Educational Psychology 490: Educational Statistics, Autumn, 2000

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Resources

Text
Gravetter, F. J., & Wallnau, L. B. (1996) *Statistics for the Behavioral Sciences (5th Edition)*

Supplementary Materials
SPSS statistical package

SCHEDULE

Sept 26	Fundamental Statistical Concepts	Chap 1
Sept 28	Descriptive Statistics; Distributions	Chap 1, 2
Oct 3	Measures of Central Tendency & Dispersion	Chap 3, 4
Oct 5	Standard Normal Distribution, Probability	Chap 5, 6
Oct 10	EXAM 1	
Oct 12	Standard Normal Distribution, Probability	Chap 5, 6
Oct 17	Sampling Distributions	Chap 7
Oct 19	Hypothesis Testing: Logic; Single Sample	Chap 8, 9
Oct 24	Hypothesis Testing: Single sample	Chap 9, 10
Oct 26	Hypothesis Testing: Two Independent Samples	Chap 10
Oct 31	EXAM 2	
Nov 2	Hypothesis Testing: Related Samples	Chap 11
Nov 7	Confidence Intervals	Chap 12
Nov 9	One-way Analysis of Variance	Chap 13
Nov 14	One-Way Analysis of Variance	Chap 13
Nov 16	One-Way Analysis of Variance	Chap 13
Nov 21	EXAM 3	
Nov 23	Thanksgiving (No class)	
Nov 28	Correlation and Regression	Chap 16
Nov 30	Statistical Inference: Nominal Data	Chap 17
Dec 5	Review; Student Ratings of Instruction	
Dec 7	Comprehensive EXAM	4:30-6:30

CLASS PROCEDURES

- Class time will be devoted to lecture, discussions, and problem solving.
- Students should work as many problems as possible since much understanding comes from working with the material. Students are encouraged to use the SPSS software to solve problems in the books. Some lecture time will be devoted to illustrating the use of SPSS. Homework should include a printout of your results as well as your interpretation of the results.
- Students are encouraged to find and share examples of proper and improper uses of statistics.
- Students are encouraged to form study groups and to seek assistance when they are encountering difficulty.
- Make-up exams are given only in extreme emergencies.

FEEDBACK ON SUCCESS IN COURSE

Feedback on your performance in the course will be provided in two ways:

1. ***Formative*:** This feedback consists of two types.
   Problems: Solutions to the problems listed on the learning objectives handout for each chapter should be turned in and redone if necessary until successful completion. However, the last day to turn in problems for the chapters in a unit is the day of the unit EXAM.
   Worksheets Short worksheets will be given frequently during class. Problem solutions will be discussed as feedback on the solution process.

2. ***Summative***: The purpose of the Summative Evaluation is to assess understanding upon completion of the unit and the course. The course grade will be based on completion of the homework problems, 3 unit exams, and the final examination. The grade will be based on the percentage of points earned on these three sources of information.

Possible Points:	
Homework	100
Unit EXAMS	100
FINAL EXAM	100

All Classes with Teaching Assistants are asked to include the following paragraph:

If you have any concerns about the course or your instructor, please see the instructor about these concerns as soon as possible. If you are not comfortable talking with the instructor or not satisfied with the response that you receive, you may contact Dean Patricia Wasley, 543-2149.

For your reference these procedures are posted on the bulletin board just outside Student Services, 206 Miller.

UNIT I OUTLINE

Descriptive Statistics, Normal Distribution Theory, and Probability

Gravetter & Wallnau: Chapters 1-6. Appendix A, B.1

Overview: Unit I begins with a discussion of fundamental concepts in statistics. Chapter 1 introduces much of the terminology we will be using. Also discussed are summation rules and types of measurement scales. A first step in the analysis of data is looking at the measurements as a set of scores. Chapter 2 discusses graphing techniques for the presentation of data, the interpretation of percentiles, and the importance of percentile ranks. Three important statistics, the mean, standard deviation, and variance, are introduced in Chapters 3 and 4. Chapter 4 discusses the calculation and interpretation of the variance and standard deviation. Introduction of Chapters 5 and 6 at this time allows us to make some further probability statements about normally distributed events and binomial distributions.

Objectives:

The student who has mastered the material in Unit I is able to:

1. Define in their own words the key terms at the end of each of the chapters.
2. Distinguish between descriptive and inferential statistics.
3. Use the rules of summation to solve problems.
4. Distinguish among and provide examples of the four types of measurement scales.
5. Distinguish between discrete and continuous scales of measurement.
6. When given measurements, determine the real limits of the measurement.
7. Construct a frequency distribution and a grouped frequency distribution from raw data.
8. Identify symmetrical and skewed frequency distributions.
9. Construct and interpret histograms and cumulative frequency distributions.
10. Define percentile rank and state the importance of the normative group used to define the percentiles.
11. Calculate the mean, median, and mode from ungrouped frequency distributions.
12. State three characteristics of the arithmetic mean.
13. Calculate the weighted mean.
14. Compare and contrast the mean, median, and mode in terms of their usefulness as measures of central tendency.
15. Calculate the range, variance, and standard deviation from raw data.
16. Distinguish between the biased and unbiased estimates of the population variance.
17. State the difference between $\sum X^2$ and $(\sum X)^2$.

18. Identify factors that affect the variability of scores.

19. Identify the effects on the mean and variance of adding (subtracting) or multiplying (dividing) a group of scores by a constant.

20. State the mean and standard deviation of the *Z* distribution and use Table A in the Appendix to find probabilities and percentile ranks.

21. State the values that probabilities can be and the various ways that probabilities can be expressed.

22. Distinguish between one and two-tailed probabilities.

23. Use the binomial expansion or Abbott's 4-step process to find probabilities for binomial events.

24. Use the normal approximation to the binomial to find probabilities.

Take Home Problems to be turned in for credit:

Chapter	Problem Number(s)
1.	2; 5; 6; 8; 20; 23; 27
2.	4; 6; 18;
3.	4; 8; 12; 16; 18; 19; 28
4.	2; 3; 16; 18; 26
5.	2; 4; 6; 20; 25; 27
6.	1; 3; 5; 10; 12; 18; 20

UNIT II OUTLINE

Sampling Processes, Hypothesis Testing Logic, Single Samples and Two Independent Samples

Gravetter & Wallnau: Chapters 7-10

Overview: In Unit II we first discuss sampling processes and the logic of hypothesis testing. In Chapters 9 and 10 we apply this logic to the testing of hypotheses about means of single samples and means of two independet groups.

Objectives:

The student who has mastered the material in Unit II is able to:

1. Define in your own words the key terms at the end of each chapter.

2. Discuss the meaning of and calculate the standard error of the mean.

3. State the similarities between the distribution of *X* and the distribution of a sample statistic. State the relationship between the size of the sample (*n*), the shape of the population distribution, and the properties of the distribution of sample means.

4. Discuss statistical hypothesis testing in terms of the actual situation and experimenter's decision.

5. Distinguish between one and two-tailed tests.

6. Discuss the concept of a sampling distribution for various statistics and its function in making inferences about a population.

7. Test hypotheses of the form $H_0: m_x=25$ when s is known and unknown.

8. Compare and contrast the procedures when the population standard deviation is and is not known.

9. Compare the normal distribution to various t distributions.

10. Identify factors that influence the power of a statistical test.

11. Define "degrees of freedom", and find the *df* involving two independent samples.

12. Distinguish between the sampling distribution of a sample mean and the sampling distribution of the difference between two means.

13. Test null hypotheses of the form $H_0: m_1=m_2$ with both independent groups.

14. Test hypotheses of the form $H_0: s_1^2=s_2^2$.

Unit Problems to be turned in for credit:

Chapter 7: 2; 3; 6; 10; 14; 18
Chapter 8: 1; 6; 8; 12; 18; 22; 31
Chapter 9: 1; 2 15; 21; 26
Chapter 10: 2; 9; 17; 21

UNIT III OUTLINE

Two related samples; Estimation; Analysis of Variance

Gravetter & Wallnau: Chapters 11-13

Overview: Unit III applies the logic of hypothesis testing to designs with two related samples and designs with more than two independent samples. Chapter 11 discusses testing null hypotheses about the means of two correlated treatment groups. Chapter 12 discusses the estimation of confidence intervals. Chapter 13 presents methods for testing hypotheses about means when the experiment includes more than two independent treatment groups.

Objectives:

The student who has mastered the material in Unit III is able to:

1. Test null hypotheses of the form $H_0: m_1=m_2$ with related samples.

2. Distinguish between related and independent samples on the basis of the method by which subjects are assigned to treatments.

3. Calculate and interpret confidence intervals for the sample mean.

4. Calculate and interpret confidence intervals for $(\bar{X}_1-\bar{X}_2)$ and $\bar{D}$.

7. State the purpose of the analysis of variance (ANOVA), know when it is applicable, and describe the process of subject assignment to which the method of Chapter 13 is applicable.

8. Distinguish between, define, and calculate the within group and between group mean squares.

9. State the relationship between the total sum of squares and the between and within sum of squares.

10. Test null hypotheses of the form $H_0: m_1=m_2=m_3=m_k$.

11. Use and interpret multiple comparisons to follow-up the hypothesis tested in the one way ANOVA.

12. Discuss the relationship between the F and t tests when we have two independent samples.

13. Define in your own words the key terms at the end of each chapter.

Unit Problems to be turned in for credit:

Chapter	Problem Numbers
11	3; 14; 17; 23
12	3; 8
13	1; 6; 10; 16

UNIT IV OUTLINE

Correlation and Regression; χ^2 and Nominal Data

Gravetter & Wallnau: Chapters 16 -17

Overview: Unit IV discusses two somewhat different topics: Using correlation and regression to study the relationship of two variables and in chapter 17 two examples of the application of hypothesis testing to data that are categorical .

Objectives:

The student who has mastered the material in Unit IV is able to:

1. Compute the Pearson product moment correlation from raw data.

2. Discuss the meaning of scatter diagrams, correlations, and positive and negative relationships.

3. Identify limitations of Pearson correlations and their subsequent interpretation.

4. State the conceptual and computational relationship between Pearson *r* and *z* scores and between the phi, Spearman, and Pearson correlations.

5. State the formula for a regression line, indicating what each symbol represents and its interpretation.

6. Compute the slope of the regression line and the prediction equation when given the equations.

7. Specify what is meant by "line of best fit".

8. State in words the interpretation of the residual variance and standard error of estimate.

9. State how the value of *r* changes the amount of explained and unexplained variation.

11. Define and identify correct interpretations of the coefficient of determination.

12. State the hazards of causal interpretations of correlations.

13. Specify the correct interpretation of the standard error of estimate.

14. Know when to use χ^2 tests to evaluate hypotheses.

15. Find the expected values, and value of χ^2 for the one sample case and the test of independence.

16. State the limitations in the use of χ^2.

Unit Problems to be turned for credit:

Chapter 16: 10; 32
Chapter 17: 3; 11; 23