ISyE 2027: Probability with Applications

Instruction Team

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(*please include the course number, **ISyE 2027D** in the subject line*).

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Section D: **Class Time. TBD**
Location: TBD

Undergraduate Teaching Assistant (UTA): TBA (email: TBA)
Office hours: TBA

Catalog Description

Topics include conditional probability, density and distribution functions from engineering, expectation, conditional expectation, laws of large numbers, central limit theorem, and introduction to Poisson Processes.

Course description

In this course, the students will learn the basic tools used in developing and analyzing probabilistic models with their applications.

Course learning outcomes

At the end of this course, students will be able to:

1. Grasp which distributions might be appropriate in modeling a particular situation
2. Understand measures of a distribution's location and spread
3. Model and analyze problems at a level of the newsvendor problem or the travel time for carousels and miniloads.
4. Understand the role of probability in decision-making.
5. Understand how randomness affects system behavior and performance.
6. Compute probabilities and moments such as the expected value and variance of random variables and combinations/functions of random variables.
7. Understand relationships among multiple random quantities.
8. Be able to use the central limit theorem to approximate probabilities related to sums of i.i.d. random variables. Know how much probability is within 1, 2 and 3 standard deviations of the mean of a normal distribution.

Course outcome \ Program Outcomes	1. identify, formulate solv	2. produce solutions con	3 communicate with a ran	4 recognize ethical & profess	5. effective on a team pro	6. develop and conduct exp	7. acquire and apply new kno
1. Grasp which distribution is appropriate	H						
2. Understand measures of distribution'	H						
3. Model and analyze problems as newsvendor							
4. Understand the role of probability							
5. Understand how randomness affects							
6. Compute probabilities	H						
7. Understand relationships among multiple random							
8. Be able to use the central limit theorem to approximate							

Evaluation of the important outcomes

Course outcomes 1, 2, 6 will be assessed in a complex word problem involving calculus.

Course Website

Certain course materials will be available via Canvas, see canvas.gatech.edu.

Prerequisites

MATH 2551 or MATH 2500 *
* The students are advised to take 2500 before 2027 because it is likely that the multivariate calculus will appear in ISYE 2027 before MATH 2500.

Required Textbook

Sheldon Ross, *A First Course in Probability*, Ninth Edition.
Should you use an earlier edition, it is your responsibility to find sections and/or problems that match those used in the course.

Lecture notes

Detailed lecture notes of all the lectures can be found in the homepage of the instructor:
https://www.debankur-mukherjee.com/teaching

References

9. Mor Harchol-Balter, *Introduction to Probability for Computing*. (Very good reference material with a lot of examples) Free e-copy available here: http://www.cs.cmu.edu/~harchol/Probability/book.html

10. F. M. Dekking, C. Kraaikamp, H. P. Lopuhaa, and L. E. Meester, *A Modern Introduction to Probability and Statistics: Understanding Why and How*, Springer, London, 2005.

11. Online book by Prof. Bruce Hajek: http://hajek.ece.illinois.edu/ECE313Notes.html

12. Richard Durrett, *The Essentials of Probability*, Duxbury Press, Belmont, CA, 1994.

13. Carol Ash, *The Probability Tutoring Book: An Intuitive Course for Engineers and Scientists (and Everyone Else!)*, Revised Printing, IEEE Press, New York, 1993.

Final grade

There will be **3 in-class Quick tests** (see more details below), **2 in-class midterm exams**, and **a final exam**. Assignments, Quick tests, and Midterms will be posted and collected via **Gradescope**. The duration of each Quick test will be about 30 min, and usual lecture will resume after them. Quick tests will mostly contain multiple-choice and short-calculation-type questions. **Best 2 Quick tests will be counted in the final grade**. Overall grade will be calculated as follows:

Assignments (problem sets) (10%)
Quick tests (15%)
Midterm 1 (20%)
Midterm 2 (20%)
Final exam (35%)

If the course is taken on a pass/fail basis, then the final grade will be either S (if your standing is in the C range or higher) or U (if your standing is in the D range or lower).

Grading Scale:

Your final grade will be assigned as a letter grade according to the following scale:

A	90-100%
B	80-89%
C	70-79%
D	60-69%
F	0-59%

Exam dates

Quick tests and midterm exams will be held in class during the usual lecture hours. Please be aware that the dates below are **tentative**. They may change, in which case, the students will be notified ahead of time.

Quick test 1	TBA
Quick test 2	TBA
Quick test 3	TBA
Midterm 1	TBA
Midterm 2	TBA
Final Exam	Schedule provided by the Registrar's office

All examinations will be closed book, closed notes, and must be completed alone.

Generative AI Policy

Use of Generative AI tools is strictly prohibited during tests.

Assignments

Assignments will be posted and collected via Gradescope, which is integrated with Canvas. Please submit scanned or typed copies of the assignments via Gradescope. Late submissions of any assignment will NOT be accepted. See https://www.youtube.com/user/Gradescope/videos for some tutorial videos on how to use Gradescope. There may be group assignments.

If n homework assignments are given during the course, then best $n-2$ assignments will be counted in the final grade.

Unless otherwise indicated, you are encouraged to discuss the homework with other students (**at a high level only**). Note that assignments will be graded based on their high-level accuracy and all details may not be checked by the grader. You are encouraged to look at the detailed solutions posted on Canvas after the due date.

Use of Generative AI tools (such as Microsoft Copilot, ChatGPT, Claude, Gemini, Perplexity, etc.) in this course will vary from assignment to assignment. Some assignments may allow or even require Generative AI usage while other assignments may limit or entirely prohibit use of Generative AI. Please check the instructions on each assignment to determine what, if any, usage of Generative AI is allowed and/or required. Do not assume that because Generative AI was allowed for one assignment, it will be allowed on other assignments.

Practice problems

Practice problem sets may be posted on Canvas. You do NOT need to submit their solutions. You are STRONGLY encouraged to solve them, and you are free to discuss it with other students and the TAs.

Progress Grade

Progress grades are based on work completed before the progress report deadline. In this course, the completed work typically consists of Quick test 1 (weighed at 30%), Midterm 1 (weighed at 40%) and Assignments 1, 2, and 3 (each weighed at 10%). Progress grades will be S or U. A grade of U indicates that based on the completed work, your standing is in the D or lower range, see catalog.gatech.edu/rules/5.

Class Attendance

Attendance in class is strongly recommended, but not mandatory.

Regrading Policy

If there is a mistake in grading, we will be happy to correct it. Requests for a grade correction must be made (via Gradescope) within one week of when the graded material (homework or exam) was returned. **Any issues with regrade requests must be communicated with the TA.**

Tutoring

— TBA —

Academic and Research Honesty/Integrity Statement

Georgia Tech aims to cultivate a community based on trust, academic integrity, and honor. Students are expected to act according to the highest ethical standards. Review the Student Code of Conduct and the Academic Honor Code, especially Appendix A: Graduate Addendum to the Academic Honor Code.

Students are expected to perform research in an ethical and responsible manner. All Doctoral and Master's Thesis students are required to take the Responsible Conduct of Research training, and it is expected that students abide by the principles taught in that training while performing research for this thesis course.

Allegations of scientific or scholarly misconduct are handled in accordance with the procedures outlined by the Policy for Responding to Allegations of Scientific or Other Scholarly Misconduct.

Core IMPACTS

Not applicable.

Accommodations for Students with Disabilities

If you are a student with learning needs that require special accommodation, contact the Office of Disability Services as soon as possible to make an appointment to discuss your special needs and to obtain an accommodations letter. Please also e-mail me as soon as possible in order to set up a time to discuss your learning needs.

Student-Faculty Expectations

This course will operate according to the student-faculty expectations available at catalog.gatech.edu/rules/22.