Psychology 3101-400: Research Methods and Data Analysis in Psychology
Spring, 2013

Lectures: M/W/F 9:00am-9:50am, Hale 230
Labs: Muen D346, times shown below; *no labs the SECOND week of class (week of MLK day)*
Final exam: Thur, May 9, 7:30am-10am, Hale 230
Course website: http://psych.colorado.edu/wiki/ (find link for 3101-400)
Facebook account: www.facebook.com/CuStatistics2013

Professor

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Goals of the course

1. To give you a conceptual understanding of statistics used in behavioral research.
2. To educate you to be an informed citizen who can critically evaluate statistical arguments that are presented in scientific journals and books or in the news.
3. To prepare you to take more advanced statistics courses offered at CU or in graduate school.
4. To provide an introduction to computerized data analysis and interpretation.

Course philosophy

As you will come to see, I love to teach statistics. I get a kick out of seeing the light bulbs go on for students, and I hope that you come to appreciate that statistics is one of the most important classes you will take in psychology. Statistics is a set of tools—the best and oftentimes only ones we have—to make conclusions about behavior in a noisy world. Nearly everything you learn in your past, current, and future psychology classes has used the types of tools that you are about to be exposed to. Moreover, statistics is about empowerment – giving you the tools to be able not only to understand psychological research, but also to begin to *do* psychological research. It is true, of course, that statistics is challenging – it will give your brain a good workout. Don't be afraid of that – embrace it! And remember, we're on your side; our goal is to help you understand this material so that you can succeed.

Lab sessions

410	11am-12:50am Thur.	Muenzinger D346	Yoni Ashar
411	11am-12:50am Tue.	Muenzinger D346	Chad Osterlund
412	10am-11:50pm Wed.	Muenzinger D346	Yoni Ashar
413	10am-11:50pm Mon.	Muenzinger D346	Chad Osterlund

Labs meet every week and last two hours. They are led by your TA. At the beginning of each lab, you will take a quiz that covers the last week of readings and lectures and you will begin your homework assignment for the next week.

Course evaluation

Laboratory grade (40% of final grade): Your lab grade will be weighed equally between weekly homework assignments and quizzes. Attendance in lab is mandatory and under no circumstance will make-up quizzes be offered or late homework accepted. The two lowest quiz scores and two lowest homework grades will be dropped.

Quizzes: Short (~ 10 minutes) quizzes will take place at the beginning of every lab, and will evaluate material and readings from the readings that were assigned for the last two lectures as well as one lecture in the future (so do readings beforehand!). So if your lab is Mon or Tue, your quiz will cover readings assigned for the last Friday and Monday and the next Wednesday. If Wed or Thur lab, quiz covers readings from Monday, Wed, and Friday. Quizzes are graded pass (60%+) or fail (< 60%). They are designed to encourage you to stay up with the assigned readings.

Homework: TAs will give out homework assignments every week in lab, and you will have time to begin them in lab. Homework assignments will cover material from Friday from the week before through Wednesday of the lab week. Homeworks must be turned in at the beginning of lab in person. TAs won't accept emailed homework assignments. We encourage you to work in groups of 2 or 3 to do homeworks, but your answers must be independent – no turning in identical answers. Homework is training for your exams, and as it involves using R, it is especially relevant training for your in-lab final exam.

Three midterm exams (10% of final grade each; 30% total). Although the midterms are not technically cumulative, you will be expected to have an understanding of all material learned to date. Exams cover material from lecture and readings, weighted toward topics covered in lecture. It will be tough to do well on exams if you only attend the lectures or only do the readings.

A final lab exam (10% of final grade) to be held during your final lab, between April 29-May3. This exam will be open book and open note, and will require that you use R to make inferences about populations using real data, and provide descriptions of your findings.

A cumulative final exam (20% of final grade) to be held in class on Thursday, May 9, covering all material from readings and lecture from the entire semester.

Algebra pre-test

Although this is not a course in mathematics, we do assume basic algebra skills. On the first day of class, you will be given a short basic algebra test. Those not performing well on this test will be encouraged to drop Psych 3101 and to take Math 1011 before re-enrolling in Psych 3101. This is doing you a favor: basic algebra skills are assumed, and those who do not yet have those are unlikely to do well in the course. Statistics is hard enough without having to fight with the mathematics of it too!

Exam policies

Formulas: You are required to memorize statistical formulas for the first two parts of the course (through April 2). For the most part, these are simple formulas, and you should know them intimately, not just for this class, but for any class you take from now on. Knowing these basic formulas reinforces a conceptual understanding of the material. The formulas for factorial ANOVA and regression tend to become more involved; I will supply these to you for tests.

Missing an exam: Except for major life events, make-up exams will not be offered if you miss an exam. In general, illness not requiring a doctor's visit is not an acceptable excuse. If you need to miss a scheduled exam due to religious obligations, etc., we will make arrangements for you to make up the exam.

Accommodations for students with documented disabilities: If you qualify for accommodations because of a disability please submit a letter to us from Disability Services (www.colorado.edu/disabilityservices) in a timely manner so that your needs may be addressed.

Course wiki

We are using a course wiki to post the syllabus, lectures, lab/homework assignments, practice exams, etc. To get to the course wiki go to the following URL: http://psych.colorado.edu/wiki/ and find the link for "3101-400."

Course facebook account

We have set up a facebook account for the class under the name "CuStatistics2013." Just login to facebook with your account or a new account you set up just for this class and "like" that page. If you don't have a facebook account, you may create one simply for this course. If you have questions regarding the class, homework, tests, etc., this is the place to post them. Also feel free to respond to your fellow students' questions. Don't be shy – if you give a wrong answer, we will correct it soon. For issues of a personal nature (e.g., you have embarrassing gastrointestinal issues the TA needs to know about), email your TA directly.

Required readings

The primary text for the course is Gravetter, F. J. & Wallnau, L. B. (2009). Fundamental statistics for the behavioral sciences (8th edition).

Throughout the course, I will also assign interactive readings from the website, Seeing statistics: http://www.seeingstatistics.com/

Statistical software

Lab sessions involve training in computer-based statistical analyses, using the open-source software package, R. Exams will also assume familiarity with R programming and statistical output. R is available to download for free for both PCs and Macs. You will receive instruction on how to use R in lab. The program will be installed on the computers you will use in lab, but you are welcome to install it on your personal computer as well. To download R, go to http://www.r-project.org/, or bring it to the first week of lab to get help from your TA.

In particular, we will be using an interface in R called "R Commander," which students find is an easier introduction to using R than vanilla R (which is essentially just a scripting language with lots of statistics capabilities). For instructions on installing R commander, see this webpage: http://socserv.mcmaster.ca/jfox/Misc/Rcmdr/installation-notes.html. We chose R and R commander because they are free for you to install on your own computer, fairly quick to learn, and state-of-the-art—should you pursue more advanced statistical training, there should be no need for you to learn another language; most advanced statistics in most fields are done in R.

Calculators

You will need a calculator of some kind for the exams and for homeworks. It will be to your advantage to get a calculator with statistical functions on it (e.g., ΣX, $\Sigma X2$).

Schedule

Date	Topic	Reading	Lecture
	Part I: Descriptive statistics		
M, Jan 14	Overview		overview, procedures, motivating example
W, Jan 16	Research Design	Gravetter & Wallnau, ch 1 (i.e., GW 1) GW Appendix A	variables, hypotheses, & data; experimental and non-experimental studies; correlation and causation; independent and dependent variables; random assignment
F, Jan 18	Goals of statistics	Seeing Statistics (SS) 0 & 1.0-1.2	populations and samples; sampling error; random selection; parameters vs. statistics; descriptive statistics, estimators, and inferential statistics
M, Jan 21	NO CLASS (MLK day)	--	--
W, Jan 23	Distributions (guest lecturer, Yoni Ashar)	GW 2 SS 2 & 5	frequency; frequency tables; quantiles; cumulative distribution; histograms; boxplots; shape of distributions; skew; multimodality; continuous variables and density vs. distribution
F, Jan 25	Central Tendency	GW 3 SS 3	mean, median, and mode; minimizing squared error; choosing the right statistic (in readings, skip "finding the precise median of continuous variables")
M, Jan 28	Variability	GW 4	range; interquartile range; standard deviation and variance; outliers
W, Jan 30	Variability II	SS 4.0-4.4	variance and standard deviation of samples; degrees of freedom
F, Feb 1	z-scores	GW 5 *except* 5.4	standardized distributions and their role in: interpretation of individual values, comparison between distributions, evaluating effect size
M, Feb 4	Probability	GW 6.1 SS 6 (*except* binomial formula)	probability and the population-sample relationship; random sampling; bias; binomial distribution
W, Feb 6	Probability and the Normal Distribution	GW 6.2-6.4 SS 7.1-7.3	area under the curve for normal & non-normal data; probability associated with z-scores
F, Feb 8	Distribution of sample means	GW 7 SS 7.4	a sample of means; shape & variance of sample means; standard error; Central Limit Theorem and the Normal distribution;
M, Feb 11	Distribution of sample means II		law of large numbers; a measure of surprise from a sampling distribution
W, Feb 13	Review		

F, Feb 15	**Exam 1 - Covers Part I of course (descriptive statistics)**		
	Part II: Introduction to inference		
M, Feb 18	Hypothesis testing	GW 8	magic trick; null and alternative hypotheses; alpha level; test statistic; critical region; z-test; p-value
W, Feb 20	Hypothesis testing II		z-test again; effect size; worked example
F, Feb 22	Hypothesis testing III	SS 8 *except* 8.4	types I & II errors; power
M, Feb 25	Single sample t-test	GW 9 SS 9	hypothesis tests for population mean; the problem of unknown variance; t statistic; degrees of freedom again; t-test; directional tests
W, Feb 27	Two sample t-test	GW 10.1-10.2 SS 10	comparing the means of two groups; between-subjects design; independent-sample t-test
F, Mar 1	Two sample t-test II	GW 10.3-10.4	effect size; assumptions for t-test
M, Mar 4	Repeated measures t-test	GW 11	comparing two related measurements; within-subjects design; paired-samples t-test (led by TA)
W, Mar 6	Estimation	GW 12 SS 8.4	point estimates; variance in the estimate; confidence intervals
F, Mar 8	Review of hypothesis testing & t-tests		Review of last 8 lectures (by TA)
M, Mar 11	ANOVA	GW 13	comparing means of several groups; partitioning sum-of-squares; degrees of freedom; *F* distributions
W, Mar 13	ANOVA II		ANOVA again; effect size estimation in ANOVA; relationship between *t* and *F*
F, Mar 15	ANOVA III		ANOVA again
M, Mar 18	Review 1		
W, Mar 20	Review 2		
F, Mar 22	**Exam 2 - Covers Part II of course (introduction to inference)**		
Mar 26-30	Spring Break	--	--
	Part III: Introduction to the General Linear Model		
M, Apr 1	Repeated Measures ANOVA	GW 14	comparing several related measurements; within-subjects factors; subject-level variance
W, Apr 3	Factorial Designs	GW 15.1-GW15.2	Factorial design; main effects and interactions
F, Apr 5	Factorial ANOVA	GW 15.3-15.4	Interpreting results from factorial ANOVA

M, Apr 8	Factorial ANOVA II	GW 15.6	Assumptions in factorial ANOVA
W, Apr 10	Correlation	GW 16.1-16.3 SS 12.0-12.2	linear relationships between two variables; correlation coefficient
F, Apr 12	Correlation II	16.4-16.5	Hypothesis testing of a correlation coefficient; Spearman correlation
M, Apr 15	Linear regression	GW 17.1-17.2 SS 12.3-12.8	least-squares prediction; regression; residual variance and R-squared
W, Apr 17	Linear regression II	SS 12.8-12.11	t-tests of slopes; confidence intervals of slopes; assumptions of linear regression
F, Apr 19	Multiple regression	GW 17.3-17.4	unique slopes; partial correlation; mediation; controlling for other variables
M, Apr 22	Multiple regression II		mediation again; model comparison; effect size (multiple R-squared)
W, Apr 24	Review 3		
F, Apr 26	**Exam 3 – covers Part III of course (introduction to the general linear model)**		
M, Apr 19	Review for Final		~ part 1 of course
W, May 1	Review for Final		~ part 2 of course
F, May 3	Review for Final		~ part 3 of course
Apr 30 - May 3	**In LAB Final Exam – covers all material from lecture and readings from Parts I, II, & III, open book & open note. Involves using R and interpreting output (just like in HW).**		
Th, May 9	**Final Exam, 7:30am-10:00am – covers all material from lecture and readings from Parts I, II, & III**		

Standard CU Classroom Policies

CU Policy for Students with Disabilities: If you qualify for accommodations because of a disability, please submit to me a letter from Disability Services in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact: 303-492-8671, Willard 322, and www.Colorado.EDU/disabilityservices

CU Sexual Harrassment Policy: The University of Colorado at Boulder policy on Discrimination and Harassment, the University of Colorado policy on Sexual Harassment and the University of Colorado policy on Amorous Relationships apply to all students, staff and faculty. Any student, staff or faculty member who believes (s)he has been the subject of discrimination or harassment based upon race, color, national origin, sex, age, disability, religion, sexual orientation, or veteran status should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. Information about the ODH, the above referenced policies and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at http://www.colorado.edu/odh

CU Religious Observance Policy: Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please notify the instructor of anticipated conflicts as early in the semester as possible so that there is adequate time to make necessary arrangements. See full details at
http://www.colorado.edu/policies/fac_relig.html

CU Classroom Behavior Policy: Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See policies at
http://www.colorado.edu/policies/classbehavior.html http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code

CU Honor Code: All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Other information on the Honor Code can be found at http://www.colorado/edi u/policies/honor.html http://www.colorado.edu/academics/honorcode/

The 10 tips to succeeding in this class

1. Learning statistics is up to you, and it will not happen unless you give your full effort and stay on top of the material. My job and the job of the TAs is to help you learn the material, not to do it for you (how could we?). Lectures are designed to supplement your reading, as a way to clarify the conceptually challenging material.
2. Do the assigned reading BEFORE class. You will have difficulty succeeding in this class if you do not do the readings when assigned. Weekly quizzes are designed to motivate you to keep up, and lectures assume that you have already read the material. Reading doesn't mean a quick once-over, of course; it means taking the time to think about and struggle with the material. I would guess that you should be spending ~ 1 hour reading before most classes. If you do this, the quizzes should not be a problem for you.
3. Use the *Seeing Statistics* web-based 'textbook' to your benefit. Learning statistics interactively and by *seeing* the concepts is a fantastic way to gain a sound grasp of the material. That is why I assigned (short) readings from the *Seeing Statistics* website—not because I want you to do more work, but because I *know*, from previous experience, that it will help you understand the material.
4. Do homework assignments, and give yourself plenty of time to complete them. Homework is where you will learn R and begin applying the concepts that you learn in lecture and readings. You will be able to begin homework in your lab the week before they are due. You can turn them in anytime between that lab and the following Monday.
5. Attend class and labs, and pay attention. My goal in lecture is to help you gain a conceptual understanding of the material that you have already been exposed to through your reading. When I assign final grades, I will round up or down depending on attendance. Please arrive on time and limit unnecessary conversation. If you know that you have attention problems or eyesight issues, sit at the front. It should go without saying, but using cell phones, checking email, and browsing the web are not allowed. Respect your own time and education, and those of your peers.
6. Take notes in class intelligently. My lectures will tend to be a mix of power points, old fashioned writing/drawing on the board and examples using R. I'll make my powerpoints available, but some material will not be included. The point of note taking in my class is not to write down formulas, definitions, etc – doing so is a waste of time given that those will be in my powerpoints and in the book. Rather, when we get to conceptual stuff, listen and try to understand the topic at hand. Once you get it, write yourself useful notes so that you can get it again when studying.
7. Don't fall behind. The material covered in this class is cumulative. If you fall behind, it is very difficult to catch up. Cramming the night before by studying your notes and the textbook tends not to work; statistics just doesn't work that way.
8. Make a few friends in your lab in case you have to miss lecture and need lecture notes. Also, doing homework and studying with friends is highly recommended. Make sure your homework is done by each person (no identical answers in groups).
9. Ask questions in lecture, lab, and office hours. Even if your question is, "Would you say that again in another way?" If you don't understand something, it is likely others are confused as well. Don't be afraid to ask "stupid" questions – that's how we learn! And come to office hours. We've made our office hours so that it is likely that everyone can attend at least one of our office hour times.
10. And last, but not least, try to have fun. Unfortunately, statistics is a topic that instills anxiety in a lot of people, especially those without a strong math background. The best way to reduce your anxiety and enjoy this class is to follow the steps above.