STA347H1S - Probability
Summer 2023

Instructor: Ziteng Cheng

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Lecture Hours: Tuesday and Thursday 2:00-5:00pm, BA1160

Office Hours: See Quercus

Prerequisite:[1] STA247H1(70%)/ STA255H1(70%)/ STA237H1(70%)/ STA257H1/ ECO227Y1/ STAB52H3/ STA256H5; MAT223H1/ MAT224H1/ MAT240H1/ MATA22H3/ MATA23H3/ MAT223H5/ MAT240H5/ MATB24H3/ MAT224H5; MAT235Y1/ MAT237Y1/ MAT257Y1/ (MATB41H3, MATB42H3)/ (MAT232H5, MAT236H5)/ (MAT233H5, MAT236H5) (Note: STA257H1, MAT223H1/ MAT240H1, MAT237Y1/ MAT257Y1 are very strongly recommended)

Quercus Discussion Board: We will be using the Quercus Discussion Board as an online discussion forum. All questions related to the content of the course should be posted here or asked during lecture/office hours. The instructor and TAs will monitor the board and will help answer questions but students are encouraged to answer posts and help their fellow classmates.

Course Outline: An overview of probability from a non-measure theoretic point of view. Random variables/vectors; independence, conditional expectation/probability and consequences. Various types of convergence leading to proofs of the major theorems in basic probability. An introduction to stochastic processes such as Poisson and branching processes. Topics below are tentative, and subject to shuffling, merging, reduction, expansion and modification. Numbers within parenthesis indicate lecture hours.

- Introduction (7): axioms and basic properties of probability (2), random variables (1), expectation (2), Lebesgue measure and density function (1), Jacobi transformation formula (1)
- Independence (3): definition and equivalent definitions (1), Borel-Cantelli lemma (0.5), Fubini-Tonelli theorem (0.5), law of large numbers (1)
- Selections of inequalities (3): Markov, Hoeffding, Efron-Stein, Jensen, Hölder, Minkowski
- Convergence of random variables (5): various types of convergences (1), limit theorems (2), relations between convergences (2)
- Conditional expectation (3): definition (1), basic proprieties (2)

[1] This is strictly enforced by the Department of Statistical Sciences. Students who have deferred assessments/exams in prerequisite course(s) or have an equivalent course as a transfer credit should contact the Statistics Undergraduate Office at ug.statistics@utoronto.ca to request to be kept in the course.

- Weak convergence of probabilities (9): definition and equivalent definitions (4), central limit theorem (1), Slutsky's theorem (1), selections of important results (3)
- Introduction to stochastic processes (3)

Course Materials: The lecture notes will be posted on Quercus. Below is a list of supplementary materials. Please note that these supplementary materials are not mandatory for the course. They are intended to provide a deeper understanding of concepts that, while not directly covered in the course, are integral to grasping the framework of probability.

[D] R. Durrett, *Probability: Theory and Examples*, 2019. (Link)

[S1] A. N. Shiryaev, *Probability I, Third Edition*, 2016.

[S2] A. N. Shiryaev, *Probability II, Third Edition*, 2019.

[B] R. F. Bass, *Real Analysis for Graduate Students*, 2020. (Link)

[A&B] C. D. Aliprantis and K. C. Border, *Infinite Dimensional Analysis: A Hitchhiker's Guide, Third Edition*, 2006.

Grading Scheme: See Table 1 for the allocation of points. Component details are provided below:

- There will be 4 review reports due on July 16, 23 and Aug 6, 13. Each report is worth 5 points. You are expected to submit a one-page report that encapsulates your thoughts, comments, or questions on the concepts covered during the preceding 2 weeks. The grading for these reports will be relatively flexible. Late submissions will not be accepted.
- Assignments will be distributed throughout the course. The corresponding solutions will be provided approximately one to two weeks following the posting of each assignment. Although these assignments will not contribute to your course marks, it is highly recommended that you complete them independently to prepare for the term tests and final exam.
- There will be 2 in-class term tests. Each test is worth 20 points and is non-cumulative, focusing only on the materials covered in the respective section. Detailed scopes will be announced in advance during lectures and posted on Quercus for your reference. Make-up tests will be provided online via Crowdmark, featuring questions similar to those in the original tests. However, please note that the score for these make-up tests will be multiplied by a factor of 0.75. The term test marks are the higher scores between the original tests and the make-up tests.
- Several additional question-based projects will be disseminated throughout the course. Participation in these projects is optional; even if you choose not to complete any of them, it's still possible to achieve a maximum course mark of 100. Announcements regarding the posting of new projects will be made during lectures and on Quercus.
- The final exam is comprehensive. If you want to request for a deferred final, please follow the petition guideline here.

(July 4, first day of classes)	
Review Report × 4 (July 16, 23 and Aug 6, 13)	= 20 points
Assignments (will not be graded)	
Term Test 1 (July 20, 1 hour, in class)	= 20 points
Term Test 2 (August 3, 1 hour, in class)	= 20 points
Extra Project × 3 (due date TBA)	≈ 15 points
(August 15, last day of classes)	
Final (Aug. 17-25, 2 hours, schedule TBA)	= 40 points

Table 1: *Allocation of points.*

While it's possible to score more than 100 points, please note that the score will be capped at 100. This score will then be converted into a letter grade in accordance with the academic handbook available at here.

Regrading Policy: To request a regrade, you must send an email to sta347@utoronto.ca:

- more that 24 hours, no more than 5 days after receiving your grade,
- with title 'Regrade request report #' or 'Regrade request term test #',
- including your full name and student number in the body of the email,
- specifying a clear and concise reason for each request, referring to a possible error or omission by the grader; regrade requests without a specific reason will not be accepted.

Regrade and point increase are not guaranteed. Requests to increase partial points on incorrect solutions will not be treated favorably.

Accessibility Needs: The University of Toronto offers academic accommodations for students with disabilities. If you require accommodations, or have any accessibility concerns about the course, the classroom, or course materials, please contact Accessibility Services as soon as possible: accessibility.services@utoronto.ca. More information available at here.

Academic Integrity: Academic integrity is fundamental to learning and scholarship at the University of Toronto. Participating honestly, respectfully, responsibly, and fairly in this academic community ensures that the University of Toronto 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 Matters available at here.