

## SYLLABUS

<b>Course Home Page</b>	ICON (login at <a href="https://icon.uiowa.edu/">https://icon.uiowa.edu/</a> )
<b>Lectures</b>	Notes and online videos available on ICON, anytime.
<b>Student Drop-In Hours</b>	10:30-11:20, M [grad priority, community building]; 11:30-12:20, T [undergrad priority, community building]; 10:30-11:20, W [grad priority, lab]; TBD (2 hours) [grad TA-led help]; or by appointment (zoom)
<b>Instructor</b>	Professor Joseph B. Lang, 207 SH, <a href="mailto:joseph-lang@uiowa.edu">joseph-lang@uiowa.edu</a>
<b>Pre-Requisites</b>	STAT:5100 or equivalent
<b>Department, College</b>	Statistics and Actuarial Science, College of Liberal Arts and Science
<b>DEO</b>	Professor Kung-Sik Chan, 335-0712, <a href="mailto:kung-sik-chan@uiowa.edu">kung-sik-chan@uiowa.edu</a>
<b>Department Main Office</b>	241 SH

<a href="#">Required Text</a>	<a href="#">Supplementary Texts</a>	<a href="#">Description and Objectives</a>	<a href="#">Organization</a>	<a href="#">CLAS Info for Students</a>
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### Required Text:

Casella, G. and Berger, R.L. (2002). *Statistical Inference*. 2nd edn. Belmont, CA: Duxbury Press.

### Supplementary Texts:

DeGroot, M.H. and Schervish, M.J. (2002). *Probability and Statistics*, 3rd ed. Boston: Addison-Wesley.

Hogg, R.V. and Tanis, E.A. (1997). *Probability and Statistical Inference*, 5th ed. Upper Saddle River, NJ: Prentice Hall.

Hogg, R.V. McKean, J.W., and Craig, A.T. (2005). *Introduction to Mathematical Statistics*, 6th ed. Upper Saddle River, NJ: Pearson Prentice Hall.

Wackerly, D.D., Mendenhall, W. and Scheaffer, R.L. (1996). *Mathematical Statistics with Applications*, 5th ed. Belmont, CA: Duxbury Press.

**Description:** This is the second course in the two-semester, master's level, statistical inference sequence STAT 5100-1. The first course covered introductory probability and distribution theory. This second course gives a non-measure theoretic treatment of the foundations of statistical inference, primarily from the Frequentist perspective. We will begin with a discussion of important asymptotic/approximation results, including the delta method. We then discuss estimation and hypothesis testing theory as covered in Chapters 6-10 in Casella and Berger (2002). Time-permitting, we will delve deeper into the foundations and compare Frequentist and Bayesian inference paradigms. Topics covered will include continuous mapping theorems, delta method, finding and evaluating point and interval estimates, and finding and evaluating hypothesis tests. To address these topics, we will explore such concepts as sufficiency, completeness, ancillarity, unbiasedness, consistency, efficiency, asymptotic approximations, and stochastic operating characteristics. Other key phrases include, method of moments, maximum likelihood, mean square error, minimum variance unbiased estimation, information identities and

inequality, asymptotic efficiency, asymptotic normality of estimators, likelihood and score functions, size, power, p-values, uniformly most powerful tests, conditioning arguments, etc. Finally, computer simulation will be used to corroborate many of the important results.

**Objectives:** The successful student will leave this course with a basic understanding of many of the important foundational concepts in statistical inference. They will be comfortable using a wide variety of mathematical tools for solving statistical inference problems. And they will appreciate the usefulness of the computer program R for addressing inference questions and for simulating to corroborate findings and to check answers.

### **Course Organization:**

**Overview.** Student learning will be facilitated through a blend of asynchronous and synchronous means.

On the asynchronous side, audio-video presentations of animated lecture slides will be made available in ICON modules for viewing/listening at any time, night or day. Regularly assigned homework problems taken directly from the lecture slides will serve as signposts for where students are expected to be in the material.

On the synchronous side, students will regularly attend zoom-based lab sessions, which are scheduled during the Wednesday 10:30-11:20 class time. These will be problem-solving and topic-clarification sessions. Additionally, students are invited to Monday drop-in hours and a teaching-assistant-led help session (time to be determined). Students will also attend zoom-based “community building” sessions, which are meeting sessions that serve to highlight the importance of seeing learning as a community-based project or group-based endeavor. These sessions will afford students the opportunity to meet each other and the instructor in a setting where the focus is not on course material or questions.

In addition to reading/viewing/listening to lectures and attending the lab/drop-in/community-building/help sessions, students will submit to ICON approximately 12 homework solution sets and two exam solution sets. Finally, point earning opportunities in the form of extra problem assignments and specified attendance requests may be made available at the instructor’s discretion.

**Lab Sessions.** Attendance is strongly recommended but will not generally be required (see the discussion of Point Earning Opportunities below). During these problem-solving sessions you may ask questions about the material and exercises.

**Community Building Sessions.** You are required to attend at least one of these zoom-based, Monday (10:30-11:20) sessions by February 8<sup>th</sup>. And, in total, you are required to attend at least two of these Monday sessions by March 1<sup>st</sup>. To get credit for attending, you must email grader, Zongyi Xu, at [zongyi-xu@uiowa.edu](mailto:zongyi-xu@uiowa.edu) within one week. Your message must include “Community Building STAT:5101” in the subject line and “[your name] attended Community Building session on [date attended]” in the text.

**Homework.** Homework assignments (approximately 12 of them) will be posted on ICON, usually at least one week before they are due. Due dates will typically be Fridays, at 10:30am. You must submit to ICON your solution sets in a **single PDF file**. (For those of us without scanners, there are

free apps available for taking pictures of multiple pages and combining them into a single PDF file—I have had some success with the iOS version of the free *Adobe Scan* app.) It is your responsibility to make sure that your submission is easily readable.

**Computing.** Some of your homework will require the use of the computer. I will give sample code as needed. The freeware package [R](#) will typically be used to perform calculations, create graphics, and carry out small-scale simulation studies.

Note: R is available on the HP machines in the UNIX Computing Lab (346 SH) and most all of the ITC labs, such as the Myers Computing Lab (41 SH). It can also be downloaded from <http://cran.us.r-project.org> to your personal computer.

**Exams.** There will be two exams in this course: a midterm (submission deadline is 5:00pm, Friday, March 12) and a final exam (submission deadline is to be determined, but will be during the week of May 10-14). Both exams are open-book and open-web, and you may use the computer as you wish. However, you must work alone on these exams! For instance, you may consult existing documents online, but **you may not pose a question to elicit a response**. Of course, you may email clarification questions to the instructor.

Your exam solutions, like homework solutions, must be submitted to ICON in a **single PDF file** by the submission deadline. It is your responsibility to make certain your submission is clearly readable.

**Point Earning Opportunities.** Point-Earning Opportunities (PEOs) will be of three primary forms. (1) You will receive participation points for attending the requisite number of community building sessions ([see above](#)). (2) You may be asked to submit a solution to a problem that is assigned one to three days before it is due--so check ICON frequently. (3) You may be asked to attend and participate in a particular lab session--again check ICON frequently for announcements.

### Course Pace (Tentative):

Lectures 1.1-2.1	(CB Chap 5)	Weeks 1-2	
Lectures 4.1-6.1	(CB Chap 6, 7)	Weeks 3-5	
Lectures 7.1-8.1	(CB Chap 6, 7)	Weeks 5-7	Midterm Exam (due 5:00pm, Fri, Mar 12)
Lectures 9.1-9.4	(CB Chap 8)	Weeks 8-10	
Lectures 10.1-10.2	(CB Chap 9)	Weeks 11-12	
Lectures 11.1-11.2	(CB Chap 10)	Weeks 13-15	Final Exam (to be determined)

### Course-Specific Guidelines and Policies:

**Course Web Page.** Announcements, lecture notes, videos, homework, exam descriptions, supplementary materials, and zoom invitations will be made available on ICON. You should check the course for announcements and updates daily.

**Stay Caught Up.** Especially with an online course like this, it is vitally important that you are self-disciplined enough to stay caught up. You should take note of the due dates of the homework problems and make sure to read and view the lectures at least up to that point.

**Effort Expectations.** My effort expectations align with the guideline adopted by the college of LAS: *"for each semester hour credit in the course, students should expect to spend two hours per week preparing for class sessions (e.g., in a three-credit-hour course, standard out-of-class preparation is six hours)."* Of course, you need to keep in mind that the '6 hours per week' is an average taken over the weeks in the semester. It is also an average taken over a heterogeneous collection of [undergrad and grad] students and courses. Thus, effort amounts will vary. It is fair to say, however, that the more effort you put in, the more you will get out of the course.

**Attendance and Participation.** Students are required to attend at least one zoom-based community building (CB) session by Monday, Feb 8<sup>th</sup>, and, in total, they must attend at least two of these CB sessions by Monday, Mar 1<sup>st</sup>. (To get credit for attending a CB session, see the instructions [above](#).) Students are strongly encouraged to attend zoom-based Wednesday lab sessions, but these are not required. Students are expected to participate through the point-earning-opportunities (PEOs) described above.

**Working Together.** You must work alone on exams! Unless instructed otherwise, you may work together on the homework problems. However, you must write up your own solutions in your own words. If you are personally asked to write up your own solutions, but then subsequently turn in material that is obviously in the same words as a fellow student, the work will be considered plagiarized. Plagiarism will be dealt with according to the policies of the College of Liberal Arts and Sciences and the University (see additional information at the end of this syllabus).

**Late Homework.** Late submissions of homework will be penalized by 50% each 24-hour period. For example, if you scored a 38 out of 50 on a homework, but it was submitted an hour late, you would receive a score of 19 out of 50; and if you submitted it 25 hours late, you would receive a score of 9.5 out of 50.

**Grading Questions.** Questions about grading must be asked within one week of the graded work's return. It is recommended that you reach out directly to the grader, Zongyi Xu, at [zongyi-xu@uiowa.edu](mailto:zongyi-xu@uiowa.edu).

**Zoom/Electronic Etiquette.** You are strongly encouraged to attend zoom meetings with your video ON. While in attendance, please remain attentive and listen respectfully to your fellow classmates and the instructor. Do not record any sessions without express permission.

### Grading and Components for Evaluation:

Your final score  $S$  will be computed as  $S = 0.35H + 0.30F + 0.30M + 0.05P$ , where  $H$  = percent credit on [homework](#),  $F$  = percent credit on final exam,  $M$  = percent credit on midterm exam, and  $P$  = participation score, which is the percent credit on [point-earning-opportunities](#).

Letter grades (including +'s and -'s) will be awarded according to a 90-80-70-60 schedule (e.g. if  $S \geq 90$  then a grade of A- or better will be awarded). These are guaranteed cutoffs, so it is possible (but unlikely) that everyone receives an 'A.' I do, however, reserve the right to lower (but not raise) the cutoffs. Note that with this grading scheme you are not "graded on a curve," and so you are not

competing with fellow students. Therefore, you are not penalized for working together to better understand concepts.

### **Miscellaneous Help and Resources:**

#### **Help Outside of Class:**

This course has a teaching assistant (TA) who will have regular student drop-in hours. The TA will also hold a weekly help session. I also have regular zoom-based drop-in hours. Sometimes it is effective to ask specific questions via email. (Do be aware that the volume of email I receive is such that messages sometimes get lost. Do not hesitate to send your message again or to attend a drop-in hour.)

A list of tutors is maintained by the Department of Statistics and Actuarial Science. Start at <https://stat.uiowa.edu/resources/tutoring> .

#### **Help with R software:**

An Introduction to R ( <https://cran.r-project.org/doc/manuals/r-release/R-intro.pdf> ) by W. N. Venables, D. M. Smith and the R Core Team (accessed 8/17/20)

SimpleR. Go to <http://www.math.csi.cuny.edu/Statistics/R/simpleR/index.html> , J. Verzani

#### **Scanning Apps (for creating images and combining them into a single PDF file):**

The iOS version of the free *Adobe Scan* app seems to work pretty well.

## College of Liberal Arts and Sciences

### Information for Students

#### Absences and Attendance

Students are responsible for attending class and for contributing to the learning environment of a course. Students are also responsible for knowing their course absence policies, which will vary by instructor. All absence policies, however, must uphold the UI policy related to student illness, mandatory religious obligations, including Holy Day obligations, unavoidable circumstances, or University authorized activities (<https://clas.uiowa.edu/students/handbook/attendance-absences>). Students may use the CLAS absence form to aid communication with the instructor who will decide if the absence is excused or unexcused. The form is located on ICON within the top banner under "Student Tools."

#### Academic Integrity

All undergraduates enrolled in courses offered by CLAS have, in essence, agreed to the College's [Code of Academic Honesty](#). Misconduct is reported to the College, resulting in suspension or other sanctions, with sanctions communicated with the student through UI email. Visit this page for information: (<https://clas.uiowa.edu/students/handbook/academic-fraud-honor-code>).

#### Accommodations for Disabilities

UI is committed to an educational experience that is accessible to all students. A student may request academic accommodations for a disability (such as mental health, attention, learning, vision, and physical or health-related condition) by registering with Student Disability Services (SDS). The student is then responsible for discussing specific accommodations with the instructor. More information is at <https://sds.studentlife.uiowa.edu/>.

#### Administrative Home of the Course

The College of Liberal Arts and Sciences (CLAS) is the administrative home of this course and governs its add/drop deadlines, the second-grade-only option, and related policies. Other colleges may have different policies. CLAS policies may be found here: <https://clas.uiowa.edu/students/handbook>.

#### Classroom Expectations

Students are expected to comply with University policies regarding appropriate classroom behavior as outlined in the [Code of Student Life](#). This includes the policies and procedures that all students have agreed to regarding the Steps Forward for Fall 2020 in response to the COVID-19 pandemic. Particularly, all students are required to wear a face cover when in a UI building, including a classroom. In addition, the density of seats in classrooms has been reduced. In some instances, this will allow 6 feet or more of distance while other cases, it may be less. Regardless, wearing face coverings and maintaining as much distance as is possible are vital to slowing the spread of COVID-19. In the event that a student disrupts the classroom environment through their failure to comply with the reasonable directive of an instructor or the University, the instructor has the authority to ask that the student immediately leave the space for the remainder of the class period. Additionally, the instructor is asked to report the incident to the [Office of Student Accountability](#) for the possibility of additional follow-up. Students who need a temporary alternative learning arrangement related to COVID-19 expectations should contact [Student Disability Services](#) (<https://sds.studentlife.uiowa.edu/fall-2020/covid-19-temporary-learning-arrangements/>; +1 319 335-1462).

#### Class Recordings: Privacy and Sharing

Some sessions of a course could be recorded or live-streamed. Such a recording or streaming will only be

available to students registered for the course. These recordings are the intellectual property of the faculty, and they may not be shared or reproduced without the explicit written consent of the faculty member. Students may not share these sessions with those not in the class; likewise, students may not upload recordings to any other online environment. Doing so is a breach of the Code of Student Conduct and, in some cases, a violation of the Federal Education Rights and Privacy Act (FERPA).

### **Communication and the Required Use of UI Email**

Students are responsible for official correspondences sent to the UI email address (uiowa.edu) and must use this address for all communication within UI ([Operations Manual, III.15.2](#)).

### **Complaints**

Students with a complaint about an academic issue should first visit with the instructor or course supervisor and then with the Chair of the department or program offering the course; students may next bring the issue to the College of Liberal Arts and Sciences; see this page for more information:

<https://clas.uiowa.edu/students/handbook/student-rights-responsibilities>.

### **Final Examination Policies**

The final exam schedule is announced around the fifth week of classes; students are responsible for knowing the date, time, and place of a final exam. Students should not make travel plans until knowing this information. No exams of any kind are allowed the week before finals with a few exceptions made for particular types of courses such as labs or off-cycle courses: <https://registrar.uiowa.edu/final-examination-scheduling-policies>.

### **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 on the basis of race, class, gender, sexual orientation, national origin, and other identity categories set forth in the University's Human Rights policy. For more information, contact the Office of Equal Opportunity and Diversity (<https://diversity.uiowa.edu/eod>; +1 319 335-0705 or ([diversity.uiowa.edu](https://diversity.uiowa.edu)).

### **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 must uphold the UI mission and contribute to a safe environment that enhances learning. Incidents of sexual harassment must be reported immediately. For assistance, please see <https://osmrc.uiowa.edu/>.

*I do hope you all have an enjoyable and rewarding semester. Good luck in all your courses.*