 12

Quizzes: Weekly quizzes will begin on **Wednesday July 15 at 8 PM EST**. The quizzes will be timed, and the format a mix of multiple choice and short answer problems. You will be required to upload a picture and/or file of your work. Topics covered in the weekly quizzes will emphasize the material covered in the previous week, but are also cumulative in nature. Quizzes are every Wednesday, with the last quiz on **Monday August 17**.

Minimum Passing Requirement: Students must complete and submit at minimum:

- 3 of the 6 mandatory tutorials
- 3 of the 6 quizzes
- Both parts of the final assessment

If you miss more than these minimum passing requirements, even with accommodation, you will not be able to pass this course. There are no make-up quizzes or tutorials. If there are extenuating circumstances that will affect your performance in the course in the long term, it will be your responsibility to contact the instructor as early as possible.

Accommodations: Accommodation requests must be made by email to the course instructor (karen.huynhwong@utoronto.ca) at least 24 hours before the assessment date. Extensions will be arranged where possible.

Missed Work: Missed term work (tutorial or quizzes, up to a maximum of 3 each) due to legitimate reasons (e.g., injury, illness, or other exceptional circumstances) should be communicated to the instructor within 1 week of the assessment. Documented missed work will be redistributed within its assessment category. All other cases will have a 0 recorded.

Students who missed any part of the final assessment for legitimate reasons should communicate this to the instructor within 1 week of the assessment by email. These students have one opportunity to make up the missed work through an oral exam to be arranged with the instructor. You must include in your email your full name, student number, and the following statement:

I affirm that I am experiencing an illness or personal emergency and I understand that to falsely claim so is an offence under the Code of Behaviour on Academic Matters. I understand that the weight of this assessment will be made up through an oral exam.

Grading: Marking schemes/solutions will be provided (except the final assessment). These should be reviewed before requesting a reread. If you still have concerns about your grading, send me an email with a brief explanation **no later than 1 week** after the assessments have been released back to you. Late requests will not be accepted.

Course Conduct:

- **Email:** Any administrative or personal concerns regarding the course should be addressed to the course instructor (karen.huynhwong@utoronto.ca). Questions regarding course material and concepts should be left for office hours or the discussion board.
- **Programming Languages:** We will be using R Statistical Sofware regularly, R statistical software which is available for free download. It is strongly recommended that you also download R Studio. If you have problems with setting up R, you may find it easier to use through R Studio Cloud. Starter code will be provided where appropriate. You are expected to understand how the code works, and predict the output that will be generated. You should anticipate to have R ready to use during all tutorials and synchronous lecture times.

Accessibility Services: The University of Toronto provides accommodations through accessibility services to students with diverse learning styles and needs. If you have a disability or health consideration that may require accommodations, please feel free to reach out to Accessibility Services at 416-978-8060 or through accessibility.utoronto.ca.

Academic Integrity: Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that the U of T degree that you earn will be valued as a true indication of your individual academic achievement, and will continue to receive the respect and recognition it deserves. Familiarize yourself with the University of Toronto's Code of Behaviour on Academic Matter. Potential offences include, but are not limited to:

Quizzes & Tutorials:

- Obtaining or providing unauthorized assistance on any quiz including:
  - working in groups on individual assessments, including giving hints to the answer!
  - having someone rewrite, edit, or add material to your work while editing.
  - researching for inspiration, hints, or answers to any graded problem
  - posting active assessment questions on discussion boards/private tutoring companies for hints/solutions
- Lending your work to a classmate who submits it as their own with or without your permission

The University of Toronto treats cases of academic misconduct very seriously. All suspected cases of academic dishonesty will be investigated following the procedures outlined in the Code. The consequences for academic misconduct can be severe, including a failure in the course and a notation on your transcript. **If you have any questions about what is or is not permitted in this course, please do not hesitate to contact the instructor.** If you are experiencing personal challenges that are having an impact on your academic work, please speak to the instructor or seek the advice of your college registrar.

Week	Tentative Schedule & Suggested Problems
1A: July 6	Welcome to the Course! EDA: Summary Statistics
Problems:	MIPS Ch. 16: All quick exercises (QE), 16.1, 16.3-16.9, extra: 16.15, 16.17
1B: July 8	EDA: Graphical Summaries
Problems:	MIPS Ch. 15: All QE, 15.1-2, 15.4-6, 15.8-10, extra: 15.12
2A: July 13	Approximations and Limiting Theorems, What is a Statistical Model?
Problems:	MIPS Ch. 13: All QE, 13.2-7, extra: 13.9-10, Ch. 14: All QE, 14.2-6, 14.10, Ch. 17: All QE, 17.1-4, 17.7
2B: July 15	Estimators and their Properties, Method of Moment Estimation
Problems:	MIPS Ch. 19: All QE, 19.1-5, 19.7-8, extra: 19.9, Ch. 20: All QE, 20.1-4, extra: 20.5, 20.8-9, MMSA Ch. 7.2: 22, 23a, 27a
3A: July 20	Maximum Likelihood Estimation, MLE Properties
Problems:	MIPS Ch. 21: All QE, 21.1-6, 21.8-9, 21.11, 21.14
3B: July 22	Intro to Bayesian Statistics and Estimation
Problems:	MMSA Ch. 14.4: 23, 24a, 25a. E&R Ch. 7.1: 1, 2, 4, 5, 8, 9, 13-15
4A: July 27	Bayesian Estimation, Bootstrap Principle, Parametric Bootstrap
Problems:	MIPS Ch. 18: All QE, 18.1-4, 18.6-11
4B: July 29	Common Sampling Distns, Confidence Intervals
Problems:	MIPS Ch. 23: All QE, 23.1-7, 23.9-11, Ch. 24: 24.1, 2b, 3-7, 9

Week	Tentative Schedule & Suggested Problems
5B: August 5	Confidence Intervals, Bootstrapped CI
Problems:	MIPS Ch. 23: All QE, 23.1-7, 23.9-11, Ch. 24: 24.1, 2b, 3-7, 9
6A: August 10	Intro to Hypothesis Testing, Types of Errors
Problems:	MMSA Ch. 9: 1-5, 9, 10, 18, 22, 26, 30, 37, 39, 42, 44
6B: August 12	Hypothesis Testing, Simulated P-Values
Problems:	MMSA: Ch. 9: 55 (sim), 56 (sim)
7A: August 17	Simple Linear Regression
Problems:	MIPS Ch. 22: All QE, 22.1-2, 22.5, 22.7, 22.12
	MMSA: Ch. 12.1: 3-4(R), 7-8, 11, Ch. 12.2: 16, 17(R), 18, 21(R)