C11: STATISTICS

Contents

Aims of the course

The aim of this course is to aquaint you with the basics of mathematical statistics: the ideas of estimation, hypothesis testing and statistical modelling.

After studying this material you should be familiar with

1. the notation and keywords listed on the following pages;
2. the definitions, theorems, lemmas and proofs in these notes;
3. examples in notes and examples sheets that illustrate important issues concerned with topics mentioned in the schedules.

Schedules

Estimation
Review of distribution and density functions, parametric families, sufficiency, Rao-Blackwell theorem, factorization criterion, and examples; binomial, Poisson, gamma. Maximum likelihood estimation. Confidence intervals. Use of prior distributions and Bayesian inference.

Hypothesis Testing
Simple examples of hypothesis testing, null and alternative hypothesis, critical region, size, power, type I and type II errors, Neyman-Pearson lemma. Significance level of outcome. Uniformly most powerful tests. Likelihood ratio, and the use of likelihood ratio to construct test statistics for composite hypotheses. Generalized likelihood-ratio test. Goodness-of-fit and contingency tables.

Linear normal models
The χ^2, t and F distribution, joint distribution of sample mean and variance, Student's t-test, F-test for equality of two variances. One-way analysis of variance.

Linear regression and least squares
Simple examples, *Use of software*.

Recommended books

M. H. De Groot, *Probability and Statistics*, 2nd edition, Addison-Wesley, 1986.
J. A. Rice, *Mathematical Statistics and Data Analysis*, 2nd edition, Duxbury Press, 1994.
G. Casella and J. O. Berger, *Statistical Inference*, Brooks Cole, 1990.
D. A. Berry and B. W. Lindgren, *Statistics, Theory and Methods*, Brooks Cole, 1990 (out of print).