Course Overview

Course: Introductory Psychological Statistics, U09-Psychology 300

Semester: Spring 2014

Description: Introduction to the basic methods of descriptive and inferential statistics. Major topics include graphic representation of data, central tendency and variability, probability, the normal distribution, sampling distributions, correlation, analysis of variance, chi-square and non-parametric tests. Emphasis will be placed on understanding the logic of statistics and on determining appropriate statistical tests. The course is rigorous; an understanding of high-school algebra is required.

Instructor: David E. Crowley, Ph.D. Office hours by appointment. Contact by e-mail: dcrowley@artsci.wustl.edu. Mobile phone: 314-378-5173.


Note: Students are advised to avoid electronic-only editions of the text, or ordering from the internet.

Recommended Calculator: TI-30Xa

Free Online Text Resources (for first edition)

Weekly Course Schedule:

1. Course introduction, Introduction to statistics and research design (Ch1) - January 14
2. Frequency distributions and visual displays of data (Ch 2-3) – January 21
3. Exam 1 – January 28
4. Central tendency, variability, sampling and probability (Ch 4-5) – February 4
5. The normal curve, standardization and z-scores (Ch 6) – September February 11
6. Exam 2 – February 18
7. Hypothesis testing with z-tests (Ch 7) – February 25
8. Confidence intervals, effect size and statistical power (Ch 8) – March 4
    Spring Break – March 11
9. Single-sample and paired-sample t-tests (Ch 9) – March 18 (ACTRAC proposal due)
10. Exam 3 – March 25
11. Independent samples t-test (Ch 10) – April 1
12. One-way between-, and within-groups ANOVA (Ch 11) – April 8 (ACTRAC draft due)
13. Exam 4 – April 15
14. Correlation and regression (Ch 13-14) – April 22
15. Chi square and other nonparametric tests (Ch 15) – April 29 (ACTRAC project due)
16. Exam 5 – May 6
**Grading Criteria:**

<table>
<thead>
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<th>Type</th>
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<tr>
<td><strong>Standard</strong></td>
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<td>5 Exams</td>
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<tr>
<td>Attendance-Homework</td>
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<td>Weekly Quizzes</td>
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* See Attendance-Homework option for explanation
Learning Objectives

1. To refresh and apply basic math skills
2. To understand the fundamental definition of statistics and experimental design
3. To comprehend the difference between descriptive and inferential statistics
4. To understand and apply descriptive statistical techniques
5. To understand and use theoretical distributions including the normal and sampling distributions
6. To understand and apply null-hypothesis testing to experimental designs using the t-test
7. To understand and use analysis of variance
8. To understand apply correlation and regression techniques
9. To understand and apply nonparametric statistics

Course Requirements and Grading

1. The course is divided into five units, each consisting of 2-3 text chapters. There will be one exam per unit, covering both conceptual material and computations. Since advanced statistical concepts naturally build from simpler ones exams will emphasize material presented in their respective units but will include more basic material.
2. Each exam contributes approximately 19% toward the final grade.
3. Weekly online quizzes are required and cover definitions and other conceptual material for the following week's class. The quizzes contribute 5% to the final grade.
4. Students may individually choose an attendance-homework option. This option requires class attendance and homework. The final grade for students choosing this option will be based on the five exams, each contributing approximately 15% toward the final grade, and on attendance/homework contributing the equivalent of a sixth exam with a grade of 100.
5. No extra credit assignments will be available. No make-up exams are possible for students who are dissatisfied with their exam scores.
6. A grade of incomplete will not be given, unless supported by timely documentation. When such circumstances occur prior to the deadline for dropping a course, students are encouraged to drop the course rather than requesting an incomplete..

Grade Conversion

<table>
<thead>
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<th>Minimum Cutoff</th>
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Attendance-Homework Option

1. The attendance/homework will probably improve your grade, but can’t hurt it.
2. If you fulfill this option, your attendance/homework will count one exam grade. Your final grade will be based equally on the five exams and your attendance/homework, instead of just five exams.
3. You are expected to attend all classes, including the exam dates, and complete all homework assignments by the posted due dates. Attending all classes and turning in all homework, if
satisfactory, will yield an attendance/homework grade of 100. Missing one class or homework will yield a grade of 93.

4. Solutions to odd-numbered homework problems may be found at the back of the textbook or in Excel files posted to Blackboard. To be considered satisfactory, your homework must show that you have worked through each assigned problem, not merely copied the final answer from the posted solution. If you are unable to arrive at an answer that agrees with the text, please contact the instructor, attend the regular help session, work with a classmate or contact one of the Cornerstone Mentors.

5. **Two or more missed classes, unless excused in advance, will make you ineligible for this option.** Your final grade will be based only on your exams and you quizzes.

6. An absence is excused when a student e-mails the instructor at least a day before the class day or telephones the instructor on the class day. E-mailed excuses will not be accepted on or after the day of the class.

7. You may withdraw from this option at any time.

8. Homework is due at the class session after it was assigned. For example, Chapter 1 homework is due at the second class meeting.

9. Homework grades for current and past assignments will be communicated via Blackboard: The following grades are used:
   - 90 - 98 - More or less satisfactory completion of all assigned problems;
   - 80 - 88 - At least one assigned problem missing with more or less satisfactory completion of the remainder.
   - 70 - 78 - Unsatisfactory completion of at least one problem, with more or less satisfactory completion of the remainder.
   - 0 - not handed in;
   - null - opted out.

10. Five percent of the final grade for students choosing this option will be based on homework grades.

Thanks to Dr David Dodd for devising this option.

**ACTRAC Option**

For students taking the 4-credit ACTRAC option, the ACTRAC project will count 20% of the final grade. An ACTRAC project may be a paper between 2500 and 3000 words, or another effort approved by the instructor.

**Late and Missed Exams**

1. Students are expected to take all exams during class on the announced exam dates. Course history has shown that students who miss an exam usually do not perform well on the make-up exam and might also fall behind, which affects performance on subsequent exams.

2. **All exams must be taken during class on the date indicated on the course calendar, unless extenuating circumstances exist and are documented in writing.** Students who have emergencies that prevent them from attending exams must inform the instructor as soon as the emergency arises. Excuses presented after the missed exam will not be accepted, unless supported by documentation.

3. If a student misses an exam and cannot provide documentation, the exam can be taken late, but a 10% late penalty will be assessed. A missed final exam unsupported by prior notice or by adequate documentation will be given a grade of zero.

4. All late exams, excused or unexcused, are administered in the University College offices by appointment for a $5.00 fee, and require authorization by the instructor. To schedule a make-up appointment, please contact University College at 314-935-6700.

5. Students who miss more than one exam are urged to drop the course.

6. All makeup exams, homework and quizzes must be completed before the final exam. Any work submitted after the final receives a grade of zero.
The Final Exam

The instructor grades the final in the classroom, as he does the other exams. If you want to review your final exam after it’s graded, please wait in the classroom. The instructor will not make a special trip to the campus after grades are turned in to meet with you.

Grading Disputes

If you feel that an item on your test has been graded incorrectly, you may submit the Item Review Form available on Blackboard. The instructor will re-grade the item in question (meaning you may end up with a higher or a lower score than you were initially assigned).

The instructor is happy to explain why a particular answer is correct (or incorrect), but will not debate points (in class or in office hours). If you have a question or concern about the grading of a particular item, the only way to have your grade reviewed is to fill out the Item Review Form. You must fill out an Item Review Form for each item that you would like to have reviewed. Finally, Item Review Forms must be submitted before the next scheduled exam. If you would like to have an item reviewed from Exam 1, you must submit the form before Exam 2.

Important recommendations

1. Mastering statistics requires that students work regularly and avoid procrastination and cramming. Attend every class session. Read the text and complete assigned homework problems either prior to or soon after the lecture that covers the material.
2. Each topic depends on understanding the material that precedes it.
3. Regular class attendance is strongly recommended but not required. Students missing class are responsible for all material presented in class and for any modifications to the course calendar that are announced in class. If you expect to miss a class, make arrangements before hand with a classmate who takes good class notes.
4. Homework will be assigned for each chapter. It is strongly recommended that students complete homework assignments, but it is not required. Homework provides excellent preparation for exams. Time will be provided during class for students to ask questions or seek help with homework problems.
5. Students should contact the instructor at the FIRST sign of difficulty with the material.
6. Students should have a pocket calculator capable of taking square roots and having a memory. Cell-phone calculators are usually inadequate. The instructor suggests the TI-30Xa.
7. Please get a quad-ruled pad or notebook for homework or print free downloadable graph paper.

Additional Suggestions

1. Many students benefit by copying their homework over neatly before handing it in. Not only is it easier on the instructor but it also helps in understanding the problem solution process.
2. Similar benefits can be found by copying class notes over.
3. The student workbook and text websites (above) contain helpful practice exams and other useful learning aids.
4. With statistics, optimal learning styles differ among students: For some, the ability to solve computational problems flows naturally from a basic understanding of the underlying concepts. For others, it is better to focus on solving problem first, and then let an understanding of concepts emerge after practicing with many kinds of statistical computations.
5. If unusual circumstances arise please notify the instructor right away.
6. Triple-check computations for all tests, for all homework, and for all quizzes!
7. If you require special accommodations for lectures or for taking exams please contact the Disability Resources Coordinator at 314-935-4062. For general academic assistance, consult your academic adviser and take advantage of Cornerstone’s wide variety of student resources: http://cornerstone.wustl.edu 314-935-5970.
8. The instructor holds review and help sessions most Tuesdays, before class, from 4:00-5:30 PM, in January Hall, Room 104. These sessions review computation problems on the board and help students prepare for exams. Please check with instructor by phone (314-378-5173) or email dcrowley@artsci.wustl.edu before attending.

Students are expected to comply fully with the University’s policy on academic integrity. If you are uncertain about what constitutes a violation of the policy, ask the instructor, or access the policy at: http://www.wustl.edu/policies/undergraduate-academic-integrity.html

You should plan on participating in the course evaluation at the end of the semester and may do so by visiting: http://evals.wustl.edu
Lessons

Session 1: Intro to Statistics and Research Design: January 14, 2014: 6:00 PM – 8:30 PM

Assignment due at class time: Read Chapters 1 and Appendix A, complete Chapter 1 quiz online.

Topics:

1. Course introduction
2. Description and inference
3. Populations and samples
4. Continuous and discrete observations
5. Independent, dependent and confounding variables
6. Reliability and validity
7. Hypothesis testing
8. Experiment vs. correlation

Session 2: Frequency Distributions and Visual Displays of Data: January 21, 2014 6:00 PM – 8:30 PM

Assignment due at class time: Read Chapters 2 & 3; Complete Chapter 2 & 3 quizzes online; Nine (9) homework problems: 1.1, 1.13, 1.24, 1.25, 1.27, 1.29, 1.30, 1.34 & 1.35(a-d only)

Topics:

1. Frequency tables
2. Grouped frequency tables
3. Histograms and frequency polygons
4. Normal and skewed distributions
5. Misleading graphs
6. Scatterplots
7. Line graphs
8. Bar graphs & Pareto charts
9. Pictorial graphs
10. Pie charts

Session 3: Exam 1 (Covers chapters 1-3): January 28, 2014: 6:00 PM – 8:30 PM

Assignment due at class time: Prepare for Exam 1 (Covers Ch 1-3): Homework problems 2.15, 2.16, 2.19, 2.20, 2.29 (a-d), 2.30 (a-e), 2.32, 2.36 (a-c,e-f), 3.18, 3.19, 3.20, 3.29, 3.30

Session 4: Central tendency, variability, sampling and probability: February 4, 2014: 6:00 PM – 8:30 PM

Assignment due at class time: Read Chapters 4 & 5; Complete Chapter 4 & 5 quizzes online; No homework problems due.

Topics:

1. Mean
2. Median
3. Mode
4. The effect of outliers
5. Which measure of central tendency is best
6. Range
7. Variance
8. Standard deviation
9. Random sampling
10. Biased samples
11. Frequency-based probability
12. Independence and probability
13. Developing hypotheses
14. Decision making
15. Type I and Type II errors

Session 5: The normal curve, standardization and z-scores: February 11, 2014: 6:00 PM – 8:30 PM

Assignment due at class time: Read Chapters 6; Complete Chapter 6 quiz online. Homework problems: 4.12, 4.13, 4.14, 4.22, 4.27, 5.26, 5.27, 5.28, 5.29, 5.47

Topics:

1. Standardization
2. Transforming raw scores to z scores
3. Transforming z scores to raw scores
4. Using z scores to make comparisons
5. Transforming z scores into percentiles
6. The central limit theorem
7. Creating a distribution of means
8. Characteristics of a distribution of means
9. Using the central limit theorem to make comparisons with z-scores

Session 6: Exam 2 (Covers chapters 4-6) February 18, 2014: 6:00 PM – 8:30 PM

Homework problems: 6.14, 6.16, 6.17, 6.20, 6.21, 6.25, 6.26, 6.27 & 6.42

Session 7: Hypothesis testing with z tests: February 25, 2014: 6:00 PM – 8:30 PM

Assignments due at class time: Read Chapter 7; Complete Chapter 7 quiz online. No homework problems due.

Topics:

1. The z table
2. Raw scores, z scores and percentages
3. The z table and distributions of means
4. The three assumptions for statistical analysis
5. The six steps of hypothesis testing

Session 8: Confidence intervals, effect size and statistical power: March 4, 2014: 6:00 PM – 8:30 PM

Assignments due at class time: Read Chapters 8; Complete Chapter 8 quiz online. Homework problems: 7.1, 7.3, 7.17, 7.18, 7.19, 7.23, 7.24, 7.42, 7.49

Topics:

1. Interval estimates
2. Confidence intervals based on z distributions
3. Effect size and Cohen’s d
4. Statistical power
Session 9: The single-sample and paired-sample t tests: March 18, 2014: 6:00 PM – 8:30 PM

Assignment due at class time: Read Chapter 9, complete Chapter 9 quiz online. Homework problems: 8.22, 8.27, 8.28, 8.29, 8.30, 8.31, 8.32, 8.33 & 8.34 (ACTRAC proposal due)

Topics:

1. t distributions
2. Estimating population standard deviation from the sample
3. Calculating standard error for t
4. and paired-sample t tests
5. Calculating t
6. Degrees of freedom
7. The six stages of single-sample sample t tests
8. The six stages of paired sample t tests


Session 11: The independent samples t test: April 1, 2014: 6:00 PM – 8:30 PM

Assignments due at class time: Read Chapter 10, complete Chapter 10 quiz online. No homework problems due.

Topics:

1. A distribution of differences between means
2. The six stages of independent sample t tests
3. Reporting the statistics
4. Confidence intervals
5. Effect size

Session 12: Between-, and within-groups ANOVA: April 8, 2014: 6:00 PM – 8:30 PM

Assignments due at class time: Read Chapter 11, complete chapter 11 quiz online. Homework problems 10.5, 10.6, 10.7, 10.8, 10.19, 10.24 (a & b only), 10.28 & 10.29 (ACTRAC draft due)

Topics:

1. The F distribution
2. The F table
3. The language and assumptions of ANOVA
4. One-way between-groups ANOVA
5. The logic and calculation of the F statistic for a between-group ANOVA
6. The ANOVA Summary table
7. Making a decision
8. $R^2$ ANOVA effect-size index
9. Post-hoc tests
10. The Tukey HSD

Session 14: Correlation and regression: April 22, 2014: 6:00 PM – 8:30 PM Assignments due at class time: Read chapters 13 & 14, complete chapter 13 and 14 quizzes online. No homework problems due.

Topics:

1. The characteristics of correlation
2. Correlation is not causation
3. The Pearson correlation coefficient
4. Hypothesis testing with the Pearson correlation coefficient
5. Linear regression
6. Regression with z scores
7. The regression equation
8. Regression and error
9. Regression to the mean

Session 15: Chi Square and other nonparametric tests. April 29, 2014: 6:00 PM – 8:30 PM

Assignments due at class time: Read Chapter 15 and complete Chapter 15 quiz online. Homework problems: 13.18, 13.19, 13.33, 13.34, 14.21 & 14.23 (ACTRAC project due)

Topics:

1. When to use nonparametric tests
2. Chi-Square test for independence
3. Chi-Square test for goodness of fit
4. Cramer’s V, the effect-size index for Chi-Square
5. Spearman’s rand-order correlation coefficient
6. Mann-Whitney U test for independent samples