# STA 131B: Mathematical Statistics
## Spring 2024
## Department of Statistics, UC Davis

**Instructor: Hang Zhou**

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**Teaching Assistant: Jedidiah Harwood**

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*Office Hour:* Tu 10:00-12:00
*Classroom:* MSB 1117 (the TA office)

**Schedule:**

Class sessions (lectures) will take place Mondays, Wednesdays, and Fridays from 3:10 PM to 4:00 PM at Wellman Hall 216. Discussion sessions are on Thursday 2:10-3:00 at Olson Hall 205.

**Prerequisite:**

A grade of C- or better in either STA 131A or MAT 135A is required. A working knowledge of probability at the level of STA 131A, along with the mathematical background corresponding to the prerequisites of STA 131A, is essential and will be assumed. The necessary background can be found in Chapters 1-5 of the textbook by Morris D. & Mark S (see below). It is strongly advised that you review this material. Note that if you took STA 130A, or if you are struggling with the material in STA 131A, your best option would be to continue with STA 130B. Be aware that most students consider STA 131B to be more challenging than STA 131A.

**Recommended Textbook:**

The class material will draw from the following textbook, but the class will be self-contained so no purchases are necessary.
Probability and Statistics, 4th Edition, by Morris DeGroot and Mark Schervish, Addison and Wesley, ISBN-13: 978-0321500465

**List of Topics:**

1. **Introduction**: Concept of a statistical model; observations as random variables, definition/examples of a statistic, statistical inference and examples throughout the entire course; Review of probability.

2. **Point Estimation**: Methods of Estimation: Maximum Likelihood Estimation (MLE); Method of Moments (MOM) and Bayes approach.

3. **Point Estimation**: Criterion of Estimators: Mean Square Error (MSE), Bias-Variance Decomposition; Unbiased Estimation.

4. **Point Estimation**: Sampling Dsitributiaon: Distributions of Transformed Random Variables; Independence of Sample Mean and Sample Variance under Normality

5. **Point Estimation**: Information Bound: Fisher Information inequality; CR-Lower Bound.

6. **Interval Estimation**: Confidence Interval

## Homework:

There will be weekly assignments which will require substantial time and effort, especially as the course moves at a fast pace. The HW will be due **Mondays at 4pm**. Solutions will be discussed in the discussion sections on Thursday. **Late HW will not be accepted**.

## Communication:

We will use Canvas and Gradescope. All class materials, handouts, assignments and zoom recordings will be posted on Canvas, and the homework are graded on Gradescope. The lecture notes will be posted one day before the lectures. Homework will be posted on both Canvas and the course website (https://hg-zh.github.io/teaching/STA131B2024S) before Tuesday each week.

## Grading:

| Homework | Midterm 1 | Midterm 2 | Final |
|---|---|---|---|
| 20% | 20% | 20% | 40% |

## Importants Dates:

- Midterm 1: In Class (April 22). Scope: Introduction, MLE, Method of Moments, Bayesian Method.

- Midterm 2: In Class (May 15). Scope: Sufficient Statistics, Properties of Estimators.

- Final: Jun 10 (Mon) 3:30-5:30pm. Scope: Fisher Information and Efficient Estimation, Sampling Distribution, Confidence Intervals, Large Sample Properties of Estimators (if time permitted).

**Midterm dates and scopes may change.**