

# Y502: Intermediate Statistics Applied to Education

## Information

### Course

- Y502, Spring 2006, Section Number 15787 (January 10–April 27).
- Y500, which is a laboratory component to the course, is required.
- Web Page <http://www.indiana.edu/~kenkel/courses>.
- Note: Y502 and Y500 require block enrollment (Course Number BE22436), and thus one cannot register for either course directly.

### Instructor

- Ken Kelley, Ph.D.
- Email Address: [KKIII@Indiana.Edu](mailto:KKIII@Indiana.Edu)
- Office Location: 4004 W. W. Wright Education Building
- Office Phone Number: (812) 856-8330
- Office Hours: Tuesday 8:00–9:30AM and by appointment.

### Laboratory Instructor

- Tsai-Feng Wang
- Email Address: [TsWang@Indiana.Edu](mailto:TsWang@Indiana.Edu)
- Office Location: 4015F W. W. Wright Education Building
- Office Phone Number (outside of the School of Education): (812) 856-8313 Ext. 36752.
- Office Phone Number (inside the School of Education): 36752.

### Time and Location

- Where: Room 1220 in the W. W. Wright Education Building.
- When: 2:30PM to 3:45PM each Tuesday and Thursday.
- Students are expected to attend all lectures and laboratory meetings.

### Prerequisites

- Competency in basic algebra, evaluated via a universal Y502 Pretest.
- Familiarity with introductory research and statistical concepts as might be learned in a successful completion of an “introduction to statistics” course at the undergraduate level or P501.

## Course Description

This course is designed as an intermediate statistics course for doctoral level students in the behavioral and educational sciences. The course will review basic concepts of statistics and probability, as well as descriptive and graphical techniques. The course will cover correlational techniques and the following inferential techniques: comparisons of means (e.g., the  $z$ -test,  $t$ -test, one-way analysis of variance), multiple comparisons procedures for means, simple regression (i.e., one outcome and one predictor), correlation procedures (in addition to Pearson’s product moment correlation), goodness of fit and tests of independence (e.g., chi-square tests), issues of sample size planning (from a power and precession perspective), overview of multiple regression and two-way analysis of variance, and time permitting a brief introduction to the bootstrap technique. The assumptions in which the inferential tests are based will be stressed and the consequences of failing to meet the assumptions will be discussed. The importance of defining the question of interest and

the use of confidence intervals and effect sizes for reporting and interpretation of results will be a theme permeating the course.

## Grading

Grading for the lecture component of the course will be based on homework assignments, the midterm exam, data analysis application, and the final exam (the laboratory component will have satisfactory/fail grade independent of the course). The weighting of the four components of the course grade will be 30%, 25%, 10%, and 35% for the homework assignments, the midterm exam, data analysis application, and the final exam, respectively. Thus, the following equation governs the numeric percentage score for the final course grade:

$$Grade = .30Homework + .25Midterm + .10Application + .35Final.$$

Because numeric grades are reported as ordinal variables represented by letters, the way in which the numeric grade maps onto letter grades will be as follows:

<i>Numeric Score</i>	<i>Letter Grade</i>	<i>Description of Achievement</i>
96–100	A+	Incredible achievement
91–95	A	Outstanding achievement
86–90	A–	Excellent achievement
81–85	B+	Very good achievement
76–80	B	Good achievement
71–75	B–	Fair achievement
66–70	C+	Not wholly satisfactory achievement
61–65	C	Marginal achievement
56–60	C–	Unsatisfactory achievement
51–55	D	Significant lack of achievement
≤ 50	F	Complete lack of achievement

After the midterm exam, there will be an option of doing one extra credit assignment. The extra credit assignment will be student specific and worth up four raw percentage points added to the final grade. Thus, the equation governing the numeric score for the final course grade is functionally defined as follows:

$$Grade = .30Homework + .25Midterm + .10Application + .35Final + .04Extra,$$

with scores greater than 100 being considered an A+. The extra credit assignment will require the student to contact the instructor so that the student and instructor can determine exactly what topic the extra credit assignment will cover. The extra credit assignment is broadly defined so that each student can potentially tailor the assignment to his or her particular area of interest.

Each extra credit assignment will require the student to first read a chapter or a review article covering a statistical technique or methodological aspect of research not covered in the course, yet one that might be a useful technique for the student’s research area. A manuscript reviewing the chapter or article will then be written that discusses the work, relates the covered technique(s) to other techniques, and discusses how the technique is currently (mis)used or how it might be useful for the student’s area of interest. The length of the paper should be 5–7 double spaced pages (conforming roughly to APA style). The goal of the extra credit assignment is to introduce the student to statistical techniques and methodological issues not covered in Y502, but yet are potentially helpful when trying to understand data. No more than 20% of the paper should focus on the applied research where the technique is used or can be valuable. *Thus, at least 80% of the paper should be written purely about the methodological technique itself.*

If the student has an idea for an extra credit project that differs from the one proposed here, he or she should discuss the idea with the instructor for possible consideration.

## References

### Textbooks

- Howell, D. C. (2002). *Statistical Methods for Psychology* (5th ed.). Pacific Grove, CA: Duxbury
- Carver, R. H., & Nash, J. G. (2002). *Doing Data Analysis With SPSS: Version 12*. Belmont, CA: Brooks/Cole

### Articles (Posted on Course Web Page)

- Cohen, J. (1990). Things that I have learned (so far). *American Psychologist*, *45*, 1304–1312.
- Cohen, J. (1994). The earth is round ( $p < .05$ ). *American Psychologist*, *49*, 997–1003.
- Hagan, R. (1997). In praise of the null hypothesis. *American Psychologist*, *52*.
- Kelley, K., Maxwell, S. E., & Rausch, J. R. (2003). Obtaining power or obtaining precision: Delineating methods of sample size planning. *Evaluation & the Health Professions*, *26*, 258–287.
- Rodgers, J. (1999). The bootstrap, the jackknife, and the randomization test: A sampling taxonomy. *Multivariate Behavioral Research*, *34*, 441–456.
- Rosenthal, R. (1990). How are we doing in soft psychology? *American Psychologist*, *45*, 775–776.
- Thompson, B. (2002). What future quantitative social science research could look like: Confidence intervals for effect sizes. *Educational Researcher*, *31*, 24–31.
- Wilkinson, L., & the American Psychological Association Task Force on Statistical Inference. (1999). Statistical methods in psychology: Guidelines and explanations. *American Psychologist*, *54*, 594–604.

### Suggested Supplemental Resources at the Introductory Level

- Howell, D. C. (2004). *Fundamental statistics for the behavioral sciences* (5th ed.). Pacific Grove, CA: Duxbury.
- Lomax, R. G. (2001). *An introduction to statistical concepts for education and behavioral sciences*. Mahwah, NJ: Lawrence Erlbaum Associates.
- Moore, D. S. & McCabe, G. P. (2006). *Introduction to the practice of statistics* (5th ed.). New York, NY: W. H. Freeman and Company.

### Suggested Supplemental Resources at the Intermediate Level

- Everitt, B. S. (2001). *Statistics for psychologists: An intermediate course*. Mahwah, NJ: Lawrence Erlbaum Associates
- Hays, W. L. *Statistics* (5th ed). New York, NY: Harcourt Brace College Publishers.
- Tamhane, A. C. & Dunlop, D. D. (2000). *Statistics and data analysis: From elementary to intermediate*. Upper Saddle River, NJ: Prentice Hall.

## Tentative Course Schedule

Topic(s)	Reading(s)
<ul style="list-style-type: none"> <li>●Introduction to course</li> <li>●Design, Measurement, and Statistics in Research</li> </ul>	<ul style="list-style-type: none"> <li>●Preface</li> <li>●Chapter 1</li> </ul>
<ul style="list-style-type: none"> <li>●Visualizing Data</li> </ul>	<ul style="list-style-type: none"> <li>●Chapter 2, Sections 1–5</li> </ul>
<ul style="list-style-type: none"> <li>●Notation</li> <li>●Expectation</li> <li>●Central Tendency</li> <li>●Variability</li> </ul>	<ul style="list-style-type: none"> <li>●Chapter 2, Sections 7–10, 12–13</li> </ul>
<ul style="list-style-type: none"> <li>●Probability Density Functions</li> <li>●The Standard Normal Distribution</li> </ul>	<ul style="list-style-type: none"> <li>●Chapter 3</li> </ul>
<ul style="list-style-type: none"> <li>●Sampling Distributions</li> <li>●Hypothesis Tests</li> <li>●Type I and Type II Errors</li> </ul>	<ul style="list-style-type: none"> <li>●Chapter 4</li> </ul>
<ul style="list-style-type: none"> <li>●Introduction to Probability Theory</li> <li>●The Binomial Distribution</li> </ul>	<ul style="list-style-type: none"> <li>●Chapter 5, less Section 9</li> </ul>
<ul style="list-style-type: none"> <li>●Categorical Data Analysis</li> <li>●Chi Square Distribution</li> <li>●Cohen’s Kappa</li> </ul>	<ul style="list-style-type: none"> <li>●Chapter 6, less Section 5</li> </ul>
<ul style="list-style-type: none"> <li>●<b>Midterm Exam</b></li> </ul>	<ul style="list-style-type: none"> <li>●Covers <i>all</i> material up to this point.</li> </ul>
<ul style="list-style-type: none"> <li>●Hypothesis Tests for one or two means</li> </ul>	<ul style="list-style-type: none"> <li>●Chapter 7</li> <li>●Chapter 9, Sections 8, 10–13</li> </ul>
<ul style="list-style-type: none"> <li>●Issues in research and the use of null hypothesis significance tests</li> </ul>	<ul style="list-style-type: none"> <li>●Wilkinson &amp; APA Task Force Reading (1999)</li> <li>●Cohen Reading (1990)</li> <li>●Cohen Reading (1994)</li> <li>●Hagen Reading (1997)</li> </ul>
<ul style="list-style-type: none"> <li>●Effect Size Measures</li> </ul>	<ul style="list-style-type: none"> <li>●Rosenthal (1990) Reading</li> <li>●Thompson Reading (2002), Pages 25–31, less 28</li> </ul>
<ul style="list-style-type: none"> <li>●Statistical Power</li> <li>●Statistical Precision</li> <li>●Power versus Precision</li> </ul>	<ul style="list-style-type: none"> <li>●Chapter 8</li> <li>●Kelley et al. reading (2003), Pages 258–273; 276–279</li> </ul>

•Correlation and Regression: Description	•Chapter 9, Sections 1–6, 10–13
•Correlation and Regression: Inference	•Chapter 9, Sections 7–13
•Other Correlation Measures	•Chapter 10
•One-Way ANOVA	•Chapter 11
•Multiple Comparison Procedures	•Chapter 12
•Overview of Factorial ANOVA	•Chapter 13
•Overview of Multiple Regression	•Chapter 15
•Overview of the Bootstrap Technique	•Chapter 18, Sections 1–5 •Rodgers Reading (1999) •Review all exam material
• <b>Final Exam: 7:15–9:15PM, May 2nd</b>	•Covers <i>all</i> post-midterm material •Knowledge of pre-midterm material is necessary only for its cumulative effects on post-midterm material

## Assignments

Homework will be assigned on a regular basis and it will be due at the beginning of class the following week. Students are encouraged to work together on homework assignments. However, each student is responsible for turning in his or her own work.

## **Academic Honesty and Intellectual Integrity**

Academic dishonesty of any kind (e.g., cheating, plagiarism, record altering, etc.) will not be tolerated. As stipulated in *General Principles and Policy* section of Indiana University's Academic Handbook (2005, pp. 174–175; which is available in Portable Document Format [i.e., a PDF file] at the following Internet address:

[http://www.indiana.edu/~deanfac/acadhbk/acad\\_handbk\\_2005.pdf](http://www.indiana.edu/~deanfac/acadhbk/acad_handbk_2005.pdf)):

The faculty member has a responsibility to foster the intellectual honesty as well as the intellectual development of students. He or she should carefully scrutinize methods of teaching and assignments in order to be sure that they encourage students to be honest....should the faculty member detect signs of plagiarism or cheating, it is his or her most serious obligation to investigate these thoroughly, to take appropriate action with respect to the grades of students, and in any event to report the matter to the Dean for Student Services (or equivalent administrator). The necessity to report every case of cheating, whether or not further action is desirable, arises particularly because of the possibility that this is not the students first offense, or that other offenses may follow it. Equity also demands that a uniform reporting practice be enforced; otherwise, some students will be penalized while others guilty of the same actions will go free. A university is devoted to the discovery and communication of knowledge. In this endeavor, intellectual integrity is of the utmost importance, and correspondingly, its absence is taken very seriously. By enrolling at Indiana University, students commit themselves to its ideals and must expect to find these ideals actively fostered and defended....in order to encourage learning and to judge its quality, examinations and assignments are employed. To evaluate these with justice and fairness, it is necessary that they be executed with complete honesty.

Thus, any incident of academic dishonesty will be reported and the student will be required to complete an alternate form of the particular assignment where the dishonesty occurred.

### **Syllabus Disclaimer**

The information provided on this syllabus is tentative and subject to change. In fact, it will almost certainly change from time to time. Major changes to the syllabus will be noted during lecture.