Math 3670 - Probability and Statistics with Applications
Fall 26

Dr. Alexandre Locquet

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

- **Title:** *Introduction to Probability and Statistics for Engineers and Scientists*
- **Author:** Sheldon Ross
- **Publisher:** Academic Press (6th Edition)
- **Availability:** The book is available for free to Georgia Tech students here.

Instructor

- **Name:** Dr. Alexandre Locquet
- **Office:** Room 206
- **Communication:** Use the Canvas Inbox for all communication. Please do not use email. Typical response time: within 24 hours on weekdays.

Lecture Times

- **Days:** TBD
- **Time:** TBD
- **Location:** TBD

Office Hours

- **Days:** TBD
- **Time:** TBD
- Appointments outside of these times can be arranged by request.

Grading Policy

Component	**Weight**
Homework	14%
Project 1 (Probability)	6%
Project 2 (Statistics)	6%
Quiz 1	17%
Quiz 2	17%
Quiz 3	17%
Final Exam	23%
Peer Grading Bonus	+1%
In-lecture Polling Bonus	+2%
Attendance Bonus	+1%
CIOS Completion Bonus	+0.5%

Grade Scale:

- **A:** $\geq 90\%$
- **B:** 80-90%
- **C:** 70-80%
- **D:** 60-70%
- **F:** $< 60\%$

Important Dates

Event	Date
Quiz 1 (75 mins)	**TBD**
Quiz 2 (75 mins)	**TBD**
Quiz 3 (75 mins)	**TBD**
Project 1	TBD
Project 2	TBD
Final Exam	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 should be cleared.
3. **Regrading Policy:** Requests must be made within one week of receiving a graded quiz.
4. **Missed Quizzes:**
   - Acceptable reasons (e.g., illness) must be documented. Must be approved by Dr. Voss, Dean of Students representative. Contact them for documentation. The quiz weight will transfer to the final exam.
   - Unexcused absences result in a score of zero with no weight transfer.
5. **Performance Transfer:** Students dissatisfied with one quiz score may request its weight to be transferred to the final exam. This must be requested in writing within one week of receiving the quiz, and in any case before taking the final exam. Only one quiz can be transferred, and the decision is irreversible.
6. **Potential Online Administration:** Quizzes and the final exam may be conducted online if necessary due to public health situations.

Homework

1. **Assignments:** 7 problem sets.
2. **Submission:** Submit electronically on Canvas as a single, legible PDF file.
3. **Grading:**
   - Full credit (2% per assignment): Submitted on time and all problems attempted.
   - Partial credit (1%): Submitted late (up to 2 days) or incomplete.

- No credit: Submitted more than 2 days late or submitted up to 2 days late and incomplete.

4. **Excused Late Submissions:** Must be approved by Dr. Voss, Dean of Students representative. Contact them for documentation.

Projects and Peer Grading

This course includes two applied projects designed to deepen your understanding of probability and statistics through real-world modeling, simulation, and data analysis.

Project 1 – Gaming the Odds @ GT Europe: Designing and Analyzing a Game of Chance

In this individual project, you will design a simple, original game of chance involving randomness (e.g., dice, coins, spinners, or cards). You will analyze your game mathematically and support your results with a simulation.

Your submission must include:

- A clearly written PDF report (max 5 pages, excluding appendix)
- A short MP4 video (2–4 minutes) explaining your game and one key result

Your report must include:

1. **Game Description:** Clear rules, randomness involved, and payouts or outcomes
2. **Probability Model:** Sample space, at least three event probabilities, assumptions
3. **Expected Value and Fairness:** Compute expected gain/loss and evaluate fairness (i.e., who benefits and why, based on the math)
4. **Simulation Results:** Run and interpret 50+ trials using Python, Excel, or manual methods
5. **Personal Reflection:** Brief, personal paragraph on what was difficult, surprising, or interesting

You do not need to appear on camera in the video, but your voice must be your own. Submissions that appear to be AI-generated or templated may be flagged during peer review or instructor moderation.

The project will be peer-graded using a structured rubric. Timely participation in peer grading is required to receive credit and the peer grading bonus.

Project 2 – Statistics Across Borders: Statistical Inference in Practice

In this individual project, you will collect original data from at least 20 people and apply statistical inference techniques to answer a meaningful question. You will analyse your data using tools such as confidence intervals and hypothesis testing, then reflect on your findings and the data collection process.

Your submission must include:

- A clearly written PDF report (max 5 pages, excluding appendix)
- A short video (2–4 minutes) explaining your project and one key result

Your report must include:

1. **Research Question**: A clear and specific question involving a population parameter
2. **Data Collection Summary**: Description of how and from whom you gathered the data (must be your own)
3. **Raw Data Table**: Full dataset included with appropriate labels and anonymised entries
4. **Descriptive Statistics**: Summary statistics and visuals to explore your data
5. **Confidence Interval**: Construction and interpretation for a mean or proportion
6. **Hypothesis Test**: Statement of H_0, H_1, test statistic, p-value, and conclusion
7. **Personal Reflection**: Insights, challenges, and what you would do differently

You do not need to appear on camera, but the narration must be in your own voice. Submissions that appear AI-generated or overly scripted may be flagged during peer review or instructor moderation.

The project will be peer-graded using a structured rubric. Timely participation in peer grading is required to receive credit and the peer grading bonus.

Peer Grading

Each project will be peer-graded using a rubric provided on Canvas. After the submission deadline, each student will anonymously evaluate **4 peer projects** within one week. Your own grade will be the average of 3 peer scores, moderated by the instructor if needed.

Peer grading is mandatory. Students who complete all assigned peer reviews **on time** will receive a **+1% bonus** toward their final grade. Incomplete or missing peer evaluations may result in forfeiting this bonus or having one's project ungraded.

Attendance Policy

1. **Bonus:** Up to 1% bonus for attendance.
2. **Tracking:**
    - Attendance will be tracked via Point Solutions Technology or attendance sheets.
    - Students must install the **Point Solutions app** and set the region to "North/South America."
3. **Criteria:**
    - 0-2 absences: 1% bonus.
    - 3+ absences: No bonus.

In-Lecture Polling

1. **Participation Bonus:** Bonus will be computed according to the following formula: (% of correct answers) * (2%).
2. **Missed Questions: All unanswered questions (including absences) are counted as incorrect.**
3. **Implementation:** Students must install the **Point Solutions app** and set the region to "North/South America."
4. **Session ID: gtl57160**.

Mid-Course Feedback Survey

Around the halfway point of the course, students will be invited to complete a short, anonymous feedback survey administered via **Canvas (Quizzes tool)**. The purpose of this survey is to gather your reflections on what is working well and what improvements could enhance your learning experience for the remainder of the term.

The survey will take approximately 5 minutes to complete. Your responses will be read carefully and may inform adjustments to teaching, course materials, or pacing. Participation is strongly encouraged.

Final Exam Exemption Policy

A student may request in writing to have the weight of the final exam set to 0% if, by the last day of class, **all** of 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. Peer-grading bonus of 1% is earned.

Student-Faculty Expectations Agreement

At Georgia Tech, mutual respect, acknowledgment, and responsibility between students and faculty are essential. Details of these expectations can be found here.

Honor Code

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

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 are essential for improving the course and are highly encouraged.

Tentative Table of Contents

Chapter	Topics and Details
I. Probability Basics (Textbook: Chapter 3)	• Introduction: Origin of uncertainty, Probability vs. Statistics • Basic Definitions • Sets and Set Operations • Axiomatic Definition of Probability: Special Case - Simple Sample Space • Conditional Probability: Probability of Event Intersections, Independence of Events • Bayes' Theorem • Counting Techniques: Permutations, Combinations
II. Random Variables	• Introduction and Basic Definitions • Probability Mass Function of Discrete RVs (Textbook: 4.1, 4.2) • Cumulative Distribution Function (Textbook: 4.1, 4.2) • Probability Density Function of Continuous RVs (Textbook: 4.1, 4.2) • Expectation and Variance (Textbook: 4.4, 4.5, 4.6): Expectation, Median, Variance, Moments • Famous Discrete Random Variables: Bernoulli, Binomial (Textbook: 5.1), Geometric, Poisson • Famous Continuous Random Variables: Uniform (Textbook: 5.4), Exponential (Textbook: 5.6), Normal (Textbook: 5.5) • Relatives of the Normal Distribution: Chi-Square, t-Distribution, F-Distribution

Chapter	Topics and Details
III. Pairs of Random Variables and Combinations	• Pairs of Random Variables: Discrete Case (Textbook: 4.3), Continuous Case (Textbook: 4.3), Independence (Text: 4.3), Covariance and Correlation (Textbook: 4.7) • Linear Combinations: Single RV, Multiple RVs (Textbook: 6.2), Central Limit Theorem (Textbook: 6.3)
IV. Statistics	• Descriptive Statistics (Textbook: 2): Data Grouping, Charts, Sample Statistics (Measures of Central Tendency and Spread, Textbook: 2.3) • Point Estimation (Textbook: 7): Introduction, Unbiased Estimator, Minimum-Variance Estimates • Confidence Intervals: Introduction (Textbook: 7.3), Population Mean (Variance Known and Unknown, Textbook: 7.3, 7.3.1), Difference of Means (Equal and Unequal Variances, Textbook: 7.4), Variance of a Normal Population (Textbook: 7.3.3) • Hypothesis Testing: Introduction (Textbook: 8.1, 8.2), Normal Mean Tests (Variance Known and Unknown, Textbook: 8.3.1,8.3.2), Variance Tests (Textbook: 8.5), Tests for Differences in Means and Variances (Textbook: 8.4.1-8.4.3, 8.5.1)