STAT 4530 - Design of Experiments 1
Fall Term 2015

Course Outline

Instructor: Dr. Saumen Mandal

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Time, Location & CRN: Tuesdays, Thursdays 10:00 a.m. – 11:15 a.m., 316 Machray Hall. CRN: 12509.

Office Hours: Tuesdays, Thursdays: 11:30 a.m. – 1:00 p.m., or by appointment.

Calendar Description: (Formerly 005.453) Objectives in designing experiments; designs commonly used in research including analysis and an introduction to the construction of designs. Prerequisites: STAT 3800 or the former STAT 3600 (005.360) (C); and STAT 3480 (005.348) (C); or consent of department.

Textbook: Design and Analysis of Experiments by Douglas C. Montgomery.
8th Edition, ISBN: 978-1-1181-4692-7, John Wiley & Sons.

Some notes will be provided.

Assignments and Tests: There will be two assignments, two in-class midterm tests and the final exam. The dates of the midterm tests will be given later. The midterm tests and final exam are closed book. The final exam will cover the entire course. A formula sheet and relevant statistical tables will be provided if required. A non-programmable calculator will be needed. Note that graphing calculators are not permitted. There will be no make-up term test. Students who miss a term test with legitimate reasons will have the term test weight added to the final exam. Assignments are due in class. No late assignments will be accepted.
Information, notes, data sets and SAS codes will be posted in UM Learn System: www.umanitoba.ca/d2l

Marks Breakdown:

Assignments:	10%
Midterm Test 1:	20%
Midterm Test 2:	20%
Final:	50%

Grade Cut-offs: The following are the minimum percentage grades required to receive the final grades: A+ (90%), A (80%), B+ (75%), B (70%), C+ (65%), C (60%), D (50%).

Computer Packages: SAS statistical software will be used to perform the analysis of experiments. Instructions will be given in the class. Data sets and SAS codes will be posted in UM Learn. There are many computers on campus that can be used for running SAS. In particular, you can practice this software in the Stats Lab at 311 Machray Hall. Opening hours are posted outside the lab. You can also install a copy of the SAS University Edition in your computer for free:
www.sas.com/en_us/software/university-edition.html#for-students-learners
Documentation, including installation guides:
support.sas.com/software/products/university-edition/#s1=3

Academic Integrity: I have been asked to draw your attention to the sections in the *University of Manitoba Academic Calendar* regarding academic integrity and dealing with academic dishonesty including "plagiarism and cheating" and "examination personation". Links to resources that describe academic dishonesty can be found at: umanitoba.ca/faculties/science/undergrad/resources/webdisciplinedocuments.html umanitoba.ca/calendar

Voluntary Withdrawal: The voluntary withdrawal deadline is November 18, 2015.

Course Contents: The following is a non-exhaustive list of topics to be covered in the course. In the beginning, we will revisit some topics that you have encountered before. Then we will start advanced topics. Our primary goal will be to reinforce the fundamental concepts and to have a solid understanding of Design of Experiments.

1. BASIC DESIGNS and PRELIMINARIES (Chapters 1, 2, 3, 4, 13)

- Basic principles of design
- Linear Models and its applications in Design of Experiments
- Distributions and properties of least squares estimates
- Fixed, Random and Mixed effects models
- Completely Randomized Design (CRD)
- Randomized Complete Block Design (RCBD)
- Latin Square Design (LSD)
- Derivations of expected mean squares, F tests

2. 2^k and 3^k FACTORIAL DESIGNS (Chapters 5, 6, 9)

- Estimation and interpretation of main effects and interactions
- SS due to factorial effects and tests of factorial effects
- Formal tests of significance in 2^k and 3^k experiments

3. BLOCKING AND CONFOUNDING IN 2^k and 3^k FACTORIAL DESIGNS (Chapters 7, 9)

- Orthogonality of a design
- 2^k designs in 2^b blocks, 3^k designs in 3^b blocks
- Introduction of general notation: s^k designs in s^b blocks ($s = 2, 3$) : (s^k, s^b) designs
- Construction of (s^k, s^b) designs

4. FRACTIONAL FACTORIAL DESIGNS (Chapter 8, 9)

- 2^{k-p} and 3^{k-p} Fractional factorial designs
- Generators, Defining Relation
- Alias Structure, Resolution

5. SPLIT-PLOT DESIGNS (Chapter 14)

- Testing the whole plot treatments
- Testing the subplot treatments
- Testing the interaction between whole plot and subplot treatments
- Expected mean squares
- Estimates of the standard errors for different types of comparisons

If time permits, the following topics will be considered.

6. ANALYSIS OF COVARIANCE (ANOCOVA) (Chapter 15)

7. INCOMPLETE BLOCK DESIGNS (IBD) (Chapter 4)