

Mathematical Statistics 1, MTH 5411

Course Objectives

1. Introduce probability theory including random variables, common probability distributions, joint probability distributions, covariance and correlation, and essential concepts of statistics including point estimators, confidence intervals, and hypothesis testing.
2. Learn and understand the connection between probability & statistics and other fields.
3. Gain the ability to solve real-world problems using probability theory and statistical methods.

Course Topics

1. Experiments and Events
2. Combinatorial Methods
3. Conditional Probability and Bayes' Theorem
4. Discrete and continuous probability distributions
5. Common Discrete Distributions (Bernoulli, Uniform, Binomial, Geometric, Hypergeometric, Negative Binomial, and Poisson)
6. Common Continuous Distributions (Uniform, Normal, Exponential, Gamma, Weibull, Lognormal)
7. Sampling Distributions (Chi-square, T, and F distributions)
8. The Central Limit Theorem
9. Expectation
10. Covariance and Correlation
11. Estimation (Method of Moments, Maximum Likelihood)
12. Statistical Inference and Hypotheses Testing

13. Confidence Intervals
14. Least Squares and Regression
15. Analysis of Variance
16. Reliability and Hazard
17. Bayesian Methods (Prior and Posterior)
18. Simulation
19. Monte Carlo