MATH 466 - Theory of Statistics

Fall 2020

Instructor: Vahan Huroyan

Instructor's Webpage: https://math.arizona.edu/∼vahanhuroyan

Lecture: Tu Th 8:00AM – 9:15PM

Regular Office Hours: Tu Th 2:00PM – 3:00PM (check D2L for the zoom link)

Tutoring Office Hours: Th 11:00AM–12:00PM (check D2L for the zoom link)

Email: vahanhuroyan@math.arizona.edu

Description of Course:

This course will serve as an introduction to the study of theory of statistics. Topics covered include sampling theory, point estimation, maximum likelihood estimation, hypothesis testing, limiting distributions, confidence intervals, small/large sampling methods. In this course we will use our previous knowledge of probability to study the problems of data analysis, collection, interpretation, and presentation.

Prerequisites:

MATH 464: Theory of Probability.

Course Format and Teaching Methods:

This class is scheduled to be taught in the IN-PERSON modality.

Course Webpage:

https://vahan.huroyan.com/math466.html

Class Meetings:

Meeting Times:

We will be meeting remotely until the University notifies us that in-person meetings may commence. We will meet **Tu Th 8:00AM - 9:15AM by Zoom.**

When the COVID-19 situation permits teaching on campus, we will be meeting **Tu Th 8:00AM - 9:15AM in ILC Room 141 (M Pacheco Integrated Learning Center).**

Remain flexible. If pandemic conditions warrant, the University may require that we return to remote operations. If that is the case, we will notify you by D2L Announcement and email that we are moving to remote operations.

Remote/online only after Thanksgiving: After the Thanksgiving holiday, we are scheduled to move to remote teaching. That means we will meet **Tu Th 8:00AM - 9:15AM by Zoom.**

Face coverings are required in our classroom:. Per UArizona's Administrative Directive, face coverings that cover the nose, mouth, and chin are required to be worn in all learning spaces at the University of Arizona (e.g., in classrooms, laboratories and studios). Any student who violates this directive will be asked to immediately leave the learning space, and will be allowed to return only when they are wearing a face

covering. Subsequent episodes of noncompliance will result in a Student Code of Conduct complaint being filed with the Dean of Students Office, which may result in sanctions being applied. The student will not be able to return to the learning space until the matter is resolved.

- The Disability Resource Center is available to explore face coverings and accessibility considerations if you believe that your disability or medical condition precludes you from utilizing any face covering or mask option. DRC will explore the range of potential options as well as remote course offerings. Should DRC determine an accommodation to this directive is reasonable, DRC will communicate this accommodation with your instructor.

Physical distancing is required in our classroom. During our in-person class meetings, we will respect CDC guidelines, including restricted seating to increase physical distancing. Any student who does not maintain physical distance from others may be asked to immediately leave the learning space. Noncompliance may result in a Student Code of Conduct complaint being filed with the Dean of Students Office, which may result in sanctions being applied.

Classroom attendance:

- If you feel sick, or may have been in contact with someone who is infectious, stay home. Except for seeking medical care, avoid contact with others and do not travel.
- Notify your instructors if you will be missing an in person or online course.
- Campus Health is testing for COVID-19. Please call (520) 621-9202 before you visit in person.
- Visit the UArizona COVID-19 page for regular updates.
- *Students who need to miss more than one week of classes in any one semester must provide a doctor's note of explanation to* DOS-deanofstudents@email.arizona.edu.

Class Recordings:

For lecture recordings, which are used at the discretion of the instructor, students must access content in D2L only. Students may not modify content or re-use content for any purpose other than personal educational reasons. All recordings are subject to government and university regulations. Therefore, students accessing unauthorized recordings or using them in a manner inconsistent with UArizona values and educational policies are subject to suspension or civil action.

Assignments and Examinations: Schedule/Due Dates

Homework:
There will be weekly or biweekly homework (depending on the difficulty of the material). The homework with the lowest score will be dropped.

Exams:
There will be 2 midterms and one final exam
Midterm 1: *Oct.1, 2020* (tentative, in case of a change you will be notified at least 2 weeks before)
Midterm 2: *Nov.19, 2020* (tentative, in case of a change you will be notified at least 2 weeks before)
Final Exam: 8:00am-10:00am *Dec 17, 2020*

Cameras: *Students will be proctored using Zoom, with video sharing. Any student who has concerns about sharing video during an exam must must meet with their instructor at least two weeks prior to the exam to discuss options. This is not a conversation that can take place immediately prior to an exam.*

Grading Policy:
Homework: total 20%; 2 midterms: total 40% (20% each); final exam (40%).
Grades will be no lower than the following: A $\geq$ 90%, B $\geq$ 80%, C $\geq$ 70%, D $\geq$ 60%

Incomplete (I) or Withdrawal (W):
Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete and http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal respectively.

Course Goals, Objectives and Expected Learning Outcomes:

Students will learn the definitions and fundamental frameworks of statistical inference. This course will give an opportunity to get some hands-on experience with a popular statistical software (such as R) to test the notions learned in class (this is not required, but highly recommended). Those who successfully complete this course are expected to be able to:

- Calculate and interpret confidence intervals.
- Define and use consistency, efficiency, and sufficiency for point estimators.
- Apply the method of moments.
- Perform basic procedure of estimation and hypothesis testing.
- Use method of maximum likelihood to derive optimal statistics.
- Derive and apply t-tests and z-tests.

Course Communications:

For communication: Official UA e-mail address,
For updates: Check the course webpage and D2L
To submit assignments/exams online: Use Gradescope

Required Texts or Readings:

The class will closely follow to the following textbook:
"Mathematical Statistics with Applications", by Wackerly, Mendenhall, and Scheaffer, 7th Edition (2008). Thomson Brooks/Cole. ISBN: 978-0495110811
The textbook is available through D2l Inclusive access.

Tentative schedule of topics and activities:

Week 1 Review of probability, random samples, sampling from a normal population; Sections 7.1-7.2

Week 2 Central Limit Theorem, Normal Approximation to the Binomial distribution; Sections 7.3-7.5

Week 3 Introduction to Estimation, The Bias and Mean square error of point estimators, some common unbiased point estimators; Sections 8.1-8.3

Week 4 Evaluating the goodness of a point estimator, confidence intervals, large sample confidence intervals; Sections 8.4-8.6

Week 5 Selecting the sample size, Small sample confidence intervals, Confidence intervals for σ^2; Sections 8.7-8.9

Week 6 Introduction to properties of point estimators and methods of estimation, Relative efficiency; Sections 9.1-9.2

Week 7 Consistency, Sufficiency; Sections 9.3-9.4

Week 8 The Rao-Blackwell theorem and minimum variance unbiased estimation, the method of moments; Sections 9.5-9.6

Week 9 The method of maximum likelihood, some large-sample propertes of maximum likelihood estimators; Sections 9.7-9.8

Week 10 Introduction to hypothesis testing, elements of a statistical test; Sections 10.1-10.2

Week 11 Common large sample test, calculating Type II Error Probabilities and finding the sample size for Z test; Sections 10.3-10.4

Week 12 Relationships between hypothesis-testing procedures and confidence intervals, another way to report the results of a statistical test: attained significance levels, or p-values; Sections 10.5-10.6

Week 13 Some comments on the theory of hypothesis testing, small sample hypothesis testing for μ and μ_1, μ_2; Sections 10.7-10.8

Week 14 Testing hypothesis concerning variances, power of tests and the Neyman-Pearson Lemma; Sections 10.9-10.10

Week 15 Likelihood ratio tests, Review; Section 10.11

Week 16 Review

University-wide Policies link

Links to the university-wide olicies are provided here: https://academicaffairs.arizona.edu/syllabus-policies

Class Policy:

Regular attendance or online participation by zoom is essential and expected. No make up exams, quizzes or late submitted homework will be accepted. However, in complex and unusual circumstances, which are beyond your control, a make-up exam may be given on a case-by-case basis. This will require providing a detailed account of the situation and supporting documents. Approval in these cases is at the sole discretion of the instructor and/or the dean of students. Homework assignments not turned by the due date receive an automatic zero. Extensions may be granted on a case by case basis, either with prior permission of the instructor (a valid reason must be given) or with instructor's agreement in cases of emergency. In the latter case, the student must contact the instructor within 24 hours if possible.

Classroom Behavior Policy:

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.). Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

Threatening Behavior Policy:

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students.

Accessibility and Accommodations:

At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience barriers based on disability or pregnancy, please contact the Disability Resource Center (520-621-3268, https://drc.arizona.edu/) to establish reasonable accommodations.

Code of Academic Integrity:

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise

instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity. The University Libraries have some excellent tips for avoiding plagiarism, available at http://new.library.arizona.edu/research/citing/plagiarism.

UA Nondiscrimination and Anti-harassment Policy:
The University is committed to creating and maintaining an environment free of discrimination; see http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy.

Academic Honesty:
Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation.

Absence and Class Participation Policies:
The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop.
The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable: http://policy.arizona.edu/human-resources/religious-accommodation-policy.
Absences preapproved by the UA Dean of Students (or dean's designee) will be honored.
See http://policy.arizona.edu/employmenthuman-resources/attendance.

Changes to the Course Syllabus:
Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advance notice, as deemed appropriate by the instructor. In particular, the dates of midterm exams, the number of exams, and the order in which topics are covered may differ from the dates and arrangement in the tentative weekly schedule.

Additional Resources for Students
UA Academic policies and procedures are available at http://catalog.arizona.edu/policies Student Assistance and Advocacy information is available at http://deanofstudents.arizona.edu/student-assistance/students/student-assistance

Academic advising:
If you have questions about your academic progress this semester, or your chosen degree program, please note that advisors at the Advising Resource Center can guide you toward university resources to help you succeed.

Life challenges:
If you are experiencing unexpected barriers to your success in your courses, please note the Dean of Students Office is a central support resource for all students and may be helpful. The Dean of Students Office can be reached at 520-621-2057 or DOS-deanofstudents@email.arizona.edu.

Physical and mental-health challenges:
If you are facing physical or mental health challenges this semester, please note that Campus Health provides quality medical and mental health care. For medical appointments, call (520-621-9202. For After Hours care, call (520) 570-7898. For the Counseling & Psych Services (CAPS) 24/7 hotline, call (520) 621-3334.