

SYLLABUS

ENS 505: Methods of Statistical Inference

Spring 2023-2024

Instructor: Sinan Yildirim

Lecture times and places:

Wednesday, 15:40-17:30, @FENS L027

Thursday, 10:40-11:30 @FENS L047

About the course

The main objective of this course is to review the basic concepts of the theory of statistics and further develop understanding of some fundamental applied statistical methods. Our emphasis will be on applications of the theory in the development of statistical procedures. Practical applications of statistics to some problems in engineering and management will be given. Computational assignments will be given to help the students to understand the concepts and to have an opportunity to practice applying them.

Tentative course outline

1. Fundamental concepts of statistics
2. Analysis of variance
3. Multiple hypothesis testing
4. Regression
5. Bayesian inference and Monte Carlo

Grading

- **Midterm exam or Term project** (25%),
- **Final exam** (30%)
- **Homework assignments** (45%)

Software

You will be encouraged to learn and/or use a programming language in your assignments and your final project. In the lectures, I will show my numerical examples in MATLAB. There is no restriction on which programming language you use - you can use MATLAB, R, Python, C, C++, etc.

Textbooks and References

There is no specific reference text for the course. The material will develop with lecture notes and assignments. However, you are encouraged to read textbooks as well as useful tutorials available on the internet. Below are some of them.

1. *Mathematical Statistics and Data Analysis (with CD Data Sets) (3rd Edition)*, John A. Rice.
2. *Probability and statistics in engineering and management science*, William W. Hines and Douglas C. Montgomery.
3. *Principles of Statistical Inference (1st Edition)*, David R. Cox.
4. *Computer Age Statistical Inference: Algorithms, Evidence, and Data Science*, Efron, B., & Hastie, T. (2016).
5. *Applied Linear Statistical Models (4th Edition)*, John Neter, Michael H. Kutner, Christopher J. Nachtsheim and W. Wasserman.
6. *Applied Multivariate Statistical Analysis*, R.A. Johnson, D.W. Wichern.
7. *A Second Course in Statistics: Regression Analysis (6th Edition)*, W. Mendenhall, T. Sincich.
8. *The Elements of Statistical Learning: data mining, inference and prediction*, T. Hastie, R. Tibshirani, and J. Friedman,
9. *Bayesian Data Analysis, (3rd Edition)*, Andrew Gelman, John B. Carlin, Hal S. Stern, Donald B. Rubin
10. *Monte Carlo Statistical Methods (2nd Edition)*, Robert, C. P. and Casella, G. (2004),
11. *Monte Carlo: Simulation Methods for Statistical Inference*, Sinan Yıldırım, lecture notes, 2017

Reference	1	2	3	4	5	6	7	8	9	10	11
Fundamental concepts of statistics	✓	✓	✓	✓							
ANOVA	✓	✓			✓	✓	✓				
Multiple hypothesis testing	✓	✓			✓	✓	✓				
Regression			✓		✓	✓	✓	✓	✓		
Bayesian inference				✓				✓	✓	✓	✓
Monte Carlo									✓	✓	✓