MSDS 504 Review Probability and Stats

Summer 2023

Instructor: Shan Wang
Class time: T/H 1-3 pm @ Room 104-106
Instructor contact info: Slack or email swang151@usfca.edu; Slack channel #summer-2023-Prob-Stats
Office hours (in-person): T/H 3-3:45 pm in classroom 104-106
Office hours (virtual): Wed 9-10 am Zoom link on Canvas

Course Description

This course provides a review on probability theories and statistical inference. The topics include but not limited to random variables, distribution functions, joint distributions, central limit theorem, maximum likelihood estimation, confidence interval and hypothesis testing.

Course Materials

The lecture notes are a summary from several books and online resources.

- Hogg, Robert V. and Elliot A. Tanis. *Probability and Statistical Inference*, 8th or 9th edition (Strongly recommend to obtain a copy)
- Ghahramani, Saeed. *Fundamentals of Probability, with Stochastic Processes*, 4th edition (optional)
- Freund, John. *Mathematical Statistics*, 8th edition (optional)
- Lecture notes and other courses materials are available on Canvas. Some book chapters can be found from "MSDS Admitted 2023" canvas course.

Course Topics

The course topics can be summarized to Probability Theory, and Statistical Inference. Details see Lecture 1: Overview.

Course Objects

By the end of this course, students will be able to

- Understand the fundamental axioms, rules, and laws of probability theory;
- Understand the definitions of probability mass functions, probability density functions, cumulative distributions functions, and key distribution parameters like moments;
- Know the properties of the most famous examples of random variables and distributions;
- Master the underpinnings of the most common parameter estimation technique, maximum likelihood estimation;
- Understand the difference between a sample and a population;
- Understand the importance of the concept of independence;
- Work with multivariate distributions, as well as the concepts of conditional expectation and independence in a high-dimensional setting;
- Work with the multivariate Normal and its related distributions;
- Be able to state the Central Limit Theorem, understand its importance, and apply it in a variety of basic situations;
- Be able to understand and implement, both by hand and Python, all elementary one- and two-sample tests of hypotheses and confidence interval constructions (e.g., means, proportions, correlation, ratios of variances, etc.);

Assessments

Attendance/Professionalism: 5%

Attendance is expected in all lectures **in person**. Valid excuses for absence with permission (see Attendance policy) will be accepted, but students are required to review the course materials and submit class practice questions on Canvas if any, in 24 hours, before 3pm PDT next day. The attendance will be graded based on class practice submission. Students are required to attend all the quizzes. Make-up quizzes are not granted unless you provide official documents (like doctor's note) BEFORE the quiz time, and it will be considered case by case.

Remote attendance request will need the approval from both program academic and administrative directors.

Professionalism is also, if not more, important:

- Showing respect for your classmates and your professor
- Getting to class on time every time

- No cellphones use, laptops use including but not limited to email, social media, slack, texting during the class
- Turn off all of your various notifications so you are not distracted
- Mute all your devices.
- **Do not share course materials publicly unless you get permissions from me to do so.**
- **Don't cheat.**

Homework: 20%

You will be assigned WEEKLY homework assignments to be completed and turned in on Canvas on Wednesdays before **4 PM**. The submission of homework required two file: a .pdf file including all your answers (and code if applied), and a Python file including all your codes (if applied).

Homework 1	Homework 2	Homework 3	Homework 4	Homework 5
Wed 07/12	Wed 07/19	Wed 07/26	Wed 08/02	Wed 08/09

Quizzes: 50%

There will be 4 written- quizzes on Thursdays 9-10 am. All quizzes —whether in-person or remote — will focus on material that we have recently discussed in class (generally, the topics from the previous two lectures). However, because of the nature of this course, all quizzes will in some sense be cumulative, since each week's results build upon results introduced in previous weeks.

Quiz 1	Quiz 2	Quiz 3	Quiz 4
Thu 07/13	Thu 07/20	Thu 07/27	Thu 08/03

Final Exam: 25%

- There will be a final cumulative exam that test your abilities on all knowledge we have learned for this course. It will be a 2-hr written exam from 1-3pm on Friday, August 11.

Final Exam
Fri 08/11 1-3pm

The quizzes and final exam are closed book exams, but you can bring

- One-page two-sided A5 cheatsheet for each quiz;
- Two-page two-sided A5 cheatsheet for the final;
- Blank papers;
- Hand calculator;
- **No phone or laptop allowed**

Grading Policies

Attendance	5%
Homework	20%
Quizzes	50%
Final exam	25%

Grading Scale

A+: 97-100	A: 93-96	A-: 90-92
B+: 87-89	B: 83-86	B-: 80-82
C+: 77-79	C: 73-76	C-: 70-72
F: below 70		

The scaled might be adjusted based on the class performance.

Course Policies

Attendance policy

Please refer to the attendance grading.All students are expected to participate in the in-person modality unless granted permission for the remote modality by the MSDS program's administrative and academic directors. Permission for the remote modality is only being granted to incoming international students with documented visa and/or travel issues.

Program information

MS in Data Science program learning outcomes and course requirements: https://catalog.usfca.edu/preview_program.php?catoid=22&poid=13078

Students with Disabilities.

The University of San Francisco is committed to providing equal access to students with disabilities. If you are a student with a disability, or if you think you may have a disability, please contact Student Disability Services (SDS) at sds@usfca.edu or 415 422-2613, to speak with a disability specialist. (All communication with SDS is private and confidential.) If you are eligible for accommodations, please request that your accommodation letter be sent to me as soon as possible; Students should contact SDS **at the beginning of the semester**. **Accommodations are not retroactive**.For more information please visit the SDS website: https://www.usfca.edu/student-disability-services.

Behavioral Expectations

All students are expected to behave in accordance with the Student Conduct Code and other University policies (see http://www.usfca.edu/fogcutter/). Students whose behavior is disruptive or who fail to comply with the instructor may be dismissed from the class for the remainder

of the class period and may need to meet with the instructor or Dean prior to returning to the next class period. If necessary, referrals may also be made to the Student Conduct process for violations of the Student Conduct Code.

Illnesses and Emergencies

If you fall ill or have an emergency (personal or otherwise) that significantly affects your ability to complete an assignment or take an exam, you must notify the instructor before the task or artifact is due. Do not simply skip an exam or an assignment and say you were sick after the fact. Always make arrangements with the instructor beforehand, rather than declaring illness or emergency later. **Accommodations are not retroactive**. Illness and emergency related situations must be disclosed to both the instructor and program director in writing. Illness-related issues must be accompanied by a doctor's note.

Withdraws and Incomplete

Students who withdraw or take a leave of absence from the university on or after the first day of the semester must comply with the official USF Withdrawal or Leave of Absence policy. A pro-rated (i.e., 80%) refund of tuition charges (https://myusf.usfca.edu/billing-tuition/refunds#withdrawal) will be applied for students withdrawing or taking a leave of absence by July 8, 2022. Withdrawals or leaves of absences taken before the first day of boot camp will generally be honored with a 100% refund of tuition charges.

Academic Integrity.

As a Jesuit institution committed to *cura personalis* – the care and education of the whole person – USF has an obligation to embody and foster the values of honesty and integrity. USF upholds the standards of honesty and integrity from all members of the academic community. All students are expected to know and adhere to the University's Honor Code. You can find the full text of the code online at http://myusf.usfca.edu/academic-integrity/. The policy covers:

- Plagiarism – intentionally or unintentionally representing the words or ideas of another person as your own; failure to properly cite references; manufacturing references.
- Working with another person when independent work is required.
- Submitting work written by another person or obtained from the internet.
- The penalties for violation of the policy may include a failing grade on the assignment, a failing grade in the course, and/or a referral to the Academic Integrity Committee.

Counseling and Psychological Services (CAPS).

CAPS' diverse staff offers brief individual, couple, and group counseling to student members of our community. CAPS services are confidential and free of charge. Call (415) 422-6352 for an initial consultation appointment. Telephone consultation through CAPS After Hours is available Monday - Friday from 5:00 p.m. to 8:30 a.m., 24 hours during weekends and holidays; call the above number and press 2. Further information can be found at https://myusf.usfca.edu/student-health-safety/caps.

Confidentiality, Mandatory Reporting, and Sexual Assault.

As instructors, one of our responsibilities is to help create a safe learning environment on our campus. We also have a mandatory reporting responsibility related to our role as faculty. We are required to share information regarding sexual misconduct or information about a crime that may have occurred on USF's campus with the University. Here are some useful resources related to sexual misconduct:

- To report any sexual misconduct, students may visit the Title IX coordinator (UC 5th floor) or see many other options by visiting usfca.edu/student_life/safer.

- Students may speak to someone confidentially or report a sexual assault confidentially by contacting Counseling and Psychological Services at (415) 422-6352.
- To find out more about reporting a sexual assault at USF, visit USFs Callisto website at: usfca.callistocampus.org.
- For an off-campus resource, contact San Francisco Women Against Rape (SFWAR) (415) 647-7273 (sfwar.org).