Probability

University of Toronto
Department of Statistical Sciences
STA347H1F Fall 2022
Instructor: Mohammad Kaviul Anam Khan
Email: sta347@utoronto.ca
Office Hours: After the class (Place will be announced later)

	LEC 0101/2001:	**LEC0201:**
Class Day/Time:	T 11am-1pm, R 11am-12pm ET in WB1116	T 3pm-5pm, R3pm-4pm ET in SF1105

COURSE OVERVIEW

Course Description: 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 simple stochastic processes such as Poisson and branching processes.

Pre-requisites: Pre-requisites are **strictly enforced by the department, not by the instructor.** If you do not have the equivalent pre-requisites, you will be un-enrolled from the course. The pre-requisites are STA247H1(70%)/STA255H1(70%)/STA237H1(70%)/STA257H1/ECO227Y1/STAB52H3/ STA256H5/MAT223H1/MAT240H1/MATA22H3/MATA23H3/MAT223H5/MAT240H5; MAT235Y1/ MAT237Y1/ MAT257Y1/(MATB41H3, MATB42H3)/(MAT232H5, MAT236H5)/(MAT233H5, MAT236H5) (Note: STA257H1, MAT223H1/MAT240H1, MAT237Y1/MAT257Y1 are very strongly recommended)

COURSE MATERIALS

Course Content: All lecture slides and materials will be posted on the Quercus course page for each lecture section. Further, any important announcements will also be posted in Quercus. Please make sure to check it regularly so you don't miss anything.

Textbook: We will be mostly following lecture notes posted in Quercus. However, there will be problems assigned at the end of each week from some recommended books. The books are:

1. Ross, S. (2007). *Introduction to probability models.* [Ch. 1-5]
2. Evans, M. and Rosenthal, J. (2002). *Probability and statistics.* [Ch. 1-4, 11] (**Link**)
3. Rosenthal, J. (2006). *A first look at rigorous probability theory.* [Ch. 2.1-2.2, 3.1-3.4, 4.1-4.2, 10.1-11.2]
4. Durrett, R. (2013). *Probability: Theory and Examples* [Ch. 1.2-1.3, 1.6, 2.1-2.4, 3.1-3.4, 5.1-5.2] (**Link**)

5. Rosenthal, J. (2020). *A first look at Stochastic Processes.* [Ch. 1.1-1.5, 2.1-2.5, 3.1-3.2, 4.1-4.3]

COURSE COMPONENTS

Lectures: Lectures will be held in person in the assigned classrooms. During lectures, we will cover important course materials, as well as cover a number of examples illustrating the uses of these methods. Each lecture builds on the material from previous weeks, so it is recommended that you attend lectures regularly/keep on top of the material.

Office Hours: Instructors and TAs will hold office hours through Zoom and in person. The office hour schedule will be posted on Quercus after the first week. It is recommended that you visit office hours whenever you have a question about the material. The classes will focus more on describing the concepts, theories and methods. To solve the assigned examples after each class you need to visit the office hours with potential questions.

Quercus Discussion Board: We will be using the Quercus Discussion Board as an online discussion forum. **All questions about course material should be posted here** or asked during TA/instructor 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.

GRADING SCHEME

Assessment	Date Due/Occurring	Grading Weight
Assignment 1	Will be assigned on 20th September due on 6th October	10%
Assignment 2	Will be assigned on 30th October due on 17th November	10%
Term test # 1	October 11th	20%
Term test # 2	November 22nd	20%
Final Exam	Dec 10-20	40%

Please note that the last day to drop the course without penalty is November 16, 2022

EVALUATION BREAKDOWN

Assignment: You will be given two assignments in the term. The purpose of these assignments is to provide you with practice problems and exercises, which will help you to understand the concepts taught during the course. The assignment may have a focus on the use of statistical software (R specifically). Most of the problems will be assigned from the textbooks.

Term Test: There will be two term tests which will be held on October 11th and on November 22nd in class. More details will be provided later.

Final Exam: The details about the final exam will be provided during the last week lectures. For the final exam we will be following standard University of Toronto Schedule. the final exam will be 3 hours in duration and will be scheduled by the Faculty of Arts and Science during the final assessment period.

MISSED ASSESSMENT POLICY FOR THE TERM TEST

Students are responsible to attend the assessments. If a student is sick and needs to request a re-weighting for the assessment. In order for the request to be considered, the email:

- must be received within 48 hours after assessment is due
- must include the course code in the subject line
- must include your full name and student number
- must include the following sentences:
  - "I affirm that I am experiencing an illness or personal emergency and I understand that to falsely claim so is an offense under the Code of Behaviour on Academic Matters."
  - "I understand that the weight of this assessment (term test) will be moved to the assignments (5%, 2.5% each) and to the final exam (15%)"

COMMUNICATION

Please do not email the instructor with questions related to the content of the course. These types of questions are much easier to answer through the discussion board or during office hours. Emails that do not contain sensitive or personal information will be directed to post the questions on the discussion board. If you need to email the instructor for personal reasons, please use your official University of Toronto email address, include STA347H1 F 2022 in the subject and also include your full name and UTORid in the body of the email (in case we need to look anything up).

INTELLECTUAL PROPERTY

Course materials provided on Quercus, such as lecture slides, assignments, tests and solutions are the intellectual property of your instructor and are for the use of students currently enrolled in this course only. **Providing course materials to any person or company outside of the course is unauthorized use**. This includes providing materials to predatory tutoring companies.

ACADEMIC INTEGRITY

The University treats cases of plagiarism and cheating very seriously. It is the students' responsibility for knowing the content of the University of Toronto's Code of Behaviour on Academic Matters. All suspected cases of academic dishonesty will be investigated following procedures outlined in the above document. 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 (see `http://academicintegrity.utoronto.ca/`). Here are a few guidelines regarding academic integrity:

- Students must complete all assessments individually. Working together is not allowed.
- Having anyone else to complete your assessments for you is academic misconduct.

- Sharing answers/work/code for STA347 assessments with any other student is academic misconduct.
- Looking up solutions to assessments problems online or in textbooks and copying any part of what you find is an academic offense.
- All work that you submit must be your own! You must not copy mathematical derivations, computer output and input, or written answers from anyone or anywhere else or must not have possession/use of unauthorized aids or assistance associated with tests during the tests. Unacknowledged copying or unauthorized collaboration will lead to severe disciplinary action, beginning with an automatic grade of zero for all involved and escalating from there. Please read the University of Toronto Policy on Cheating and Plagiarism, and don't plagiarize.

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 or `http://accessibility.utoronto.ca`.

CLASS SCHEDULE - TENTATIVE

Week	Content
1 (Sept. 8)	Review of the concepts of probability.
2 (Sept. 13 & 15)	Continuity of probability. Random Variables. Data generation with `R`.
3 (Sept 20 & 22)	Joint, conditional and marginal distributions. Change of Variables.
4 (Sept. 27 & 29)	Expectations, variances, generating functions, Conditional Expectations.
5 (Oct. 4 & 6)	Inequalities. Sampling distributions and order statistics. **Assignment 1 due**.
6 (Oct. 11 & 13)	**Term Test 1**. Simulation methods with `R`.
7 (Oct. 18 & 20)	Convergence in probability and convergence in distribution.
8 (Oct. 25 & 27)	Stochastic process. The random walk. Introduction to Markov chain.
9 (Nov.1 & 3)	Recurrence and transience. Stationary distribution. Time reversible Markov chain.
Nov.7 - 11	**Reading week**. No classes or office hours.
10 (Nov.15 & 17)	Poisson process. **Assignment 2 due**.
November 16	**Deadline to drop course without penalty**.
11 (Nov. 22 & 24)	**Term Test 2**. Stochastic process with `R`.
12 (Nov.29 & Dec. 1)	Martingales (continued), Brownian motions.
13 (Dec. 6)	Brownian motions (continued). Final exam review.
Final Exam	Final assessment period (Dec. 10-20).