STA672: Design and Analysis of Experiments

Spring 2011

Meeting Times and Places

Lectures:

Time: MWF 11:00-11:50am, March 7 – April 29 (Excluding March 14 – 18)

Place: Whitehall Classroom Building Room 238

Computing labs:

Section 001: M 5:00–6:15pm (March 28 – April 27) in WCB Rm 307

Section 002: W 5:00–6:15pm (March 29 – April 29) in WCB Rm 307

Section 003: T 8:00–9:15am (March 30 – April 28) in WCB Rm 307

Instructor

Dr. Simon Bonner

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Office hours: Monday and Thursday 4:00–5:00 or by appointment.

Teaching Assistants

Sections 001 & 002

Zilong Wang
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Section 003

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Course Description

What factors affect the growth of crops? What are the optimal conditions for manufacturing a product? Is a new drug safe enough to be released to market? Questions like these are answered through carefully controlled experiments. In this class, you will explore the fundamental concepts for designing good experiments and analysing the data that is collected. We will begin by studying the basic principles established by the father of experimental design, Sir R.A. Fisher, during his time at the Rothamsted Experimental Station in the early 20-th century. Building on these ideas we will examine some of the key concepts and methods for designing experiments to test scientific hypotheses.

Course Objectives

The course will focus on developing a non-mathematical understanding of the concepts of experimental design, implementing the methods you learn in the SAS statistical software package, and interpreting of the results. By the end of this course you should have developed the skills necessary to:

1) Design simple experiments to test hypotheses about specified treatments,

2) Analyse the data you collect in SAS and report on your results, and

3) Think critically about the design of experiments in your own work and in published work from researchers in your field.

Online Resources

Materials for the course will be posted on Blackboard. Please make certain that you have access to the site for this class.

Evaluation

Your performance in the course will be assessed through the following:

1. Assignments (40% of final grade):
   There will be a total of 4 assignments during the course. These assignments will combine questions testing your conceptual understanding of the material and requiring you to analyse data in SAS.

   Assignments will be posted on Blackboard and are due at the **start** of the computer lab in the week following their posting, as indicated on the Tentative Timeline.

2. Examinations (30% of final grade):
   There will be two examinations during the course. The midterm exam (worth 10%) will be held in class on April 15. The final exam (worth 20%) will be held during the scheduled exam period. Both exams will cover all material introduced through the lectures, labs, and assignments. Makeup exams will only be provided for students with an approved, official university excuse. Further details will be provided later in the course.

3. Class project (30% of final grade):
   The class project will require you to design your own experiment, collect and analyse the data, and report on your results. You will have to submit a proposal for your experiment on **April 11** and your final report will be due on **April 29**. Further details will be provided later in the course.

Note: All work to be assessed must be submitted either in hard copy or by email, as specified, by the assigned due dates. Late work will only be accepted with an official university excuse. Please see the UK policy on Student Rights and Responsibilities, Part II, Section 5.2.4.2 (http://www.uky.edu/StudentAffairs/Code/part2.html) for details on official excuses.

Materials

The recommended textbook for this course is:

- Kuehl, Robert O. (1999) *Design of Experiments: Statistical Principles of Research Design and Analysis*. Second Edition, Duxbury Press.

You may also find useful information in other introductory texts on the design and analysis of experiments. Come to my office hours if you would like recommendations on further reading.

Course Policies

Academic accommodations:
Please see me as soon as possible if you have a documented disability that requires academic accommodations. In order to receive accommodations in this course, you must provide me with a Letter of Accommodation from the Disability Resource Center (Room 2, Alumni Gym, 257-2754, jkarnes@uky.edu) for coordination of campus disability services available to students. We can then work together to find the best solutions for you.

Attendance:
Your attendance in class will not be checked but regular attendance is the best way to learn the material. You are responsible for all material covered during the class. If you know that you will be away ahead of time then I recommend stopping by my office hours and I will do the best I can to accommodate.

Academic integrity:
Academic dishonesty of any form will not be tolerated. Minor forms of dishonesty will result in a score of zero for that component of the course work. More serious forms of dishonesty will be reported to the university. Further information on plagiarism, how to avoid plagiarism, and the university's academic offense policy are available from the web-site of the Office of Academic Ombud Services (http://www.uky.edu/Ombud).

Classroom behaviour:
I view my role as a teacher is not to deliver knowledge to you, but to guide you through your own learning process. The course will require participation from every student, and I expect you to come to class willing to participate by completing exercises to the best of your ability and by engaging in class discussions. I will work to maintain an open and respectful atmosphere in the classroom and expect you to do the same. This includes providing others with the opportunity to ask questions and express opinions. Please turn of all mobile devices before class so that they will not interrupt the other students.

Tentative Timetable

Topics	Section(s)	**Anticipated Timing**
Basic Principles of Experimental Design		March 7–9
Planning an experiment	1.2	
Types of experiments and terminology	1.3, 1.4	
Replication and randomization	1.6, 1.8	
Designs with a Single Factor and ANOVA		March 11 – 25
Completely randomized design	2.1, 2.2	
Model and estimation	2.4, 2.5, 2.7	
Analysis of variance	2.6,2.8,2.9	
Inference	2.10, 2.11, 2.12	
Treatment Comparisons		March 28 – April 1
Introduction	3.1	
Planned comparisons	3.2	Assignment #1 due
Adjusting for multiple comparisons	3.4, 3.5	
Unplanned comparisons	3.6,. 3.7, .3.8	
Experiments with Multiple Factors		April 4 – 8
Factorial Designs	6.1, 6.2	
Experiments with two-factors	6.3, 6.4	Assignment #2 due
Experiments with three or more factors	6.6	
Blocking		April 11 – 15
Introduction to blocking	1.5, 8.1	
Completely randomized block designs	8.2	Class Project – proposal due
Latin squares	8.3	Midterm exam
Split-plot Designs		April 18 – 22
Different sized experimental units	14.1	
Model and estimation	14.2, 14.3, 14.4	Assignment #3 due
Other topics		April 25 – 29
Power analysis and sample size	1.7, 2.14, 6.8	
Relative efficiency of designs	1.9, 14.6	Assignment #4 due
		Class Project – report due

Section information refers to the recommended text, Kuehl (1999). Note that the course will not cover all of the material in these sections and may also contain material not included in this text.