Statistical Methods in Psychology
Fall/Spring 20xx
M/W/F 10:00am – 10:50am

Instructor Information:
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Office hours Wednesday, XX:00 – YY:00
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Figure 1.
Horrendously
misrepresentative
bar graph.

Course Description:

Do you find yourself confused or overwhelmed by the numbers and jargon in research presentations and academic journal articles? A working knowledge of statistical techniques is essential for success in any field of psychological science. This course will provide you with the tools necessary to analyze data using the appropriate statistical techniques (both by hand and using IBM's statistical package software, SPSS), accurately interpret the results of the techniques you apply, and conduct a hypothesis test from start to finish in order to answer a research question. We will explore both descriptive statistics (measures of central tendency, frequency distributions, variability, and correlations) and inferential statistics (hypothesis significance testing, sampling distributions, t-tests, linear regression, and ANOVA).

In addition to understanding the mathematical approach to statistical methods, students will learn to apply the concepts of statistical analysis in the field of Psychology by conducting statistical tests on real-world data (generated by you!) throughout the semester. Finally, we will pay careful attention to the interpretation of statistical results. By the end of this class, students will be able to read and interpret statistical findings reported in peer-reviewed journal articles. Because of the growing prevalence of psychological science in popular media, we will also spend class time applying what we learn to the real world by identifying cases where statistical analyses are misused and inappropriate conclusions are drawn (see Figure 1 below).

Note: This course is a prerequisite to all advanced offerings in Psychology and is a requirement for Psychology concentrators. One credit in Introduction to Psychology is recommended but not required.

Course Goals:
After completing this course, students will be able to:

1. Articulate the purpose of each major statistical test.
2. Select and apply an appropriate statistical technique to a given dataset.
3. Conduct a hypothesis test to answer a psychological research question.
4. Accurately interpret the results of a statistical technique.
5. Apply the concepts and logic of statistics to popular and scientific reporting and, when appropriate, recommend a better alternative.
6. Utilize common statistical software (IBM SPSS) to analyze data electronically.
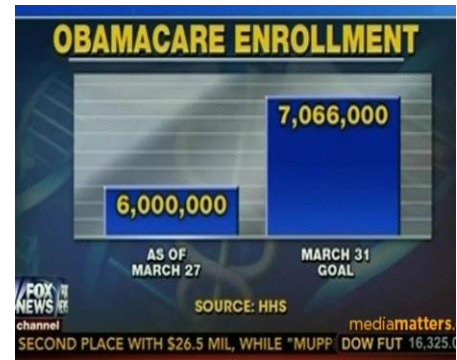
Course Materials
Howell, David C. (2004). *Fundamental Statistics for the Behavioral Sciences*. (7th Edition). Wadsworth.

IBM SPSS Statistical Analysis Software. Available for purchase in the bookstore, or for free on all university-owned computers. NOTE: please remember to back up your data! Consider using free cloud-synchronization programs Dropbox, Google Drive, etc. Almost every student loses their hard work at some point in college because it isn't backed up – this is now a completely preventable occurrence.

Any calculator for use on exams. Calculators on phones will not be permitted.

Assessments
1. Weekly problem sets (10% of course grade)
2. Two course midterms (20% of course grade each x2)
3. Final exam (30% of course grade)
4. Final project write-up (20% of course grade)
5. Extra Credit opportunity (up to 3% in extra credit)

Assignment Details
The assignments for this course are designed to facilitate learning with two distinct goals: conceptual knowledge and practical application.

Weekly problem sets will ensure that students are able to apply the concepts learned in lecture and guide students toward the kinds of problem solving, critical thinking, and mathematical expertise required on the midterm exams. The midterm exams will cover core course concepts and serve as progress checks for each student in how they are doing in the class. The final exam, although non-cumulative, will serve as a culmination of the course by asking students to solve and address problems that make holistic use of introductory statistics.

The final project is a unique opportunity in an introductory statistics class. It is designed to engage students' critical thinking and independent problem solving skills in a way that is not offered by many statistics courses, namely, by generating and testing your own psychological research hypothesis. Halfway through the course, students will submit a proposal for a research question they intend to answer, including how they will collect and structure a small amount of data and which statistical tools they plan to implement. After this proposal is approved, each student will generate his/her own dataset and attempt to answer their original research question using the tools made available in class and through SPSS. Finally, students will submit brief written research reports summarizing their question, scientific approach, statistical analyses, results, and conclusions. Because this assignment is designed to allow students to *practice* using statistics, emphasis will be placed on the statistical techniques used and their interpretation. It will not require rigorous theory or research design.

As an **extra credit opportunity,** students may (by the end of the semester) submit a two-page (double spaced) summary of misuse or misinterpretation of statistics in popular media, complete with a recommendation for an appropriate alternative. No two summaries may report on the same article or story, however; this is a case where the early bird gets the worm. A discussion thread on Canvas will report which articles have already been critiqued. See your professor if you would like to discuss a news article or story. This assignment will contribute up to 3% of your final course grade in extra credit.

Expectations for Students

The single best predictor of final course grades is students' attendance during lecture. All students are expected to attend lecture each week and to keep up with the material by completing problem sets. The content of this course will build on critical concepts covered early in the term – if you find yourself falling behind, set aside some extra time to focus on the core concepts covered in class! Students with questions about concepts, assignments, or the final project should come to office hours or make an appointment with the professor/TA.

Similarly, begin considering a research question/topic as early as possible. This will allow you to complete your proposal and final report early enough to not overlap with the final exam.

Late work will be accepted with a 10% off per day penalty.

Intentional and accidental violations of the academic honor code will be taken seriously and pursued according to the University policy (www.brown.edu/academics/college/degree/policies/academic-code). If you have any questions about what is and what is not considered acceptable, please contact your professor or TA and ask.

Academic Resources

- University library – databases, and online journals. Great for choosing a research topic and doing some background review: (library.brown.edu)
- IBM SPSS Statistical Package tutorials and manuals (available from Google search)
- University writing center – useful for editing your final report!
  (http://www.brown.edu/academics/college/support/writing-center)
- Departmental tutoring (http://brown.edu/academics/college/support/tutor)

SEAS/Disability Services Statement:

Course Outline/Schedule (broken down into weeks and individual meetings)

1.   Introduction to the Basics of Statistics
1.1.   Introduction - why does Psychology need statistics? (Howell, Chapter 1) *Complete introductory survey to collect class dataset.*
1.2.   Measurement, variables, and distributions. (Howell, Chapter 2)

2.   Descriptive Statistics
2.1.   Central tendency: mean, median, and mode. (Howell, Chapter 2 continued)
2.2.   Variability (Howell, Chapter 3)
2.3.   Z-scores and the normal distribution (Howell, Chapter 3 continued)

3.   Probability and the sampling distribution
3.1.   Overview of probability (Howell, Chapter 4)
3.2.   Sampling distribution of the mean and variance (Howell, Chapter 5)
3.3.   Sampling distribution, continued (Howell, Chapter 5 continued)

4.   Introduction to hypothesis testing
4.1.   History of hypothesis testing and the six steps (Howell, Chapter 6)
4.2.   Conducting a hypothesis test on a single sample (z-test) (Howell, Chapter 6 continued)
4.3.   Type I and Type II error, effect size. **Final project proposal due.** (Howell, Chapter 7)

5.   The *t*-distribution and *t*-tests
5.1.   *MIDTERM EXAM #1*
5.2.   Single sample *t*-tests: *t*-distribution, degrees of freedom, and parameter estimation (Howell, Chapter 8)
5.3.   Paired sample *t*-tests (Howell, Chapter 8 continued)

6.   *t*-tests, continued
6.1.   Independent samples *t*-tests (Howell, Chapter 9)
6.2.   Power and effect size (Cohen's *d*) (Howell, Chapter 14)
6.3.   Confidence intervals (Howell, Chapter 9 continued)

7.   Correlation, covariation and regression
7.1.   Covariance and Pearson's *r* (Howell, Chapter 10)
7.2.   Regression, part I. (Howell, Chapter 11)
7.3.   Regression, part II. (Howell, Chapter 11 continued)

8.   Complex analyses: multiple regression and ANOVA
8.1.   *MIDTERM EXAM #2*
8.2.   A brief introduction to multiple regression (Howell, Chapter 17)
8.3.   Analysis of Variance (ANOVA): introduction and logic (Howell, Chapter 12)

9.   ANOVA continued
9.1.   One-way ANOVA (Howell, Chapter 12 continued)
9.2.   One-way ANOVA continued, post-hoc comparisons of means (Howell, Chapter 12 continued)
9.3.   Two-way (factorial) ANOVA (Howell, Chapter 13)

10.   ANOVA wrap-up; alternative and non-parametric tests (if time remains.)
10.1.   Two-way ANOVA continued – more examples (Howell, Chapter 13 continued)
10.2.   Chi-squared: tests for goodness of fit and independence (Howell, Chapter 18)
10.3.   Chi-squared: more examples. *Final project report due.* (Howell, Chapter 18)

11.   Application of statistics, real-world issues, and review
11.1.   Statistical ethics and current issues in psychological science (Rosenthal article)
11.2.   Extra credit results (for fun) and final exam review
11.3.   Final exam review continued

12.   Final Exam