

Dr. Christian Aßmann

Methodenlehre der Statistik III / Advanced Statistics

1 Schedule

The lecture is scheduled for each winter term.

to be announced on UNIVIS - Lecture

to be announced on UNIVIS - Tutorial

2 Syllabus

The course will provide a rigorous foundation in the principles of probability and mathematical statistics underlying statistical inference in the field of social science, economics and business. This course is recommended as a prerequisite for the lecture *Advanced Econometrics / Fortgeschrittene Ökonometrie*, which focuses on the methods of statistical inference including parameter estimation and hypothesis testing and statistical modelling. Furthermore, the course provides the foundation for the specialization courses in statistics and econometrics.

The objective of this course is to familiarize the students with the application of established statistical methods. Furthermore it contains theoretical basic principles of statistical methodology which allow the participants to acquire knowledge about further methodologies not covered by the course in self-study.

In the accompanying tutorial, the students will practice the use of the methods and models presented in the lecture.

3 Prerequisites

The course assumes knowledge of the basic topics taught in the statistics and mathematics courses of the Bachelor program.

4 Method of Assessment

Written or Oral exam.

5 Further Information about the Course

Upon request the lecture will given in English.

Password Virtual Campus: to be announced

6 Contents

1. Introduction to Statistical Theory

(a) Moments of Random Variables

- i. Expectation of a Random Variable
- ii. Expectation of a Function of Random Variables
- iii. Conditional Expectation
- iv. Moments of a Random Variable
- v. Moment-Generating Functions
- vi. Joint Moments and Moments of Linear Combinations
- vii. Means and Variances of Linear Combinations of Random Variables

(b) Parametric Families of Density Functions

- i. Discrete Density Functions
- ii. Continuous Density Functions
- iii. Normal Family of Densities
- iv. Exponential Class of Distributions

(c) Basic Asymptotics

- i. Convergence of Number and Function Sequences
- ii. Convergence Concepts for Sequences of Random Variables
 - A. Convergence in Distribution
 - B. Convergence in Probability
 - C. Convergence in Mean Square
- iii. Weak Laws of Large Numbers
- iv. Central Limit Theorems
- v. Asymptotic Distributions of Functions for Asymptotically Normally Distributed Random Variables

(d) **Sample Moments and their Distributions**

- i. Random Sampling
- ii. Empirical Distribution Function
- iii. Sample Moments
- iv. Sample Mean and Variance from Normal Random Samples
- v. Probability Density Functions of Functions of Random Variables

(e) **Order Statistics**

- i. Joint Distribution and Density function

7 Literature

The course is based on the following textbooks:

Greene, W.H. (2001). *Econometric Analysis*. Prentice Hall International. 5th, 6th or 7th edition.

Mittelhammer, R.C. (1996). *Mathematical Statistics for Economics and Business*. New-York: Springer-Verlag.

Mood, A.M., Graybill, F.A. und D.C. Boes (1974). *Introduction to the Theory of Statistics*. Boston: McGraw-Hill. 3. Edition.

Further useful textbooks are:

Casella, G. und R. Berger (2002). *Statistical Inference*. Pacific Grove: Duxbury, 2. Edition.

Dudewicz, E.J. und S.N. Mishra (1988). *Modern Mathematical Statistics*. New-York: John Wiley & Sons.

Fish, M. (1989). *Wahrscheinlichkeitsrechnung und Mathematische Statistik*. Berlin: VEB Deutscher Verlag der Wissenschaften. 11. Auflage.

Hogg, R.V. und R. Craig (1995). *Introduction to Mathematical Statistics*. Prentice Hall: London, 5. Edition.

Rohatgi, V.K. und A.K. Saleh (2001). *An Introduction to Probability Theory and Mathematical Statistics*. New-York: John Wiley & Sons, 2. Edition.