STAT:3120 Probability and Statistics (for Data Science) Fall 2022

Lectures   **MW** 7:00 PM – 8:50 PM
110 MLH (face-to-face mode)

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DEO   Kung-Sik Chan, 241 SH, `kung-sik-chan@uiowa.edu`

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-3jVr45yQHoL`
`i27X1IcW-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.
In person: 3:30 PM – 5:00 PM Wednesday
Online: 1:00 PM – 2:30 PM Thursday

Reserve your slot using the following google sheet and send me a zoom link before the scheduled time.
`https://docs.google.com/spreadsheets/d/1I4dUIErEgweMItzSmVooVJXYZ857zImz`
`Qb84qae3dMQ/edit#gid=0`
You may use your first name or simply write "Reserved" to reserve a time slot. You can reserve consecutive slots if you want to request more than 15 minutes.

Homework.
Homework is weekly assigned on Friday and due 11:59 PM on the next Friday and must be submitted **online**. No late homework is accepted.

Two lowest assignments will be dropped. To avoid grading penalty, place a $\boxed{\text{box}}$ 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 Wednesdays. 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.
The 110-minute midterm will be held in-class on Oct 26 in our 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%
Final Exam	25%
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, confidence interval, maximum likelihood estimator (MLE), consistency of MLE, asymptotic normality of MLE, t-test, p-values, likelihood ratio test, multiple testing

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.

University Policies.
Accommodations for Students with Disabilities
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