STAT 442/850 Mathematical Statistics and Inference

2026-2027 T2

Instructor:

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Course Details

STAT 442 CRN 21741
STAT 850 CRN 23530

Schedule:

Term 2
T, R 11:30am – 12:50pm

Tentative Topics:

Some of the topics covered will include:

- Decision theory
- Bayesian Inference
- Likelihood theory
- Maximum likelihood estimation
- Hypothesis testing
- Uniformly minimum variance unbiased tests

Course Objective:

After completing this course, students should be able to:

- Calculate frequentist risk function
- Derive posterior distributions
- Identify minimal sufficient statistics
- Derive MLEs analytically
- Construct UMP tests using MLR
- Derive UMVUE in exponential families
- And much, much more!

Students Who May Be Interested:

Undergraduate and graduate students in statistics, biostatistics, computer science, engineering, science programs, with prerequisites in linear algebra, multivariate calculate, multivariate probability theory, multiple linear regression.

Other Information:

This course presents a rigorous theoretical treatment of statistical inference, offering a comparative analysis of frequentist and Bayesian paradigms. The curriculum explores several core areas of statistical theory, beginning with foundational concepts in Decision theory (Risk Function, Minimaxity Theorem) before moving into a comprehensive treatment of Bayesian inference (Posterior, Bayes Rules, Bayes Risk, Minimax Rules, James-Stein Estimator, Empirical Bayes, Hierarchical Bayesian, MCMC, Case Study). The course then transitions to focus heavily on Likelihood theory (Sufficient Statistic, Bartlett's Identities, Cramér-Rao Lower Bound, Exponential Families) and the mechanics of MLE (Score, Fisher Information, Newton-Raphson Methods, Asymptotics of Maximum Likelihood Estimators, Alkeike Information Criteria, Deep Learning). Finally, we cover hypothesis testing and optimal point estimation through the lens of the Likelihood ratio test (Neyman-Pearson Lemma, Monotone Likelihood Test, Likelihood-based Tests) and UMVUE (Complete Statistic, Uniformly Minimum Variance Unbiased Estimators/Tests).