

Bus 701: Advanced Statistics

Fall 2010

The aim of this course is to illustrate statistical thinking in the context of social sciences. We shall (i) go through modern statistical terminology, concepts, and methodology, (ii) look into concepts of statistical simulation in social sciences, (iii) show how to use a powerful statistical software package. Students are required to present and discuss a topic concerned with social simulation or the philosophy of probability, and to participate in a statistical research project.

Contents of the Methodological Part of This Course:

Part I: Introduction to Statistics; Basic Concepts; Descriptive Statistics

1. Introduction
2. Fundamentals: Populations; scales; sample surveys
3. The presentation of univariate data: The notion of distribution; techniques of exploratory data analysis (e.g., stem-and-leaf diagram)
4. Location and dispersion parameters: Mean values and their application; quantiles; variance and standard deviation; variation coefficient

Part II: Probability and Stochastic Models

5. Stochastic models behind the observations: Introduction to stochastic models; urn models and probability
6. Probability and its philosophical background: Ideas of probability; theories about probability; personal probability; frequency-type probability
7. Discrete probability distributions: Binomial and related distributions; Poisson distribution; examples
8. Continuous probability distributions: The normal and related distributions; the exponential distribution; applications
9. More about random variables and their distributions: Sampling; the central limit theorem; the law of large numbers; further distributions.

Part III: Statistical Inference

10. Estimation: Point estimation; confidence intervals
11. Significance tests: Introduction; performing a significance test; errors in significance tests; appropriate formulation of the null hypothesis

Part IV: Further Topics

Grading:

Presence and presentation:	50%
Research project:	50%

Reading list:

- HACKING, I.: *An Introduction to Probability and Inductive Logic*. Cambridge University Press, 2001.
- HOWIE, D.: *Interpreting Probability. Controversies and Developments in the Early Twentieth Century*. Cambridge University Press, 2004.
- GILBERT, N. & TROITZSCH, K.: *Simulation for the Social Scientist*. Mcgraw-Hill, 2005.
- NEWBOLD, P., CARLSON, W.L., & THORNE, B.: *Statistics for Business and Economics*, sixth edition. Prentice Hall, 2006.
- PORTER, T.M.: *The Rise of Statistical Thinking 1820–1900*. Princeton University Press, 1986.
- VENABLES, W.N. & RIPLEY, B.D.: *Modern Applied Statistics with S*, fourth edition. Springer, 2002.
- Further references will be given in the lectures.