Colorado State University

STAT512: Experimental Design and Data Analysis for Researchers II (4 credits)

Objectives:
This course is a continuation of STAT511. The major topics are: (1) Multiple regression (including model selection and logistic regression), (2) Fixed-effect factorial designs, and (3) Random and mixed-effect models (including RCB, split-plot and repeated measures). Emphasis throughout will be on the principles of design and inference, rather than the mechanics of computations.

Prerequisites: STAT511 or consent of instructor.

Required Text: Ott and Longnecker, An Introduction to Statistical Methods and Data Analysis, 7th Edition, Duxbury, 2016. ISBN: 9781305269477

Computing: STAT 512 will use R. R is a free software environment for statistical computing and graphics. To install R, go to www.r-project.org, and click on "download R", choose a CRAN mirror, and download R for your platform (binaries for base distribution).

We will also use RStudio, an IDE (integrated development environment). It is a program that makes it more convenient to work in R. Go to the website (www.rstudio.com) and download RStudio. We will use the free Desktop Open Source License.

Course Web Page at Canvas: All course materials are available from Canvas. This will include lecture notes, examples, assignments and other material. You will need your eid and password to log onto Canvas.

Grading

	Grade Percentage	Tentative Dates
Homework	20 %	Due on Fridays by 4pm
Midterm 1	25 %	Wednesday 2/28
Midterm 2	25 %	Wednesday 4/18
Final Project	30 %	Tuesday 5/8 midnight
Total:	**100 %**	

Academic Integrity: This course will adhere to the Academic Integrity Policy of the CSU General Catalog and the Student Conduct Code. On exams, students will sign a statement of the honor pledge "I have not given, received or used any unauthorized assistance."

Exams: Exams are open book, open notes. No computers or phones allowed. Calculator recommended. For any exam conflicts, please email the instructor at least one week prior to the scheduled exam date. Also see the instructor for exam grading problems.

Homework: Homework will be assigned weekly, typically assigned by Friday and due on Friday (4:00 pm) of the following week. You are encouraged to work together on homework, but the work turned in should be your own. By that I mean that all the computer output should be generated by you and the answers should be written by you. No late homework will be accepted (without prior approval). Homework can be submitted in pdf format via Canvas or turned in to the grader's mailbox (Statistics 102)**.** Please do not slide work under my office door.

Final Project:
Students need to provide data for their project. Ideally this data would be part of your own research (or work) or at least from your lab (or company). The analysis for this project needs to focus on a topic from the course: multiple regression, factorial ANOVA or mixed models. Note that all of these topics include at least two predictor variables. Very small ($n \leq 10$?) and very large ($n > 1000$?) data sets are probably not a good fit for the project.

A (brief) project proposal will be due around Spring break. There will be at least one project review day toward the end of the semester, where students will discuss and review projects with each other. The final write-up will be due during finals week. I expect that the final write-up will be a few pages in length and include a detailed discussion of the variables, design, analysis, conclusions and some graphics as well as the code.

Course Content:

1. Multiple Regression
    a. Basic model, assumptions, hypothesis testing, confidence and prediction intervals
    b. Polynomial terms, interactions, ANCOVA
    c. Model selection: stepwise selection and AIC/AICc/BIC
    d. Influence and collinearity diagnostics
    e. Generalized linear models: logistic and poisson regression
2. Fixed Effects models
    a. Blocked and latin square designs
    b. Factorial designs and pairwise comparisons
    c. Unbalanced and unreplicated designs
3. Mixed Effect models
    a. Random effects models
    b. Mixed models: crossed and nested factors, randomized complete block design, split-plot design, strip-plot design
    c. Repeated measures with one and two-factors