STAT:5400 Computing in Statistics
Fall 2024

Lectures	**MWF 9:30 AM –10:20 AM**	51 SH
	Lectures on Fridays and between Nov 4 and Nov 22 will be held in the computer lab 41 SH. See Course Schedule.	

Instructor	Boxiang Wang, 261 SH, `boxiang-wang@uiowa.edu`
Teaching Assistant	Yikai Zhang, `yikai-zhang@uiowa.edu`
Department	Statistics & Actuarial Science, 241 SH. `http://www.stat.uiowa.edu`
DEO	Professor Kung-Sik Chan, DEO, 319-335-0712, `kung-sik-chan@uiowa.edu`

Course Website.
Announcements, homework problems, lecture notes, etc: http://icon.uiowa.edu.

Course Schedule.
https://docs.google.com/spreadsheets/d/1BX5J-H-Ej457uUB8q8IAGbH63B4jvujgox8NPWiBxGY/edit?usp=sharing

Course Description and Objectives.
This is a required course for master students in statistics. Through hands-on experience with real problems, we will learn computing skills essential in applied statistics and in research in methodological and theoretical statistics.

This course is bilingual: coding is primarily in R and secondarily in Python.

The course mainly consists of two components.

- Component 1: Introduction to Statistical Computing Methods. Topics include generating random variables, Monte Carlo studies, resampling methods (Bootstrap, jackknife, and permutation tests), computing linear models, computations in high-dimensional statistics, and machine learning algorithms.
- Component 2: Tech Guide. Topics include the Linux operating system, R Markdown, LATEX (mathematical document preparation language), SAS, GitHub (version control), Sublime (text editor), ggplot2 R package, C and Fortran, writing R packages, parallel computing, among other topics.

Course Home.
The College of Liberal Arts and Sciences (CLAS) is the home of this course, and CLAS governs the policies and procedures for its courses. Graduate students, however, must adhere to the academic deadlines set by the Graduate College.

Prerequisites.
CS:1210 and STAT:3200 and (STAT:3120 or STAT:3101 or STAT:4101).

Corequisites.
STAT:5100 and STAT:5200 if not already completed.

Textbook.
No required textbook.

Optional Reference:

- Maria L. Rizzo (2008). *Statistical Computing with R.* Chapman & Hall/CRC.
- Trevor Hastie, Robert Tibshirani, and Jerome H. Friedman (2009). *The elements of statistical learning: data mining, inference, and prediction.* The 2nd Edition, New York: Springer.
  https://hastie.su.domains/ElemStatLearn/printings/ESLII_print12.pdf
- Norman Matloff (2011). *The Art of R Programming: A Tour of Statistical Software Design.* No Starch Press.
- Hadley Wickham and Grolemund Garrett (2016). *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data.* O'Reilly Media, Inc.
  https://r4ds.had.co.nz/
- Rafael A. Irizarry (2019). *Introduction to Data Science.* Chapman & Hall/CRC.
  https://rafalab.github.io/dsbook/

Grading.
Your semester grade will consist of the following components:

Homework	30%	
Midterm Exam	25%	Nov 4
Instructional Project	15%	
Computing Project	30%	
Total	100%	

As a **rough** guide, **A,A-**$= 90\% - 100\%$, **B+,B,B-**$= 80\% - 90\%$, **C+,C,C-**$= 70\% - 80\%$, **D+,D,D-**$= 60\% - 70\%$.

Grading will be on a curve, with +/− grade used. A grade of A+ represents exceptional work and is given only in extraordinary situations.

Homework.
In general, weekly homework will be assigned each Friday and will be due at 9:30 AM the following Friday. Exceptions to this schedule will be announced in class. Homework should be submitted electronically through the ICON submission tools for this course

(https://icon.uiowa.edu). Show your work when solving written homework problems. Complete code and output must be submitted for computer problems. Always document your answer.

You are encouraged to study with others. However, if you work with others on homework, please: a) write up your own assignment and make sure you completely understand all solutions that you submit, and b) write the names of the others in your study group on your assignment.

Late homework is accepted only as required by the university policy, i.e. due to "illness, mandatory religious obligations, or other unavoidable circumstances or University activities." This is a strict rule; however, you are allowed to drop the lowest homework grade.

Office Hours.
10:20 AM – 12:20 PM Wednesday, 10:20 AM – 11:20 AM Friday

If you have some questions regarding the homework, you may also reach out to our TA, Yikai Zhang, 9:00 - 10:00 AM, every Thursday, in 266 SH

Midterm Exam.
There is a two-hour hands-on computing midterm exam that will be held 6:30 PM – 8:30 PM on Nov 4. The computing exams are open book and open notes. You are not allowed to discuss with others about the exam.

Students 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.

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.

More teaching policies and resources are seen in:
https://clas.uiowa.edu/faculty/teaching-policies-resources-examination-policies.

Instructional Project.
Students will work in groups of five to study and present a topic that is not covered in this class. You are expected to give a whole lecture to introduce the topic to other students. You are free to use any resource, including some tutorials available online, but

you must cite them clearly. You are encouraged to design your lecture in the format of a lab, allowing students to have hands-on experience of the tools that you introduce. You are also required to make a short homework question based on your material.

Possible topics include: R packages shiny, dplyr; Hadoop, Julia, web scraping.

The project is collaborative. Each student on a team is expected to complete a similar amount of work and to contribute equally to the final project. Students who misrepresent themselves as equal partners in this collaborative project but who are actually letting others do the bulk of the work will be reported to the College for academic dishonesty.

Computing Project.
Students will work in groups of three or four to carry out projects involving application of the statistical computing methods covered in the course to problems of their own choosing. Examples of possible types of projects are:

- Design and carry out a simulation study to compare the properties of two or more statistical procedures.
- Choose a research paper. Use simulation and find data to verify results in the paper.
- A real-world project that will be provided later by the instructor.

The computing project will be carried out in two stages. Please meet with me while you are working on each stage.

- Project proposal (due 5:00 PM Nov 11. Grade is 30% off if submission is late within one less day, otherwise no grade is given.)

  Each team should write a two-page summary. This is a detailed description of what you plan to do, including questions to be addressed, software to be used, and methods to be applied.

  No proposal is needed for the team who plans on a real-world project.

- Project presentation.

  Each team will give a 25-minute presentation during the week of Dec 9. A list of which tasks each team member has performed should be submitted.

It is required to work with different people for the instructional and computing projects.

Attendance.
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/.

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Copyright.
The lectures, slides, homework, quiz and exam questions are for use only by students attending STAT:5400 (0001). It is illegal to share with anyone else the course materials without instructor's permission.

"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. Undergraduate academic misconduct must be reported by instructors to CLAS according to these procedures. Graduate academic misconduct must be reported to the Graduate College according to Section F of the Graduate College Manual.

Student Complaints
Students with a complaint about a grade or a related matter should first discuss the situation with the instructor and/or the course supervisor (if applicable), and finally with the DEO (Chair) of the department, school or program offering the course. Sometimes students will be referred to the department or program's Director of Undergraduate Studies (DUS) or Director of Graduate Studies (DGS).
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
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 course-related concerns. For additional mental health support, please see the guidance and resources at mentalhealth.uiowa.edu, including the 24-7 UI Support and Crisis Line.

Additionally, the Office of the Dean of Students can help students navigate personal crisis situations. They can provide one-on-one support, help with identifying options, and access to basic needs resources (such as food, rent, childcare, etc.). Student Care and Assistance: 132 IMU, dos-assistance@uiowa.edu, or 319-335-1162 and more info: dos.uiowa.edu/assistance.

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