NEW YORK UNIVERSITY
ROBERT F. WAGNER GRADUATE SCHOOL OF PUBLIC SERVICE
Course Syllabus
Fall 2017
Statistical Methods for Public, Nonprofit, and Health Management

Section	Format	Day	Begin	End	Building	Rm#	Instructor
001	Lecture	Wed	11:00 AM	12:55 PM	12 WV	L120	Blustein
002	Lecture	Wed	6:45 PM	8:40 PM	Silver	411	Polyne
003	Lecture	Thurs	6:45 PM	8:40 PM	Silver	414	Vakilifathi
004	Lecture	Fri	8:00 AM	9:55 AM	Tisch	LC11	Polyne
005	Lab	Mon	9:00 AM	10:40 PM	Silver	411	Polyne
006	Lab	Mon	6:45 PM	8:25PM	194M	307	Ballerini
007	Lab	Mon	8:35 PM	10:15PM	194M	307	Ballerini
008	Lab	Fri	10:00 AM	11:40 PM	Bobst	LL 138	Polyne
009	Lab	Fri	1:00 PM	2:40PM	Bobst	LL 138	Polyne

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* (4th Edition), Wadsworth/Cengage Learning 2016, ISBN-3:9781305093836)– hereinafter *Essentials*. This book, which covers basic statistical theory and manual computation, can be purchased at the NYU Professional Bookstore or online. You may also use the 3rd or 2nd edition of this book; equivalent page numbers are provided later in his syllabus. 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 Main Stat 1 site in NYU Classes as a free .pdf download.

Math preparation. This course assumes a working knowledge of the algebra skills that are covered in the Wagner/ALEKS online math program. If you have completed ALEKS successfully, you

should be well prepared. If you have not yet checked your skills using ALEKS, you should begin as soon as possible. You may also want review the "Basic Mathematics Review" that appears as the prologue chapter of your textbook, or take one of the math review courses that is offered by the Wagner School.

NYU Classes sites. You will use two sites for this class: (a) the "Main" Stat 1 site, housing material for all of the lecture sections, and (b) another site housing material just for your lecture section. In addition to housing the course syllabus, the Main Site houses electronic materials for download that will help you to master the course material (practice problems, challenge problems, and copies of old exams – solutions are provided for all of these), as well as all homework assignments. You should plan to work (and rework!) the practice problems, the challenge problems, and old exams prior to taking the midterm and final. Your Lecture Section site houses the powerpoint slides that your lecturer will use each week. Hardcopies or electronic versions of these slides should be brought to each lecture. In addition, your Lecture Section site houses a gradebook where you can check all grades that you receive.

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 (but are not limited to): creating tables and figures and interpreting p-values. For the final exam, students will be expected to be familiar with all of the material in *Wagner Way*.

Calculator. A highly recommended calculator for the class is the Casio fx-300ESPLUS, which has a "Natural Display." It is $12.95, and it accommodates long Stat 1 calculations easily; and is available at the NYU Bookstore, as well as many online sites.

Tutoring sessions. Tutors will be available for weekly in-person meetings and discussion of homework problems (times and locations TBA on the Main Stat 1 site in NYU Classes). 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 to confirm that there is available space.

Weekly readings and arriving for class prepared: mini-quizzes. In order to get the most out of your class time, complete the assigned reading before attending class. For each class and each lab, that will mean devoting about an hour to reading the assigned material. After doing the reading for each lecture, you will take a brief online multiple choice mini-quiz, which will count toward your course grade.

Mini-quizzes (which will count toward your course grade) will be administered through your lecturer's Classes site, and will close one hour before the scheduled lecture. You should plan to log in and take the quiz well before the site closes; you cannot be excused from taking a quiz due to last minute connectivity problems. In tallying your score on the mini-quizzes, you are permitted to have missed (i.e. received a zero) on one quiz, without penalty. In other words, your lowest scored mini-quiz will be dropped.

Homework. There is homework nearly every week of class. Homework is graded on a scale of 0 (not submitted)/ 1 (submitted but deficient)/ 2 (submitted and adequate). In tallying homework grades, students are permitted to have missed (i.e. received a zero) for one homework, without penalty. In other words, your lowest scored homework will be dropped.

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 assignments handed into sections other than your "home" section.

Academic integrity. Students are reminded that they have signed an Academic Oath at NYU/ Wagner and they are bound by this oath and the principles of the academic code of the school, which can be found here: http://wagner.nyu.edu/portal/students/policies/code. Violations of these standards will automatically result in all participating students failing the course and being remanded to the discipline committee for further action.

Late assignment policy. Extensions will be granted only in case of emergency, out of respect to those who abide by deadlines despite equally hectic schedules. Late submissions without extensions will be penalized 20% per 24-hour period.

Students with disabilities. Any students requiring accommodations should contact their professor to make arrangements. Please be prepared to share your documentation from the NYU Moses Center regarding appropriate accommodations.

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

- 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.
- A capacity to use data and statistics to communicate with "lay" and expert audiences. A special focus is on the ability to communicate statistical concepts and findings in everyday English.
- A healthy skepticism about claims made with numbers.

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

- in-class midterm exam (25%);
- analytical memo assignment (25%);
- in-class final exam (30%); and
- completion of mini-quizzes and homework, attendance and contribution to class discussion (20%).

For the written exams, students will be expected to use a standard calculator (described above). Students 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). There are no make-ups for missed written exams. Unexcused failure to attend will result in a grade of zero.

Important notes 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 11 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

4th Ed: Ch. 1 - 2
3rd Ed: Ch. 1 - 2
2nd 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

4th Ed: Ch. 3 - 4
3rd Ed: Ch. 3 - 4*
2nd Ed: Ch. 4 - 5*
Wagner Way Ch. 2
**and see "Box Plots" p. 97-100 4th ed.*

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

4th Ed: Ch. 5
3rd Ed: Ch. 5
2nd Ed: Ch. 6
No new reading in *Wagner Way*

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

CLASS 4 – Sampling and the Sampling Distribution

4th Ed: Ch. 6 pp 139 - 151
3rd Ed: Ch. 6 pp 128- 138
2nd 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

4th Ed: Ch. 6 pp 150-170
3rd Ed: Ch. 6 pp 138- 156
2nd Ed: Ch. 7 pp. 154-172
No new reading in *Wagner Way*

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

4rdEd: Ch. 7
3rd Ed: Ch. 7
2nd Ed: Ch. 8
Wagner Way Ch. 4

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

4th Ed: Ch. 8
3rd Ed: Ch. 8
2nd Ed: Ch. 9
No new reading in *Wagner Way*
Midterm Review held in labs

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

4rd Ed: Ch. 9
3rd Ed: Ch. 9
2nd 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

4th Ed: Ch. 10, Ch. 11 pp 292 – 301
3rd Ed: Ch. 10, Ch. 11 pp 277 – 287
2nd Ed: Ch. 11, Ch. 12 pp. 282-290
No new reading in *Wagner Way*

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 & 12 – Bivariate Regression & Correlation

4th Ed: Ch. 12
3rd Ed: Ch. 13 pp 332 – 354
2nd Ed: Ch. 14 pp. 330-351
Wagner Way Ch. 6

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

2. How do we measure the strength of the association between two continuous variables?
   - coefficient of correlation (r)
   - coefficient of determination (R^2)
   - explained and unexplained variation
   - test of significance for r

3. Computer demo: Bivariate regression and correlation in SPSS

CLASS 13 – Controlling for Other Variables *Wagner Way* Ch. 7

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

CLASS 14 – Dummy Variables; Controlling for other variables, cont'd *Wagner Way* Ch. 8/9

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

Class 15: Wrap up and review – final class of the semester Open Labs

** Important dates and locations – see next page **

Important dates and locations

Midterm Exam

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

- Lecture Sections 001 and 002: Wednesday October 25
- Lecture Section 003: Thursday October 26
- Lecture Section 004: Friday 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 on the following dates and times:

- Wednesday 12/20 11 AM - 12:45 PM
- Wednesday 12/20 6:45 PM - 8:40 PM
- Thursday 12/21 6:45- PM 8:40 PM

Students must sign up for one of these as their exam sitting date. Sign up will take place later in the semester, and exam locations will be announced shortly before the exam dates.

The last lecture period of the term (falling on Wednesday December 13, Thursday December 14, and Friday December 15) will be devoted to a course look-back, wrap up, and review for the final exam.

Final Assignment

The final assignment is due on Monday 12/18 at 6pm for all sections. Assignments will only be accepted as hard copy. Each lecturer will provide instructions re: the logistics of submission.

Homework assignments and mini-quizzes

Homework assignments are posted on the Main Stat 1 Classes site under "Resources." 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.

Mini-quizzes are posted on your lecture section Classes site under "Tests and Quizzes." There will be no mini-quiz for the Class 1 material. The first mini-quiz, covering the Class 2 material, will be due just before your Class 2 lecture meets.