Y502: Intermediate Statistics

Information

<u>Course</u>

- •Y502, Fall 2007, (August 27–December 10, 2007).
- •Web Page http://www.indiana.edu/~kenkel/courses.
- •Note: Y502 and Y500 require block enrollment (Course BE502).

Instructor

- •Ken Kelley, Ph.D.
- •Email Address: KKIII@Indiana.Edu
- •Office Location: 4040 W. W. Wright
- •Office Phone Number: (812) 856-8330
- •Office Hours: Monday, 8:00–9:30AM and by appointment.

Laboratory Instructor

- •Jocelyn Holden
- •Email Address: jeholden@indiana.edu
- •Office Location: 4015D W. W. Wright
- •Office Phone Number: (812) 856-8313 Ext. 36750.
- •Office Hours: Wednesday, 1:00–2:30PM and by appointment.

Time and Location

Lecture

- •Where: Room 1006 in W. W. Wright.
- •When: 9:30–10:45AM Mondays and Wednesdays.
- •The final exam is December 10th, 10:15–12:15AM (Room TBA).
- •Students are expected to attend all lectures.

Laboratory

- •Where: Room 2015 in W. W. Wright.
- •When: 12:00AM-1:00PM Wednesday.
- •Students are expected to attend all laboratory meetings.

Prerequisites

•Competency in algebra at the high school level (evaluated with a universal Y502 assessment).

•Familiarity with introductory research and statistical concepts as might be learned in an "introduction to statistics" course at the undergraduate level, P501, or Y520.

Course Description

This course is designed to provide doctoral level students with an understanding of the fundamental descriptive and inferential statistical techniques used in the behavioral, educational, and social sciences. The course will first *review* basic concepts of graphical techniques, descriptive statistics, and probability. The course will then cover the following inferential issues and techniques:

(a) the conceptual underpinnings of effect sizes, null hypothesis significance tests, confidence intervals, (b) the comparison of means (specifically the z-test, t-test, one-way analysis of variance, and multiple comparisons procedures), (c) correlation procedures (Pearson's product moment correlation and beyond), (d) simple regression (i.e., one outcome and one explanatory variable), (e) basic categorical data analysis (specifically χ^2 goodness of fit as well as χ^2 tests of independence), and (f) issues of research design (such as the lack of randomization as well as sample size planning from a power analytic and accuracy in parameter estimation perspective). The assumptions the inferential procedures are based will be stressed and the consequences of failing to meet the assumptions will be discussed. The importance of defining the precise research question of interest and the use of confidence intervals and effect sizes for reporting and interpreting the results will be a theme permeating the course. In addition to the methods and techniques discussed in the lecture component, students will be introduced to the statistical program SPSS in the laboratory component so that the methods discussed in the lecture component can be implemented with a computer program. Necessary routines not available with SPSS will be done in the statistical program R.

Grading

Grading for the lecture component of the course will be based on homework assignments (35%), the midterm exam (25%), data analysis application (2.5%), research critique (2.5%), and the final exam (35%). The following equation will thus govern the numeric percentage score for the course grade:

Grade = .35Homework + .25Midterm + .025Application + .025Critique + .35Final.

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

| Numeric Score | Letter Grade | Description of Achievement |
|---------------|--------------|-------------------------------------|
| ≥ 96 | A+ | Incredible achievement |
| 91 - 95.99 | A | Outstanding achievement |
| 86 - 90.99 | A- | Excellent achievement |
| 81-85.99 | B+ | Very good achievement |
| 76 - 80.99 | В | Good achievement |
| 71 - 75.99 | B- | Fair achievement |
| 66-70.99 | C+ | Not wholly satisfactory achievement |
| 61 - 65.99 | C | Marginal achievement |
| 56-60.99 | C- | Unsatisfactory achievement |
| 51 - 55.99 | D | Significant lack of achievement |
| < 51 | 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 to 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 = .35Homework + .25Midterm + .025Application + .025Critique + .35Final + .04Extra.

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. Information about the extra credit is available on the course web page. Note that the extra credit assignment is broadly defined so that each student can potentially tailor the assignment to his or her particular area of interest.

The laboratory component is graded on a satisfactory/fail scale that is independent of the course grade.

References

<u>Textbooks</u>

Required

Howell, D. C. (2007). Statistical Methods for Psychology (6th ed.). Pacific Grove, CA: Duxbury *Optional*

Kirkpatrick, L. A. & Feeney, B. C. (2006). A Simple Guide to SPSS for Windows, Version 14. New York, NY: Wadsworth

Articles (Posted on Course Web Page)

- 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.
- 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

| Date(s) | $\operatorname{Topic}(\mathbf{s})$ | $\mathbf{Reading}(\mathbf{s})$ |
|--------------|--|---|
| •8/27 | •Welcome to Y502 | |
| •8/29 | •Introduction and Rationale of Y502 | •Preface •Chapter 1 |
| •9/3 | •Visualizing Data | •Chapter 2, Section 1–5 |
| •9/5 | Central TendencyVariabilityOther Ways to Describe Data | •Chapter 2, Sections 7–10, 12–13 |
| •9/10-9/12 | Probability Density FunctionsThe Standard Normal Distribution | •Chapter 3 |
| •9/17-9/19 | Sampling DistributionsHypothesis Tests | •Chapter |
| •9/24 | •Introduction to Probability Theory | •Chapter 5, less Section 10 |
| •9/26-10/1 | •The Binomial Distribution | •Chapter 5, less Section 10 |
| •10/3 | •Review and solidification of material | •Midterm Study Guide |
| •10/8 | •Midterm Exam | •Covers <i>all</i> material up to this point |
| •10/10-10/17 | •Hypothesis Tests for One or Two Means | •Chapter 7 |
| •10/22 | •Issues of Sample Size Planning | Chapter 8, Sections 1–6 Kelley et al. reading (2003) |
| •10/24-10/31 | •Correlation and Regression | •Chapter 9 |
| •11/5-11/12 | •One-Way Analysis of Variance | •Chapter 11 |

| •11/14 | $\bullet {\rm Multiple}$ Comparison Procedures | •Chapter 12 |
|--------------|---|--|
| •11/19 | •Chi Square (χ^2) Distribution • χ^2 Goodness of fit | •Chapter 6, Sections 1–2 |
| •11/21 | •No class: Happy Thanksgiving! | |
| •11/26-11/28 | $\bullet \chi^2$ Test of Independence \bullet Measures of Association & Agreement | •Chapter 6, Sections 3, 6, 7, 9, & 10 |
| •12/3 | Issues in Quantitative ResearchThe Use of Null Hypothesis Significance Tests | Wilkinson & APA Task Force (1999) Rosenthal (1990) Thompson (2002) |
| •12/5 | $\bullet \ensuremath{\operatorname{Review}}$ and solidification of material | •Final Study Guide |
| •12/10 | •Final Exam: 10:15–12:15 | Covers all post-midterm material Location will be announced |

Assignments

Homework will be assigned after each topic. This homework will be due at the beginning of class the week after the topic is finished. Students are encouraged to work together on homework assignments. However, each student is responsible for turning in his or her own work. Notice that the homework assignments are collectively worth more than the midterm and much as the final exam, which illustrates the importance of the out-of-class assignments for understanding the material. As Harris (2001) argues, "true understanding of any statistical technique resides at least as much in the fingertips (be they caressing a pencil or poised over a desk calculator or PC keyboard) as in the cortex" (p. 51).¹ Furthermore, the out-of-class assignments collectively (i.e., the homework, review, and critique) are worth 20% more than the midterm and 11% more than the final.

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 (available here: http://www.indiana.edu/~deanfac/acadhbk/), academic dishonesty of any kind will be reported.

¹Harris, R. J. (2001). A primer of multivariate statistics. Mahwah, NJ: Erlbaum.

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.