

Course Information Sheet
MATH 5080/6824
STATISTICAL INFERENCE I, Fall 2021

Instructor: Jyothsna Sainath

E-mail: sainath@math.utah.edu (This is the only email I check regularly.)

Class Hours: TR 6:00 - 7:30 PM, on Zoom and in-person.

Office Hours: W 4 - 5 PM, or by appointment, on Zoom.

Course Material: Class sessions that are conducted on Zoom will be recorded and posted on Canvas with the corresponding class notes. Strictly speaking, there is no required textbook for this course. However, it would help to work problems from exercises (and understand proofs not covered in class) from the following text books:

A bulk of the material will be based on: Introduction to Probability and Mathematical Statistics, 2nd edition.
by Bain and Engelhardt (BE)

It is recommended that students maintain access to BE in some form.

Supplemental reading 1: Probability and Mathematical Statistics: Theory, Applications, and Practice in R, 1st edition.
Mary C. Meyer (MM)

Supplemental reading 2: Mathematical Statistics with Applications, 7th edition.
Wackerly, Mendenhall, and Scheaffer (WMS)

Prereq: The pre-requisite for this course is a grade of 'C' or better in Math 5010 (Introduction to Probability Theory). However, this course assumes a solid knowledge also of Calculus (at least Calc I, II, and III), and linear algebra (Math 2270). If you're not comfortable with all of those you will probably struggle in this course.

Course Content: This course covers classical approaches to statistical inference. It concentrates on inference problems for univariate *iid* data. This means data that is generated from multiple repetitions of the same experiment, with the outcome of each experiment being a single number.

We will primarily focus on **parametric inference**, the idea of which is:

- Choose a family of probability distributions that accurately models the data generated by your experiment. In practice one must choose the family based on your own intuition and experience, but in this class you are often just told which family to use.
- Your chosen family of distributions will be indexed by parameters. It is assumed that the data is generated by a particular member of the family corresponding to some specific parameters, but they are unknown to you. The goal is to determine which function of the data is the best estimate of the hidden parameters.
- Finally you have to choose which type of estimate to return: a point estimator (a single number), an interval estimator (an entire range of estimates), or a Bayesian estimator (a probability distribution on the unknown parameters that reflects the observations from the data). In a broad sense the purpose of this class is the optimality theory of estimation. There are many different possible estimators for the hidden parameters, and we will focus on which estimators are optimal and in which sense they are optimal. This does require some relatively sophisticated mathematics.

Some of the concepts may be illustrated using simulations in the statistical language R. You are not required to know R or even to learn it in this course, but putting in the effort to do so will be highly beneficial. Information about downloading R and RStudio is at the links below:

<https://www.r-project.org/about.html>

<https://rstudio.com/>

Course Details:

- Course Type: Interactive Video Conferencing (IVC - synchronous online) and in-person. The IVC portion of the class will meet via a Zoom meeting scheduled during class time. The in-person sessions will be held at **M LI 1130**. Please see posted schedule of class sessions.
- During the IVC sessions the instructor will share their screen and write material on an iPad. This material will be posted on Canvas as a PDF file after the class session. Partially typed notes may be provided periodically via Canvas. Students are expected to download the material prior to class. In-person sessions will be taught as a traditional lecture session using resources in the class room.
- Links to short videos may be posted about 24 hours ahead of class time periodically. When such videos are posted, students are expected to watch the video prior to the class and familiarize themselves with the material.

Home Work: There will be roughly 1 HW each week. No late submissions will be accepted, except in extenuating circumstances (which should be brought to the instructor's notice at the earliest possible). However, two of the lowest HW scores will be dropped at the end of the semester. Please see posted schedule of IVC and in-person class sessions. HWs will need to be uploaded on Canvas by students. It is recommended that students type up HW using Latex as it is good practice toward further education in Statistics.

Solutions will be provided ahead of time for about half of the homework problems, as an aid for self-learning. Some of the homework problems will not have solutions and you will need to type/write those up and submit them. I will grade only one of the problems submitted and that will form your weekly homework score.

Students are encouraged to work with each other on the homework problems. But, each student is required to submit their own work. Please come by during office hours or set up a time to talk to the instructor if there are questions with respect to HW problems.

Exams: There will be two mid terms and a comprehensive final exam on the following days:

- Mid Term I: Thursday, October 7, In-Person (**M LI 1130**)
- Mid Term II: Thursday, October 16, In-Person (**M LI 1130**)
- Comprehensive Final: Tuesday, Dec 14 (6-8 pm), In-Person (**M LI 1130**)

All exams are closed book and will only be given on the scheduled days. Students are expected to arrange personal work around the announced dates. However, please contact the instructor in the event of illness or other extenuating circumstances.

Grading: The *minimum* scores for a certain grade *category* are: 90 for an A, 80 for a B, 70 for a C and so on. This is a rough guide and may be subject to change. The break up of points in this course is as follows:

Homework: 30 %

2 Mid Term exams: 20 % each

Final Exam: 30 %

Communication: Class announcements will be done via Canvas Announcements and through email through the Canvas server. You will be responsible for any information contained in them as well as the information announced in class. Students should check Canvas regularly and set up notifications that are directly forwarded to their email inbox. You should also regularly check your UMail or forward it to an address that you monitor regularly.

The is the best way to contact the instructor is to write to: sainath@math.utah.edu.

This is the only email I check regularly.

COVID-19: Students must self-report if they test positive for COVID-19 via coronavirus.utah.edu. Even though this class is primarily delivered online I understand the stress related to contracting COVID-19 or having a household member contract COVID-19. Please feel free to contact me if you are in this situation so that I may work with you to keep you in touch with the course.

University leadership has urged all faculty, students, and staff to model the vaccination, testing, and masking behaviors we want to see in our campus community. These include:

- Vaccination
- Masking indoors
- If unvaccinated, getting weekly asymptomatic coronavirus testing

Vaccination

- Get a COVID-19 vaccination if you have not already done so. Vaccination is proving highly effective in preventing severe COVID-19 symptoms, hospitalization and death from coronavirus. Vaccination is the single best way to stop this COVID resurgence in its tracks.
- Many in the campus community have already got vaccinated:
 - More than 80% of U. employees
 - Over 70% of U. students
- Visit <http://mychart.med.utah.edu/>, <http://alert.utah.edu/covid/vaccine>, or <http://vaccines.gov/> to schedule your vaccination.

Masking

While masks are no longer required outside of Health Sciences facilities, UTA buses and campus shuttles, CDC guidelines now call for everyone to wear face masks indoors.

- Check the CDC website periodically for masking updates? <https://www.cdc.gov/coronavirus/2019-ncov/vaccines/fully-vaccinated-guidance.html>
- Treat masks like seasonal clothing (i.e.during community surges in COVID transmission, masks are strongly encouraged indoors and in close groups outside).

Testing

If you are not yet vaccinated, get weekly asymptomatic coronavirus tests. This is a helpful way to protect yourself and those around you because asymptomatic individuals can unknowingly spread the coronavirus to others. Asymptomatic testing centers are open and convenient:

- Online scheduling Saliva test (no nasal swabs)
- Free to all students returning to campus (required for students in University housing)
- Results often within 24 hours
- Visit alert.utah.edu/covid/testing

Remember: Students must self-report if they test positive for COVID-19 via this website: <https://coronavirus.utah.edu/>.

Student Mental Health Resources:

<https://studentaffairs.utah.edu/mental-health-resources/index.php>

The Americans with Disabilities Act: The University of Utah seeks to provide equal access to its programs, services and activities for people with disabilities. If you will need accommodations in the class, reasonable prior notice needs to be given to the Center for Disability & Access, 162 Olpin Union Building, 801-581-5020. CDA will work with you and the instructor to make arrangements for accommodations. All written information in this course can be made available in alternative format with prior notification to the Center for Disability & Access. Addressing Sexual Misconduct: Title IX makes it clear that violence and harassment based on sex and gender (which includes sexual orientation and gender identity/expression) is a Civil Rights offense subject to the same kinds of accountability and the same kinds of support applied to offenses against other protected categories such as race, national origin, color, religion, age, status as a person with a disability, veterans status or genetic information. If you or someone you know has been harassed or assaulted on the basis of your sex, including sexual orientation or gender identity/expression, you are encouraged to report it to the University's Title IX Coordinator; Director, Office of Equal Opportunity and Affirmative Action, 135 Park Building, 801-581-8365, or to the Office of the Dean of Students, 270 Union Building, 801-581-7066. For support and confidential consultation, contact the Center for Student Wellness, 426 SSB, 801-581-7776. To report to police, contact the Department of Public Safety, 801-585-2677(COPS).

Campus Safety: The University of Utah values the safety of all campus community members. To report suspicious activity or to request a courtesy escort, call campus police at 801-585-COPS (801-585-2677). You will receive important emergency alerts and safety messages regarding campus safety via text message. For more information regarding safety and to view available training resources, including helpful videos, visit safeu.utah.edu