# LTCC Basic Statistics Course

- Title: **Fundamental Theory of Statistical Inference**
- Basic Details:
  - Core Audience: Statistics.
  - Course Format: Basic (10hr)
- 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: Neyman-Pearson, optimal testing and estimation. [2]
  - Recommended reading:

    D.R. Cox. 'Principles of Statistical Inference'. Cambridge University Press, 2006.

    G.A. Young and R.L. Smith. 'Essentials of Statistical Inference'. Cambridge University Press, 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, Jeffreys and Neyman have agreed on testing (with discussion)? Statistical Science, **18**, 1–32.

    B. Efron. (1998). 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 very suitable revision of background material, as well as 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 for download.
  - Proposed timing: Autumn.
  - Lecture/computer session/tutorial/discussion h split: the 10hr will be split as indicated in the syllabus, but each section will contain extensive discussion of example sheet material.
- Lecturer Details:
  - Lecturer: Alastair Young
  - Lecturer home institution: Imperial College London