

ST 755: Advanced Analysis of Variance
(Mixed Models and Variance Components)
(Spring 2008)

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Class Hours	Tu & Th 11:45-1:00
Location	Room 208, PT Hall
Office Hours	2:00-4:00pm TH or by appointment
Teaching Assistant	None
Office Hours	NA
Evaluation	Based on 4 ~ 5 independent projects.
Textbook	None
References	<ol style="list-style-type: none">1. Diggle, P.J., Heagerty, P., Liang, K.-Y., and Zeger, S.L. (2002), <i>Analysis of Longitudinal Data</i>, 2nd edition, Oxford University Press.2. Davidian, M. and Giltinan, D.M. (1995), <i>Nonlinear Models for Repeated Measurement Data</i>, Chapman & Hall, London.3. Mardia, K.V., Kent, J.T. and Bibby, J.M. (1979), <i>Multivariate Analysis</i>, Academic Press, London.4. Morrison, D.F. (1990), <i>Multivariate Statistical Methods, Third Edition</i>, McGraw-Hill, New York.5. Searle, S.R., Casella, G. and McCulloch, C.E. (1992), <i>Variance Components</i>, Wiley, New York.6. Tanner, M. (1996), <i>Tools for Statistical Inference, Third Edition</i>, Springer-Verlag, Berlin.

Topics to be covered

1. Linear mixed models
 - (a) Model specification
 - (b) Estimation: Maximum likelihood estimation and restricted Maximum likelihood estimation (REML), BLUP
 - (c) Mixed models and missing data: EM algorithm
2. Generalized linear mixed models
 - (a) Model specification
 - (b) Approximate inference: PQL, bias correction
 - (c) Exact inference: Monte Carlo EM algorithm, adaptive quadrature.
 - (d) Non-linear mixed models
3. Variance components testing in mixed models
 - (a) Why the traditional likelihood ratio test and Wald test fail
 - (b) Likelihood ratio tests under nonstandard conditions
 - (c) Score test for variance components
 - (d) Application in genetic studies
4. Mixed models and nonparametric smoothing
 - (a) Smoothing spline estimation, choice of smoothing parameters
 - (b) Mixed model representation of smoothing spline
 - (c) Generalized additive mixed models
 - (d) Testing polynomial covariate effects
5. Relaxing distributional assumption of random effects
 - (a) Non-parametric approach
 - (b) Semi-nonparametric (SNP) approach
 - (c) Mixture of normal approach
 - (d) Conditional approach