MATH 3670

Probability and Statistics with Applications

Spring 2027 | Dr. Alexandre Locquet

Preliminary syllabus. Items marked TBD will be confirmed on Canvas.

Course information

Catalog description. Introduction to probability, probability distributions, point estimation, confidence intervals, hypothesis testing, linear regression, and analysis of variance.

Prerequisites. Completion of MATH 2401 or MATH 24X1 or MATH 2411 or MATH 2551 or MATH 2550 or MATH 2X51.

Textbook. Sheldon Ross, *Introduction to Probability and Statistics for Engineers and Scientists*, Academic Press, 6th edition. Electronic textbook access through Georgia Tech.

Instructor / office	Dr. Alexandre Locquet / Room 206
Lecture days / time	**TBD** / **TBD**
Lecture location	**TBD**
Office hours	Days: **TBD**; time: **TBD**. Other times by appointment.
Communication	Use the Canvas Inbox for all course communication, rather than email. Typical response time: within 24 hours on weekdays.

Grading

Component	Weight
Homework (7 problem sets)	14%
Project 1 (Probability)	6%
Project 2 (Statistics)	6%
Quiz 1	17%
Quiz 2	17%
Quiz 3	17%
Final exam	23%

Bonus	Maximum
Peer grading	+1%
In-lecture polling	+2%
Attendance	+1%
CIOS completion	+0.5%

Grade scale

A: $\geq 90\%$; B: 80%–$< 90\%$;
C: 70%–$< 80\%$; D: 60%–$< 70\%$;
F: $< 60\%$.

Important dates

Assessment	Date	Assessment	Date
Quiz 1 (75 minutes)	**TBD**	Project 1	**TBD**
Quiz 2 (75 minutes)	**TBD**	Project 2	**TBD**
Quiz 3 (75 minutes)	**TBD**	Final exam	**TBD**

Homework due dates (PS1–PS7): **TBD**. Final exam time and location: **TBD**.

Quizzes and final exam

1. **Format.** In person, closed book and closed notes. The official formula sheet provided on Canvas is permitted. No other formula sheets are allowed.
2. **Calculator.** Allowed during quizzes and the final exam. Its memory must be cleared.
3. **Regrading.** Requests must be made within one week of receiving a graded quiz.
4. **Missed quizzes.** Acceptable reasons (e.g., illness) must be documented and approved by the designated Dean of Students representative (Spring 2027 contact: **TBD**). For an approved absence, the missed quiz weight transfers to the final exam. An unexcused absence results in a zero with no absence-based weight transfer.
5. **Automatic quiz-to-final transfer.** After the final exam, the instructor will automatically compare the final-exam percentage with the student's lowest quiz percentage. If the final-exam percentage is higher, the weight of that quiz will be transferred to the final exam. Otherwise, the original quiz grade and weight will remain unchanged. This adjustment applies automatically to everyone; no request is required. It can only improve the course grade, never lower it. Only one quiz is transferred under this performance policy; any approved absence-based transfers are handled separately.
6. **Potential online administration.** Quizzes and the final exam may be conducted online if necessary due to public health situations.

Homework

There are seven problem sets. Submit each assignment electronically on Canvas as a single, legible PDF file.

- **Full credit (2 percentage points per assignment):** submitted on time with all problems attempted.
- **Partial credit (1 percentage point):** submitted up to two days late with all problems attempted, or submitted on time but incomplete.
- **No credit:** submitted more than two days late, or both late and incomplete.

Excused late submissions require approval from the designated Dean of Students representative (Spring 2027 contact: **TBD**).

Final exam exemption

A student may request in writing to have the final exam weight set to 0% if, by the last day of class, all the following conditions are met:

1. Scores on all quizzes are greater than 90%.
2. The homework score is 100%.
3. The attendance bonus of 1% is earned.
4. At least 85% of in-lecture polling questions are answered correctly.
5. Both projects are submitted on time and each receives a score of at least 80%.
6. The peer-grading bonus of 1% is earned.

Projects and peer grading

Two individual applied projects develop understanding of probability and statistics through real-world modeling, simulation, and data analysis. Each project is worth 6% of the course grade.

Project 1: Gaming the Odds @ GT Europe

Designing and analyzing a game of chance

Design a simple, original game involving randomness (e.g., dice, coins, spinners, or cards). Analyze it mathematically and support your results with a simulation.

Deliverables: a PDF report (maximum five pages, excluding appendix) and an MP4 video (2–4 minutes) explaining the game and one key result.

1. **Game description:** clear rules, randomness involved, and payouts or outcomes.
2. **Probability model:** sample space, at least three event probabilities, and assumptions.
3. **Expected value and fairness:** expected gain/loss and an explanation of who benefits and why, based on the mathematics.
4. **Simulation:** run and interpret at least 50 trials using Python, Excel, or manual methods.
5. **Personal reflection:** what was difficult, surprising, or interesting.

Project 2: Statistics Across Borders

Statistical inference in practice

Collect original data from at least 20 people and apply statistical inference to answer a meaningful question. Reflect on your findings and the data collection process.

Deliverables: a PDF report (maximum five pages, excluding appendix) and a video (2–4 minutes) explaining the project and one key result.

1. **Research question:** a specific question involving a population parameter.
2. **Data collection:** how and from whom you gathered your own data.
3. **Raw data:** the full dataset with labels and anonymized entries.
4. **Descriptive statistics:** summary statistics and visuals.
5. **Confidence interval:** construction and interpretation for a mean or proportion.
6. **Hypothesis test:** H_0, H_1, test statistic, p-value, and conclusion.
7. **Personal reflection:** insights, challenges, and what you would do differently.

Authenticity and peer review

For both videos, you need not appear on camera, but narration must be in your own voice. Submissions that appear AI-generated, templated, or overly scripted may be flagged during peer review or instructor moderation.

Each project is peer-graded using a structured Canvas rubric. Within one week of the deadline, each student anonymously evaluates four peer projects. The project grade is the average of three peer scores, moderated by the instructor if needed. Timely peer grading is mandatory for credit and the bonus. Completing all assigned reviews on time earns a +1% bonus toward the final grade; incomplete or missing reviews may forfeit the bonus or leave the project ungraded.

Attendance

Up to 1% bonus is available for attendance:

- 0–2 absences: +1% bonus.
- 3 or more absences: no attendance bonus.

Attendance will be tracked through Point Solutions Technology or attendance sheets. Install the Point Solutions app and set its region to "North/South America."

In-lecture polling

The polling bonus is calculated as

$$\text{Polling bonus} = \text{fraction of all polling questions answered correctly} \times 2\%.$$

All unanswered questions, including questions missed through absence, count as incorrect. Use the Point Solutions app with the region set to "North/South America." Spring 2027 session ID: **TBD**.

Mid-course feedback

Around the halfway point of the course, students will be invited to complete a short, anonymous survey through the Canvas Quizzes tool. The survey takes approximately five minutes and asks what is working well and what could improve the learning experience. Responses will be read carefully and may inform adjustments to teaching, materials, or pacing. Participation is strongly encouraged. Survey date: **TBD**.

Course-Instructor Opinion Survey (CIOS)

If 100% of students complete the CIOS survey by the last instructional day, the class will receive a 0.5% bonus. Surveys help improve the course and are highly encouraged. Spring 2027 completion deadline: **TBD**.

Student-faculty expectations

Mutual respect, acknowledgment, and responsibility between students and faculty are essential. See the Georgia Tech Student-Faculty Expectations Agreement.

Honor Code

Students must adhere to the Georgia Tech Honor Code. Academic misconduct will be reported to the Dean of Students.

Tentative course outline

Textbook references below refer to Ross, 6th edition. The sequence is tentative; topic dates are **TBD**.

I. Probability basics *(Textbook: Chapter 3)*

- Origin of uncertainty; probability versus statistics; basic definitions.
- Sets and set operations.
- Axiomatic definition of probability; simple sample spaces.
- Conditional probability, event intersections, and independence.
- Bayes' theorem.
- Counting techniques: permutations and combinations.

II. Random variables

- Basic definitions; probability mass functions, cumulative distribution functions, and probability density functions (Sections 4.1–4.2).
- Expectation, median, variance, and moments (Sections 4.4–4.6).
- Discrete distributions: Bernoulli, binomial (Section 5.1), geometric, and Poisson.
- Continuous distributions: uniform (Section 5.4), exponential (Section 5.6), and normal (Section 5.5).
- Relatives of the normal distribution: chi-square, t, and F distributions.

III. Pairs of random variables and combinations

- Pairs of discrete and continuous random variables; independence (Section 4.3).
- Covariance and correlation (Section 4.7).
- Linear combinations of one or several random variables (Section 6.2).
- Central limit theorem (Section 6.3).

IV. Statistics

- Descriptive statistics: grouping data, charts, and sample measures of central tendency and spread (Chapter 2; Section 2.3).
- Point estimation: unbiased estimators and minimum-variance estimates (Chapter 7).
- Confidence intervals for a population mean with known or unknown variance (Sections 7.3 and 7.3.1); differences of means with equal or unequal variances (Section 7.4); variance of a normal population (Section 7.3.3).
- Hypothesis testing: introduction (Sections 8.1–8.2); normal mean tests with known or unknown variance (Sections 8.3.1–8.3.2); variance tests (Section 8.5); tests for differences in means and variances (Sections 8.4.1–8.4.3 and 8.5.1).