



Department of Educational and Counseling Psychology
Research and Measurement

EDRM611

Applied Statistics in Education and Psychology I

Syllabus

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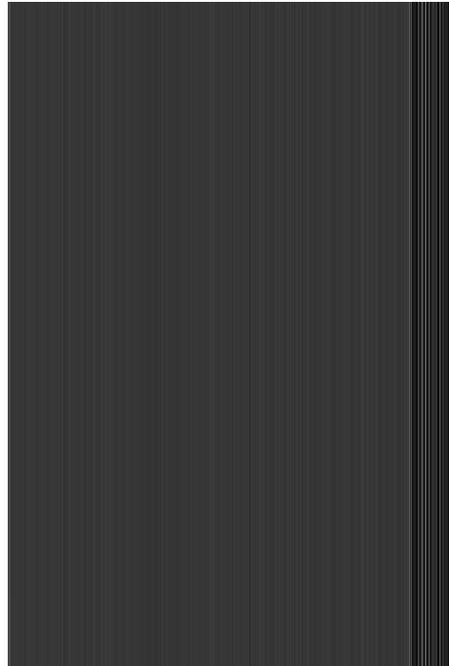
Summer 2005, Term 3

Monday–Friday, 10:30 am–12:45 pm, Bell Hall 114

Instructor: Keith G. Calkins (Smith Hall 106)
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Office hours (for course duration only): 8:30–10:20 am



"The statistics are shocking—more than half of all Americans don't understand basic math concepts ... that's almost 50%."



try this for gs version

5 out of every 4 Americans has problems with fractions!

*Numbers are our friends.
Most of our friends are irrational,
and many more are imaginary.*

1 Course Description

EDRM611 Applied Statistics in Education and Psychology I

The application of basic descriptive and inferential statistics to the fields of education and psychology. Data analysis using statistical packages (e.g., SPSS).

This course description and other references can be located online at:
<http://www.andrews.edu/academics/bulletin/2005-2006> or equivalent.

2 Mission Statements (via ACLU & abbrev.)

Note: Parts XII C, E, and H of the 1993 contract between this university and the local county which has supported the instructor's recent work requires the scrupulous avoidance of either the fact or appearance of inadequate separation of secular and sectarian activities. This note is included here since this deviation from the established university norm will thus carry over into this class.

2.1 Andrews University

Andrews University educates its students for generous service to . . . society in keeping with a faithful witness . . . [to its parent organization]. Accordingly, students are challenged

- to be inquisitive
- to think clearly and communicate effectively
- to explore the arts, letters, and sciences . . .
- to develop competencies in their chosen fields of study
- to prepare for a meaningful position in the work place
- to respect ethnic and cultural diversity
- to embrace a wholesome way of life
- . . . to personal and moral integrity
- to nurture life . . ., and
- to affirm their faith commitment.

2.2 School of Education

The School of Education mission is to . . . prepare professionals for global service.

[Six Elements (were knowledge bases) of Worldview; Human Growth & Change; Groups, Leadership & Change; Communication & Technology; Research and Evaluation; and Personal & Professional Growth are listed, each with several subitems.]

2.3 Department of Educational and Counseling Psychology

The mission of the Department of Educational and Counseling Psychology is to

- Prepare professional psychologists, counselors, and learning specialists who are committed to excellence and world-wide service
- Provide training ... that promotes the balanced development of the mental, physical, social, and spiritual nature of persons
- Respect human diversity and the uniqueness of each person ...
- Uphold ... principles ... as a guide for interpersonal relations.

3 Introduction

EDRM611 is an introductory course in statistics for students in education and psychology. The course is designed for students with minimal background in mathematics who may or may not pursue further studies in statistics. The major emphasis is on forming a basic conceptual understanding while not ignoring the associated computational skills.

EDRM611 serves as a prerequisite for EDRM604/612 and is a required course for many degree programs within the School of Education. It is similar in content and approach to BHSC230 while being less mathematically based than STAT285.

4 Prerequisite

The only prerequisite is knowledge of algebra and elementary mathematics (generally an MPE \geq P2). In this regard it is similar to a standard college introductory course in statistics (e.g. STAT285) but less stringent than Advanced Placement Statistics which expects completion of a high school Algebra II course (which would include exponentiation and logarithms). Since less math-based, the probabilistic foundations and review of relevant distributions of hypothesis testing is minimized. Students who have forgotten algebra will be given the opportunity at the beginning of the course to review this material. (See especially the first few pages of chapter 1 of the required textbook.)

5 Knowledge Base

In addition to its established role in physics, biology, chemistry, and computer science, statistical analysis is fundamental to the fields of **social and behavioral**

sciences. One can scarcely open a book or journal in these disciplines without finding some aspects of statistics: correlations, statistical significance, *t*-tests, *etc.* Without statistics we would quickly become lost in the sea of numbers, facts, and figures. Statistics are a means of organizing, condensing, and analyzing numerical and categorical data in ways that find order in chaos.

Statistics as a general field consists of two major subdivisions: descriptive and inferential statistics. Descriptive statistics involves techniques for presenting information in a succinct but clear manner. Inferential statistics involves procedures for making generalizations about a population by studying a subset of that population. Some aspects of both descriptive and inferential statistics will be presented in this course. In descriptive statistics particular emphasis will be given to the following concepts: scales of measurement, frequency distribution, measures of central tendency, measures of dispersion, standard [*z*-]scores, correlations, and linear regression. For inferential statistics, hypothesis testing for one and two sample groups (means, proportion, and correlation) will be presented. Beginning concepts in power analysis and nonparametric statistics will also be presented.

6 Objectives

The course has three major objectives. Upon completion of the course the student should be able to:

1. demonstrate comprehension of basic statistical concepts and procedures.
2. demonstrate the ability to apply basic statistical procedures and concepts to solve theoretical and practical problems.
3. identify appropriate statistical procedures for specific problems or hypotheses.

7 Course Textbook

Required: Hinkle, D. E., Wiersma, W. and Jurs, S. G. **Applied Statistics for the Behavioral Sciences.** (5th Edition). Boston, MA: Houghton Mifflin Company, 2003.

An electronic calculator with simple statistical functions or access to a computer with the same is expected. The TI-83 (now TI-84) was designed to accommodate statistical testing at this level.

The department and later courses tend to emphasize the use of SPSS (Statistical Package for the Social Sciences), which the required textbook makes frequent

reference to with corresponding examples. Their website at <http://www.spss.com> indicates version 13 for Windows is shipping and a 14-day demo is available. Other options include: BMDP (documented at <http://www.statsol.ie/bmdp/bmdp.htm>), SAS (documented at <http://www.sas.com>), Minitab (a 30-day demo of release 14 is available at <http://www.minitab.com/products/minitab/14/demo>), S-Plus (documented at <http://www.insightful.com>), JMP (a demo of release 5.1.2 is available at <http://www.jmp.com/index.shtml>), and Fathom (an evaluation edition for instructors of version 2 is available at <http://www.keypress.com/fathom/>). Another common statistical learning environment is called Activstat which uses DataDesk. Use of various spreadsheet programs is not recommended.

8 Grades

Several factors are used to compute the final grade for this course. These include scores on oral and written examinations, quizzes, a project (with an oral report and paper), skill demonstration, assignments, and class attendance/participation.

8.1 Tests (30%) and Final Examination (20%)

Three tests covering multiple chapters will be given. Each text will be worth 10% of your grade. A large component of each test may well consist of multiple-choice questions which will NOT include an equalizing guessing penalty.

A final examination worth 20% of your grade will be given probably during the final class period. It will be comprehensive and be similar in format to the unit tests.

8.2 Project with Presentation (10%) and Paper (10%)

A project about inferential statistics is required. The project will consist of a short presentation (30 minutes, including a group activity), and a topic summary (paper). The five to six page paper should conform to the guidelines found in the *Andrews University Standards for Written Work*. A minimum of three references is required (other than the required textbook). The project topics will be selected from Mean Estimation (9), 2-Sample Mean Hypothesis Testing (11), Power and Sample Size (13), Linear Regression (17), Correlation Coefficients (20), χ^2 (Chi Square) (21), and Nonparametric Tests (22). If there are more than seven class members, some collaboration or other accommodation will occur. The values in parentheses above refer to the corresponding chapter in the required textbook. The projects will be presented in increasing chapter order and assigned either randomly or by selection of

Table 1: Letter Grade and Percentage Correspondence

Grade	Percentage
A	90+%
A-	85-89%
B+	80-84%
B	75-79%
B-	70-74%
C+	65-69%
C	60-64%
C-	55-59%
D	40-54%
F	-39%

the earliest date. The paper is due at the final examination. The project is 20% of your grade, equally weighted between the presentation and paper.

8.3 Assignments (15%), Quizzes (5%), Attendance (5%), and Participation (5%)

Fifteen assignments each worth 1% of your grade will be made. The remaining 15% of your grade will be composed equally of quizzes, attendance, and class participation.

Note: the University bulletin indicates that faculty members are expected to keep regular attendance records and that whenever the number of absences exceeds 10% (for graduate classes) of the total course appointments, the teacher may give a failing grade. Absences recorded because of late registration, suspension, or early/late vacation are not excused. The class work missed **may** be made up **only if** the teacher allows. Three tardies are equal to one absence.

8.4 Grading Scale

Each letter grade spans 15% with each applicable subletter spanning 5%. A corresponding table is included as Table 1.

8.5 Student diversity and disability

Andrews University accepts and appreciates diversity in its students, including students with disabilities. Accordingly, qualified students with documented disabili-

ties are encouraged to inform the University of their disability. The office of Student Success assists students with disabilities in establishing reasonable accommodations.

8.6 Academic Integrity

A column on academic integrity in the University bulletin summarizes the full details of the policy and associated procedures given in the *Student Handbook*. Hopefully no need for further reference will be necessary.

9 Class Schedule

Class time: 10:30–12:45, Monday–Friday, July 11–August 5, 2005. An outline of topics with corresponding timeline is included as Table 2.

References

- [1] Philip R. Bevington and D. Keith Robinson. **Data Reduction and Error Analysis for the Physical Sciences** (second edition). McGraw-Hill, Boston, 1992.
- [2] George E. P. Box, William G. Hunter, and J. Stuart Hunter. **Statistics for Experimenters**. John Wiley & Sons, Inc, New York, 1978.
- [3] Keith G. Calkins. **An Introduction to Statistics, revised⁶**. Andrews University/Berrien County Math & Science Center, 2004.
<http://www.andrews.edu/~calkins/math/webtexts/stattoc.htm>
- [4] Keith G. Calkins. **Statistical Probabilities and Distributions**. Andrews University/Berrien County Math & Science Center, 2005.
<http://www.andrews.edu/~calkins/math/webtexts/prodtoc.htm>
- [5] George W. Cobb. **Introduction to Design and Analysis of Experiments**. Springer-Verlag, New York, 1998.
- [6] The College Board. **Released Exam, 1997 Advanced Placement Statistics**. Educational Testing Service, 1998.
- [7] The College Board. **Released Exam, 2002 Advanced Placement Statistics**. Educational Testing Service, 2002.
- [8] Larry Gonick and Woollcott Smith. **The Cartoon Guide to Statistics**. Harper Perennial (Harper Collins Publishers), 1993.

Table 2: 2005 Class Schedule, 10:30 am–12:45 pm

Day	Date	Topic	Chapter
Mon.	July 11	Syllabus and Statistics	1
Tue.	July 12	Organizing and Presenting Data	2
Wed.	July 13	Central Tendency and Variation	3
Thu.	July 14	The Normal Gaussian Bell-Curve	4
Fri.	July 15	Review and Test 1	1–4
Mon.	July 18	Correlation	5
Tue.	July 19	Linear Regression	6
Wed.	July 20	Sampling and Distributions	7
Thu.	July 21	Probability and Distribution Overview	own
Fri.	July 22	Review and Test 2	5–7, own
Mon.	July 25	Hypothesis testing and Confidence Int.	8
Tue.	July 26	1-Sample Mean Testing	9
Wed.	July 27	2-Sample Mean Testing	11
Thu.	July 28	Power and Sample Size	13
Fri.	July 29	Review and Test 3	8,9,11,13
Mon.	August 1	Testing Linear Regression	17
Tue.	August 2	Other Correlation Coefficients	20
Wed.	August 3	Chi Square (χ^2)	21
Thu.	August 4	Nonparametric Tests	22
Fri.	August 5	Final Exam	1–22

- [9] Donald L. Harnett. **Introduction to Statistical Methods** (second edition). Addison-Wesley Publishing Company, 1975.
- [10] David S. Moore and George P. McCabe. **Introduction to the Practice of Statistics** (second edition). W. H. Freeman and Co., New York, 1993.
- [11] Roxy Peck, Chris Olsen, and Jay Devore. **Introduction to Statistics and Data Analysis**. Duxbury (Thompson Learning), 2001.
- [12] Richard L. Scheaffer, Mrudulla Gnanadesikan, Ann Watkins, and Jeffrey A. Witmer. **Activity-Based Statistics**. Springer, 1996.
- [13] Richard L. Scheaffer, William Mendenhall III, R. Lyman Ott. **Elementary Survey Sampling** (5th edition). Duxbury Press (International Thomson Publishing Company), 1996.
- [14] Andrew F. Siegel and Charles J. Morgan. **Statistics and Data Analysis: An Introduction** (second edition). John Wiley & Sons, Inc, New York, 1996.
- [15] Martin Sternstein. **How to Prepare for the AP Statistics Examination** (second edition). Barron's, 2000.
- [16] Allan J. Rossman and J. Barr Von Oehsen. **Workshop Statistics**. Springer, New York, 1997.
- [17] Mario F. Triola. **Elementary Statistics** (sixth edition). Addison-Wesley Publishing Company, 1995.
- [18] Dennis D. Wackerly, William Mendenhall III, Richard L. Scheaffer. **Mathematical Statistics with Applications** (fifth edition). Duxbury Press (International Thomson Publishing Company), 1996.
- [19] Ann E. Watkins, Rosemary A. Roberts, Christopher Olsen, and Richard L. Scheaffer. **Teachers Guide—AP Statistics**. Educational Testing Service, 1997.
- [20] B. J. Winer. **Statistical Principles in Experimental Design**. McGraw-Hill Book Company, New York, 1962.
- [21] Daniel Yates, David Moore, George McCabe. **The Practice of Statistics TI-83 Graphing Calculator Enhanced**. W. H. Freeman and Company, NY, 1999.