

# LTCC Basic Statistics Course

- Title: **Statistical Modelling and Estimation**
- Basic Details:
  - Core Audience: Statistics
  - Course Format: Core (10h)
- Course Description:
  - Keywords: analysis of variance; least squares; linear algebra; linear model; matrix; regression.
- Syllabus:
  - This course covers the theory of linear models, with an emphasis on estimation and inference. The aim is to give statistical researchers a thorough grounding in this fundamental area of the subject. Modern methods of estimation will be discussed and links will be made to broader classes of statistical models. The course should also be of interest to other mathematical scientists who use least squares or who are interested in applications of linear algebra. Results and techniques from matrix algebra and linear algebra are described and used when they are needed. The following topics will be covered:
    1. Least squares estimation: Gauss-Markov conditions and theorems; properties of least squares estimators; estimating variance; geometry of least squares.
    2. Other methods of estimation: maximum likelihood and residual maximum likelihood; biased estimation methods; robust estimation.
    3. Inference from linear model: Cochran's theorem; inference on a single parameter; simultaneous inference.
    4. Interpretation of linear models: reparameterization and overparameterization; inference on nonlinear functions of parameters.
    5. Model building: model specification; model selection and its impact on inference; model checking.
    6. Extending the linear model: transformations; components of variance; generalized linear models; lifetime data models; semi-parametric models.
- Recommended reading: Christensen, R. (2002) *Plane Answers to Complex Questions: The Theory of Linear Models*. 3<sup>rd</sup> ed. Springer.
- Additional/Optional reader: Rao, C.R. (1973) *Linear Statistical Inference and Its Applications*. Wiley.
- Prerequisites: Fundamental Theory of Statistical Inference (or other inference course); UG level courses on probability and linear algebra.

- Format:
  - No. of problem sheets: 5
  - Electronic lecture notes: yes
  - Necessary support facilities: none
  - Necessary software requirements for computing facilities: None
  - Proposed timing: early Spring 2010
  - Lecture/computer session/tutorial/discussion h split: 7.5/0 /2.5/0
  
- Lecture details:
  - Lecturer: Heiko Grossman, UCL