

# Probability and Statistics 1

University of Toronto  
Department of Statistical Sciences  
STA257H1-F

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<b>Instructor:</b>	Katherine Daignault	<b>Synchronous Classes:</b>	
<b>Email:</b>	katherine.daignault@mail.utoronto.ca	LEC0101:	Wed. 3-5pm EST
<b>Course Page:</b>	Quercus and <a href="#">Piazza</a>	LEC5101:	Wed. 6-8pm EST

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## COURSE INFORMATION

**How will this course operate?** This course will be offered entirely online, with a combination of synchronous lectures and asynchronous video lectures. The majority of course content will be uploaded to Quercus as pre-recorded videos to be watched prior to the synchronous meetings. The synchronous classes will occur through Bb Collaborate in Quercus and will focus on additional materials, worked examples and demonstration of concepts using statistical software. It is your responsibility to make sure you are available during scheduled lecture times and stay on top of the course material and all relevant deadlines.

*\*\*\* Please ensure that you have access to reliable internet service, as evaluations will take place online and there is no guarantee that accommodations can be provided for faulty internet during an evaluation.*

**Course Description:** A mathematically rigorous introduction to probability, with applications chosen to introduce concepts of statistical inference. This course serves as the necessary foundation for many of the core statistics courses that follow. Broadly, this course will cover the following: probability models, random variables, discrete and continuous distributions, multivariate models, large-sample limiting results, some statistical applications

**Learning Outcomes:** By the end of this course, all students should understand the concepts above and be prepared to show their understanding in the following ways:

- be able to solve straightforward problems regarding the material,
- be able to approach an unfamiliar problem and recognize how it is solved by an extension of the material presented during lectures
- be able to prove results that are extensions of those shown in class,
- be able to explain concepts in non-technical language and understand common misconceptions of these concepts.

**Pre-/Co-requisites:** You must be taking, or have taken and passed, both a second year calculus course and a second year linear algebra course (see [course calendar](#) for details). These concepts are frequently used in both this and the subsequent course (STA261) and students must therefore be comfortable with them. *Students without this background should consider alternative courses.*

## COMMUNICATION

**Instructor communications:** All communication will be made through Quercus announcements or during lectures. Please ensure that you check Quercus regularly so you don't miss anything important.

**Questions about course content:** We will be using Piazza as an online question forum. **All questions about course material, quizzes and assignments should be posted here** or asked during TA/instructor office hours. Posts on Piazza can be done anonymously so that other students cannot see your name but TAs and instructors can. The instructor and TAs will monitor Piazza and will help answer questions but students are encouraged to answer posts and help their fellow classmates. You can join Piazza for our course [here](#), but be sure to familiarize yourself with the [privacy policy](#) before opting in.

**Emailing the Instructor:** The instructor will only respond to emails of a private or sensitive nature. If you email the instructor with content related questions, you will be asked to post your question on Piazza so the answer may benefit all students. Should you need to email the instructor, please use your official mail.utoronto.ca email, include your full name and student number in the text, and include “STA257” in the subject line.

## COURSE MATERIALS

*\*\*\* All materials provided on Quercus are for the use of students currently enrolled in this course only. Sharing (e.g. posting, providing, selling, etc.) of any course content with anyone outside of the course is considered unauthorized use.*

**Course Notes and Videos:** All course materials will be posted on Quercus. Links to pre-recorded videos of each week’s content will be posted to Quercus and will take you to the university’s MyMedia login page, which hosts the files. The corresponding slides from the video will also be posted so you can follow along and annotate where needed. Additional notes regarding knowledge from pre-requisite courses required that week will also be available. The synchronous lectures will also be recorded and accessible through Quercus.

**Textbook:** The **required** textbook for this course is [Probability with Applications in Engineering, Science and Technology](#), by Matthew A. Carlton and Jay L. Devore, 2nd Edition. It is freely available as an e-book through your University of Toronto Library account. We will be covering the first four chapters.

An additional textbook if you’re looking for a second reference would be *Mathematical Statistics and Data Applications* by John Rice, 3rd edition. This has been the textbook in past years and is available at the University of Toronto bookstore. It is also often used as the required textbook for STA261.

**Statistical Software:** We will be using R mainly for demonstrations during lecture time. R is a very popular statistics software in the department. While it is not required for students to learn in this course, some content may be illustrated using it, so it is worth becoming familiar with its use. It can be downloaded for free at [cran.r-project.org](http://cran.r-project.org) for all operating systems. Some students find that RStudio is a more user-friendly platform for beginners. It can also be downloaded for free at [www.rstudio.com/products/rstudio](http://www.rstudio.com/products/rstudio) but requires that base R (above) is already installed. A very helpful introduction to R document can be found [here](#). Future statistics courses may require familiarity with R, so there’s no harm giving it a try!

## ASSESSMENT BREAKDOWN

Your final course grade will be determined by 5 different components:

1. **Quizzes:** There will be 9 weekly multiple choice quizzes throughout the term which will occur in the last 20 minutes of the synchronous lecture time (except for weeks with a term test) in Quercus:
  - LEC0101: from 4:40-5:00PM EST
  - LEC5101: from 7:40-8:00PM EST

Quizzes are worth a total of 30% of your final grade, but only the best 7 out of 9 quiz grades will be used. Quizzes will cover material up to the end of the previous week. See the schedule at the end of the syllabus for details. The first quiz will be on **Wednesday September 23**, although there will be a practice (no-credit) quiz on September 16.

2. **Term Tests:** There will be 2 term tests during the term, up to 90 minutes long each, worth a total of 30% (i.e. 15% each). These will be online and available through Crowdmark. A link will be emailed to all students at the start of the test time with the questions and student solutions must be uploaded to Crowdmark by the end-time of the test. The dates of the 2 term tests are:
  - Wednesday October 7, 2020 during class time
  - Wednesday November 18, 2020 during class time
3. **Assignment:** A short assignment worth 10% of the final grade will be due the last class of the term, **December 9, 2020**, and will be handed out 2 weeks before the due date. More details regarding the assignment will be available at a later date. The assignment will be done individually and will be submitted via Crowdmark.
4. **Participation:** We will have two participation components: the group study discussion board and in-class participation polls. All students must participate in the group study discussions worth 5% of the final grade. However, if a student also participates in the in-class polls, then they will receive an additional 5% in participation marks, worth a total of 10% participation in their final grade.
  - **In-class participation:** Poll questions will be posed using the Poll Everywhere software. See Quercus for instructions on how to join. You will receive participation credit for each question answered (correctness does not matter). If you answer > 80% of all questions, you will receive the full 5% for the in-class participation. Otherwise, you'll receive 4% for answering 61 – 80% of polls, 3% for answering 41 – 60% of polls, etc.
  - **Group study participation:** Students will be randomly allocated to a discussion group on Quercus. Each week (starting in Week 2), groups will be given a set of practice questions to work on and will be expected to post to their group with any difficulties or questions about the problems or if they want their answers checked. Group members will also be expected to answer their fellow members' questions. Students do not need to post each week but must contribute to their group study discussion for at least 5 weeks to receive full marks. A rubric will be provided with details about how participation will be graded. The board will remain open throughout the term but only contributions made within the specific week-long timeframe will be considered for participation marks.
5. **Final Assessment:** Scheduled by FAS during the final assessment period (Dec. 11-22), the final assessment (worth 20%) will be an online assessment that will cover all material throughout the term. Exact details of the format of this assessment will be communicated at a later date.

Each component above will receive the following weight in the calculation of the final grade:

Assessment	Scheme 1	Scheme 2	Due Dates
Participation	10%	5%	Sundays by 23:59PM EST
Quizzes (best 7 out of 9)	30%	30%	Each Wednesday in class
Term Tests (×2)	30%	30%	October 7 and November 18
Assignment	10%	15%	December 9
Final Assessment	20%	20%	Scheduled by FAS

Marking scheme 1 is the default scheme for all students. Should a student opt to not attend class or simply not answer the Poll Everywhere questions, they will be evaluated using Scheme 2.

## MINIMUM PASSING REQUIREMENT

Students must complete and submit: **at least one term test, the final assessment, and 5 out of the 9 quizzes** to be eligible to pass the course. If a student fails to submit the minimum passing requirements, even with accommodation, you will not be able to pass this course as not enough work has been completed to demonstrate your competence in the material.

## QUIZ/TERM TEST INFORMATION

**Procedures:** Quizzes and term tests will be written during scheduled class time, and should be written in the section in which the student is enrolled. No exceptions will be given. They will be conducted online and will require each student to sign a statement indicating that no academic misconduct has occurred during the course of the quiz/test.

**Calculators:** Handheld, non-programmable calculators may be used during quizzes and tests. Any calculator that has a logarithm, square root, and one memory button will suffice for this course, so there is no need to buy an expensive calculator.

**Grading/Regrading:** Term tests will be graded using Crowdmark. Regrading requests will only be considered for the term tests and must be made via email to the instructor within one week of the grades being released. All regrade requests must provide a justification in order to be considered and the decision whether or not to regrade the term test will be made based on this justification. You will need to indicate exactly where you think marks were deducted incorrectly and explain why your answer should receive these marks. Disagreement with the grading scheme is not a valid justification. If your request is granted, your entire test will be regrade and thus it is possible that the instructor will identify errors that were missed. Therefore a regrade may result in a lower grade than was originally given.

## MISSED ASSESSMENT POLICY

**Missed Quizzes/Midterm:** There are no make-up tests in this course.

- **Missed Quiz:** each student is allowed to miss 2 quizzes without penalty, as the best 7 out of 9 quizzes will be counted in the final grade. Students can also miss 2 additional quizzes with a valid medical reason and have the weight of these quizzes redistributed among the remaining quizzes. Students will be required to **both** fill out the absence declaration form on ACORN **and** contact the instructor within 48 hours of the missed quiz. Emails after this deadline will not be accepted. A grade of zero will be given unless these requirements are met.
- **Missed Term Test:** Students are permitted to miss only one term test with a valid medical reason. If a term test is missed for a valid reason, the student must **both** fill out the absence declaration form on ACORN **and** contact the instructor within one week of the missed term test. Failure to do so will result in a grade of zero. If requirements are met, then the weight of this term test will be redistributed such that weekly quizzes will be worth 35% of the final grade, the remaining term test will be worth 20%, and the assignment will be worth 15%. **Reminder, it is not possible to miss both term tests, even with documentation, and pass the course.**

**Missed Assignment:** There are no accommodations for a missed assignment. The assignment must be handed in by the submission deadline. There will be a 1-hour grace period, after which the assignment will be penalized 15% per day late, up to a maximum of 3 days late. Extensions in general will not be granted unless under extreme circumstances which will be decided by the instructor.

**Missed Participation:** There are no accommodations for missed participation. In-class participation must be made during class time and there are built-in accommodations in how the grade is calculated in case a student has to miss the synchronous lecture time. The group study participation is open for a week and a built-in accommodation has been made so that students may miss some weeks without penalty.

## **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/>).

## **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](mailto:accessibility.services@utoronto.ca) or <http://accessibility.utoronto.ca>.

## **CANADIAN INSTITUTE OF ACTUARIES (CIA)s University Accreditation Program (UAP)**

STA257 is an accredited course under the UAP program. The minimum grade for you to use this course for CIA credentialing purpose is 77. For detailed information on UAP, please visit the following [webpages](#).

Note: The CIA will grant credits to students for SOA/CAS examinations based on the achievement of the minimum Grade towards Associateship (ACIA) and Fellowship (FCIA) in the CIA. At the time of this agreement, CIA credits are recognized by the following actuarial organizations towards their respective designations:

- Casualty Actuarial Society (CAS): ACAS, FCAS
- UK Institute and Faculty of Actuaries (IFoA): FIA, AIA
- Institute of Actuaries of Australia (IAA): AIAA, FIAA
- Actuarial Society of South Africa (ASSA): AMASSA, FASSA
- American Academy of Actuaries (AAA): MAAA

The CIA does not guarantee that credits granted to students under the CIA UAP will be recognized by any other actuarial organizations towards their actuarial designations.

## CLASS SCHEDULE

Below is a tentative schedule and list of topics to be covered in class. The content corresponds to Chapters 1-4 in the textbook. The instructor reserves the right to modify this schedule as needed due to time constraints.

Week	Content	Textbook
1	<b>Probability Basics</b> Set notation, Venn diagrams, probability models, basic combinatorics Sept. 16 - Practice Quiz (not for credit)	Ch. 1.1-1.3
2	<b>Rules of probability:</b> Conditional probability, Law of total probability, Bayes' rule, independence Sept. 23 - Quiz # 1 (on Week 1 content) Sept. 27 - Group Study Participation due by 23:59 EST	Ch. 1.4-1.5
3	<b>Intro to Random Variables:</b> types of variables, probability mass/density and cumulative distribution functions Sept. 30 - Quiz # 2 (on Week 2 content) Oct. 4 - Group Study Participation due by 23:59 EST	Ch. 2.1-2.2, 3.1
4	<b>Named Distributions:</b> Various discrete and continuous named random variables Oct. 7 - TERM TEST # 1 (Weeks 1-3 inclusive) Oct. 11 - Group Study Participation due by 23:59 EST	Ch. 2.4-6, 3.3-3.4, 3.5.3
5	<b>Functions of Random Variables:</b> functions of Normals, univariate transformation methods Oct. 14 - Quiz # 3 (on Week 3 and 4 content) Oct. 18 - Group Study Participation due by 23:59 EST	Ch. 3.3.2, 3.7, 3.8.1
6	<b>Moments:</b> Expectations, Variances, Generating Functions Oct. 21 - Quiz # 4 (on Week 5 content) Oct. 25 - Group Study Participation due by 23:59 EST	Ch. 2.3, 2.7, 3.2
7	<b>Intro to Multivariate Distributions:</b> univariate inequalities, multivariable calculus, joint CDFS and RVs Oct. 28 - Quiz # 5 (on Week 6 content) Nov. 1 - Group Study Participation due by 23:59 EST	Ch.4.1
8	<b>Joint Distributions:</b> Discrete and continuous distributions, independence Nov. 4 - Quiz # 6 (on Week 7 content) Nov. 8 - Group Study Participation due by 23:59 EST	Ch. 4.1
READING WEEK		
<b>Nov. 9 - Course drop deadline</b>		
9	<b>Conditional Distributions:</b> Multivariable conditional distributions, joint and conditional expectations, joint MGFs Nov. 18 - TERM TEST # 2 (Weeks 4-8 inclusive) Nov. 22 - Group Study Participation due by 23:59 EST	Chapter 4.2, 4.4

10	<p><b>Multivariable Transformations:</b> Covariance and correlation, bivariate transformation method, sums of RVs</p> <p>Nov. 25 - Quiz # 7 (on Weeks 8/9 content)</p> <p>Nov. 29 - Group Study Participation due by 23:59 EST</p>	Chapter 4.2, 4.3, 4.6
11	<p><b>Limit Theorems:</b> Law of Large Numbers, convergence in distribution, CLT</p> <p>Dec. 2 - Quiz # 8 (on Week 10 content)</p> <p>Dec. 6 - Group Study Participation due by 23:59 EST</p>	Chapter 4.5
12	<p><b>Setting up Inference:</b> Distributions derived from Normal, sample means and variances</p> <p>Dec. 9 - Quiz # 9 (on Week 11 content)</p> <p>Dec. 9 - Assignment due by 23:59 EST</p>	NA