

**NEW YORK UNIVERSITY**  
**ROBERT F. WAGNER GRADUATE SCHOOL OF PUBLIC SERVICE**

**Course Syllabus**  
**Summer 2015**  
**Statistical Methods for Public, Nonprofit, and Health Management**

This course introduces students to basic statistical methods and their application to management, policy, and financial decision-making. The course covers the essential elements of descriptive statistics, univariate and bivariate statistical inference, and an introduction to multivariate analysis. In addition to covering statistical theory, the course emphasizes applied statistics and data analysis, using the software package SPSS.

The course has several “audiences” and goals. For all Wagner students, the course develops basic analytical skills and encourages a critical approach to reviewing statistical findings and using statistical reasoning in decision-making. For those planning to continue studying statistics (often those in policy and finance concentrations), this course additionally provides the foundation for that additional work.

**Textbooks.** There are two course texts. The first is J.F.Healey’s *The Essentials of Statistics: A Tool for Social Research* (3<sup>rd</sup> Edition), Wadsworth/Cengage Learning 2013 (ISBN-13: 978-1-111-82956-8) – hereinafter *Essentials*. This book, which covers basic statistical theory and manual computation, can be purchased at the NYU Professional Bookstore or on Amazon.com. You may also purchase the 2<sup>nd</sup> edition of this book but note that the book chapters may not correspond. The other text is J. Blustein’s *SPSS: The Wagner Way* – hereinafter *Wagner Way*. This text covers the use of SPSS software for data analysis. It is available on the Stat 1 site in NYU Classes as a free .pdf download.

**Other online/written material.** PowerPoint slides will be used during lectures throughout the course. Electronic versions are posted on the Stat 1 site in NYU Classes. Copies of the week’s PowerPoint slides should be brought to each lecture.

Several other written print and online resources are available to assist you in mastering the material. Your instructor will provide numerous practice problems and answers, as well as copies of old exams and answers. In order to master the course material, you should plan to work (and rework!) all of the practice problems, the “challenge problems”, and old exams prior to taking the midterm and final.

**Calculator.** Students are required to use the Casio FX-300ES Natural Display Scientific Calculator; available at the NYU Computer Bookstore (@\$12.95; note that the Computer Bookstore is at 242 Greene Street). The calculator is also available on many online sites.

**SPSS and the weekly lab sessions.** This is a course in applied statistics, with a lot of data analysis, both for homework and for the final analytical memo assignment. Some of these analyses will be

done manually, with the help of a hand-held calculator. However, computers do this sort of work quickly and without error, making a software package such as SPSS indispensable. Most weeks, in addition to reading and homework based on the *Essentials* texts, you will also have reading and homework from *Wagner Way*.

Some students will find that carefully reading *Wagner Way* provides adequate support for learning SPSS. Those in need of additional assistance with SPSS must attend the weekly lab sessions. During those sessions, I will demonstrate SPSS procedures, explain SPSS output, and generally reinforce and support use of the computer program. For the final exam, students will be expected to be familiar with all of the material in *Wagner Way*.

**Homework.** There is homework nearly every week of class. Homeworks are graded on a scale of 0 (not submitted)/ 1 (submitted but deficient)/ 2 (submitted and adequate) / 3 (submitted and extraordinary). Very few 3's are awarded; students should expect to earn a 2 for a job well done, and that constitutes full credit. In tallying homework grades, students are permitted to have missed (i.e. received a zero) for one homework, without penalty. In other words, your best 12 of the 13 assignments are counted toward your final grade.

Your homework must be submitted by the beginning of each lecture, either during class or before class in my faculty mailbox (#69 on the 3<sup>rd</sup> floor of the Puck Bldg). If you are unable to attend class, please ask one of your classmates to hand in your homework. E-mailed assignments and assignments handed in after class will not be accepted.

**Course objectives.** Students completing the course should gain the following knowledge and skills:

- An understanding of the different levels of measurement (nominal, ordinal and interval) and their relevance for different analytic techniques.
- An understanding of basic descriptive statistics including the mean, median, mode, range and standard deviation; and ability to calculate these statistics and to generate them using SPSS software; an understanding of when each may be appropriate for descriptive purposes.
- An ability to calculate confidence intervals for means and proportions and to assess the relative merits of point versus interval estimates for means and proportions.
- An understanding of the basic principles of statistical inference including the importance of sampling distributions and the standard error.
- An ability to determine appropriate tests of statistical significance for differences in means, differences in percentage distributions and cross-tabulations, and to execute that work manually and using SPSS software.
- An ability to determine when bivariate regression and correlation are appropriate analytic approaches, and to calculate and interpret regression and correlation coefficients, both manually and using SPSS software.
- An ability to design a multiple regression analysis, to generate regression results using SPSS software, and to interpret these results for statistical and theoretical significance.

**Requirements and grades.** Course grades are based on the following:

- in-class mid-term exam (25%);
- analytical memo assignment (25%);
- in-class final exam (35%); and
- timely completion of assigned homework and contribution to class discussion (15%).

For the written exams, students will be expected to use the standard calculator (described above). They will be permitted to bring an 8 ½-by-11-inch, single-sided, handwritten sheet of notes. The notes may not be electronically produced or reproduced (i.e., cut and paste).

**Important note regarding the Final Assignment.** Doing the final assignment takes planning, time and concentration. Many students report that completing the assignment is the best learning experience in the course. You should allocate significant time to it, starting in Class 10 of the course. Please note the following:

- I will orient you to the assignment.
- You may work with your fellow students, but this is not a group project. You must run your own analysis, write your own memo, and create your own tables.
- Final assignments written by prior students in Stat 1 *may not* be used as sources for writing your final assignment memo.
- Problem-solving is a big part of the exercise. I will field *specific* questions that are limited in scope. "How should I do this part of the analysis?" will not be answered. "I'm thinking of using procedure X to answer question Y because I believe that the assignment is asking me to examine relationship Z. Does this make sense?" is an appropriate question.
- Working and re-working the presentation of your findings is also a big part of the exercise. However, I cannot review your written drafts.
- Please do not ask the tutor for assistance with this assignment. Their responsibility is to handle questions related to the lecture/homework.

### **CLASS 1 – Introduction**

3<sup>rd</sup> Ed: Ch. 1 - 2  
2<sup>nd</sup> Ed: Ch. 1 - 3  
*Wagner Way* Ch. 1

1. What are statistics and how are they useful?
  - descriptive vs. inferential statistics
  - populations and samples
  - levels of measurement
2. How can information (data) be summarized: Basic Descriptive Statistics
  - percentages and proportions
  - ratios and rates
  - frequency distributions: one-way and two-way tables
  - graphs and figures

### **CLASS 2 – Central Tendency and Dispersion**

3<sup>rd</sup> Ed: Ch. 3 – 4  
2<sup>nd</sup> Ed: Ch. 4 - 5  
*Wagner Way* Ch. 2

1. Measures of Central Tendency
  - mode, median, percentiles, means; weighted means
2. Measures of Dispersion
  - range
  - average deviation
  - standard deviation
  - coefficient of variation

### **CLASS 3 – The Normal Curve**

3<sup>rd</sup> Ed: Ch. 5  
2<sup>nd</sup> Ed: Ch. 6  
*No SPSS Lab*

1. The normal distribution
  - the normal curve
  - standard (z) scores
  - using the normal curve to estimate probabilities

### **CLASS 4 – Sampling and the Sampling Distribution**

3<sup>rd</sup> Ed: Ch. 6 pp 128 - 138  
2<sup>nd</sup> Ed: Ch. 7 pp. 146-154  
*Wagner Way* Ch. 3

1. How are samples selected?
  - drawing representative samples
  - simple random sampling and other sample techniques
  - sampling distributions
2. How do we infer from sample estimates?
  - sampling error - standard error of a sample statistic
  - the central limit theorem
3. Computer demo: Sampling Distribution applet

## **CLASS 5 – Estimation**

3<sup>rd</sup> Ed: Ch. 6 pp 138 - 156  
2<sup>nd</sup> Ed: Ch. 7 pp. 154-172  
*Wagner Way Ch. 4*

1. What is a “good” estimator?
  - point estimates and confidence intervals
  - bias and efficiency
2. How do we construct a confidence interval when the population standard deviation is known?
  - confidence levels and alpha
  - interval estimates for means and proportions

## **CLASS 6 – Hypothesis Testing-1**

3<sup>rd</sup> Ed: Ch. 7  
2<sup>nd</sup> Ed: Ch. 8  
*No SPSS Lab*

1. How do we make decisions about a population parameter based on one sample estimate?
  - null and research hypotheses
  - establishing the critical region; decision rules
  - one-tailed (< or >) and two-tailed (not =) tests
  - type I and type II error
  - means and proportions
2. How are interval estimates constructed and hypothesis tests conducted for small samples when the population standard deviation is unknown?
  - the  $t$  distribution

## **CLASS 7 – Hypothesis Testing-II**

3<sup>rd</sup> Ed: Ch. 8  
2<sup>nd</sup> Ed: Ch. 9  
*Exam Review*

1. How do we make decisions about population parameters based on two sample estimates?
  - difference of means - large and small samples
  - difference of proportions - large samples

## **CLASS 8 – MIDTERM EXAM**

The midterm is an in-class exam that covers material through Class 6.

## **CLASS 9 – Analysis of variance**

3<sup>rd</sup> Ed: Ch. 9  
2<sup>nd</sup> Ed: Ch. 10  
Wagner Way Ch. 5

1. How can we test for a difference in means when our independent variable is categorical and has more than two categories?
  - the underlying concept of ANOVA
  - Sum of Squares Within and Sum of Squares Between
  - the F ratio
  - applying the five-step model of hypothesis testing to ANOVA
  - limitations to ANOVA and post hoc tests

## **CLASS 10 – Bivariate tables, chi-square**

3<sup>rd</sup> Ed: Ch. 10, Ch 11 pp 277 – 287  
2<sup>nd</sup> Ed: Ch. 11, Ch. 12 pp. 282-290  
Wagner Way Ch. 6

1. How can we test if there is an association between two categorical variables (or, how do we make decisions about more than two population proportions based on sample estimates)?
  - bivariate tables
  - independent and dependent variables
  - expected and observed frequencies
  - the chi-square distribution and statistic
  - sample size considerations
2. Beyond *Essentials*: Joint and conditional probability

## **CLASS 11 – Bivariate Regression and Correlation**

3<sup>rd</sup> Ed: Ch. 13 pp 332 – 354  
2<sup>nd</sup> Ed: Ch. 14 pp. 330-351  
Wagner Way Ch. 7

1. How do we estimate the magnitude and strength of the relationship between two continuous variables?
  - the concept of association, including pattern or direction
  - dependent and independent variables
  - use of scattergrams
  - the regression line and linear relationships
  - using least squares to compute estimates of the intercept and slope
  - coefficient of correlation ( $r$ )
  - coefficient of determination ( $R^2$ )
  - explained and unexplained variation

- test of significance for  $r$
2. Computer demo: Bivariate regression and correlation in SPSS

## **CLASS 12 – Controlling for Other Variables**

*Wagner Way* Ch. 8 & 9

1. How do we control for the effects of a third variable?
  - direct relationships, spurious relationships, intervening variables
2. How do we estimate the magnitude of the relationship between one dependent variable and more than one independent variables?
  - multiple regression equation
  - coefficient of multiple determination
3. How can we use categorical data in the regression framework?
  - dummy coding of independent variables
4. Computer demo: dummy variables in SPSS

## **Important dates**

### **Midterm Exam**

The midterm exam will be given during the usual lecture class period on **Monday June 22<sup>nd</sup>**.

### **Final Exam**

The final exam will be given during the usual lecture class period on **Thursday July 16<sup>th</sup>**.

### **Final Assignment**

The final assignment is due on **Monday July 13<sup>th</sup>** at 6pm. **Final assignments will only be accepted as hard copy.**

**Note that homework assignments are posted on the Stat 1 site in NYU Classes under “Resources” link in the “Assignments” folder.** You will not hand in homework in Class 1. You will hand in homework beginning with Class 2; you will submit your homework at the beginning of each lecture.