Mahidol University
Center of Excellence in Mathematics Workshop
July 21st and 22nd, 2011

"Applied Nonlinear Statistical Methods"

Course Overview

Researchers often realize that nonlinear regression models may well be more applicable for modelling their physical and medical processes than are linear ones for several important reasons. Nonlinear models usually fit their data well and often in a more parsimonious manner (i.e., typically with fewer model parameters). Also, nonlinear models and the corresponding model parameters are usually more scientifically meaningful. But selecting an efficient experimental design; choosing, fitting and interpreting an appropriate nonlinear model; and deriving and interpreting confidence intervals for key model parameters often present practitioners with fundamental and important challenges.

This course reviews the essentials of linear regression and introduces and illustrates generalized linear models (such as logistic regression), Gaussian nonlinear models, and generalized nonlinear models; the focus of this course is on applications. Illustrations are given from the domains of bioassay, relative potency and drug or similar compound synergy useful in biomedical and environmental sciences. Caveats are discussed regarding convergence, diagnostics, and the inadequacy of standard (Wald) confidence intervals – these are the intervals provided by most software packages. Extensions to bivariate situations (e.g., those focusing on both efficacy and safety of drugs) and censored data (survival analysis) are also provided, as are implications for experimental design. Implementation using the SAS® and R statistical software packages will be discussed, but references will be made to other packages (such as SPSS and STATA) as well.

Course Outline

I.   Review of simple and multiple linear regression; two-sample t-tests, ANOVA, analysis of covariance; diagnostics and model checking; logistic regression.

II. Introduction to Gaussian nonlinear models; practical concerns (e.g., choosing a good model and starting values); nonlinear contrasted with linear models and with generalized linear models; applications (substance dissolution and enzyme kinetics); confidence regions, intervals, and the impact of curvature (nonlinearity, asymmetry).

III. Diagnostics and model checking; examples involving ELISA's (and other assays) and pharmacokinetics; extensions of classical methods including modelling variance functions and correlated responses; mixed and hierarchical nonlinear models.

IV. Generalized nonlinear models and applications in bioassay, relative potency, and drug/similar compound synergy modelling; usefulness and limitations of the IML and NLMIXED SAS® procedures, and the NLS R procedure.

V.   Experimental design strategies including benefits and limitations of optimal designs; robust 'optimal' design strategies; geometric designs.

VI. Extensions to (multivariate) bivariate Gaussian and binomial responses and to censored data in the context of the detection of drug/similar compound synergy.

Venue Room N101 Faculty of Science, Mahidol University, Rama 6 Road, Bangkok 10400

Timetable

Thursday 21st July	
8:30 am	Registration
8:45 am	Welcoming Speech by Professor Yongwimon Lenbury
9:00 – 10:30 am	Review of Statistical Methods and Logistic Regression
10:30 – 10:45 am	Morning Coffee Break
10:45 am – 12:15 pm	Nonlinear Models – Introduction and Examples
12:15 – 1:30 pm	Lunch Break
1:30 – 3:00 pm	Nonlinear Models – Confidence Intervals and Curvature, Practical Considerations
3:00 – 3:15 pm	Afternoon Tea Break
3:15 – 4:45 pm	Nonlinear Models – Diagnostics and Random Effects

Friday 22nd July	
9:00 – 10:30 am	Bioassay and Relative Potency
10:30 – 10:45 am	Morning Coffee Break
10:45 am – 12:15 pm	Assessing Synergy (Interaction); Discussion of Software (SAS/IML and SAS/NLMIXED)
12:15 – 1:30 pm	Lunch Break
1:30 – 3:00 pm	Experimental Design Strategies
3:00 – 3:15 pm	Afternoon Tea Break
3:15 – 4:45 pm	Applications in Bivariate Models and Survival Analysis; Conclusions and Comments

ผู้สนใจโปรดแจ้งชื่อ-ที่อยู่ และหมายเลขโทรศัพท์ที่สามารถติดต่อกลับได้ที่
รศ. ดร. มนต์ทิพย์ เทียนสุวรรณ E-mail : scmts@mahidol.ac.th
โทรศัพท์ 02-201-5538, 02-201-5340
หรือ คุณ ณัฐวุฒิ เสียงดี โทรศัพท์ 02 201-5340 และโทรสาร 02-201-5343
ภาควิชาคณิตศาสตร์ คณะวิทยาศาสตร์ มหาวิทยาลัยมหิดล ถนนพระรามที่ 6 กทม
:-โดยไม่เสียค่าใช้จ่ายใดๆทั้งสิ้น-: