

STAT:5400

Fall 2021

Computing in Statistics

Lectures MWF 9:30 AM – 10:20 AM
W228 CB (face-to-face mode)

Instructor Boxiang Wang, 261 SH, boxiang-wang@uiowa.edu
Office Hours Th 10:00 AM – 1:00 PM.
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<http://www.stat.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/16jvnPYQ_bHpc41z0vL164yPBSPpB7Vn0GUvBJ5RMFkw/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), computations in high-dimensional statistics, optimization algorithms (e.g., bisection search, Newton's method, gradient descent), and some machine learning methods if time permits.
- Component 2: Tech Guide. Topics include the Linux operating system, R Markdown, LATEX (mathematical document preparation language), SAS, GitHub (version control), Sublime (text editor), C and Fortran, writing R packages, parallel computing, among other topics.

Textbook.

No required textbook.

Optional Reference:

- Maria L. Rizzo (2008). *Statistical Computing with R*. Chapman & Hall/CRC.
- Rafael A. Irizarry (2019). *Introduction to Data Science*. Chapman & Hall/CRC.
Online: <https://rafalab.github.io/dsbook/>

Grading.

Your semester grade will consist of the following components:

Homework	30%	
Midterm Exam	30%	Oct 28
Instructional Project	15%	
Computing Project	25%	
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Total	100%	

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 in class 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.

Online Office Hours.

The office hours are held between 10 am and 1 pm every 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/1I4dUIErEgweMITzSmVooVJXYZ857zImzQb84qae3dMQ/edit?usp=sharing>

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.

Proficiency Exam.

The Incoming Statistics Graduate Students Computer Programming Proficiency Test is designed to determine whether you have already met the programming proficiency

requirement. Students who are not deemed proficient will be required to do an extra programming practice homework in this class. The exam result will not affect the grade of this course. The exam results of statistics graduate students will be reported to DGS of the department.

The exam will be held online. You are allowed to use any resource but you cannot communicate with others about the exam. You may use your choice of the following programming languages, R (preferred), Python, C, C++, and Fortran.

The proficiency exam will be posted at noon on Aug 23 and will be due by 9:30 AM Aug 25. No late submission is accepted.

Midterm Exam.

There is a two-hour hands-on computing midterm exam on 6:30 PM Oct 28, 2020 in 140 SH. 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 three to four to study and present a topic that is not covered in this class. You are expected to give a 50-minute 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 ggplot2, shiny, caret; Hadoop, Julia.

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.
- Analyze a complicated or large-scale real data.
- Choose a research paper. Use simulation and find data to verify results in the paper.

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

- Project proposal (due 9:30 AM Nov 9. 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.

- Project presentation.

Each team will give a twenty-minute presentation during the week of Dec 7. A list of which tasks each team member has performed should be submitted.

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

Extra bonus will be considered if you attend our department colloquia regularly.

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/>.

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.

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.

College of Liberal Arts and Sciences: Information for Graduate Students

Attendance and Classroom Expectations.

Students are responsible for attending class and for knowing an instructor's attendance policies, which vary by course and content area. All students are expected to attend class and to contribute to its learning environment in part by complying with University policies and directives regarding appropriate classroom behavior or other matters.

Absences.

Students are responsible for communicating with instructors as soon they know that an absence might occur or as soon as possible in the case of an illness. Delays in communication could result in a forfeit of what otherwise might be an excused absence.

Absences: Illness, Unavoidable Circumstances, and University Sponsored Activities.

Students who are ill, in an unavoidable circumstance affecting academic work, or who miss class because of a University sponsored activity are allowed by UI policy to make up a missed exam. Documentation is required by the instructor except in the case of a brief illness. Students are responsible for communicating with instructors as soon as the absence is known (<https://opsmanual.uiowa.edu/students/absences-class#8.1>).

Absences: Holy Days.

Reasonable accommodations are allowed for students whose religious holy days coincide with their classroom assignments, tests, and attendance if the student notifies the instructor in writing of any such religious Holy Day conflicts within the first days of the semester and no later than the third week. (See the UI Operations Manual, <https://opsmanual.uiowa.edu/students/absences-class#8.2>).

Absences: Military Service Obligations.

Students absent from class due to U.S. veteran or U.S. military service obligations (including military service-related medical appointments, military orders, and National Guard Service obligations) must be excused without penalty. Instructors must make reasonable accommodations to allow students to make-up exams or other work. Students must communicate with their instructors about the expected possibility of missing class as soon as possible. (For more information, see

<https://opsmanual.uiowa.edu/iv-8-absences-class%C2%A0-0>).

Academic Misconduct.

Plagiarism and the process for addressing academic misconduct of graduate students are defined in Section IV, Article F “Plagiarism by Graduate Students” of the UI Graduate College Manual of Rules and Regulations. Please contact the CLAS Associate Dean for Graduate Education for any necessary assistance in navigating the process mandated by the Graduate College.

Academic Accommodations for Students with Disabilities.

UI is committed to providing an educational experience that is accessible to all students. A student may request academic accommodations for a disability (such as a mental health, attention, learning, vision, and a physical or health-related condition) through the Student Disability Services (SDS) office. The student is responsible for discussing specific accommodations with the instructor. Note that accommodations are not granted retroactively but from the time of the student’s request to the instructor onward; additionally, accommodations must be requested at least two weeks in advance of the related assignment or exam (<https://sds.studentlife.uiowa.edu/>).

Class Recordings: Privacy and Sharing.

Course lectures and discussions are sometimes recorded or live-streamed. These are only available to students registered for the course and the intellectual property of the faculty member. These materials may not be shared or reproduced without the explicit written consent of the instructors. Students may not share these recordings with those who are not enrolled in the course; likewise, students may not upload recordings to any other online environment. Doing so is a breach of the Code of Student Conduct and could be a violation of the Federal Education Rights and Privacy Act (FERPA); also see <https://dos.uiowa.edu/policies/code-of-student-life/>.

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 (Operations Manual, III.15.2). Emails should be respectful and brief, with complex matters addressed during the instructor’s drop-in hours, for example. Faculty are not expected to answer email after business hours or during the weekends.

Complaints About Academic Matters.

Students with a complaint about a grade or a related academic matter should first visit with the instructor and then with the course supervisor (if applicable), and finally with the Director of the school, department, or program offering the course. If a graduate student has not been able to resolve the issue through the Director of the school, department, or program, they should contact the associate dean for graduate education in the college of liberal arts and sciences.

Final Examination Policies.

The final exam schedule is published during the fifth week of the fall and spring semesters or on the first day of summer classes; students are responsible for knowing the date, time, and place of their final exams. Students should not make travel plans until knowing this information. A student with exams scheduled on the same day and time or who have more than two final exams on the same day should visit this page for how to resolve these problems by the given deadline (<https://registrar.uiowa.edu/makeup-final-examination-policies>). No exams are allowed the week before finals, but with some exceptions made for labs, language courses, and off-cycle courses (<https://registrar.uiowa.edu/final-examination-scheduling-policies>).

Free Speech and Expression.

The University of Iowa supports and upholds the First Amendment protection of freedom of speech and the principles of academic and artistic freedom. We are committed to open inquiry, vigorous debate, and creative expression inside and outside of the classroom. Visit Free Speech at Iowa for more information on the University's policies on free speech and academic freedom (<https://freespeech.uiowa.edu/>).

Home of the Course.

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. See <https://grad.uiowa.edu/academics/deadlines>.

Mental Health.

Students are encouraged to seek help as a preventive measure or if feeling stressed or overwhelmed. Students should talk to their instructors for guidance with specific class-related concerns and are encouraged to contact University Counseling Service (UCS) at 319-335-7294 during regular business hours to schedule an appointment. USC offers group and individual therapy as well as counseling for couples about relationships while making referrals to other resources (<https://counseling.uiowa.edu/>). Student Health can also address related concerns (<https://studenthealth.uiowa.edu/>). These visits are free to students. After hours, students are encouraged to call the Johnson County Community Crisis Line at (319) 351-0140 or dial 911 in an emergency.

Nondiscrimination in the Classroom.

The University of Iowa is committed to making the classroom a respectful and inclusive space for people of all gender, sexual, racial, religious, and other identities. Toward this goal, students are invited in MyUI to optionally share the names and pronouns they would like their instructors and advisors to use to address them. The University of Iowa prohibits discrimination and harassment against individuals based on race, class, gender, sexual orientation, national origin, and other identity categories indicated by the University's Human Rights policy. Contact the Office of Equal Opportunity and Diversity at <https://diversity.uiowa.edu/division/office-equal-opportunity->

and-diversity-eod.

Sexual Harassment.

Sexual harassment subverts the mission of the University and threatens the well-being of students, faculty, and staff; all members of the UI community are expected to conduct themselves in a manner that maintains an environment free from sexual harassment and sexual misconduct. Those experiencing sexual harassment are strongly encouraged to report the incidents and to seek help (<https://osmrc.uiowa.edu/>).