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 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 further 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 – hereinafter Essentials. This book, which covers basic statistical theory and manual computation, can be purchased at the NYU Professional Bookstore. The other text is J.Blustein’s SPSS: The Wagner Way – hereinafter Wagner Way. This text covers the use of the SPSS software for data analysis. It is available for purchase at the Wagner School café (WagnerWorks) on the 2nd floor of the Puck Building.
**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 for free (it is recommended that you use one of the University’s labs where there is a rapid printer). Printed copies of the week’s overheads or 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 + answers, as well as copies of old exams + answers. In order to master the course material, you should plan to work (and rework!) all of the practice problems, many of the circulated “challenge problems”, and at least 2 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 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 having reading and homework based on the Essentials, you will also have reading and homework from Wagner Way.

The SPSS procedures in Wagner Way will be discussed and demonstrated during the lectures, via overhead projection. Some students – and perhaps most – will find that reading Wagner Way prior to the lecture and then watching the demonstrations 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.

During the weeks when there is no new SPSS material, the lab sessions will be devoted to review of material from the lecture portion of the course. Your lab instructor will tell you more about how s/he plans to run the sessions.

**Tutoring sessions.** Finally, a tutor will be available for weekly in-person meetings, discussion of homework problems, and pre-exam review sessions (place and time TBA on the Blackboard sites).

**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 structure a multiple regression analysis, to generate regression results using SPSS software, and to interpret these results for statistical and theoretical significance.

Requirements and Grades. The course grade will be based on the following:
• in-class mid-term exam (25%);
• term paper [a.k.a the final computer assignment] (25%);
• in-class, final exam (35%); and
• timely completion of assigned homework and contribution to class discussion (15%).

For each written exams, students will be permitted to use a hand-held calculator and one 8 ½ by 11 single sided handwritten sheet of their own notes (not electronically reproduced, no cut-and-paste).
Schedule

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

3. Computer demo: Getting started with SPSS

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

3. Computer demo: Univariate descriptive statistics with SPSS

CLASS 3 – The Normal Curve

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

2. Computer demo: Bivariate descriptive statistics with SPSS
CLASS 4 – Sampling and the Sampling Distribution

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

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

3. Computer demo: Recoding variables in SPSS

CLASS 6 – Hypothesis Testing-1

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 exam 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

2. Computer Demo: Hypothesis testing with means in SPSS

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

3. Computer demo: Chi square test in SPSS
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  
2. Computer demo: Bivariate regression and correlation in SPSS

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 – Controlling for Other Variables and Selected Topics  
*Wagner Way* Ch. 9

1. How can we use categorical data in the regression framework?  
   • dummy coding of independent variables  
2. Computer demo: dummy variables in SPSS  
3. Discussion of final assignment  
4. Violation of the underlying assumptions  
   • Collinearity

CLASS 15 – In-class Final Exam  
This is given during the regular class period.

The final paper is due **Friday, December 18th at 12 noon**, for all sections.
<table>
<thead>
<tr>
<th>CLASS</th>
<th>LECTURE TOPIC</th>
<th>READING IN Essentials</th>
<th>READING IN Wagner Way</th>
<th>IN CLASS COMPUTER DEMO</th>
<th>Homework to hand in during lecture?</th>
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<tr>
<td>1</td>
<td>Introduction</td>
<td>Ch. 1 - 3</td>
<td>Ch. 1</td>
<td>Introduction to SPSS</td>
<td>No</td>
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<td>2</td>
<td>Central tendency and dispersion</td>
<td>Ch. 4 and 5</td>
<td>Ch. 2</td>
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<td>3</td>
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<td>Ch. 6</td>
<td>Ch. 3</td>
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<td>Yes</td>
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<td>4</td>
<td>Sampling &amp; sampling distribution</td>
<td>Ch. 7 (pp. 146-154)</td>
<td>(none in WW), but 3 documents on BB</td>
<td>Sampling distribution applet</td>
<td>Yes</td>
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<td>5</td>
<td>Estimation</td>
<td>Ch. 7 (pp. 154-172)</td>
<td>Ch. 4</td>
<td>Recoding variables in SPSS</td>
<td>Yes</td>
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<td>6</td>
<td>Hypothesis testing I</td>
<td>Ch. 8</td>
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<td>7</td>
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<td>8</td>
<td>(Midterm exam)</td>
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<td>9</td>
<td>Hypothesis testing III</td>
<td>Ch. 10</td>
<td>Ch. 5</td>
<td>Hypothesis testing of means in SPSS</td>
<td>Yes</td>
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<td>10</td>
<td>Bivariate tables, chi-square</td>
<td>Ch. 11, Ch. 12 (pp.282-290)</td>
<td>Ch. 6</td>
<td>Chi Square in SPSS</td>
<td>Yes</td>
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<td>11</td>
<td>Bivariate regression</td>
<td>Ch. 14 (pp. 330-339)</td>
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<td>12</td>
<td>Bivariate correlation</td>
<td>Ch. 14 (pp. 339-351)</td>
<td>Ch. 7</td>
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<td>Yes</td>
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<tr>
<td>13</td>
<td>Multivariate regression</td>
<td>Ch. 15 (pp. 362-364)</td>
<td>Ch. 8</td>
<td>Multiple regression in SPSS</td>
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<td>14</td>
<td>Multivariate analysis</td>
<td>(none)</td>
<td>Ch. 9</td>
<td>Dummy variables in SPSS</td>
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Note that homework assignments are posted on Blackboard under “Assignments”. You will not hand in homework in Class 1. You will hand in homework in Class 2; it will be based on the material covered in Class 1. In Class 3 you will hand in homework based on material covered in Class 2, and so on. You will submit your homework to your lecture instructor.

Final exams will be held during the usual class time on the date in the lecture schedule below. The final paper is due Friday, December 18th at 12 noon, for all sections.
LECTURES
Lectures will meet on the following dates (room locations listed on first page); particularly important dates are in bold:

<table>
<thead>
<tr>
<th>Wednesdays (Guo)</th>
<th>Wednesdays (Weinstein)</th>
<th>Thursdays (Polyne)</th>
<th>Mondays (Polyne)</th>
<th>Mondays (Brabazon)</th>
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<tr>
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<td>6:45 – 8:40</td>
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<td>3:30 – 5:25</td>
<td>8:00 – 9:55 PM</td>
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<td>Sep 10  Class 1</td>
<td>Sep 14  Class 1</td>
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<td>Oct 22  Class 7</td>
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<td>Oct 29 Class 8: Midterm</td>
<td>Nov 2 Class 8: Midterm</td>
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<td>Nov 25  Class 12</td>
<td>Nov 25  Class 12</td>
<td>Nov 26  NO CLASS: Thanksgiving</td>
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<td>Dec 2  Class 13</td>
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<td>Dec 10  Class 13</td>
<td>Dec 14  Class 14</td>
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<tr>
<td>Dec 16  NO CLASS: Reading Day</td>
<td>Dec 16 NO CLASS: Reading Day</td>
<td>Dec 15 Class 14: Meets on Tuesday</td>
<td>Dec 21 Class 15: Final Exam</td>
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