LTCC Basic Statistics Course

- Title: **Applied Bayesian Methods**
- Basic Details:

  - Core Audience: Statistics
  - Course Format: Basic/Core (10 h)

- Course Description:

  - This course will introduce the Bayesian approach to statistical inference and develop relevant theory, methodology and computational techniques for its implementation.
    The following elements will be covered.
    - Interpretations of probability; brief revision of probability theory and probability distributions; utility and introduction to decision theory
    - Inference via Bayes rule, with emphasis on normally-distributed data with unknown mean and variance
    - Summarising posterior distributions: point estimates and credible intervals; kernel-density plots of marginal and conditional distributions
    - Prior distributions: conjugate priors, Jeffrey's prior and concept of non-informative prior
    - Representing models using directed acyclic graphs
    - Hierarchical models
    - Markov chain Monte Carlo methods, with emphasis on Gibbs sampling
    - Model criticism: posterior and cross-validation predictive p-values and ordinates; discrepancy functions
    - The WinBUGS software for fitting Bayesian models
  - Recommended reading: Lee, P.M. *Bayesian Statistics: An Introduction* (3rd edition, Arnold).
  - Additional Optional reading: Gilks, W.R., Richardson, S. and Spiegelhalter, D. *Monte Carlo Markov Chain in Practice* (Chapman and Hall/CRC); Gelman, A., Carlin, J.B., Stern, H.S. and Rubin, D.B. *Bayesian Data Analysis* (Chapman and Hall); and Mignon, H.S. and Gamerman, D. *Statistical Inference — An Integrated Approach* (Arnold).
  - Prerequisites: basic knowledge of probability, random variables, probability distributions (including joint and conditional distributions), frequentist hypothesis tests and confidence intervals.
  - Preliminary reading (if not already familiar with prerequisite concepts): Rice, J.A. *Mathematical Statistics and Data Analysis* (3rd edition, Duxbury, 2007) Sections 1.0–3.5.1 (probability, random variables, distributions), 4.1–4.4 (expected values, variance, correlation) and 9.1–9.3 (hypothesis testing and confidence intervals).

- Format:

  - No of discussion/problem sheets: 4 (with solutions)
  - Electronic lecture notes: copies of lecture slides will be provided
  - Necessary support facilities: OHP projector; blackboard or whiteboard; computer room (for last two hours)
  - necessary software requirements for computing facilities: WinBUGS
  - Proposed timing: early autumn 2007
  - Lecture/computer session split: 8/2 hours

- Lecturer Details:

- Lecturer: Shaun Seaman
- Lecturer home institution: UCL