Colorado State University

STAT511A: Experimental Design and Data Analysis for Researchers I (4 credits)

Learning Objectives: This course (together with STAT512) is designed to provide an introduction to statistical thinking and statistical methods for graduate researchers. After completing this course, a successful student will be able to:

1. Understand basic statistical concepts and inferential approaches (estimation, hypothesis testing and confidence intervals) and their role in addressing research questions.
2. For a given study and research question, students should be able to:
    a. Identify an appropriate analysis
    b. Check assumptions and provide alternative approaches if assumptions are not met
    c. Use statistical software for graphing and data analysis
    d. Interpret the results and draw conclusions
3. When planning a study, students should be able to:
    a. Calculate power using statistical software
    b. Justify choice of sample size

Prerequisites: Graduate standing plus one undergraduate statistics course (even if it was some time ago) 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 511A 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: You will need your eid and password to log onto Canvas. All course materials are available from Canvas. This will include lecture notes, examples, assignments and other material.

Grading:

	Grade Percentage	Tentative Dates
Homework	20 %	Due on Fridays by 4pm
Midterm 1	25 %	Thursday 9/28
Midterm 2	25 %	Thursday 11/2
Final Exam (Take home)	30 %	Due by Wed 12/13 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. For the two in-class midterms, 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 questions.

Homework: Homework will be assigned weekly and typically due on Fridays by 4:00 pm. 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.

Course Content:

1. Basic concepts: estimate vs parameter, experiment vs observational study, randomization, random variables and probability distributions

2. Inference about a single mean (or median): assessing normality, one-sample t-test and confidence interval, sign test and confidence interval for a median

3. Inference for comparing two means (or medians): Pooled and Welch-Satterthwaite two-sample t-tests and confidence intervals, paired t-test and confidence interval, Wilcoxon Rank Sum test, Wilcoxon Signed Rank test

4. Inference for comparing more than two means: one-way ANOVA, pairwise comparison of means, multiple testing adjustments, Kruskal-Wallis test

5. Inference for categorical data: large and small sample inference for a single population proportion, large and small sample inference for comparing two population proportions, chi-square test for contingency tables

6. Simple linear regression and correlation

7. Simple logistic regression

8. Power and sample size calculations for inference about means and proportions