THE UNIVERSITY OF TENNESSEE KNOXVILLE

Math 525, Statistics I, Fall 2022

University of Tennessee, Knoxville

Meeting time: Tuesday and Thursday, 11:20AM–12:35PM
Classroom: Ayres Hall, room 111

Faculty contact information
Instructor: Ioannis Sgouralis
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Zoom: http://tennessee.zoom.us/my/sgouralis

Office hours

- *Standard office hours:* Starting from September 2, I will be hosting office hours every **Friday, 12:00Noon–2:00PM** and **Monday, 2:30PM-4:30PM.** During office hours I will foster an open discussion format. All office hour meetings will be **online** via Zoom.
- *Alternative office hours:* In addition to the standard office hours, I will be available after each class or by **appointment.**

Course description and objectives: In this course we will cover the essentials of Statistics with an emphasis on *Data Science* and recent developments. More specifically, we will go through the basics of Statistical modeling, Bayesian inference and computation. Throughout the semester we will meet a variety of analytical and computational approaches that are used in Machine Learning and Data Analysis. By the end of the course, you will have a solid background in probabilistic modeling, Bayesian statistics, and a wide toolset of specific techniques for the solution of problems commonly arising in Engineering and the Sciences.

Course announcements: Throughout the semester, I will make all important announcements in class and electronically. To ensure that you have received all the latest updates, I advise that you check your inbox regularly and *at least 1 hour before* each lecture.

Course policy: When you can do so, I expect you to attend the classes and participate in the class discussions. I require attendance to the degree possible; however, *I will not grade attendance.* For those of you that will not be able to attend, course material such as lecture notes and assignments will be posted online.

Texts and supplemental resources: There are *no required textbooks* for this course. For **additional** reading, I recommend the following references:

• *D.S. Sivia, Data Analysis: A Bayesian Tutorial, 2nd edition, Oxford University Press.*

• *A. Gelman et al, Bayesian Data Analysis, 3rd edition, CRC Press.*

• *P.M. Lee, Bayesian Statistics: An Introduction, 4th edition, Wiley.*

• *C.P. Robert and G. Casella, Introducing Monte Carlo Methods with R, Springer.*

Software: You are encouraged to use any software package you prefer; however, I will only be able to provide feedback on homework and exam assignments that are implemented in Matlab. You can access, download, and install Matlab to your computer from OIT's website https://oit.utk.edu/research/research- software/matlab-simulink/. To ensure that we all have the necessary background in programming, this course will start with an introduction to Matlab and the commands necessary in this course during the first two lectures of the semester.

Course resources: I will be posting lecture notes on **Canvas** after each lecture. To avoid conflicts, *do not distribute* any course related material or content (including lecture notes, homework assignments, and exams) outside the class.

Course assignments:

• **Homework:** Throughout the semester, we will have **4 assignment** sets with due dates roughly every 6 lectures. Assignments should be *typed* and handed in electronically in PDF format. In preparing your reports, you can use any software you prefer. However, if you are unfamiliar with scientific typesetters, I recommend reading "*The not so short introduction to LaTeX 2ε"* that is available online http://ctan.mirrors.hoobly.com/info/lshort/english/lshort.pdf.

• **Assignment due:** Assignment due dates depend on how much material we will cover each week. For this reason, I will be posting specific due dates during the semester. All assignments should be turned in *electronically* via email by the posted date. To avoid posting solutions before I have collected all assignments to be graded, I will accept **late submissions** only when you notify me at least one day before the due date.

• **Teamwork:** In preparing your homework assignments, I encourage you to *collaborate* with your classmates. However, I expect each student to hand in for grading and feedback their own report.

Course evaluation:

• **Exams:** We will have one *midterm* and one *final* exam. The midterm exam will cover the material taught until the exam date and the final exam will cover the material taught afterwards.

• **Grading:** Homework assignments will account for 20% each and the two exams for 10% each of the coursework. On assigning final grades, I will use the following tentative scale:

A: 90-100%, B: 80-89%, C: 70-79%, D: 60-69%, F: 0-59%.

Tentative course outline

- Lecture 1: *Introduction to Math 525*
- Lectures 2–3: *Introduction to Matlab and statistical programming*
- Lectures 4–5: *Random variables and likelihood based analysis*
- Lectures 6–7: *Statistical modeling*

1st assignment due

- Lectures 8–9: *Generative and graphical models*
- Lectures 10–11: *The exponential family of random variables*
- Lectures 12–13: *Bayesian inference*

2nd assignment due

- Lectures 14–15: *Laplace approximations*
- Lectures 16–17: *Monte Carlo methods*

Midterm exam

- Lectures 18–19: *Importance sampling*

3rd assignment due

- Lectures 20–21: *Markov chain Monte Carlo*
- Lectures 22–23: *The Metropolis-Hastings algorithm*
- Lectures 24–25: *Gibbs samplers*

4th assignment due

- Lectures 26–28: *Topics will be decided based on class interest.*

Final exam

I reserve the right to revise, alter or amend this syllabus as necessary. You will be notified in writing / email of any such changes.

Key campus resources for students:

- Center for Career Development and Academic Exploration (Career counseling and resources; Handshake job search system)
- Course Catalogs (Listing of academic programs, courses, and policies)
- Hilltopics (Campus and academic policies, procedures, and standards of conduct)
- OIT HelpDesk (865) 974-9900
- Schedule of Classes/Timetable
- Student Health Center (visit the site for a list of services)
- Academic Success Center (Academic support resources)
- Undergraduate Academic Advising (Advising resources, course requirements, and major guides)
- University Libraries (Access to library resources, databases, course reserves, and services)