Statistics 230: Syllabus
Analysis of Variance

Winter 2019

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Office Hours: 11:00 AM to 12:00 PM MW

Course Description:
Scientific method, statistical thinking, sources of variation, completely randomized design, ANOVA, power and sample size consideration, multiple testing, randomized complete blocks, factorial designs, interactions. Introduction to statistical software.

Prerequisite:
Introductory Statistics (Stat 121, 151, 201, 301, or a "4" or higher on AP Statistics Exam)

Course Learning Outcomes:
A student completing Stat 230 will be able to:

1. Define the experimental unit, response variable, factor(s), and level(s) of a basic experiment.
2. Understand the role of randomization and replication in inferring causation.
3. Perform a completely randomized design and construct the ANOVA table in R.
4. Compute the minimum number of replicates in a completely randomized design to achieve a given level of power.
5. Compute pairwise tests of differences in means in R to understand a significant overall F-test.
6. Perform a randomized complete block design and construct the ANOVA table in R.
7. Perform a factorial design and construct the ANOVA table in R.

8. Explain a statistically significant interaction.
9. Describe the differences between a split plot and a two-way ANOVA.
10. Work in teams to write a technical report and make a technical presentation of a designed experiment.

Course Materials

* Textbook: *Introduction to Design and Analysis of Experiments* (we'll call it "Cobb")
by George W. Cobb, Wiley (link on Amazon)

* Lecture Notes (Slides) are available on Learning Suite.

* Software: You will be using R for this course…we'll introduce this language to you gradually, but not at all like slow poisoning. R is available on all department machines, but you are also encouraged to install them on your personal computer.

- R. R is free and can be downloaded by following the instructions at http://cran.r-project.org/. (See the links under "Download and Install R" to choose the correct version for your operating system. Several summaries of R commands are available online (see e.g., http://www.personality-project.org/r/r.commands.html).
- SAS. SAS is a commercial product but is available to BYU students to use on their personal computers while they are students. Bring your laptop in to the Statistics Department's CSRs to have it installed. We will not use SAS in this course, but it is a very useful language to learn.

Grading

Your semester grade will be determined as follows:

Midterm #1	15%	TBA
Midterm #2	15%	TBA
Final Exam	20%	TBA
Homework	25%	Mostly textbook and textbook-like problems

Term Project	20%	Design, execution, and analysis of an experiment; report
Writing Quizzes	5%	Clear, grammatically correct statistical phrases, definitions and explanations.

Project, Presentation and Quizzes

There is a required group project for this class. See below for link to more details.
The group will make a 15 minute presentation of this project at the end of the semester.

There are several quizzes given throughout the semester. These quizzes entail a written response on some statistical concept, definition or explanation. These are graded critically for grammar, punctuation and clarity. Examples of these quizzes are the following

1. Explain what a 95% confidence interval is.
2. What is the power of statistical test?
3. Describe the design of experiments.
4. Illustrate multiple comparisons.
5. What does "protection of the alpha level" mean?
6. Explain "overall" analysis and what proceeds subsequent to such an analysis.

Tentative Schedule & Textbook Sections

Lecture number	**TOPIC & READING ASSIGNMENT (reading in Cobb to be completed in advance)**	**Homework, Project, & Exams**
Jan 7	***Syllabus & Intro***	
9	***Section 0:*** ***"Stat 121 on Steroids"***	Homework 0 (Hand Calculations)
11	(continued)	
14	(continued)	HW#1 (Stat 121 Review)
16	(continued)	
18	(continued)	
23	(continued)	HW#2: 1-12 from Master HW File
25	***Section 1:***	

	Intro to Experimental Design -- Planning an Experiment (1.1, 4.1-4.3)	
28	(continued)	
30	(continued)	HW#3: 13-24 from Master HW File
Feb 1	-- Principles of experimentation and Experimental designs (1.2-1.3)	
4	(continued)	
6	*Catch up/Review Day*	
8	***Section 3:*** ***ANOVA*** -- Model, data decomposition, components of variance (2.1, 2.2, 2.4, 3.1-3.3, 3.A1)	HW#4: 25-37 from Master HW File
11	(continued)	*Midterm #1*
13	(continued)	
15	(continued)	
18	-- Hypothesis testing and confidence intervals (3.4, 3.5)	
20	(continued)	HW#5: 38-46 from Master HW File
22	***Section 5:*** ***Randomization and the Basic Factorial Design*** (5.1-5.4, 5.6)	
25	(continued)	
27	(continued)	HW#6: 47-55 from Master HW File
March 1	(continued)	
4	(continued)	
6	(continued)	HW#7: 56-59 from Master HW File
8	***Section 6:*** ***Multi-way ANOVA and Interactions*** (6.1-6.3, 6.5)	
11	(continued)	

13	(continued)	HW#8: 60-64 from Master HW File
18	(continued)	
20	(continued)	
22	*Catch up/Review Day*	
25	***Section 7:*** ***Blocking*** (7.1-7.4, 7.7, 9.3) -- CB[1]	HW#9: 65-68 from Master HW File
27	-- CB[2]	PROJECT must be approved
29	-- SP/RM	*Midterm #2*
April1	***Section 11:*** ***Comparisons and Contrasts*** (11.1, 11.2, 11.4)	HW#10: 69-74 from Master HW File
3	(continued)	
5	***Project Oral Presentations***	
8	(continued)	HW#11: 75-82 from Master HW File
10	(continued)	
12	(continued)	
15	(continued)	
17	*Catch up/Review Day*	Term Project Due

For Homework consult Learning Suite for Master HW File.

Some HW policies: See Learning Suite

TERM PROJECT: See Learning Suite.

Learning Suite also has DATA that will be useful throughout the course.