LTCC Proposed Course

- Title: Likelihood and asymptotic theory for statistical inference
- Basic Details: An overview of asymptotic theory based on the likelihood function, and discussion of extensions of likelihood for complex models.
  - Core Audience: 2nd/3rd year statistics PhD students
  - Course Format: extended
- Course Description:
  - Keywords: significance functions; posterior distributions; Laplace approximation; saddlepoint approximation; empirical likelihood; nuisance parameters
  - Syllabus:
    1. Asymptotic theory for likelihood; likelihood root, maximum likelihood estimate, score function, pivotal quantities, exact and approximate ancillary. Laplace approximations for Bayesian inference.
    2. Higher order approximations for non-Bayesian inference. Marginal, conditional and adjusted log-likelihoods for inference in the presence of nuisance parameters. Examples: regression models with non-normal error; logistic regression.
    3. Sample space differentiation and approximate ancillary; tangent exponential models; Examples: contingency tables; risk difference and risk ratio; nonlinear regression
    4. Likelihood inference for complex data structure: time series, spatial models, space-time models, extremes. Composite likelihood: definition, summary statistics, asymptotic theory. Examples: longitudinal binary data; Gaussian random fields; Markov chains
    5. Semi-parametric likelihoods for point process data; empirical likelihood.
  - Recommended reading: Davison, A.C. (2003). *Statistical Modelling.* Cambridge University Press (Chs 11, 12).
    Cox, D. R. (2004). *Principles of Statistical Inference.* Cambridge University Press.
  - Additional Optional reading: Reid, N. (2010). Likelihood inference. *WIRES Computational Statistics* **2**, 517 – 525. DOI: 10.1002/wics.110
    Fraser, D.A.S. (2011). Is Bayes posterior just quick and dirty confidence? *Statistical Science* **26**, 299–316.
  - Prerequisites: statistical theory at the level of Davison (2003, Chs. 1– 7) or Young & Smith (2005) or Cox & Hinkley (1974).
- Format:
  - Problems given at the end of weeks 1-4, solutions discussed at end of course.
  - Electronic lecture notes will be provided.
  - Necessary support facilities: -none
  - Necessary software requirements for computing facilities: `R`
  - Proposed timing: late autumn
  - Lecture/computer session/tutorial/discussion split (hours of each): 8/0/0 /2 /
- Lecturer Details:
  - Lecturer: Nancy Reid
  - Lecturer home institution: University of Toronto, visiting UCL
  - Lecturer e-mail: reid@utstat.utoronto.ca
  - Lecturer telephone number: