# STA261H1 S LEC0101
# Probability and Statistics II
# Winter 2025
# Course Outline

**Lecture Times:** Monday 2:00 PM-5:00 PM  Room: WB 116

**Instructor:** Lijia Wang

**Course E-mail:** sta261@course.utoronto.ca
Note: Do not email me directly.

**Office Hours:** Wednesday 3:00 - 4:00 PM at SU 432 (Student Commons: 230 College Street, Toronto, ON M5T 1R2).

**Course Website:** https://q.utoronto.ca/courses/380289

**Course Description:** A rigorous introduction to the theory of statistical inference and to statistical practice. Statistical models, parameters, and samples. Estimation, sampling distributions, and the properties of consistency, bias, and variance. The likelihood function and maximum likelihood estimation. Hypothesis tests and confidence regions. Examples illustrating statistical theory and its limitations. Introduction to the use of `R` for statistical analysis.

Note: STA261H1 does not count as a distribution requirement course

**Pre-requisite**: STA257H1/ STAB52H3/ STA256H5
**Co-requisites**: MAT237Y1/ MAT257Y1/ MAT257Y5; MAT223H1/ MAT224H1/ MAT240H1/ MATA22H3/ MATA23H3/ MAT223H5/ MAT240H5/ MATB24H3/ MAT224H5
**Exclusion**: ECO227Y1/ STA238H1/ STA248H1/ STAB57H3/ STA260H5/ ECO227Y5
**Recommended Preparation**: None
**Arts & Science Distribution Category**: Science

**Arts & Science Breadth Requirements**: The Physical and Mathematical Universes (5)
**Mode of Delivery**: In Class

Students who lack a pre/co-requisite can be removed at any time unless they have received an explicit waiver from the department.

**Delivery Mode:** This course is to be delivered **in person** as specified on the University Timetable Builder website. In case there is any change in the mode of delivery, the details will be announced on the course website.

**Tutorials:** Tutorials will be held **in person** every week from the second week. The details are available on the University Timetable Builder website and the Quercus page. Tutorials will be administered by the TAs to review topics, solve problems and answer questions. The TA contact information will be posted on Querucs.

**Textbook:** Mathematical Statistics & Data Analysis, Third Edition, by John A. Rice. A PDF copy can be found here!

## Additional References

- Mathematical Statistics with Applications (7th Edition) by Wackerly, D., Mendenhall, W., and Scheaffer, R. L. 2008.

**Statistical Computing:** Statistical software R will be used occasionally. No previous computing experience is assumed. Students will not be tested on their expertise on this software. Any code used in the lectures to demonstrate any example will be available on the course webpage for students to practice on their own time. Here are the links to download this open source software:

- For Windows: https://cran.r-project.org/bin/windows/base/
- For Mac: https://cran.r-project.org/bin/macosx/

**After installing R**, you can install posit (RStudio) which is available HERE.

**Assessments:** Your final grade will be based on the following assessments:

| Type | Weight |
|---|---|
| Term Test 1 | 35% |
| Term Test 2 | 35% |
| Term Test 3 | 30% |

**Term Tests:** Details such as the content and the location will be announced on Quercus approximately a week before each term test. All term tests will take place in lecture on the date given in the lecture schedule at the end of the syllabus.

**Missed Term Work Policy:** For a missed term test, students must provide valid documentation such as the Verification of Illness or Injury. The documentation must be sent to the course email (sta261@course.utoronto.ca) within seven days of the missed term test. For more information, Please check the university policy.
Once per semester, each student is allowed to miss work without any documentation. In that case you must fill out the ACORN absence declaration form. The form can be used at most ONCE per semester (once in total for all of your courses, not once per course). The absence you declare can be for a maximum of 7 consecutive days.
There is NO make-up test in this course. For missed term test with valid documentation or absence declaration, the weight will be distributed equally to the other 2 term tests.

**Re-Marking Policy:** The course re-mark policy exists to correct mistakes and any request should clearly identify the error (for example, a question that was not marked, or a total incorrectly calculated). Requests to correct such mistakes must be sent by email to the course email address. Before you request for a re-mark, please make sure you review the solutions posted in Quercus. To be considered for a re-mark,

- the email should include student's full name and ID number, and give a specific, clear, and concise reason for each request, referring to a possible error or omission by the marker.
- students should make such requests as soon as reasonably possible after receiving the work back, but no later than 1 week after it was returned.

Note that if a student requests for a re-mark, the entire term test may be re-marked so the new grade may go up, down, or remain the same.

**Piazza:** Piazza will be used for discussions. This is for student-led discussion. The TAs will check Piazza posts on a regular basis and might participate in discussions. Please do not email questions about course content to the instructor/TAs. Instead, post your question on Piazza. Volume of messages increases one or two days before the test. As this is a large course, it will not be possible for the the TAs to answer all questions on Piazza. We encourage you to attend lecture and tutorial to get questions answered in-person.

**Academic Integrity:** Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, U of T treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters outlines behaviours that constitute academic dishonesty and the process for addressing academic offences. Potential offences include, but are not limited to:

In papers and assignments:

1. Using someone else's ideas or words without appropriate acknowledgement.
2. Submitting your own work in more than one course, or more than once in the same course, without the permission of the instructor.
3. Making up sources or facts.
4. Obtaining or providing unauthorized assistance on any assignment.

On tests and exams:

1. Using or possessing unauthorized aids.
2. Looking at someone else's answers during an exam or test.
3. Misrepresenting your identity.

In academic work:

1. Falsifying institutional documents or grades.
2. Falsifying or altering any documentation required, including (but not limited to) doctor's notes.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources.

**Use of Generative AI:** Students may use artificial intelligence tools, including generative AI, in this course as learning aids. However, students are ultimately accountable for the work they submit.

**Plagiarism Detection:** Normally, students will be required to submit their course essays to the University's plagiarism detection tool for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of this tool are described on the Centre for Teaching Support & Innovation website. Students may wish to opt out of using the plagiarism detection tool. In order to opt out, contact your instructor by email no later than two (2) weeks after the start of classes. If you have opted out, then specific information on an alternative method to submit your assignment can be found below.

**Email Policy:** Email is most appropriate for personal questions. Before you send an e-mail, make sure that you are not asking for information that is already on the course outline/ website/announcements, or questions about the course material that are more appropriately discussed during office hours. If you do not get a response, this may be why. If your question is conceptual and does not require calculations or an elaborate answer, you can ask in office hours or lecture. For personal matters, contact the course email with your U of T email address. The subject line must contain the course number, lecture section number, and a relevant subject (indicating what the email is about). Be sure to include your full name and student number in the body of the message. You will not get a response if you email from other email addresses or do not follow the email policy.

**Privacy and Use of Course Materials Notifications:** Course materials belong to your instructor, the University, and/or other source depending on the specific facts of each situation and are protected by copyright. In this course, you are permitted to download session materials for your own academic use, but you should not copy, share, or use them for any other purpose without the explicit permission of the instructor. For questions about recording and use of videos in which you appear please contact your instructor.

**Accessibility Needs:** The University of Toronto is committed to accessibility. If you require accommodations for a disability, or have any accessibility concerns about the course, the classroom, or course materials, please contact Accessibility Resource Center as soon as possible.

**Students Responsibilities:**

- It is up to students to know all course policies and important dates. It is also up to students to know about any important announcements; these will come to their inbox. Check Quercus regularly!
- Students are responsible for their own learning. The instructor/TAs are happy to help you learn, but in the end it is up to you. Use office hours and Piazza often. Keep asking questions until you are satisfied. Ask about big concepts or small details - there is no such thing as a stupid question. Always take advantage of extra help and don't wait until it is too late.
- Students must follow the U of T code of Behaviour, this means that cheaters will be prosecuted. The Academic Regulations of the University are outlined in the Code of Behaviour on Academic Matters. They are expected to be familiar with, and to abide by, all components of the Code of Behaviour on Academic Matters. Full details can be found here.

**Lecture Schedule:** This schedule is tentative and subject to change. Updates will be posted on Quercus.

| Weeks | Topics | Reading |
|---|---|---|
| Week 1 (Jan. 06 - Jan. 10) | Lecture 1: Course Introduction, Review | Chps 1-3 |
| Week 2 (Jan. 13 - Jan. 17) | Lecture 2: Review, Limit Theorems | Chp 4-5 |
| Week 3 (Jan. 20 - Jan. 25) | Lecture 3: Normal Theory, Sampling | Chp 6-7 |
| Week 4 (Jan. 27 - Jan 31) | Term test 1: Covers Lectures 1 & 2 | |
| Week 5 (Feb. 03 - Feb. 07) | Lecture 4: Properties of Estimators | Chp 8 |
| Week 6 (Feb. 10 - Feb. 14) | Lecture 5: Method of Moments, MLE | Chp 8 |
| **Reading Week (Feb. 17 - 21)** | - | - |
| Week 7 (Feb. 24 - Feb. 28) | Lecture 6: MLE Asymptotics, Optimality | Chp 8 |
| Week 8 (Mar. 03 - Mar. 07) | Term test 2: Covers Lectures 3, 4, & 5 | |
| Week 9 (Mar. 10 - Mar. 14) | Lecture 7: Hypothesis Testing, Bayesian Inference | Chp 8-9 |
| Week 10 (Mar. 17 - Mar. 21) | Lecture 8: Linear Regression | Chp 14 |
| Week 11 (Mar. 24 - Mar. 28) | Lecture 9: Additional Topics, Review | |
| Week 12 (Mar. 31 - Apr. 04) | Term test 3: Covers Lectures 6, 7, 8, & 9 | |