

SYLLABUS

Course Home Page	ICON (login at https://icon.uiowa.edu/)
Lectures	1:30-2:20, MTWF 15 SH
Student Drop-In Hours	3:15-4:45pm, MW [zoom] or by appointment [zoom]
Instructor	Professor Joseph B. Lang, 207 SH, joseph-lang@uiowa.edu
Pre-Requisites	MATH:1560 or MATH:1860
Department, College	Statistics and Actuarial Science, College of Liberal Arts and Science
DEO	Professor Kung-Sik Chan, 335-0712, kung-sik-chan@uiowa.edu
Department Main Office	241 SH

Required Text	Supplementary Texts	Description and Objectives	Organization	CLAS Info for Students
Pace	Guidelines	Grading	Miscellaneous	

Required Text: None. An audio-enhanced online text is available in ICON (see Modules page).

Supplementary Texts:

- “Probability and Statistics—The Science of Uncertainty, 2nd ed., 2009, Evans and Rosenthal
Free! Available online at <http://www.utstat.toronto.edu/mikeevans/jeffrosenthal/>
- “A Brief Course in Mathematical Statistics,” 2008, Tanis and Hogg
- “Probability and Statistical Inference,” 10th ed., 2020, Hogg, Tanis, and Zimmerman
- “Mathematical Statistics with Applications,” 5th ed., 1996, Wackerly, Mendenhall, and Scheaffer

Description: This is a one semester undergraduate course in probability and statistics. Course material, including an audio-enhanced textbook, will be available on ICON. Lectures will cover topics in probability, distribution theory, descriptive statistics, and inferential statistics (see the [appendix](#) for more details). The material is pitched at a level that should be comfortable to a student who has successfully passed a full year of undergraduate calculus.

Objectives: The successful student will leave this course with a basic understanding of many of the important foundational concepts in probability and statistics. They will be equally comfortable explaining basic probability and distribution results, graphically and numerically describing data, and applying elementary inference procedures to their own data.

Course Organization:

Lectures. The 50-minute meetings on MTWF will typically be used to work through examples and to give a running summary of the material ("the big picture"), as seen from the instructor's perspective. Students will be expected to participate in the worked examples. We will cover topics from Chapter 1 through Chapter 9, in the online textbook. To be better prepared for lectures, students are strongly encouraged to look over the relevant material before class. The homework assignments (see Assignments in ICON) will serve as a guide to see where we are and will be in the material.

Homework. Homework assignments (approximately 12 of them) will be posted on ICON, usually several weeks before they are due. Due dates will typically be Fridays, at 1:30pm (before class). 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've 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.

Pass Level vs. Surpass Level. Homework assignments will typically include a pass-level (or core) set of problems plus one or two extra problems. A perfect score on the pass-level set will earn you a 100% on that homework. A perfect score on the combined pass-level plus extra (=surpass-level) set could earn you as much as 120% on that homework.

Computing. The freeware package R will occasionally be used to perform calculations and statistical analyses, create graphics, and carry out small-scale simulation studies. The audio text will include some sample code that you may find useful. You are not required to become proficient with R, but you may find it helpful in this and subsequent courses. Note: R is available in most of the ITC labs on campus, such as the Myers Computing Lab (41 SH). It can also be downloaded to your personal computer from <http://cran.us.r-project.org>.

Exams. There will be two online exams in this course: a midterm (submission deadline is 5:00pm, Friday, October 15th) and a final exam (submission deadline is to be determined, but will be sometime during the week of Dec 13-17). Both exams are (tentatively) 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) may be given on occasion; some will be pre-announced. PEOs may be in the form of in-class exercises, minute papers, or attendance checks.

Course Pace (Tentative):

Intro to Probability	Weeks 1-4
Random Variables and Distribution Theory	Weeks 4-8 Midterm Exam (due 5:00, Fri, Oct 15)
Descriptive Statistics	Weeks 8-10
Inferential Statistics	Weeks 10-15 Final Exam (to be determined)

Course-Specific Guidelines and Policies:

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

Stay Caught Up. 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 audio text 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 4-credit-hour course, standard out-of-class preparation time is 8 hours. Of course, you need to keep in mind that the '8 hours per week' is an average taken over the weeks in the semester. It is also an average taken over a heterogeneous collection of 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 strongly encouraged to attend all lectures. 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 course grader, Shamriddha De, at shamriddha-de@uiowa.edu.

Zoom/Electronic Etiquette. You are strongly encouraged to attend any 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 $S = 0.50H + 0.25F + 0.20M + 0.05P$, where H = percent credit on [homework](#) (in theory, this could be above 100 if surpass-level problems are solved), 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:

I have regular zoom-based drop-in hours. Alternatively, 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.

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COLLEGE OF LIBERAL ARTS AND SCIENCES

Information for CLAS Undergraduates

Fall 2021

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 or an unavoidable circumstance. Students can use the CLAS absence form to help communicate with instructors who will decide if the absence is excused or unexcused; the form is located on ICON within the top banner under "Student Tools." Delays by students in communication with an instructor could result in a forfeit of what otherwise might be an excused absence (<https://clas.uiowa.edu/students/handbook/attendance-absences>).

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

All undergraduates enrolled in courses offered by CLAS have in essence agreed to the College's Code of Academic Honesty. Academic misconduct affects a student's grade and is reported to the College which applies an additional sanction, such as suspension. Outcomes about misconduct are communicated through UI email (<https://clas.uiowa.edu/students/handbook/academic-fraud-honor-code>).

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 issue should first visit with the instructor and then with the course supervisor (if one is assigned), and next with the Chair of the department or program offering the course. If not resolved, students may bring their concerns to the College of Liberal Arts and Sciences: <https://clas.uiowa.edu/students/handbook/student-rights-responsibilities> .

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 may be scheduled the week before finals; some exception, however, have been 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 course's add and drop deadlines, the "second-grade only" option (SGO), and other undergraduate policies and procedures. Different UI colleges may have other policies or deadlines. See <https://clas.uiowa.edu/students/handbook> . Questions? Contact CLAS at clasps@uiowa.edu or 319-335-2633.

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. UCS 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/>).

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APPENDIX: An Unabridged Description of STAT:3120 Course Content

Some of the topics in probability that are covered include axiomatic probability, equally-likely probability models and counting, conditional probability, Bayes rule, independent events, composite multi-trial processes, independent trials, replication processes, and IID trials.

In distribution theory, we discuss random variables (discrete, continuous, and mixed) and associated concepts such as probability mass and density functions, cumulative distribution functions, and expectations (including moment-generating functions). We will motivate and describe several “named” distributions such as binomial, geometric, Poisson, Gamma, and Normal. We then introduce random vectors, linear combinations of random variables, and the important concept of independent and IID random variables.

Our coverage of descriptive statistics highlights the important distinction between sample distributions, population distributions and process/probability distributions. We introduce graphical and numerical methods for describing sample distributions (e.g., barplot, histogram, scatterplot, sample mean, median, sample standard deviation, percentiles, sample correlation, regression line, etc.).

With any eye toward inferential statistics, we describe two famous results that link data to inference targets: The Law of Large Numbers and The Fundamental Theorem of Statistics. We then give important approximation results that are commonly used in statistical inference; specifically, the Central Limit Theorem and Standardized/Studentized Mean Approximations.

After stating Student’s Theorem for IID samples from a Normal distribution, we go on to describe several elementary inference procedures, such as one- and two- sample tests and confidence intervals for means, variances, and proportions.

Finally, we describe several statistical fallacies and paradoxes including Simpson’s Paradox, the Regression Fallacy, the Switched-Conditionals Fallacy, and the Association-Causation Fallacy (which includes a discussion of observational studies vs. designed experiments).

The interested student may choose to independently investigate some important topics not covered in this course, including conditional distributions, conditional expectations, stochastic processes, order statistics, multivariate Normal distributions, asymptotic/approximation theory, the delta method, coefficient testing and estimation is simple linear regression, chi-squared tests of goodness of fit, independence, and homogeneity, and the list goes on...

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