

Math 542: Mathematical Statistics Syllabus

Indiana State University

Winter/Spring 2023: 1/10/23 – 5/5/23

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Classroom: none (asynchronous online)
Class Hours: asynchronous online
Office Hours: online, to be determined

Course Description and Learning Outcomes

The focus of this course is maximum likelihood estimation and inference. This powerful, widely applicable methodology underlies the classical methods taught in introductory statistics courses - one and two-sample z-tests and linear regression, for example - and many other, more modern methods.

After completing this course, you will be able to

1. Use and interpret classical confidence intervals for population parameters
2. Conduct classical hypothesis tests concerning population parameters
3. Construct likelihood functions
4. Derive point estimators and asymptotic confidence intervals from likelihood functions
5. Determine properties of point estimators (efficiency, consistency, sufficiency)
6. Derive Wald, score, and likelihood ratio tests from likelihood functions
7. Determine properties of hypothesis tests (most powerful, uniformly most powerful)
8. Analyze data and program simple data analysis algorithms using R.

If time permits, we will explore these methods by analyzing real data and doing simulations using the statistical software package R.

Prerequisites

Math 541/441 Probability Theory or equivalent, i.e., a semester-long upper-level introductory probability course, and familiarity with partial differentiation.

Textbook

Our required textbook is *Introduction to Mathematical Statistics, 8th edition*, by Hogg, McKean, and Craig. Please note that quizzes are open book, open notes but Not open electronics: during quizzes you will not be allowed to use programs on your laptop/computer, nor tablets, nor cell phones, nor any other electronics except a calculator. **Thus, if you purchase an electronic version of our textbook, you will not be able to use it during quizzes.** If you want to buy an electronic version (in order to save money), one option is to also rent/buy a used version hardcopy of an earlier edition to use during quizzes.

Professor

Professor Inlow earned his Ph.D. in mathematical statistics from Texas A&M in 2001. Prior to joining ISU in 2018, he was a visiting professor at the University of Arizona and a tenured professor at the Rose-Hulman Institute of Technology. In addition to his academic career, he has worked for various government labs and corporations, including DuPont and the statistical software company, Stata. Most recently he worked as a senior data scientist for the American Institutes for Research, a non-profit, from 2015 to 2017.

Technology and Software Requirements

Since this is an online course, course material including quizzes will be presented online. Thus,

- You must have reliable, high-speed internet access.
- Also, your computer must meet Indiana State's laptop minimum hardware [requirements](#).
Please note that the following Do Not meet these requirements:
 - Chromebooks
 - Ipads
- You will also need a laptop with a reliable built-in or external webcam.
- You will also want the following software:
 - R (free download at <https://cran.rstudio.com/>)
 - Rstudio (free download at <https://www.rstudio.com/products/rstudio/download/#download>)
 - Antivirus Software (free download at <http://downloads.indstate.edu>)
 - Chrome (free download at <https://www.google.com/chrome/>)
 - Microsoft Office (free download at <http://downloads.indstate.edu>)
- You will also want a good scientific calculator, preferably one that can do numerical integration.

Course Mechanics

Course material is provided on a weekly or biweekly basis:

- Each week, videos presenting course content will be posted to Canvas, our learning management system. You can log onto Canvas via this [link](#) using your Sycamore ID and password.
- Each week, a homework will be posted covering material currently or previously presented via videos. A random subset of each homework's problems will be selected and completion graded, i.e., if you put forth a good faith effort on a given problem, you will receive full credit even if it is incorrect. Solutions will be posted for even-numbered problems; answers to odd-numbered problems are provided in the back of our book. Thus, there is no need nor incentive to use homework help services like Chegg or Bartleby.
- Every other week, there will be a quiz focusing on recently covered material:
 - The quizzes are open book, open note but no electronics except calculators.
 - The quizzes are offered synchronously at various times to accommodate different schedules and time zones.
 - The quizzes are proctored using the respondus lockdown browser which disallows the use of any other programs on your computer. Because of this, and the fact that the quizzes are open book, open notes, you will want a print version of our textbook to use as a reference during quizzes. If you want to use buy an electronic version of our textbook for the course, I suggest also getting a used print version of an earlier edition to use during quizzes. Your lowest quiz score will be dropped. So, if you are unable to take a quiz for any reason, it will count as your dropped quiz score.
- In lieu of a final, there will be a quiz during finals week.

Course Grade

Your overall grade point average will be a weighted average of your homework and quizzes:

Homework:	100 pts
Quizzes:	400 pts
Total	500 pts.

Your course grade will be determined using the following scale.

A+	97-100%	C+	77-79%
A	94-96%	C	74-76%
A-	90-93%	C-	70-73%
B+	87-89%	D+	67-69%
B	84-86 %	D	64-66%
B-	80-83%	D-	60-63%
		F	0-59%

Course Policies

1. **Be responsible for your learning.** My goal is for you to excel in this class and to develop the skills necessary to succeed in your chosen career. However, **you have the major responsibility for doing well.** Achievement of course standards requires that *you* know what you need to do to improve your performance. You are expected to carefully study all material, to understand feedback provided to you on graded quizzes and exams, and to participate in group and class activities. *You cannot meet the objectives of this course by being a passive learner.* As the semester progresses, you should implement learning strategies to improve your performance. Also, you are expected and encouraged to ask questions via e-mail or Zoom to clarify evaluations or other aspects of the course not clear to you.
2. **Check your ISU e-mail daily.** **Every day**, check your ISU e-mail at <http://webmail.indstate.edu> or via Outlook to stay current and avoid missing any important announcements or other correspondence. E-mail is my primary means of communicating with you.
3. **Participate.** This is an asynchronous online course which means the course material will be presented via pre-recorded video lectures. Thus, there is no classroom attendance requirement. However, participation in online discussion boards may be required.
4. **Commit time to this course.** Time-management is an essential component of success. This is a 3-credit-hour course so you should expect to spend *at least* 10 hours a week studying the material and doing homework.

5. **Be courteous.** Be considerate of your classmates and your professor. In this course, you are expected to comply with the [Sycamore Standard](#), which emphasizes respect, dignity, and integrity, and the [ISU Code of Student Conduct](#). In this course, that includes (but is not limited to):
 - a. Maintaining a formal, respectful, civil, professional tone with *all* course communications, including but not limited to journals, discussion boards, wikis, and emails.
 - b. Avoid derogatory language, obscenity, and hate speech.
 - c. Avoid the use of CAPS in e-mails and posts, as this indicates shouting.

Communication Policy

You can expect responses to your inquiries based on the following guidelines:

-  You should **check your ISU email daily** to stay current and avoid missing any important announcements or other correspondence.
-  I commit to replying to your e-mails in a timely fashion depending on the urgency of the request and when the e-mail arrives - during the week versus during the weekend.
-  Emails involving information protected by FERPA (e.g., grades) must be sent **using your ISU email account**. Emails violating this policy will not be answered.
-  **Emails should contain at least the following information:** your name, which class you are in (MATH 442/542), and the subject of your message in the subject line of the email (e.g. Question about Homework Assignment).
-  **Email is the best way to get contact me.**
-  **Office visits:** I'm happy to schedule one on one meetings via Zoom.



Illness

If you are seriously ill you must report to Student Affairs. Student Affairs will verify the illness and notify me, and I will make every reasonable effort to accommodate your situation. Please contact the [Office of the Dean of Students](https://www.indstate.edu/student-affairs/dean) (<https://www.indstate.edu/student-affairs/dean>) at the website below to report your illness. You may also call: **812-237-3829**.
https://cm.maxient.com/reportingform.php?IndianaStateUniv&layout_id=23.

Academic Honesty

Academic Integrity is a core value of our community of learners. Every member of the academic community (students, faculty, and staff) is expected to maintain high standards of integrity in all facets of work and study. The [Student Guide to Academic Integrity](#) describes appropriate academic conduct and ethics. See also the [ISU Code of Student Conduct](#).

If you cheat on an assignment, quiz, or test you will be given a numeric grade of 0 on that assessment. You may also be subject to additional penalties such as failing the course, and referral to Student Judicial Programs to face form conduct charges. You may also have a permanent notation affixed to the official transcript indicating that an academic integrity violation occurred. Students are urged to discuss questions regarding academic integrity with instructors, advisors, or with the academic deans.

Academic Freedom

Indiana State follows the [American Association of University Professors' guidelines for academic freedom](#) as described on their website:

Teachers are entitled to freedom in the classroom in discussing their subject, but they should be careful not to introduce into their teaching controversial matter which has no relation to their subject.

Accessibility

Indiana State University seeks to provide effective services and accommodation for qualified individuals with documented disabilities. The technology tools utilized within this course offer a variety of accessibility features, such as compatibility with screen readers, text-based visual alternatives, video scripts, closed captioning, and attention to Universal Design. The central platform for this course, [Canvas, also complies with ADA requirements](#).

By federal law, if you have a documented disability, you are entitled to and eligible for accommodation through the [Center for Student Success](#) (CFSS), Normal Hall – First Floor, 812-237-2700. Such accommodation may include more time on in-class writing or a transcriber for out-of-class work. Instructors cannot grant accommodation unless they have authorization from SSS, and SSS will not authorize accommodation until you have submitted to their office all required paperwork. You are not required to disclose your disability to your instructor; however, if you would like to request accommodation for this class, you will need to contact SSS directly to initiate the process.

Statement on Discrimination, Sexual Harassment, and Sexual Misconduct

Indiana State University [Policy 923](#) strictly prohibits discrimination on the basis of: age, disability, genetic information, national origin, pregnancy, race/color, religion, sex, gender identity or expression, sexual orientation, veteran status, or any other class protected by federal and state statutes in ISU programs and activities or that interferes with the educational or workplace environment.

Title IX of the Educational Amendments of 1972 prohibits discrimination based on sex, including sexual harassment. Sexual harassment includes quid pro quo harassment, unwelcome verbal or physical conduct, sexual assault, dating violence, domestic violence, and stalking.

If you witness or experience any forms of the above discrimination, you may report to:

Office: Equal Opportunity & Title IX; (812) 237-8954; Rankin Hall, Room 426
Email: ISU-equalopportunity-titleix@mail.indstate.edu
Online: https://cm.maxient.com/reportingform.php?IndianaStateUniv&layout_id=10

Disclosures made to the following confidential campus resources will not be reported to the Office of Equal Opportunity and Title IX:

ISU Student Counseling Center: (812) 237-3939; Gillum Hall, 2nd Floor
Victim Advocate: (812) 237-3829; HMSU 7th Floor
UAP Clinic/ISU Health Center: (812) 237-3883; 567 N. 5th Street

Amendments

This syllabus may be amended during the semester. You will be notified of any amendments.