

LTCC Basic Statistics Course

- Title: **Fundamental Theory of Statistical Inference**
- Basic Details:
 - Core Audience: Statistics
 - Course Format: Core (10h)
- Course Description:
 - Keywords: Bayesian methods, data reduction, decision theory, Fisherian statistics, frequentist inference, likelihood.
 - Syllabus:
 1. Approaches to statistical inference: frequentist, Bayesian, Fisherian. [1]
 2. Decision theory: risk, utility, decision rule, criteria for a decision rule, minimax, Bayes rules. [2]
 3. Bayesian methods: fundamental ideas, general form of Bayes rules, choice of prior, empirical Bayes, hierarchical modelling, computational ideas. [2]
 4. Special families of models: exponential families, transformation families. [2]
 5. principles of inference and data reduction: sufficiency, completeness, ancillarity, likelihood. [1]
 6. Key elements of frequentist theory: Neymann-Pearson, optimal testing and estimation. [2]
- Recommended reading:
 - D.R. Cox. *Principles of Statistical Inference*. CUP, 2006.
 - G. A. Young and R. L. Smith. *Essentials of Statistical Inference*. CUP, 2005
- Additional/Optional reading:
 - M. J. Bayarri and J. Berger (2004). ‘The Interplay between Bayesian and Frequentist Analysis’. *Statistical Science* 19, 58-80.
 - J. Berger (2003). ‘Could Fisher, Jeffrey’s and Neyman have agreed on testing (with discussion)?’ *Statistical Science* 18, 1-32.
 - B Efron. ‘R. A. Fisher in the 21st Century (with discussion)’. *Statistical Science* 13, 95-122.
- Prerequisites: basic knowledge of ideas of statistical inference, distribution theory.
- Preliminary reading: Chapters 1-12 of L. Wasserman *All of Statistics: A Concise Course in Statistical Inference* (Springer, 2003) would provide a very suitable revision of background material, as well as an introduction to key aspects of the course.
- Format:

- No. of problem sheets: a single problem sheet, containing comprehensive exercises for each section, will be given, with solutions at the end of the course.
 - Electronic lecture notes: lecture material will be made available to download.
 - Proposed timing: late autumn 2009
 - Lecture/Computer session split: the 10hrs will be split as indicated in the syllabus, but each section will contain extensive discussion of example sheet material.
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- Lecture details:
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