DATA 352/551: Modeling and Simulation
Fall 2026

Instructor: Prof. Yi Lu Email: ylu1@drew.edu Office: HS 314
Lectures: W 6-8:30, HS 308 (in-person)
Office Hours: R 12-2 or by appt (in-person HS314 or via Google Meet; link on course webpage)

Course Description: Covers techniques for modeling and simulating random systems that are otherwise complicated to study. Topics may include sampling from probability distributions, approximate sampling, Monte Carlo and MCMC methods, bootstrap, and simulation based inference. Prerequisite: CSCI 149 OR CSCI 150 OR STAT120 OR DATA 505.

Learning Outcomes: Upon completing this course, students will:

- have a basic understanding of how simulation can be used in various applications;
- have a basic understanding of probability and statistical concepts;
- be able to use common parametric distributions to model random observations;
- be able to perform statistical inference using a few simulation-based techniques;
- be able to simulation random samples and random processes;
- be able to design and implement simple algorithms to perform simulations.

Text: Topics in this class are relevant to a few different fields in statistics, especially probability and computational statistics.

- Reading materials will be posted on the course webpage throughout the semester.
- For probability, we'll mostly be using *Introduction to probability* (Grinstead and Snell, 2012), which is available online (linked on course webpage).
- For computational statistics, topics will roughly follow *Statistical Computing with R* (Rizzo, 2019). This book is not required for this class. (It is more in-depth than the scope of this class and requires substantial statistical knowledge.)

Course webpage. Course content will be posted on `https://lu08.github.io/teaching/DATA352/`. Grades will be posted on Moodle. You should check both the course webpage and Moodle frequently. You should also check your email frequently for important announcements.

Programming. Lecture examples, sample codes, and homework solutions will be given in R. It is acceptable if you choose a different programming language. Some basics of R will be covered at the beginning of the semester. For simplicity, I will be using RStudio; other popular IDEs for R include: VS Code, Positron, Jupyter Notebooks, etc.; feel free to use any of these instead of RStudio, if you prefer.

Electronic devices. You are expected to bring a working laptop to each lecture. You are allowed to use an iPad (or similar devices) for class-related activities (such as taking notes). You are **prohibited** to use cell phones, headphones, and earbuds during all lectures. You are also prohibited to use electronic devices for unrelated activities, such as browsing internet, messaging, gaming, working on assignments from a different course, etc.

Attendance. You are expected to attend every class unless you have a legitimate excuse, such as illness, family emergency or participation in a college sponsored event. Attendance is mandatory for successful completion of the course. Regardless of reason, it is your responsibility to make up course material covered during absences. Note that poor attendance without a valid reason is not an excuse to misuse office hours.

Class attendance and participation are integral to the academic experience at Drew University. Along with the course attendance policy, which may outline how attendance will affect a student's grade, students should also be aware of their rights and responsibilities regarding absences for legitimate reasons, as described in the Absence Policy: Student Rights and Responsibilities, which is located in the Academic Policy section of Drew's course catalog under Attendance(`https://drew-undergraduate-catalog.coursedog.com/pages/h3iCIMkMOg5fz3KTJDgC`). Legitimate planned absences may include religious holidays, NCAA-sanctioned competition, academic conference or some Drew-sanctioned events. Students need to inform the faculty member of planned absences in the first week of the semester. For unforeseen extended health issues please see the academic accommodations statement.

Late work and missed Assignments. There are no make-ups in this class, even for excused absences. Instead, your two lowest quiz grades and two lowest assignment grades are dropped. If you have to miss an exam, please communicate with me as soon as possible. **All quizzes and exams must be taken in person; absolutely no exception.**

Grading: Final grades are assigned according to the standard scale: A = 92 to 100; A- = 90 to 92; B+ = 88 to 90; B = 82 to 88; B- = 80 to 82; C+ = 78 to 80; C = 72 to 78; C- = 70 to 72; F = 0 to 70 (if registered as an undergraduate: class D+ = 68 to 70; D = 62 to 68; D- = 60 to 62; F = 0 to 60). Components of your grades are listed below.

20% Homework quizzes (two drops allowed)

Homework problems and solutions will be assigned roughly on a weekly basis. Homework assignments are NOT collected for this class. Instead, we will have a homework quiz at the *beginning* of the lecture when the homework is due. Content of the quiz is directly based on homework questions. *There is no make-ups for this grade under any circumstance*, instead, you are allowed to drop two lowest grades.

20% In-class assignments (two drops allowed)

You will be asked to do in-class assignments during most lectures. As these are not announced ahead of time, your regular attendance is important. You are also expected to actively participate in group assignments and class discussions. *There is no make-ups for this grade under any circumstance*, instead, you are allowed to drop two lowest grades.

20% × 3 Exams

There will be three **in-class** exams (two midterms and one final). They are closed book/notes/electronics. For each exam, you can use a reference sheet: 8.5 by 11 inch (or A4) piece of paper with whatever you want on it, double sided.

Note on cross-listed class: Some components in the exams might be different for students registered in DATA352 vs in DATA551. In general, for these components, the DATA551 version will be slightly longer, more open-ended, and more comprehensive.

Final Exam Policy. If extenuating circumstances occur, students may submit a Final Exam Reschedule request for review by the Associate Provost. Students may not negotiate a make-up date directly with the course instructor. Students may request to reschedule an exam only under the following circumstances:

- Two final exams scheduled at the same time;
- Three final exams scheduled in one calendar day; one of the exams will be rescheduled at the convenience of the instructor and the student;
- Serious illness, or personal emergency; the student is required to present documentation to validate.

The final exam schedule is visible on the Registrar's website by the beginning of each semester (`https://drew.edu/academic/office-of-the-registrar/registration/final-exam-sch`
Students are expected to schedule travel plans to occur AFTER their final exams. Our final exam is scheduled for **Wednesday, December 16, 7:30 - 10:30**.

Academic Accommodations. Your experience in this class is important to me. If you have already established accommodations with the Office of Accessibility Resources (OAR), please provide me with a copy of your accommodation letter at your earliest convenience so we can discuss your needs in this course.

If you have not yet established services through the Office of Accessibility Resources (OAR), but have a temporary health condition or permanent disability that requires accommodations (conditions include but not limited to; mental health, attention-related, learning, vision, hearing, physical or health impacts), you are encouraged to contact OAR. OAR offers resources and coordinates reasonable accommodations for students with disabilities and/or temporary health conditions.

Although a disclosure may take place at any time during the semester, students are encouraged to do so early in the semester, because, in general, accommodations are not implemented retroactively. Office of Accessibility Resources contact information:
Interim Director: Stefanie Attia Location: Brothers College, Room 119B
Phone: 973-408-3962 Email: oar@drew.edu

Academic Integrity Policy. All students are required to uphold the highest academic standards. Any case of academic dishonesty will be dealt with according to the guidelines and procedures outlined in Drew University's "Standards of Academic Integrity: Guidelines and Procedures," which is located in the academic policies section of the catalog (`https://drew-undergraduate-catalog.coursedog.com/academicpolicies#academic-integrity-policy`).

Supporting Student Success, Center for Academic Excellence. All Drew students can access subject tutoring, writing support and academic coaching free of charge in the Center for Academic Excellence (CAE, `https://drew.edu/academic/student-resources/center-for-academic-excellence/`), located in the library. Seeking help through learning support resources in the CAE can help you achieve your academic goals. To access

the appointment schedule, please visit `https://drew.mywconline.com/` and follow the instructions on the landing page; if a tutor is not available, please submit the Tutor Request form. For any other questions, email cae@drew.edu.

Artificial Intelligence. I encourage you to explore Artificial Intelligence (AI) resources for learning purposes. When using AI, you must (1) fully document and cite all material (including any code, graph, formula, table, mathematical equation, etc.) in submitted work, (2) check information generated by AI and take full responsibility for its accuracy, and (3) be able to identify where and how you used any AI tools and how they contributed to your work.

Tentative Schedule (subject to change)

Date	Lecture content	Note
9/2	Introduction	
9/9	Common discrete distributions	Homework quiz 1
9/16	Review: R basics and loops	Homework quiz 2
9/23	Continuous distributions	Homework quiz 3
9/30	**Exam 1**	
10/7	Simulating The Central Limit Theorem	Homework quiz 4
10/14	Rejection and SIR sampling	Homework quiz 5
10/21	Model-based inference	Homework quiz 6
10/28	Bootstrapping	Homework quiz 7
11/4	**Exam 2**	
11/11	Monte Carlo methods	Homework quiz 8
11/18	Bayesian modeling	Homework quiz 9
11/25	**Thanksgiving - no class**	
12/2	MCMC I	Homework quiz 10
12/9	MCMC II	Homework quiz 11

The in-person final exam is on **December 16 (Wednesday), 7:30 - 10:30 pm**.