Advanced Topics in Design and Analysis
STA6247
Spring Semester 2003

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COURSE OUTLINE:

Catalog Description (Credits: 3; Prereq: STA 6246, knowledge of matrix algebra)

Introduction to response surface methodology. First and second order response surface, designs and models. Determination of optimum conditions. Criteria for choosing a response surface design. Analysis of multiresponse experiments. Nonlinear models. Generalized linear models.

Topics Listing

1. An Introduction to Response Surface Methodology
2. First-Order Models and Designs
   - (i) Designs for fitting first-order models
   - (ii) Lack of fit of first-order models
3. Second-Order Models and Designs
   - (i) Central Composite designs
   - (ii) Orthogonal designs
   - (iii) The concept of rotatability
   - (iv) Measuring design rotatability
   - (v) Box-Behnken designs
   - (vi) Blocking of second-order designs
   - (vii) The analysis of response surface models with block effects.
   - (viii) Effect of blocking on the estimation of a response surface.
4. Determination of Optimum Conditions
   - (i) The method of steepest ascent
   - (ii) Stationary points of a second-order model (canonical analysis)
   - (iii) The method of ridge analysis

5. Other Criteria for Choosing Response Surface Designs

   (i) The integrated mean squared error criterion

   (ii) The variance criterion

   (iii) The Box-Draper bias criterion

6. A Brief Introduction to Optimal Design Theory

   (i) Continuous design theory

   (ii) Alphabetic design optimality: the A, D, E, and G criteria.

7. The Analysis of Multiresponse Experiments

   (i) The general multiresponse model

   (ii) The Box-Draper determinant criterion for the estimation of parameters

   (iii) The problem of linear dependencies among the responses

   (iv) Lack of fit of a linear multiresponse model

   (v) Multiresponse optimization

   (vi) The use of PROC MULTIRES

8. Nonlinear Models

   (i) Estimation of parameters

   (ii) Designs for nonlinear models

9. Designs for Generalized Linear Models (GLM)

   (i) Estimation of parameters for a GLM.

   (ii) Designs for a logistic regression model

   (iii) Quantile dispersion graphs for comparing designs.

TEXTBOOK: Response Surfaces, 2nd Edition, by A.I. Khuri and J.A. Cornell, Marcel Dekker, Inc., NY (1996).

EXAM POLICY

Exam 1 (100 points). This exam will be given after completing Topic #5 in the course outline.

Exam 2 (150 points). This is the final exam. It is comprehensive and will be given on May 1 (10:00 A.M.-Noon).

Homework Assignments (100 points). Some of the homework problems will be collected and graded. Students are expected to do all the assigned problems, not just the ones to be collected. Occasionally, students may be asked to present the solutions to the problems in class.

Research Project (100 points). This consists of a paper on a subject selected by the student. Each student must submit a typed report (at most six double-spaced pages) followed by a class presentation of the paper by the student.

When you have chosen a subject, please see me for approval of the subject area.

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