

STAT:3120 Probability and Statistics (for Data Science) Fall 2023

Lectures MTWF 1:30 PM – 2:20 PM
40 SH

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Teaching Assistant Yiran Zeng yiran-zeng@uiowa.edu
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Course Website. Announcements, homework problems, lecture notes, and other course information are posted in ICON <http://icon.uiowa.edu>.

Course Schedule.

<https://docs.google.com/spreadsheets/d/18ZAGnV7zXEQH6LZm1zHI-3jVr45yQHoLi27X1IcW-Lo/edit#gid=0>

Course Description and Objectives.

The overarching goal of this single-semester course is to help students learn the basic theory of probability and statistics which are fundamental in data science. This is a core course for master students in data science (and upper-level undergraduate students).

As computing plays a major role in data science, R will be used in this class to produce graphs and run simulations to demonstrate theoretical results.

Prerequisites.

The course prerequisites are the mathematics courses MATH:1560 or MATH:1860.

Textbook.

No required textbook.

Main References:

Probability and Statistical Inference. (10th edition) By Hogg, Tanis, and Zimmerman
<https://www.amazon.com/Probability-Statistical-Inference-10th-Robert/dp/013518939X>

All of Statistics. By Larry Wasserman
<https://link.springer.com/book/10.1007/978-0-387-21736-9>

Introduction to Data Science. By Rafael Irizarry
<https://rafalab.github.io/dsbook/>

Office Hours.

- 3-hour in-person OH from the instructor, Boxiang Wang (261 SH):
12:30 PM – 1:30 PM Wednesday, 11:30 AM – 1:30 PM Friday
- additional 1-hour online OH from the TA, Yiran Zeng (Zoom):
3:00 PM – 4:00 PM Monday
<https://us05web.zoom.us/j/4302576611?pwd=elIwKzg3NGpaeUJ2bHMmTUxDS1cwZz09>

Homework.

Homework is weekly assigned on Monday and due 11:59 PM on the next Monday (see Course Schedule) and must be submitted **online**. **No late homework is accepted.**

Two lowest assignments will be dropped. To avoid grading penalty, place a box around each final numerical answer, show all important steps in your reasoning. Each homework is graded based on a three-point scale for completeness.

If you write your homework by hand, take pictures or preferably scan your homework, and **must combine them into a single PDF**. The homework won't be graded if it is submitted in formats other than PDF. If multiple files are submitted, only the first file will be graded.

Quizzes and Exams.

There are nine 25-minute quizzes, one midterm and one final exam. All the quizzes and exams are in-person.

All the quizzes are closed-book, no formula sheet. The quizzes will be held on Fridays. No make up quiz. You are allowed to drop two lowest quizzes.

In the midterm and final exam, you are allowed to bring one page (letter sized) of formula sheet in the midterm and the final exam.

A two-hour midterm is scheduled on Oct 27, 6:30-8:30 PM, in Sham LIB (not the regular classroom). The schedule of the final exam is to be determined by the university.

You must take exams as scheduled except in cases of officially university-approved absence such as class conflict with official exam time, illness, religious observance, and NCAA athletic competition. Makeup exams are not available for other reasons, including student org field trips, club competitions, job interviews, and personal events. An online option may be provided due to extenuating circumstances.

No make up exam for the midterm. If you miss the midterm due to legitimate reasons, your grade of final exam will be used as the grade of your missed exam. If you miss your final exam, the make-up exam will be scheduled next semester.

Grading.

Your semester grade will consist of the following components:

Homework	20%	
Quizzes	35%	
Midterm Exam	20%	Oct 27
Final Exam	25%	
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Total	100%	

As a rough guide, **A,A-** = 90% – 100%, **B+,B,B-** = 80% – 90%, **C+,C,C-** = 70% – 80%, **D+,D,D-** = 60% – 70%. The two lowest assignments and two lowest quizzes will be dropped.

References: <https://clas.stage.drupal.uiowa.edu/faculty/grades-grading-system-and-distribution>

Main Content.

- **Probability and Random Variables**

Content: sample space, probability, discrete distributions, continuous distributions, probability mass function, probability density function, cumulative distribution function, expectation and variance, moment generating function

- **Multivariate Random Variables**

Content: joint/marginal distributions, bivariate normal, conditional distribution, conditional expectation, covariance, independence, Bayes theorem, transformation

- **Convergence**

Content: convergence in probability, convergence in distribution, law of large numbers, central limit theorem, Delta method

- **Statistical Inference**

Content: point estimation, quality of estimators, confidence interval, maximum likelihood estimator (MLE), consistency of MLE, asymptotic normality of MLE, large-sample confidence interval, t-test, p-values, likelihood ratio test, Neyman-Pearson Lemma

Attendance is required. See instruction for Absence from Class due to illness, emergence, or extenuating circumstances in <https://registrar.uiowa.edu/absence-class> .

See COVID-related questions in <https://coronavirus.uiowa.edu/>.

A student who is absent for more than five days or miss an exam due to an emergency or an illness may request the UI Service Center, 17 Calvin Hall, registrar@uiowa.edu, to notify me of the reason for the absence.

A grade of “Incomplete” will only be given under extraordinarily extenuating circumstances that prevent the student from completing the course requirements. Having a failing grade in the course is not an extraordinarily extenuating circumstance.

Copyright.

The lectures, slides, homework, quiz and exam questions are for use only by students attending STAT:3120 (0001). It is illegal to share with anyone else the course materials without instructor’s permission.

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“Incomplete” Grades. A grade of “Incomplete” will only be given under extraordinarily extenuating circumstances that prevent the student from completing the course requirements. Having a failing grade in the course is not an extraordinarily extenuating circumstance.

Academic Honesty and Misconduct. All students in CLAS courses are expected to abide by the CLAS Code of Academic Honesty.

Student Complaints

Students with a complaint about a grade or a related matter should first discuss the situation with the instructor, and finally with the Director or Chair of the school, department, or program offering the course.

Undergraduate students should contact CLAS Undergraduate Programs for support when the matter is not resolved at the previous level. Graduate students should contact the CLAS Associate Dean for Graduate Education and Outreach and Engagement when additional support is needed.

Drop Deadline for this Course

You may drop an individual course before the deadline; after this deadline you will need collegiate approval. You can look up the drop deadline for this course here. When you drop a course, a “W” will appear on your transcript. The mark of “W” is a neutral mark that does not affect your GPA. Directions for adding or dropping a course and other registration changes can be found on the Registrar’s website. Undergraduate students can find policies on dropping and withdrawing here. Graduate students should adhere to the academic deadlines and policies set by the Graduate College.

Communication: UI Email

Students are responsible for all official correspondences sent to their UI email address (uiowa.edu) and must use this address for any communication with instructors or staff in the UI community. For the privacy and the protection of student records, UI faculty and staff can only correspond with UI email addresses.

Where to Get Academic Support for This Course

Instructors: Remind students here about your drop-in student hours and also provide information on departmental, collegiate, or university resources helpful for this course, such as the Writing Center <https://writingcenter.uiowa.edu> or the Tutor Iowa central academic support site <https://tutor.uiowa.edu/>.

Mental Health Resources and Student Support

CLAS encourages instructors to draw students' attention to the expanded language on mental health resources in this template at the beginning of the course and frequently throughout the semester.

Students are encouraged to be mindful of their mental health and seek help as a preventive measure or if feeling overwhelmed and/or struggling to meet course expectations. Students are encouraged to talk to their instructor for assistance with specific class-related concerns. For additional support and counseling, students are encouraged to contact University Counseling Service (UCS). Information about UCS, including resources and how to schedule an appointment, can be found at counseling.uiowa.edu. Find out more about UI mental health services at mentalhealth.uiowa.edu.

Student Care and Assistance

It provides assistance to University of Iowa students who are experiencing a variety of crisis and emergency situations, including but not limited to medical issues, family emergencies, unexpected challenges, and sourcing basic needs such as food and shelter. More information on the resources related to basic needs can be found at basicneeds.uiowa.edu/resources/. Students are encouraged to contact Student Care & Assistance in the Office of the Dean of Students (Room 135 IMU, dos-assistance@uiowa.edu, or 319-335-1162) for support and assistance with resources.

Accommodations for Students with Disabilities

The University is committed to providing an educational experience that is accessible to all. If a student has a diagnosed disability or other disabling condition that may impact the student's ability to complete the course requirements as stated in the syllabus, the student may seek accommodations through Student Disability Services (SDS). SDS is responsible for making Letters of Accommodation (LOA) available. The student must provide an LOA to the instructor as early in the semester as possible, but requests not made at least two weeks prior to the scheduled activity for which an accommodation is sought may not be accommodated. The LOA will specify what reasonable course accommodations the student is eligible for and those the instructor should provide.

Additional information can be found on the SDS website.

University Policies

Basic Needs and Support for Students

Classroom Expectations

Exam Make-up Owing to Absence

Free Speech and Expression

Mental Health

Military Service Obligations

Non-discrimination

Religious Holy Days

Sexual Harassment/Misconduct and Supportive Measures

Sharing of Class Recordings