



Educational Research and Measurements 6300
Applied Statistical Methods in Education
Spring Semester 2006
Instructor: Seock-Ho Kim

Syllabus

Course Description and Objective

Techniques for describing and summarizing data for educational research studies. Applications of the standard normal distribution and the use and interpretation of standard scores. Inferential statistics for one and two population studies including means, proportions, and correlations (*Graduate Bulletin* 2005-2006). Prerequisite: ERSH 4200/6200

The overall goal of the course is to present an introduction to statistics that emphasizes working with data and statistical ideas. The content of the course is divided into three parts:

1. Understanding data
2. Understanding inference
3. Application topics in inference

In order to achieve the overall goal, the course will involve readings of the textbooks, a series of assignments to reinforce the key concepts, a set of computer exercises, and three examinations.

Textbooks

Moore, D. S. (2003). *The basic practice of statistics* (3rd ed.). New York: W. H. Freeman and Company.

Green, S. B., & Salkind, N. J. (2005). *Using SPSS for Windows and Macintosh: Analyzing and understanding data* (4th ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

Huck, S. W. (2003). *Reading statistics and research* (4th ed.). New York: Longman.

Suggested Supplementary Texts

- American Psychological Association (2001). *Publication manual of the American Psychological Association* (5th ed.). Washington, DC: Author.
- Hays, W. L. (1994). *Statistics* (5th ed.). Fort Worth, TX: Harcourt Brace College Publishers.
- Marascuilo, L. A., & Serlin, R. C. (1988). *Statistical methods for the social and behavioral sciences*. New York: W. H. Freeman and Company.
- Moore, D. S., & McCabe, G. P. (2003). *Introduction to the practice of statistics* (4th ed.). New York: W. H. Freeman and Company.
- Rosenthal, R., & Rosnow, R. L. (1991). *Essentials of behavioral research: Methods and data analysis* (2nd ed.). New York: McGraw-Hill.

A copy of 'Solutions to Exercises' from *Instructor's Guide* will be distributed in class.

Assignments, Examinations, and Evaluation

A number of exercises will be assigned and each student is expected to complete the exercises independently. All work must be completed and turned in on time. All work should be lucid, orderly, and self-contained. A set of computer exercises will also be assigned. Specific requirements for the computer exercises will be distributed later.

There will be two midterm examinations on February 14 (Tuesday, 5:00–6:15 pm) and on March 28 (Tuesday, 5:00–6:15 pm), and a final examination on May 9 (Tuesday, 7:00–10:00 pm). The final examination hours are based on the final examination schedule. The examinations will be administered in class. The examinations will be composed predominately short answer items. Copies of sample examinations will be distributed later. Make-up examinations are not administered.

Grades will be based on completion of the assigned exercises (15%), on the computer exercises (10%), and on the three examinations (25% each). Grades will be assigned as follows: A (above 90%), B (between 80% and 90%), C or worse (below 80%). Full attendance of lectures is required.

All academic work must meet the standards contained in “A Culture of Honesty.” Students are responsible for informing themselves about those standards before performing any academic work. The link to more detailed information about academic honesty can be found at: <http://www.uga.edu/ovpi/honesty/acadhon.htm>

Advice

On any aspect of the course, see Seock-Ho Kim, 325U Aderhold from 4:00 pm to 5:00 pm on Tuesday and Thursday or by appointment. For appointments or replies to brief questions, send email to shkim@uga.edu or call me at 542-4224 (office) or 310-1218 (home). If I am not available when you call 542-4224, you may also call and leave a message at 542-4110 (i.e., the main office of the Department of Educational Psychology & Instructional Psychology). If you leave a message, I will probably reply by email, rather than call you back.

Class Procedures and Activities

The class will be conducted so as to maximize understanding of key statistical concepts. To facilitate this intention, most class sessions will include one or more of the following:

- Illustration of key concepts developed through assigned readings.
- Identification and discussion of these concepts in actual research settings.
- Analysis and discussion of selected problems involving these concepts.

The computer lab (618 Aderhold) has been scheduled for this class on nearly every other Thursday (5:00–6:15 pm). There are a total of seven computer sessions, and we will meet at the computer lab.

Course Outline

January 10

Chapter 1. Picturing Distributions with Graphs

January 12

Chapter 2. Describing Distributions with Numbers

January 17

Chapter 3. Normal Distributions

January 19

Computer Lab 1. Units 1–2, Chapter 1H (Huck)

January 24

Chapter 4. Scatterplots and Correlation

January 26

Chapter 5. Regression

January 31

Chapter 6. Two-Way Tables

February 2

Computer Lab 2. Unit 5, Chapter 2H

February 7

Chapter 7. Producing Data: Sampling

February 9

Chapter 8. Producing Data: Experiments

February 14

Midterm 1: Chapters 1–8

February 16
Chapter 9. Introducing Probability

February 21
Chapter 10. Sampling Distributions

February 23
Computer Lab 3. Unit 8, Chapter 3H

February 28
Chapter 11. Probability in Detail
Chapter 12. Binomial Distributions

March 2
Computer Lab 4. Unit 3, Chapter 5H

March 7
Chapter 13. Confidence Intervals: The Basic

March 9
Chapter 14. Test of Significance: The Basic

March 21
Chapter 15. Inference in Practice
Chapter 16. Inference About One Mean

March 23
Computer Lab 5. Unit 4, Chapter 6H

March 28
Midterm 2 : Chapters 9–15

March 30
Chapter 17. Comparing Two Means

April 4
Chapter 18. Inference About One Proportion
Chapter 19. Comparing Two Proportions

April 13
Computer Lab 6. Unit 6, Chapters 7H–8H

April 18
Chapter 20. Two Categorical Variables: Chi-Square

April 20
Chapter 21. Two Quantitative Variables: Regression

April 25
Chapter 22. Categorical Explanatory, Quantitative Response: ANOVA

April 27

Chapter 23. Nonparametric Tests

Computer Lab 7. Units 7 & 10, Chapter 10H

(also portions of Chapters 11H, 12H, & 19H—optional)

May 9

Final: Chapters 16–22

Tentative Assignments

Exercises

Due Date

Set 1: 1.26, 2.25, 3.25, 4.13, 5.18, 6.16, 7.2, 8.15

February 13

Set 2: 9.22, 10.9, 11.28, 12.22, 13.18, 14.26, 15.10

March 28

Set 3: 16.11, 17.42, 18.9, 19.20, 20.13, 21.6, 22.11

May 9

Note

The course syllabus is a general plan for the course; deviations announced to the class by the instructor may be necessary.

January 2006

SUN	MON	TUE	WED	THU	FRI	SAT
1	2	3	4	5	6	7
8	9	10 Chap 1	11	12 Chap 2	13	14
15	16	17 Chap 3	18	19 Lab 1	20	21
22	23	24 Chap 4	25	26 Chap 5	27	28
29	30	31 Chap 6				

February 2006

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2 Lab 2	3	4
5	6	7 Chap 7	8	9 Chap 8	10	11
12	13	14 Mid 1 Set 1	15	16 Chap 9	17	18
19	20	21 Chap 10	22	23 Lab 3	24	25
26	27	28 Chap 11 Chap 12				

March 2006

SUN	MON	TUE	WED	THU	FRI	SAT
			1	2 Lab 4	3	4
5	6	7 Chap 13	8	9 Chap 14	10	11
12	13	14	15	16	17	18
19	20	21 Chap 15 Chap 16	22	23 Lab 5	24	25
26	27	28 Mid 2 Set 2	29	30 Chap 17	31	

April 2006

SUN	MON	TUE	WED	THU	FRI	SAT
						1
2	3	4 Chap 18 Chap 19	5	6	7	8
9	10	11	12	13 Lab 6	14	15
16	17	18 Chap 20	19	20 Chap 21	21	22
23/30	24	25 Chap 22	26	27 Lab 7 Chap 23	28	29

May 2006

SUN	MON	TUE	WED	THU	FRI	SAT
	1	2	3	4	5	6
7	8	9 Final Set 3	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

Instructional Objectives¹

Chapter 1. Examining Distributions

- A. Make and interpret histograms/stemplots.
- B. Describe the overall pattern.
- C. Know how to use a normal distribution.

Definition: exploratory data analysis, time plot, mean, median, quartiles, five-number summary, boxplot, standard deviation, density curve, 68-95-99.7 rule, standard normal distribution

Chapter 2. Examining Relationships

- A. Make and interpret a scatterplot.
- B. Find and interpret the correlation.
- C. Find and interpret the least-squares regression.

Definition: explanatory variable, response variable, slope, intercept, residual, influential observation, extrapolation, lurking variable, conditional distribution, Simpson's paradox

Chapter 3. Producing Data

- A. Know how to use random digits.
- B. Outline the design of a completely randomized experiment.

Definition: simple random sample, multistage sample, placebo effect, matched pair, block

Chapter 4. Probability and Sampling Distributions

- A. Know the probability rules.
- B. Understand and apply the law of large numbers.
- C. Understand and apply the central limit theorem.

Definition: parameter, statistic, sampling variability, random, disjoint, independent, probability model, random variable, probability distribution, sampling distribution, unbiased estimator

Chapter 5. Probability Theory

- A. Use Venn diagram to picture relationships among events.
- B. Use the binomial distribution to find probabilities of event.

Definition: multiplication rule, general addition rule, binomial setting, binomial distribution, normal approximation for binomial distributions, conditional probability, independence

¹Please read 'Statistics in Summary' in the end of each chapter.

Chapter 6. Introduction to Inference

- A. Know how to obtain confidence intervals for μ .
- B. Recognize the relationship among the confidence level, margin of error, and the sample size.
- C. Apply the z test for a population mean.

Definition: statistical inference, statistical confidence, critical value, test of significance, null hypothesis, alternative hypothesis, P -value, one-sample z statistic, Type I error, Type II error, power

Chapter 7. Inference for Distributions

- A. Recognize situations where one-sample, matched pairs, and two-sample procedures are needed.
- B. Perform and interpret the one-sample t procedure.
- C. Perform and interpret the two-sample t procedure.

Definition: standard error, degrees of freedom, assumptions for t , robustness, pooled variance, F distribution, Levene's test, folded F test

Chapter 8. Inference for Proportions

- A. Make inference about one proportion.
- B. Perform the two-sample z procedure for comparing two proportions.

Definition: standard error of sample proportion(s), sample size for margin of error, pooled sample proportion

Chapter 9. Inference for Two-Way Tables

- A. Know how to perform the chi-square test for a two way table.

Definition: cell, expected/observed count, degrees of freedom, components of chi-square

Chapter 10. One-Way Analysis of Variance

- A. Perform and interpret the analysis of variance F test.

Definition: multiple comparisons, assumptions, mean squares, F distribution, degrees of freedom, pooled standard deviation

Chapter 11. Inference for Regression

- A. Interpret least-squares regression results.

Definition: regression model, assumptions for regression, true regression line, residuals, standard error about the line, confidence intervals for regression slope, test of β , prediction interval