# OPTIMAL STATISTICAL DECISIONS

## SYLLABUS

Last updated 07/05/2023

## Course Information

Table1: Instructor, Classroom and Meeting Time Information

| Instructor | Classroom and Meeting Times |
|---|---|
| David Mwakima | Location: TBD |
| dmwakima@uci.edu | Lectures: TBD |
| | GitHub: https://github.com/davymwax/Optimal-Statistical-Decisions |
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## Seminar Description

Decision theory studies the principles that underlie rational action. Statistical decision theory is a branch of decision theory applied to the traditional problems of statistical inference: estimation (point and interval) and hypothesis testing. For example, choosing to use a given estimator for an unknown parameter can be thought of as an action whose consequences can be evaluated using a suitable loss function. Similarly, Neyman-Pearson hypothesis testing is a special case of a decision procedure for selecting the best critical region subject to some constraints. In this seminar, we shall introduce the main ideas of statistical decision theory and Bayesian statistics. The goal will be to understand the conceptual and philosophical foundations of certain optimality properties of Bayesian methods in statistics.

## Tentative Outline of Topics

- **Week 1 –** Review of probability theory and the interpretations of probability
- **Week 2 –** Foundations of Bayesian Statistics and Representation Theorems
- **Week 3 –** Common Bayesian Models for Statistical Inference
- **Week 4 –** The Likelihood Principle and its Discontents
- **Week 5 –** Elements of Classical and Bayesian Decision Theory
- **Week 6 & 7 –** Statistical Inference from a Decision Theoretic Perspective
- **Week 8 –** Severity and Subjective Bayesian Inference

## Learning Outcomes

By the end of this seminar, participants should be able to use common Bayesian models (viz. Beta-Binomial; Poisson-Gamma; Normal-Normal) for statistical inference. In addition, participants will be introduced to the main topics currently being debated in the foundations of Bayesian statistics within the philosophy of science.

## Prerequisites

At least one-year graduate level course in probability theory and statistics OR mathematics at the undergraduate or graduate level including familiarity with some ideas from Real Analysis (sup, inf) and multivariable calculus.

## Required Texts and Recommended Reading

There is no required text for the seminar. Any the readings you will be expected to do will be provided as excerpts from various sources. The following texts are recommended:

- James O. Berger *Statistical Decision Theory and Bayesian Analysis*
- Morris G. DeGroot *Optimal Statistical Decisions*
- Deborah Mayo *Statistical Inference as Severe Testing: How to Get Beyond the Statistics Wars*
- Christian P. Robert *The Bayesian Choice*
- Mark J. Schervish *Theory of Statistics*

## Tentative Course Requirements/Grades

TBA

## Disability Accommodations

N/A?

## Academic Integrity

N/A?

## Diversity

N/A?

## Inclusion

N/A?