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

Course Syllabus
Fall 2011
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 (2nd Edition), Wadsworth/Cengage Learning 2010 (ISBN: 0495601438) – hereinafter Essentials. This book, which covers basic statistical theory and manual computation, can be purchased at the NYU Professional Bookstore or on Amazon.com. 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 course Blackboard as a free .pdf download, or for purchase of a bound hardcopy at the Wagner front desk for a few that covers the cost of photocopying. The price will be announced shortly. (Payment by personal check or money order only).

Other online/written material. PowerPoint slides will be used during lectures throughout the course. Electronic copies of these are posted on the class Blackboard site, where they may be
downloaded and printed. Printed 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.

**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, the instructor will demonstrate SPSS procedures, explain SPSS output, and generally reinforce and support use of the computer program.

Note that some non-SPSS material that is not covered during the lectures is covered in the lab sessions. These topics include: Creating tables and figures and interpreting p-values. Your lab instructor will tell you when this material will be presented.

**Tutoring sessions.** Finally, two tutors will be available for weekly in-person meetings and discussion of homework problems (times and locations TBA on the Blackboard sites). Tutors will not answer questions about the final assignment (see below).

**Attending alternate lecture sessions.** You should attend the section to which you are assigned (your “home” section). If you are unable to attend your home section on a given week, please email your instructor to let him/her know. You should also send an email to the instructor whose section you will attend.

**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 to your home lecturer, either during class or before class in the lecturer’s faculty mailbox. 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 cannot be accepted, nor can assignment handed into sections other than your “home” section.
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 permitted to use a basic calculator and an 8½-by-11-inch, single-sided, handwritten sheet of notes. The notes may not be electronically produced or reproduced (i.e., cut and paste). The calculator must have a square root key, but it may not be a graphing calculator, cell phone, PDA, laptop, or any other device that isn’t first and foremost a calculator.

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 Week 9 of the course. Please note the following:

- Your lecture instructor and your lab instructor 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. Lab & lecture instructors 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, lab & lecture instructors cannot review your written drafts.

Please do not ask your tutors for assistance with this assignment. Their responsibility is to handle questions related to the lecture/homework.
CLASS 1 – Introduction

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

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

1. The normal distribution
   - the normal curve
   - standard (z) scores
   - using the normal curve to estimate probabilities
CLASS 4 – Sampling and the Sampling Distribution  
*Essentials* Ch. 7 pp. 146-154

No new reading in *Wagner Way*

Read the 3 documents posted on BB, “Course Documents”, Week 4

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. Visualizing the concept: The sampling distribution applet

CLASS 5 – Estimation  
*Essentials* Ch. 7 pp. 154-172

*Wagner Way* Ch. 4

1. Concepts in estimation
   - bias and efficiency
   - point estimates and confidence intervals
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  
*Essentials* Ch. 8

No new reading in *Wagner Way*

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

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

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

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 & Correlation-1  
*Essentials Ch. 14 pp. 330-339*  
No new reading in *Wagner Way*

1. How do we estimate the magnitude 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

CLASS 12 – Bivariate Regression and Correlation-2  
*Essentials Ch. 14 pp. 339-351*  
*Wagner Way Ch. 7*

1. How do we measure the strength of the association between two continuous variables?  
   - coefficient of correlation (r)  
   - coefficient of determination (R²)  
   - explained and unexplained variation  
   - test of significance for r

CLASS 13 – Controlling for Other Variables  
*Essentials Ch. 15 pp. 362-364*  
*Wagner Way Ch. 8*

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

CLASS 14 – Dummy Variables; Controlling for other variables, continued  
*Wagner Way Ch. 9*

1. How can we use categorical data in the regression framework?  
   - dummy coding of independent variables  
2. Discussion of final assignment  
3. Regression going forward: violation of the underlying OLS assumptions
**Important dates**

**Midterm Exam**

The midterm exam will be given during the usual class period:

*Section 001: Tuesday October 25*
*Sections 002 and 003: Wednesday October 26*
*Sections 004 and 005: Thursday October 27*

Midterm exam review sessions will be offered during regular lab sessions. Your lab instructor will provide details.

**Final Exam**

The final exam will be given during final exam week, at the day and time of the usual class period:

*Section 001: Tuesday December 20th*
*Sections 002 and 003: Wednesday December 21*
*Sections 004 and 005: Thursday December 22*

Final Exam review sessions will be offered at a time and location TBA.

**Final Assignment**

The final assignment is due **Wednesday December 21st at 6 PM**, for all sections. Each lecturer will provide instructions re: the logistics of submission.
<table>
<thead>
<tr>
<th>CLASS</th>
<th>LECTURE TOPIC</th>
<th>READING IN Essentials</th>
<th>Homework to hand in during lecture?</th>
<th>READING IN Wagner Way</th>
<th>LAB TOPIC</th>
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<tr>
<td>1</td>
<td>Introduction</td>
<td>Ch. 1 - 3</td>
<td>No</td>
<td>Ch. 1</td>
<td>Introduction to SPSS</td>
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<tr>
<td>2</td>
<td>Central tendency and dispersion</td>
<td>Ch. 4 and 5</td>
<td>Yes</td>
<td>Ch. 2</td>
<td>Univariate descriptives in SPSS</td>
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<td>3</td>
<td>Normal curve</td>
<td>Ch. 6</td>
<td>Yes</td>
<td>Ch. 3</td>
<td>Bivariate descriptives in SPSS</td>
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<td>4</td>
<td>Sampling &amp; sampling distribution (The sampling distribution applet)</td>
<td>Ch. 7 (pp. 146-154)</td>
<td>Yes</td>
<td>See Blackboard</td>
<td>Making tables and good charts</td>
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<td>5</td>
<td>Estimation</td>
<td>Ch. 7 (pp. 154-172)</td>
<td>Yes</td>
<td>Ch. 4</td>
<td>Recoding variables in SPSS</td>
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<td>6</td>
<td>Hypothesis testing I</td>
<td>Ch. 8</td>
<td>Yes</td>
<td>(none)</td>
<td>TBA</td>
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<td>7</td>
<td>Hypothesis testing II</td>
<td>Ch. 9</td>
<td>Yes</td>
<td>(none)</td>
<td>Midterm review</td>
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<td>8</td>
<td>(Midterm exam)</td>
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<td>No</td>
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<td>9</td>
<td>Hypothesis testing III, Discussion of the Final Assignment</td>
<td>Ch. 10</td>
<td>Yes</td>
<td>Ch. 5</td>
<td>Hypothesis testing of means in SPSS p-values</td>
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<td>10</td>
<td>Bivariate tables, chi-square</td>
<td>Ch. 11, Ch. 12 (pp.282-290)</td>
<td>Yes</td>
<td>Ch. 6</td>
<td>Chi Square in SPSS</td>
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<td>11</td>
<td>Bivariate regression</td>
<td>Ch. 14 (pp. 330-339)</td>
<td>Yes</td>
<td>(none)</td>
<td>Discussion of the Final Assignment</td>
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<td>12</td>
<td>Bivariate correlation</td>
<td>Ch. 14 (pp. 339-351)</td>
<td>Yes</td>
<td>Ch. 7</td>
<td>Bivariate regression and correlation in SPSS</td>
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<tr>
<td>13</td>
<td>Multivariate regression</td>
<td>Ch. 15 (pp. 362-364)</td>
<td>Yes</td>
<td>Ch. 8</td>
<td>Multiple regression in SPSS</td>
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<td>14</td>
<td>Multivariate analysis Discussion of the Final Assignment</td>
<td>TBA</td>
<td></td>
<td>Ch. 9</td>
<td>Dummy variables in SPSS</td>
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</table>

Note that homework assignments are posted on Blackboard under “Assignments”. You will not hand in homework in Class 1. You will hand in homework beginning with Class 2; you will submit your homework to your lecture instructor.

August 26 2011
Lecture sections: dates and topics

<table>
<thead>
<tr>
<th>Tuesday section (Blustein)</th>
<th>Wednesday Sections (Prasad)</th>
<th>Thursday Sections (Guo, Polyne)</th>
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<td>October 4</td>
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<td>October 18</td>
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<td>October 19</td>
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<tr>
<td>October 25</td>
<td>Class 8 (Exam)</td>
<td>October 26</td>
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<tr>
<td>November 1</td>
<td>Class 9</td>
<td>November 2</td>
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<td>Class 10</td>
<td>November 9</td>
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<td>November 15</td>
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<td>November 16</td>
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<td>November 29</td>
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<td>November 30</td>
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<td>December 6</td>
<td>Class 14</td>
<td>December 7</td>
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</tbody>
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Lab topics by date

September 8, 9, 12 Lab 1: Wagner Way Chapter 1 – Intro to SPSS
September 15, 16, 19 Lab 2: Wagner Way Chapter 2 – Univariate Descriptive Stats
September 22, 23, 26 Lab 3: Wagner Way Chapter 3 – Bivariate Descriptive Stats
September 29, 30, October 3 Lab 4: No SPSS. Good Tables and Figures
October 6, 7, 10 No lab sessions
October 13, 14, 17 Lab 5: Wagner Way Chapter 5 – Recoding
October 20, 21, 24 Lab 6: Midterm Review Sessions
October 27, 28, 31 No lab sessions
November 3, 4, 7 Lab 8: Wagner Way Chapter 6 – Hypothesis Testing with Means
November 10, 11, 14 Lab 9: Chi-Square
November 17, 18, 21 Lab 10: No New SPSS material
November 28, Wagner Way Chapter 7 Bivariate Regression and Correlation
December 1, 2 Wagner Way Chapter 7 & 8 Bivariate Regression and Correlation and Multivariate Regression
December 5 Wagner Way Chapter 8 Multivariate Regression Dummy Variables
December 8, 9, 12 Wagner Way Chapter 9 Dummy Variables
December 14, 15, 16 Open labs