

ECONOMETRICS I: STATISTICAL FOUNDATIONS

The lectures will follow closely the lecture notes, prepared by myself and Professor Yoosoon Chang. Other references for additional reading are provided below.

GRADING: Assignments (20%, exercises at the end of each chapter, due one week after completion of each chapter); Two midterm examinations (20% each, scheduled at class time on September 24 and October 29); Final examination (40%, scheduled at 08:00am-10:00am on December 10).

OFFICE HOURS: I will have office hours in my office (Rm 215, Wylie Hall) on Tuesdays at 10:00-11:30am. Students who wish to meet me outside my office hours should email me in advance to make an appointment. My email address is joon@indiana.edu.

TEACHING ASSISTANT: Jihyun Kim is assigned as the teaching assistant for the course. Jihyun will provide weekly review sessions and also hold office hours in his office (Rm 347, Wylie Hall). Students may meet him outside his office hours by making an email request for an appointment well in advance. His email address is kimjihy@indiana.edu.

References

- Billingsley, P., *Probability and Measure*, 3rd ed., Wiley, 1995.
- Casella G. and R.L. Berger, *Statistical Inference*, 2nd ed., Duxbury Press, 2001.
- Dudley, R.M., *Real Analysis and Probability*, Cambridge University Press, 2002.
- Halmos, P.R., *Finite-Dimensional Vector Spaces*, Springer-Verlag, 1974.
- Lehmann, E.L., *Elements of Large Sample Theory*, Springer-Verlag, 2010.
- Lehmann, E.L. and G. Casella, *Theory of Point Estimation*, 2nd ed., Springer-Verlag, 1998.
- Lehmann, E.L. and J.P. Romano, *Testing Statistical Hypotheses*, 3rd ed., Springer, 2005.
- Mukhopadhyay, N., *Probability and Statistical Inference*, Marcel Dekker, 2000.
- Williams, D., *Probability with Martingales*, Cambridge University Press, 1991.
- Young, G.A. and R.L. Smith, *Essentials of Statistical Inference*, Cambridge University Press, 2005.

Contents

Part I: Probability

1. *Introduction to Probability*
Probability Space, Limits Concepts in Probability, Conditional Probability and Independence
2. *Random Variables, Distributions and Densities*
Random Variables, Random Vectors, Densities, Conditional Distributions and Independence
3. *Expectation*
Expectation, Expectational Inequalities, Conditional Expectation, Miscellanea
4. *Families of Distributions and Transformations*
Common Families of Distributions, Distributions of Functions of a Random Variable
5. *Multivariate Normal Distribution*
Multivariate Normal Distribution, Marginal and Conditional Distributions, Distributions of Quadratic Forms

Part II: Statistics

1. *Introduction*
Concepts of Statistical Inference, Sufficiency, Exponential Families, Bayesian Approach
2. *Estimation*
Sample Analogue Estimation, Maximum Likelihood Estimation, Uniformly Minimum Variance Unbiased Estimation, Information Inequality
3. *Decision Theoretic Approach*
Preliminaries, Rao-Blackwell and Lehmann-Scheffe, Bayesian Approach
4. *Hypothesis Testing*
Introduction, Neymann-Pearson Lemma, Likelihood Ratio Test

Part III: Asymptotic Theory

1. *Introduction*

Modes of Convergence, Relationships for Modes of Convergence, Basics of Asymptotic Analysis

2. *Laws of Large Numbers and Central Limit Theorems*

Laws of Large Numbers (LLN), Central Limit Theorems (CLT)

3. *Asymptotics for Maximum Likelihood Estimation*

Consistency, Asymptotic Normality, Asymptotic Tests Based on MLE

4. *Asymptotic Tests*

Wald (W), Lagrange Multiplier (LM) and Likelihood Ratio (LR) Tests