**Required Text:**


**Supplementary Texts** (ordered by degree of difficulty):


**Course Description:**

This is the second course in the two-semester mathematical statistics sequence 22S:153-4. This course gives a mathematical introduction to the foundations of statistical inference primarily from the Frequentist perspective. We discuss sampling distribution theory, estimation theory, and the theory of hypothesis testing, as covered in Chapters 5-8 in Hogg, McKean, and Craig (2005). Time-permitting, we will also cover select topics from Chapter 11 (and perhaps 9,10). Chapter 5 gives an overview of basic statistical inference concepts such as, sampling, order statistics, confidence intervals, hypothesis testing, Monte Carlo estimation, and bootstrap procedures. Chapter 6 focuses on maximum likelihood methods—estimation and testing. Chapter 7 studies the assessment or quality of estimators: for example, we will discuss unbiasedness, consistency, sufficiency, efficiency, completeness, and ancillarity. Chapter 8 explores optimality properties of statistical tests of hypotheses: for example, most powerful and uniformly most powerful tests are discussed. Chapter 9 describes topics related to Normal model inference. Chapter 10 covers non-parametric inference. And Chapter 11 introduces the reader to Bayesian inference.

**Course Objectives:**
The successful student will leave this course with a basic understanding of many of the important foundational concepts in statistical inference. In addition, he or she will be comfortable using a wide variety of mathematical tools for solving statistical inference problems.

Course Organization:

**Lectures.** The 50 minute meetings on MWF 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 the material from Chapters 5-8 and, time permitting, some of Chapter 11 (and perhaps 9, 10), all from HMC (2005). We will not necessarily cover this material one section at a time. At times, we will use an integrated approach that illustrates the concepts of several sections through multi-part examples. It follows that you will be expected to read several sections at a time with the goal of understanding the big picture.

**Homework Exercises.** Homework problems will be assigned about once per week. You will typically have one week to turn in the assigned problems. Many of the problems will be assigned during the course of working through an example in lecture. Most of these problems will come from the book, or at least they will be based on problems in the book.

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

Note: Splus, and R are available on the HP machines in the UNIX Computing Lab (346 SH). They are also available in the Myers Computing Lab (41 SH). The software **R** can be downloaded from [http://cran.us.r-project.org](http://cran.us.r-project.org) to your personal computer.

**Exams and Quizzes.** There will be two in-class midterms (Fri, Feb 19 and Fri, Apr 2) and one final exam (Thurs, May 13, 12:00 pm, 22 SH) in this course. Quizzes will be given on occasion; some will be pre-announced.

Course Pace (tentative):

Chapter 5  Weeks 1 through 4
Chapter 6...Weeks 5 through 8  
[Exam #1, Fri, Feb 19]
Chapter 7...Weeks 9 through 11  
[Exam #2, Fri, Apr 2]
Chapter 8...Weeks 12 through 14
Chapter 11 (or 9, 10)...Time Permitting  
[Final Exam, Thur, May 13, 12:00 -2:00pm, 22 SH]

Course-Specific Guidelines and Policies:

**Reading Ahead.** It is vitally important that you read ahead. If the material in a lecture is completely new to you, you will find it very difficult to get much out of lecture.

**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 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.

**Participation and Attendance.** Students are expected to attend, and participate in, class. You will be asked many questions, and you will be strongly encouraged to ask lots of questions. If you miss a class, you run the risk of missing a quiz, which cannot be made-up.

**Working Together.** 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 please write up your own solutions and subsequently turn in material that is obviously in the same words as a fellow student, the work will be considered to be 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).

**Exams.** The exams will all be closed-book. You are allowed to use one (two-sided) crib sheet for the first midterm, two for the second midterm, and three (two-sided) crib sheets for the final. Bring along a pencil and calculator.

**Quizzes.** You should always be prepared for the possibility of an unannounced quiz, e.g. always bring along the book and a calculator. Missed quizzes (and exams) cannot be made up unless you have a legitimate excuse. See Section VIII. Grading--Attendance and Examinations in the CLAS Student Academic Handbook. Your lowest quiz score will be dropped.

**Late Homework.** Unless otherwise instructed, homework is due at 8:30am. Late homework has a discrete half-life of 24 hours; that is you get 50% credit if it is handed in late, but within 24 hours of the due time; you get 25% credit for the next 24 hours, etc. Homework not handed in directly to me must be handed in to a department secretary (located in 241 SH)--it must include a hand-in time and date, and must be signed by the department secretary. (It follows that you cannot hand in homework after the main office is closed.)

**Grading Questions.** Questions about grading must be asked within one week of the graded work's return.

**Grading and Components for Evaluation**

Your final score $S$ will be computed as $S = 0.20M_1 + 0.25M_2 + 0.25F + 0.25H + 0.05Q$, where $M_i =$ percent correct on midterm $i$, $F =$ percent correct on final, $H =$ percent correct on homework and $Q =$ percent correct on quizzes. [Your lowest quiz score will not be included in the calculation of $Q$.]

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). Class participation will be considered when a student "falls on the borderline" between two grades. 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 outside of class:**

I have regular office hours. Sometimes it is effective to ask specific questions via email. Course web pages; start at http://www.stat.uiowa.edu/~jblang/s154. A list of tutors is maintained by the Department of Statistics and Actuarial Science at http://www.stat.uiowa.edu/courses/tutors.html.
Campus Resources for Students
Writing Center 110 English-Philosophy Building, 335-0188, www.uiowa.edu/~writingc
Speaking Center 12 English-Philosophy Building, 335-0205, www.uiowa.edu/~rhetoric/centers/speaking
Tutor Referral Service Campus Information Center, Iowa Memorial Union, 335-3055, www.imu.uiowa.edu/cic/tutor_referral_service

Help with R software:
SimpleR. Go to http://www.math.csi.cuny.edu/Statistics/R/simpleR/index.html (N.B. You may have to scroll down a bit to get to the simpleR table of contents.)

An Introduction to R, by Elizabeth Slate and Elizabeth Hill.

College of Liberal Arts and Sciences: Policies and Procedures

Administrative Home
The College of Liberal Arts and Sciences is the administrative home of this course and governs matters such as the add/drop deadlines, the second-grade-only option, and other related issues. Different colleges may have different policies. Questions may be addressed to 120 Schaeffer Hall, or see the CLAS Student Academic Handbook.

Electronic Communication
University policy specifies that students are responsible for all official correspondences sent to their University of Iowa e-mail address (@uiowa.edu). Faculty and students should use this account for correspondences. (Operations Manual, III.15.2. Scroll down to k.11.)

Accommodations for Disabilities
A student seeking academic accommodations should first register with Student Disability Services and then meet privately with the course instructor to make particular arrangements. See http://www.uiowa.edu/~sds/ for more information.

Academic Fraud
Plagiarism and any other activities when students present work that is not their own are academic fraud. Academic fraud is a serious matter and is reported to the departmental DEO and to the Associate Dean for Undergraduate Programs and Curriculum. Instructors and DEOs decide on appropriate consequences at the departmental level while the Associate Dean enforces additional consequences at the collegiate level. See the CLAS Academic Fraud section of the Student Academic Handbook.

CLAS Final Examination Policies
Final exams may be offered only during finals week. No exams of any kind are allowed during the last week of classes. Students should not ask their instructor to reschedule a final exam since the College does not permit rescheduling of a final exam once the semester has begun. Questions should be addressed to the Associate Dean for Undergraduate Programs and Curriculum.

Making a Suggestion or a Complaint
Students with a suggestion or complaint should first visit the instructor, then the course supervisor, and then the departmental DEO. Complaints must be made within six months of the incident. See the CLAS Student Academic Handbook.
Student Classroom Behavior
Students have the right to a classroom environment that encourages learning. The ability to learn is lessened when students engage in inappropriate classroom behavior, distracting others; such behaviors also is a violation of the Code of Student Life, as stated in the Student Services Policies document. When disruptive activity occurs, a University instructor has the authority to determine classroom seating patterns and to request that a student exit the classroom, laboratory, or other area used for instruction immediately for the remainder of the period. One-day suspensions are reported to appropriate departmental, collegiate, and Student Services personnel (Office of the Vice President for Student Services and Dean of Students).

Understanding 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 have a responsibility to uphold this mission and to contribute to a safe environment that enhances learning. Incidents of sexual harassment should be reported immediately. See the UI Comprehensive Guide on Sexual Harassment for assistance, definitions, and the full University policy.

Reacting Safely to Severe Weather
In severe weather, class members should seek appropriate shelter immediately, leaving the classroom if necessary. The class will continue if possible when the event is over. For more information on Hawk Alert and the siren warning system, visit the Public Safety web site.

*These CLAS policy and procedural statements have been summarized from the web pages of the College of Liberal Arts and Sciences and The University of Iowa Operations Manual.

University Examination Policy

Final Examinations. An undergraduate student who has two final examinations scheduled for the same period or more than three examinations scheduled for the same day may file a request for a change of schedule before the published deadline at the Registrar's Service Center, 17 Calvin Hall, 8-4:30 M-F, (384-4300).

Missed exam policy. University policy requires that students be permitted to make up examinations missed because of illness, mandatory religious obligations, certain University activities, or unavoidable circumstances. Excused absence forms are required and are available at the Registrar web site: http://www.registrar.uiowa.edu/forms/absence.pdf

I hope you all have an enjoyable and successful semester. Good luck in all of your courses.