Course	Research Methods in Behavioral and Brain Sciences—Part 1, PSYC 6312.002, HCS 6312.002, ACN 6312.002
Professor	Robert A. Ackerman, Ph.D.
Term	Fall 2016
Meetings	JO 3.209, Tuesdays and Thursdays from 10:00am-11:15am

Dr. Ackerman's Contact Information

Office Phone: (972) 883-2346
Office Location: Green Hall, Room 4.126
Email: raa110030@utdallas.edu
Office Hours: Tuesdays from 12:00pm to 2:00pm (or by appointment via email)

Kaitlin Sands' Contact Information

Office Location: Jonsson Hall, Room 4.312
Email: Kaitlin.Sands@utdallas.edu
Office Hours: Tuesdays & Thursdays from 9:00am to10:00am (or by appointment via email)

General Course Information

Restrictions

Students are assumed to have taken an introductory undergraduate course in statistics. They should be familiar with general concepts and definitions (e.g., descriptive vs. inferential statistics, independent and dependent variables), distributions (e.g., standard normal distribution, t-distribution), measures of central tendency and variability, the central limit theorem, one-sample z-tests, one-sample t-tests, independent groups t-test, and correlated groups t-test. Because this course will include a large data analysis component, students must also have access to SPSS.

Course Description

This course aims to familiarize students with how to use Analysis of Variance (ANOVA) techniques to analyze data from experimental and non-experimental research. We will cover single-factor designs, planned comparisons and post-hoc tests, Type I and II errors, power, multiple factor designs, breaking down interaction effects, repeated measures designs, and mixed designs. We will also spend a good deal of time learning how to compute relevant effect sizes for different analyses.

Learning Objectives

Students will demonstrate:

1. Knowledge of basic topics within Null-Hypothesis Significance Testing (NHST), including how to accurately interpret a p-value, Type I and Type II errors, and power.
2. Knowledge of basic topics within estimation, including effect sizes and confidence intervals.
3. Knowledge of basic topics within ANOVA, including the F ratio, between and within-groups designs, factorial designs, and mixed designs.
4. An ability to conduct basic and more advanced ANOVAs, including the single-factor between-subjects and within-subjects designs, 2-way between-subjects factorial, and mixed designs.
5. An ability to break down interaction effects in ANOVA.
6. An ability to estimate appropriate effect sizes for relevant designs.
7. An ability to write up different forms of analyses in APA style.

Students' achievement of these objectives will be evaluated through a combination of homework assignments and exams.

Required Texts

Keppel, G., & Wickens, T. D. (2004). Design and Analysis: A Researcher's Handbook (4th Edition). Prentice Hall, ISBN: 0-1351-5941-5

Cumming, G. (2012). Understanding the new statistics: Effect sizes, confidence intervals, and meta-analysis. New York: Routledge. ISBN-10: 041587968X

The course E-learning website can be accessed through this link:
https://elearning.utdallas.edu/webapps/portal/frameset.jsp
(I will be posting all course materials on e-learning. **You will need to print out copies of the outputs and other materials to bring to class each day.**)

Computer

We will be using the SPSS program for data analyses. I will show examples in class using both the drop-down menu approach and syntax. It is very important that you have access to this program, and so your first homework assignment-to be completed by Friday-is to locate a computer that has SPSS installed on it that you can use for homework in this class. If you want to purchase SPSS for your own computer, you can buy it from the UTD tech store. Be sure to buy SPSS Statistics Premium Graduate Pack for version 21 or higher (it should cost you around $100-$120). If you do not want to buy your own copy of SPSS, it is installed on several UTD computer labs (e.g., GR 3.206 Statistics Lab).

Course Requirements

Data Analysis Assignments. Homework will be assigned in class. Assignments should be completed individually. Also, examples of write-ups discussed in class are NOT TO BE USED as templates for the assignments—this is plagiarism and will not be tolerated. In most cases you will have one week to complete each assignment (I will note due dates in class for each assignment.) Completed homework will be collected in class and will be scored out of a possible 10 points. One point will be deducted for each day that an assignment is late (assignments will not be accepted after 5 days). Scores on these assignments will count for 20% of your final grade.

Exams. Grades will also be based on a midterm exam (40%) and a final exam (40%). As an initial guess (i.e., it is subject to change) the in-class midterm exam will be given on Tuesday, October 11. The date, time, and location of the final exam will be announced in class.

Grading Criteria

The following scheme will be used to provide you with a grade:

Percentage of Total Points Earned	Letter Grade
90-100%	A
87-89%	B+
83-86%	B
80-82%	B-
77-79%	C+
73-76%	C
70-72%	C-
67-69%	D+
63-66%	D
60-62%	D-
Below 60%	F

Materials for this course were adapted from a course taught by Dr. Deborah A. Kashy.

Instructor Expectations

Because the material in this course is more or less cumulative, it is imperative that you stay alert during class and keep up with the readings and assignments. It is easy to fall behind, but very difficult to catch up. I also expect you all to be respectful towards one another.

Late Work

One point will be deducted for each day that a homework assignment is late (assignments will not be accepted after 5 days).

Comet Creed

This creed was voted on by the UT Dallas student body in 2014. It is a standard that Comets choose to live by and encourage others to do the same:

"As a Comet, I pledge honesty, integrity, and service in all that I do."

UT Dallas Syllabus Policies and Procedures

The information contained in the following link constitutes the University's policies and procedures segment of the course syllabus.

Please go to http://go.utdallas.edu/syllabus-policies for these policies.

Course Schedule

Note: This schedule is tentative and subject to change. Changes will be noted in class. Note also that the reading assignment should be completed before class on the day it is assigned. KW = Keppel & Wickens (2004).

Date	Topic	Reading Assignment
Aug 23	Introduction to course Data exploration	Raykov & Marcoulides (2008)- Chapter 3
Aug 25	Introduction to SPSS	
Aug 30	Review of material prior to ANOVA	KW: Chapters 1,2
Sep 1	Review of material prior to ANOVA (continued)	
Sep 6	Introduction to ANOVA	KW: Chapter 3
Sep 8	Introduction to ANOVA (continued)	
Sep 13	Confidence intervals	Cumming (2012)-pp. 75-117 (optional to read Chapter 2 and beginning of Chapter 3)
Sep 15	Introduction to effect sizes for ANOVA	Grissom & Kim (2012)-Chapter 6
Sep 20	Cohen's *d* and confidence intervals	Cumming (2012)-Chapter 11
Sep 22	ω^2 and confidence intervals	Kelley (2007)
Sep 27	Power, effect size, and sample size	KW: Chapter 8
Sep 29	Accuracy-of-parameter estimation	Cumming (2012)-Chapter 13
Oct 4	The linear model and ANOVA assumptions	KW: Chapter 7
Oct 6	The linear model and ANOVA assumptions (continued)	
Oct 11	**Midterm Exam**	

Oct 13	Dealing with assumption violations (e.g., non-parametric alternatives)	
Oct 18	Comparisons among means	KW: Chapters 4.1-4.3, 6 Cumming (2012)-Chapter 6
Oct 20	Comparisons among means (continued)	
Oct 25	Introduction to factorial ANOVA	KW: Chapter 10
Oct 27	**NO CLASS**	
Nov 1	Two-factor Between-Subjects ANOVA	KW: Chapter 11
Nov 3	Breaking down the interaction	KW: Chapter 12
Nov 8	Effect sizes for factorial designs	Grissom & Kim (2012)-Chapter 7 (pp. 205-230) Cumming (2012)-Chapter 15 (pp. 411-424)
Nov 10	Three-factor ANOVA & breaking down the 3-way interaction	KW: Chapters 21, 22
Nov 15	Unequal sample sizes in factorial ANOVA	KW: Chapter 14
Nov 17	Single-factor within-subjects designs	KW: Chapters 16, 17
Nov 22	**NO CLASS: Fall Break**	
Nov 24	**NO CLASS: Fall Break**	
Nov 29	Two-factor within-subjects design	KW: Chapter 18
Dec 1	Effect sizes for factorial within-subjects designs	Grissom & Kim (2012)-Chapter 7 (pp. 230-239)
Dec 6	Mixed Designs	KW: Chapters 19, 20

Below is a list of topics that you should be familiar with from your undergraduate statistics course. Hopefully each of you will look at the list and feel reasonably comfortable with the topics. Perhaps for some of you, a brief perusal of your undergraduate statistics text and notes might help to rekindle the knowledge. Unfortunately, there may be some of you that look at this list and panic. You may never have had this material or it may have been very long ago.

The problem is twofold. First, we already have far too much to do in this course. Second, a brief review tends to be boring and useless to students who are comfortable with the material, but is far too fast and overwhelming for students who are uncomfortable.

All of you should go home today and look through your undergraduate statistics books to be sure that you are really familiar with the listed material. If you do not have a book, I should be able to find one that you can use on a temporary basis. Note that I don't expect you to memorize formulas – just to be familiar with the statistics, what they tell you, what assumptions are necessary, and so on.

Topics from undergraduate statistics that I assume you know (formulas need not be memorized – just know how to use them if you need to):

General Concepts & Definitions you should know

Descriptive Statistics vs Inferential Statistics
Population vs Sample
Random Sampling
Representative Sample
Independent and Dependent variables
Experimental research
- manipulate the independent variable,
- random assignment

Observational research
Confounding variables
Qualitative versus Quantitative measurement

Distributions

The Normal Distribution - characteristics of it
The Standard Normal Distribution = the Normal distribution with $\mu = 0$ and $\sigma = 1$
The t-distribution and how it relates to the Normal distribution

Measures of Central Tendency

Mean, Mode, Median
- What each of these measures tell you (how to interpret them)
- characteristics of each, i.e.,
  - is it a stable measure from sample to sample?
  - is it sensitive to outliers?
  - can there be more than one?

Measures of variability

Range - What it is and properties of it
Sum of Squares
Variance
Standard Deviation
- What it is, how you compute it, and what it tells you

Inferential Statistics

You should be able to explain/define:
Population and sample, and the difference between them
Sampling error - why it occurs and its importance
The sampling distribution of the mean
The Central Limit Theorem and its importance to inferential statistics
The standard error of the means

One Sample z-test.

You should be able to
- understand how the Central Limit Theorem relates to the z-test
- understand the role of the standard error of the means in this test
- state the null & alternative hypotheses being tested
- conduct the test
- state your conclusions about the test both in terms of the null hypothesis and in terms of the research question being addressed in the problem

One Sample t-test.

You should be able to

- recognize that the question is a one-sample t-test problem versus a one-sample z-test problem (i.e., the comparison μ is known but the true population σ is unknown so it must be estimated)
- state the null & alternative hypotheses being tested
- conduct the test
- state your conclusions about the test both in terms of the null hypothesis and in terms of the research question being addressed in the problem
- explain the relationship between the degrees of freedom and the shape of the t-distribution

Independent Groups t-test

You should be able to

- recognize that the question is an independent groups t-test problem (versus a one-sample problem or a correlated groups problem)
- state the null & alternative hypotheses being tested
- conduct the test
- state your conclusions about the test both in terms of the null hypothesis and in terms of the research question being addressed in the problem

Correlated Groups t-test.

You should be able to

- recognize that the question is a correlated groups t-test problem (versus a one-sample problem or an independent groups problem)
- state the null & alternative hypotheses being tested
- conduct the test
- state your conclusions about the test both in terms of the null hypothesis and in terms of the research question being addressed in the problem

You should also know

- what within subjects (= repeated measures) designs are
- what matched pairs designs are
- advantages and disadvantages of within subjects and matched pairs designs