LTCC Proposed Course

Title: Topics in the Design of Experiments

Basic Details:
- Core Audience (1st yr or 2nd/3rd yr: pure, app. or stats): 2nd/3rd year, statistics
- Course Format (extended or intensive): extended

Course Description:
- Keywords: clinical trials; design of experiments; $D$-optimality; equivalence
  theorems; optimal design; sequential design
- Syllabus:
  This course covers some of the topics which are essential background for much of
  the current research in design of experiments. It is in two parts:
  **Optimal design theory** A very natural way to design an experiment is to specify
  an optimality criterion which captures the objectives of the experiment and then to
  find a design which optimises this criterion. The theory of optimal design has
  been developed mainly in the context of "generally useful criteria", such as $D$-
  optimality, and this is now starting to have a major impact on practice in areas as
  diverse as mixture experiments in agrochemical formulation studies and
  pharmacokinetic and pharmacodynamic studies using nonlinear models.
  The general theory will be described, with an emphasis on equivalence theorems
  for finding optimal designs, and applications to linear and nonlinear models will
  be discussed.
  **Sequential design** In clinical medicine, there are both economic and ethical
  advantages to designing trials sequentially, due to the reduced number of subjects
  required and the possibility of early stopping. In this course, the ideas of
  stopping rules and the impact they have on inference after the experiment, will be
  introduced. The possibility of adaptive design, in which the allocation of
  treatments is decided sequentially, will also be discussed.
    *Optimal Experimental Designs, with SAS*. Oxford University Press.
    *Design and Analysis of Sequential Clinical Trials, 2nd edition*. Wiley.
  - Additional Optional reading:
  - Prerequisites: Fundamentals of Statistical Inference; Theory of Linear Models or
    an undergraduate level course in linear models.

Format:
- No of discussion/problem sheets (typically 4 for extended courses, and 1 for
  intensive courses, with solutions): 2
- Electronic lecture notes (these are strongly encouraged, as they will form the core
  of the individual study of the students): Yes
- Necessary support facilities: none
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- Necessary software requirements for computing facilities:
- Proposed timing: late spring
- Lecture/computer session/tutorial/discussion split (hours of each): 10/ 0/ 0/ 0/

Lecturer Details:
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