

STA 247 - Probability with Computer Applications

L0101	LEC: Tues. 10-11, Thurs. 10-12	TUT: Tues. 11-12
L0201	LEC: Tues. 3-4, Thurs: 2-4	TUT: Tues: 2-3

Instructor: Karen H. Wong - sta247@utoronto.ca

Office Hours: Will be posted on Quercus. Any virtual office hours will be hosted on MS Teams.

Course Meetings: All lecture sessions will take place in our designated lecture hall (MC 102) and tutorials in the classrooms listed on the [timetable](#) corresponding to your tutorial section.

Course Description: An introduction to probability using simulation and mathematical frameworks, with emphasis on the probability needed for computer science applications and more advanced study in statistical practice. Topics covered include probability spaces, random variables, discrete and continuous probability distributions, probability mass, density, and distribution functions, expectation and variance, independence, conditional probability, the law of large numbers, the central limit theorem, sampling distributions. Computer simulation will be taught and used extensively for calculations and to guide the theoretical development.

Prerequisites: See course description [here](#). Prerequisites are strictly enforced by the department and cannot be waived.

Textbooks:

1. *Probability with Applications and R*, 2nd ed. by *Wagaman and Dobrow* available through the library [here](#) and with student companion site [here](#).
2. *Modern Mathematical Statistics with Applications*, 3rd ed. by *Devore and Berk* available through the library [here](#).

Course Structure: Weekly lectures will comprise of introductions to new content/ideas, guided problem solving, R demos and code-alongs, and live Q&A. Slides will usually be available the day before lecture. Tutorials consist of a combination of R labs and collaborative pair activities.

Suggested Weekly Routine: Everyone learns at a different pace. In addition to our lecture and tutorial times (~ 3 -4 hours per week), students on average should be spending approximately 2 hours per hour of lecture on self-study which can include creating course notes for yourself (e.g. writing notes in your own words about concepts you're learning), working on practice problems/assignments, reviewing concepts or R activities, and posting on the discussion boards. This is equivalent to about 60 minutes of studying per weekday, which for a student taking 5 courses would average to a total of 45-50 hours a week dedicated attending class and self-study.

Course Materials: All lecture slides, course materials, tutorial activities, etc. can be navigated from our course home page on Quercus. Course materials provided 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.**

Grading Scheme: The course is designed to give you plenty of opportunities to demonstrate your learning, make mistakes, track your progress, and receive feedback for improvement. The grading scheme is listed below:

Weekly Discussion	4%	<u>Throughout</u> Fall Term
Syllabus Quiz	2.5%	Available from Sept. 9 to 23
Individual Assignments (2)	10% each	Oct. 14, Dec. 2 @ 8 PM
Tutorial Activities (Best 3 of 4)	2.5% each	Weekly, see course schedule at the end of the syllabus/posted on Quercus
R Labs (4)	1.5% each	
Midterm	20%	Nov. 4 @ 6-7:40 PM
Final Assessment	40%	TBD

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 exchange peer support. The instructor and TAs will be monitoring and contributing regularly on the discussion board. Students are expected to contribute by working collaboratively with each other and build upon your understanding of concepts through answering each others' questions. The grading scheme will be provided in the Welcome Slides. Note: To limit cluttering of the board space, posts that only repeat previously posted information and do not contribute something new to the discussion are not eligible for these points.

Assignments: Submission on **Crowdmark** only. Select problems on the assignments will be evaluated. Late submission receive a penalty of 5% for every hour of lateness unless prior arrangements have been made. E.g., if an assignment is submitted 10 minutes late, there would be a penalty of 5% on the assignment grade (i.e. 90% → 85%).

Tutorials: See course schedule for tutorial days. You must attend only the section you are enrolled in on ACORN to ensure equitable TA support. Tutorials will alternate between R labs led by TAs, and collaborative pair work with TA support.

- **R Labs:** This tutorial time is TA-led and is dedicated to working with R tools and/or applying tools to examine course concepts via simulation. All R Labs are worth 1.5%, **with .rmd AND knit to pdf files submitted on Quercus at the end of the tutorial time.**
- **Pair Activities:** These activities are designed to guide you through tackling more challenging problems, or explore a concept we have been discussing in class. One submission per pair at the end of your tutorial, with the best 3 of 4 tutorials counted towards your course grade.

Midterm & Final Assessment: Assessment information will be posted on Quercus approximately 1 week prior to the date of the assessment. The midterm will be a timed assessment. Any time conflicts with the midterm must be communicated as soon as you are aware, and **no later than 2 weeks prior to the midterm.** Accommodations cannot be provided for late notice of time conflicts.

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

- 2 R Labs and 2 pair activities
- 1 assignment
- Both the midterm and the final assessment.

If you do not meet these minimum passing requirements, even with accommodation, you will not be eligible to pass this course. There are no make-up tutorials or assignments. If there are extenuating circumstances that will affect your performance in the course in the long term, please connect with your college registrar and instructor as early as possible so that accommodations can be discussed/arranged.

Accommodation Requests: Accommodation requests for assignments must be made by email to the course instructor at least 48 hours before the assessment due date. Extensions will be arranged where possible.

Missed Work: Missed term work due to legitimate reasons (e.g., injury, illness, or other exceptional circumstances) should be communicated to the instructor within 1 week following the assessment or by **November 8, 2022** for the midterm **and** have the absence declaration form on ACORN completed for all days absent. For documented missed work:

- Missed tutorial weight will be redistributed among the tutorials, R labs among the other labs.
- Missed assignment weight will be distributed proportional in weight among the other assignment, midterm, and final assessment provided that efforts were made to request an accommodation as outlined above.
- Missed midterm: A make-up midterm will be scheduled during the fall Reading Break for students who missed the midterm with documentation.

Reread Requests: Marking schemes/solutions will be provided for all assessments except the final assessment. These must be reviewed before requesting a reread. If you still have concerns about your grading, complete this [MS Forms](#) to request a reread **no later than 1 week** after the assessment and solution have been released back to you. Requests after this period, without reviewing the provided solutions, or made in any other form will not be considered.

Course Conduct:

- **Email:** Any administrative or personal concerns regarding the course, or questions about active assessments should be discussed privately with the course instructor, either over email or during office hours. Private breakout rooms will be provided in virtual office hours (if offered). Questions regarding course material and concepts are best addressed during open office hours or the discussion board.
- **Programming Languages:** We will be using [R statistical software](#) and [R Studio](#), both free to download. R Studio is an Integrated Development Environment for R, so you will need to install both locally for R Studio to operate. An installation guide will be provided at the start of term. You will also need to knit your Markdown documents to .pdf which requires local installation of LaTeX <https://www.latex-project.org/get/>.

- If you have problems with any of the local installations, we strongly recommend that you access R Studio through the version hosted on [JupyterHub \(https://jupyter.utoronto.ca\)](https://jupyter.utoronto.ca)
- Log in with your U of T credentials, select ‘R Studio’. If that’s unavailable, click ‘New’, and ‘R Studio’ on drop down menu in the upper right hand corner of the landing page.
- Any R work required of you will be covered during class or by your TAs during the R Labs. R components are an important part of the course content, and you are expected to participate and practice as you would with any other course content.

It is expected that you have both installed, or have accessed the cloud version by the first tutorial, and will be required by R Lab #1. Knitted R markdown files to pdf output will be required for all R work for the rest of the course, so be sure to address any knit-issues during your ‘Getting Started’ tutorial or during office hours before your first R Lab!

By the end of the course, you are expected to be able to create simple simulations on your own, write functions in R, generally be able to explain how various code demonstrates probability concepts or results, apply/adapt starter code to solve problems, and predict the output for a given code snippet. Check the weekly pages to see if you will need to have R ready to use during class or tutorials.

Accessibility Services: 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 [here](#). 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.

Specific Medical/Personal Circumstances For 2022 F-term, a Verification of Illness (also known as a “doctor’s note”) is temporarily not required. Students who are absent from academic participation for any reason (e.g., COVID, cold, flu and other illness or injury, family situation) and who require consideration for missed academic work should report their absence through the online absence declaration. The declaration is available on ACORN under the Profile and Settings menu. **Students should also advise their instructor of their absence as soon as possible.**

If an absence extends beyond 10 consecutive days, or if you have a non-medical personal situation preventing you from completing your academic work, you must connect with your College Registrar. They can provide advice and assistance connecting with your instructors on your behalf. If you get a concussion, break your hand, or suffer some other acute injury, you should register with Accessibility Services as soon as possible.

Academic Integrity: All students, faculty and staff are expected to follow the University’s guidelines and policies on academic integrity. For students, this means following the standards of academic honesty when writing assignments, collaborating with fellow students, and writing tests and exams. Ensure that the work you submit for grading represents your own honest efforts. Plagiarism, representing someone else’s work as your own or submitting work that you have previously submitted for marks in another class or program is a serious offence that can result in sanctions. Speak to the instructor for advice on anything that you find unclear. To learn

more about how to cite and use source material appropriately and for other writing support, see the U of T writing support website at <http://www.writing.utoronto.ca>. Consult the Code of Behaviour on Academic Matters for a complete outline of the University's policy and expectations. For more information, please see <https://www.artsci.utoronto.ca/current/academic-advising-and-support/student-academic-integrity> and <http://academicintegrity.utoronto.ca>

Potential offences include, but are not limited to:

- Obtaining or providing unauthorized assistance on any test/assignment/tutorial including:
 - working in groups on individual and independent assessments, including giving hints to the answer
 - having someone rewrite, edit, or add material to your individual and independent work
 - researching/searching for inspiration, hints, or answers to any graded problem
 - posting active assessment questions on discussion boards/private tutoring companies (such as EZ 4.0) for hints or solutions
 - collaborating with members outside of your assigned groups (e.g. in tutorials)
 - plagiarizing by passing off someone's work or ideas as your own
 - distributing course materials to anyone or any organization, whether for monetary gain or not

- 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 reach out to the instructor or seek the advice of your college registrar.

Tentative Schedule:

Week Of	Topics	Tutorial	Coverage (Up To)
0: Sept. 8	Intro to Course, Important Terminology, Events ($\cup, \cap, ^c$)	–	–
1: Sept. 12	Axioms, Event Probabilities, Independence vs. Mutually Exclusive	–	–
2: Sept. 19	Counting	R Lab Prep	Getting Started
3: Sept. 26	Conditional Probability, Law of Total Probability, Bayes' Rule	Tutorial #1	Counting
4: Oct. 3	Discrete RVs & Distributions	R Lab #1	Simulating Probabilities
5: Oct. 10	Common Discrete Distributions	–	–
6: Oct. 17	Intro to Continuous RVs & Distributions	Tutorial #2	Discrete Distn.
7: Oct. 24	Continuous Distributions	R Lab #2	Functions of RVs
8: Oct. 31	Transformations of RVs	MIDTERM	Up to & incl. Week 7
Nov. 7 - 11: FALL READING BREAK			
9: Nov. 14	Transformations of RVs & Moment Generating Functions	Tutorial #3	Cont. Distn.
10: Nov. 21	Bivariate Distributions	R Lab #3	Simulating Data
11: Nov. 28	Bivariate Distributions, CLT	Tutorial #4	Bivariate Distn.
12: Dec. 6	Central Limit Theorem, Wrap-Up	R Lab #4	Sampling Distributions