APMA 1655 Fall22 Honors Statistical Inference I

08/30/2022

Canvas website: **https://canvas.brown.edu/courses/1088882**
Class Hours: MWF 9-9:50am ET
Class Room: Salomon Center 001
https://brown.zoom.us/j/3834189656

Teaching team:

Instructor: Wenjun Zhao (wenjun_zhao@brown.edu)
Office: 182 George Street, Room 219
Office Hours: Fri 10:30am-12:30pm
https://brown.zoom.us/j/3834189656
Graduate TAs: Bekarys Bekmaganbetov (Bekarys_Bekmaganbetov@Brown.edu)
Undergraduate TAs: TBD
TA Office Hours/Locations: See Canvas for details

Course Description

Students may opt to enroll in APMA 1655 for more in depth coverage of APMA 1650. Enrollment in 1655 will include an optional recitation section and required additional individual work. Applied Math concentrators are encouraged to take 1655. Prerequisites: MATH 0180 or equivalent.

For reference, below is the description for APMA 1650.

APMA 1650 is an integrated first course in mathematical statistics. The first half of APMA 1650 covers probability and the last half is statistics, integrated with its probabilistic foundation. Specific topics include probability spaces, discrete and continuous random variables, methods for parameter estimation, confidence intervals, and hypothesis testing.

Materials

- Textbook: Mathematical Statistics with Applications 7th Edition, *by Dennis Wackerly, William Mendenhall, Richard L. Scheaffer*. Most of the first 10 chapters will be covered.
- Other helpful (all optional) resources:
  - A Modern Introduction to Probability and Statistics, by Frederik Michel Dekking, Cornelis Kraaikamp, Hendrik Paul Lopuhaä, Ludolf Erwin Meester (free e-book available through Brown University library).

- Introduction to Probability, Statistics and Random Processes, by Hossein Pishro-Nik.
- Statistics and probability, by Khan Academy.

Prerequisites

MATH 0180, 0200, 0350 or minimum score of WAIVE in 'Graduate Student PreReq'.
*Knowledge on multivariate calculus is required. *

Grading Policy

The grade will count the assessments using the following proportions:

- **40%** of your grade will be determined by 8 weekly assignments. Each assignment takes 5% and will not be dropped.
- **30%** of your grade will be determined by two midterm exams (15% each). They are tentatively scheduled on Oct 12 and Nov 14, in class.
- **30%** of your grade will be determined by the cumulative final exam, tentatively scheduled on Dec 13 (as listed on cab).

In accordance with Brown's grading system, ABC/NC or S/NC grades will be **tentatively** assigned based on the following cutoffs:

- **ABC/NC**: 90%-100% (A), 75%-89% (B), 60%-74% (C), 0%-59% (NC).
- **S/NC**: 60%-100% (S), 0%-59% (NC).

*Note that I reserve the right to adjust the cutoffs slightly. However, to be fair, I will not adjust them based on requests from individuals. *

Course Policies

Required technology (all accessible through canvas)

- **Zoom:** Zoom will be used for live-streaming lectures. It may be used for office hours depending on the hosts' choice.
- **Media library:** Lecture/recitation recordings.
- **Gradescope:** Assigning/Grading weekly assignments and exams.
- **Ed discussion:** Posting questions and getting answers from instructors.

Policies on Assignments

- Problem sets will be posted on Canvas about one week in advance of the due date (every Friday). The assignments will be submitted via Gradescope (accessible on Canvas). You can submit regrading requests through Gradescope if you disagree with the released grades. These requests are handled by instructor only, instead of TAs.
- There will be a grace period of 12hrs. For example, if the due is Friday 11pm, then you may submit until Sat 11am with no penalty. It should account for all reasons like coursework, research, internship, sports...etc.
- Late assignments beyond the grace period will not be accepted unless a valid excuse (illness/emergency) is communicated to the instructor with verification (doctor's note, or dean's note, accommodation letters) no later than the end of grace period. Any requests for late deadlines or late assignments should be directly emailed to the instructor. TAs can not grant homework extensions.
- You are strongly encouraged to discuss the problems in the homework with your classmates, but you are supposed to independently write up your own solution. Students who are suspected of copying part of an assignment will receive a zero on the assignment and may be referred to the Case Administrator of the Academic Code. You are supposed to report the names of your collaborators on the top of every assignment.
- I do not plan to drop the lowest assignment grade. There will not be a bonus assignment at the end of semester either. Roughly speaking, each assignment takes 5% of your final grade, and please treat them carefully. They are excellent exercises for exams (although their level of difficulty will be higher).

Policies on Exams

- All exams are in person. The two midterms are in class. Please reserve these dates. If the time/location/format does not work for you, please inform the instructor in advance and we can figure it out together.
- I am all for flexibility. However, valid excuses with proof will be required if you cannot attend exams. Under such circumstances, please get a dean's exam excuse note and send it to me before the actual exam, so we can schedule makeup exams. Makeup exams will take place before the scheduled time under most circumstances. Requests for makeup exams are typically not acceptable after the exam. If you do not show up, the portion in the final grade will be recorded as zero. Exam grades cannot be dropped.
- The final exam is scheduled by registrar and listed on cab.
- Exams with accommodations (if SAS accommodation letters have been received by the exam) will be scheduled separately with the instructor. The instructor will reach out separately regarding this before each exam, and please feel free to reach out to make sure this is happening.

- For each midterm, 1 cheat sheet (A4, double-sided) will be allowed. For the final exam, 3 cheat sheets (A4, double-sided) will be allowed. Using other resources (internet, electronic devices, calculators etc), discussing with others etc will be prohibited during exams.

Academic Integrity and Honesty

Students are required to comply with the university policy on academic integrity. Please see Brown's Academic code for details. Students who are suspected of violating the Academic Code will may be reported to the Case Administrator of the Academic Code.

Accommodations for Disabilities

Brown University is committed to full inclusion of all students. Please inform me early in the term if you may require accommodations or modification of any of course procedures. You may speak with me after class, during office hours, or by appointment. If you need accommodations around online learning or in classroom accommodations, please be sure to reach out to Student Accessibility Services (SAS) for their assistance (`seas@brown.edu`, 401-863-9588). Students in need of short-term academic advice or support can contact one of the academic deans in the College.

Books, Supplies, and Materials

If your Brown undergraduate financial aid package includes the Book/Course Material Support Pilot Program (BCMS), concerns or questions about the cost of books and course materials for this or any other Brown course (including RISD courses via cross-registration) can be addressed to `bcms@brown.edu`. For all other concerns related to non-tuition course-related expenses, whether or not your Brown undergraduate financial aid package includes BCMS, please visit the Academic Emergency Fund in E-GAP (within the umbrella of "E-Gap Funds" in UFunds) to determine options for financing these costs, while ensuring your privacy.

Class Recording and Distribution of Course Materials

The course will be presented in a hybrid mode: the lectures will be held in person while synchronously live-streamed over Zoom. The recordings will be posted for students that are enrolled but cannot be present. Lectures and other course materials are copyrighted. Students are prohibited from reproducing, making copies, publicly displaying, selling, or otherwise distributing the recordings or transcripts of the materials. The only exception is that students with disabilities may have the right to record for their private use if that method is determined to be a reasonable accommodation by Student Accessibility Services. Disregard of the University's copyright policy and federal copyright law is a Student Code of Conduct violation.

Schedule (Tentative)

- Week 1 (Sept 7, 9) Welcome and overview, set notation (§2.1-2.3).
- Week 2 (Sept 12, 14, 16) Set notation continued, combinatorics, conditional probability (§2.3-2.7).
- Week 3 (Sept 19, 21, **23**) Independence, multiplicative law, law of total probability, Bayes' law, discrete random variables (§2.7-2.11, 3.1-3.3). **Assignment 1 Due**
- Week 4 (Sept 26, 28, **30**) Expectations, binomial distribution, geometric distribution, hypergeometric distribution (§3.3-3.5, 3.7). **Assignment 2 Due**
- Week 5 (Oct 3, 5, **7**) Poisson distribution, moments, moment-generating function, Markov's inequality, Tchebysheff's theorem (§3.8, 3.9, 3.11). **Assignment 3 Due**
- Week 6 (Oct **12**, 14) Introduction to continuous random variables (§4.1-4.2). **Midterm 1**
- Week 7 (Oct 17, 19, **21**) Expected values, uniform distribution, normal distribution, Gamma distribution, Beta distribution (§4.3-4.7). **Assignment 4 Due**
- Week 8 (Oct 24, 26, **28**) Other expected values, Tchebysheff's theorem, multivariate distributions (discrete), multivariable calculus (double integrals) (§4.9-4.10, 5.1-5.2). **Assignment 5 Due**
- Week 9 (Oct 30, Nov 2, **4**) Marginal and conditional probability, independence, expected values, covariance, statistics of linear combinations (§5.3-5.8). **Assignment 6 Due**
- Week 10 (Nov 7, 9, **11**) Conditional expectations, functions of random variables, order statistics, CLT (§5.11, 6, 7). **Assignment 7 Due**
- Week 11 (Nov **14**, 16, 18) Point estimators, bias, mean square error, consistency (§8.1-8.3, 9.3). **Midterm 2**
- Week 12 (Nov 21) Method of moments, method of maximum likelihood (§9.6, 9.7).
- Week 13 (Nov 28, 30, Dec **2**) Confidence interval, large/small sample confidence intervals for expectation (§8.5, 8.6, 8.8). **Assignment 8 Due**
- Week 14 (Dec 5, 7) Hypothesis test (§10.1-10.3, 10.6).
- Final exam (Dec 13)