HARVARD UNIVERSITY
THE JOHN F. KENNEDY SCHOOL OF GOVERNMENT
QUANTITATIVE ANALYSIS AND EMPIRICAL METHODS (API-201)
Course Syllabus for Sections A, C and D – Fall 2016
Final Version

CLASSES

Section A	Jonathan Borck	T/Th	10:15 a.m. – 11:30 a.m.	L230
Section C	Dan Levy	T/Th	11:45 a.m. – 1:00 p.m.	L280
Section D	Teddy Svoronos	T/Th	11:45 a.m. – 1:00 p.m.	1 Brattle St – 401

REVIEW SESSIONS

Teaching Fellows will hold weekly review sessions at the following times:

Session #1	Fridays	10:15 a.m. – 11:30 a.m.	L140
Session #2	Fridays	11:45 a.m. – 1:00 p.m.	STARR

We strongly recommend you attend one of these review sessions each week. You may attend either session. There will be no review sessions held on the day of the midterm (Oct. 14).

CONTACT INFORMATION

FACULTY	OFFICE	EMAIL
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OFFICE HOURS

FACULTY	TIMES
Jonathan Borck	Thursdays, 8:45 a.m. – 10:00a.m., and by appointment
Dan Levy	Fridays, 2:30-5:00 p.m.
Teddy Svoronos	Thursdays, 3:00-5:00 p.m.

Office hours for Teaching Fellows and Course Assistants will be posted on Canvas.

COURSE OVERVIEW

API-201 introduces a range of quantitative tools commonly used to inform public policy issues. It covers descriptive statistics, probability theory, decision analysis, statistical inference, and regression analysis, with an emphasis on the ways in which they are applied to practical policy questions. Our goal is that by the end of this course you will be able to:

1. Frame a broad descriptive policy question (such as "what has happened to crime rates in the U.S. in the past 30 years?"), figure out the most appropriate statistical analysis to answer the question, conduct the analysis using real world data, identify the most salient findings/patterns that emerge from the data, and present the findings in an effective manner to policymakers.

2. Become skilled in the use of probability and decision analysis tools to better tackle real world personal and policy decisions involving uncertainty.

3. Critically consume policy studies/papers/reports in which statistical analysis is used.

The course content is divided into five broad units: Descriptive Statistics (2 classes), Probability (7 classes), Decision Analysis (3 classes), Statistical Inference (9 classes), and Regression Analysis (2 classes). The course also provides you with an opportunity to become proficient in the use of Excel as a tool to analyze quantitative data.

This course is required for first-year students in the MPP program. First-year MPP students with prior coursework in statistics can place out of the course entirely by taking an exemption exam at the start of the semester. The only way to exempt from API-201 is to demonstrate a high level of mastery on the exemption exam. Students not enrolled in the MPP program may be admitted with permission of the relevant instructor.

HOW DOES SECTION Z DIFFER FROM SECTIONS A, C, AND D?

Section Z has a similar syllabus as Sections A, C, and D, but it assumes a greater level of mathematical sophistication. It will rely more on calculus and proceed faster than the other sections, allowing more time for applications, in-depth discussions, and a number of advanced topics. Students in the Z section will be given the option to use several statistical software packages (Stata, R, and Mathematica). By contrast, Sections A, C, and D will focus on the use of Excel. We encourage students considering Section Z to talk with the instructors to determine which section is a better fit. Please note that to enroll in API-202Z, you will need an A or A- in API-201Z or an A in API-201ACD.

Students may switch from the Z section to the A/C/D sections. Students who switch by October 3 at 12:00 PM are expected to take the midterm exam in the A/C/D section. Students who switch between October 3 at 12:00 PM and October 17 at 12:00 PM are expected to take the midterm in the Z section (on October 6), and this midterm grade will count as the midterm grade in the A/C/D sections. No switches will be allowed after October 17 at 12:00 PM. The process for officially switching between the Z and ACD sections will be detailed at a later date. When switching from Z to the ACD section, you will be assigned to your original ACD section.

COURSE MATERIALS

Textbooks

We do not require a textbook for this course. We strongly recommend, however, that you obtain a textbook to use to prepare for class, to complete the pre-class exercises, and to supplement the material covered in class. Two good options are:

- Introduction to the Practice of Statistics, eighth edition. David S. Moore, George P. McCabe, and Bruce A. Craig. W.H. Freeman and Company. The textbook is available online and at the Harvard Coop.

- Open Intro Statistics, third edition. David M Diez, Christopher D Barr, and Mine Çetinkaya-Rundel. The electronic version of the textbook is available for free at http://www.openintro.org/. Printed copies may be purchased online for about $10.

In addition, we recommend the following classic texts to supplement your learning:

- How to Lie With Statistics. Darrell Huff, Irving Geis. W. W. Norton & Company; Reissue edition, 1993. ISBN: 0393310728. This book is a classic that has been in print for over 60 years. It has great, though sometimes dated, examples of how policy makers, journalists, and business people abuse and misuse statistics.

- The Cartoon Guide to Statistics. Larry Gonick, Woollcott Smith. HarperResource; 1st Harper Perennial ed edition, 1994. ISBN: 0062731025. This book provides excellent and amusing non-technical explanations of many key concepts.

- Smart Choices: A Practical Guide to Making Better Decisions. John S. Hammond, Ralph L. Keeney, Howard Raiffa, Broadway, 2002. ISBN: 0767908864. This book provides an introduction to decision analysis by three prominent leaders in the field.

Copies will be on reserve at the HKS library and available at the Harvard COOP.

Excel

- One of the objectives of the course is to help you gain proficiency using spreadsheets, which are often used to conduct policy analysis. Problem sets will contain exercises designed to get you to practice the basics of Microsoft Excel. If you have had little or no prior experience with Excel, we strongly encourage you to attend the Excel sessions that will be offered at the beginning of the semester and to check some resources available at bit.ly/API201Excel.

- The data sets used in the course will be available on the course website in Excel format. You may use other software packages, but the course will provide support only for Excel.

Handouts

> Handouts will be distributed throughout the course. The main objective of the handouts is to facilitate the process of taking notes so that you can fully engage in class. They are not meant to substitute for class attendance or for studying the assigned reading material. Handouts will contain blank spaces for you to fill in during class, usually in response to questions.

Canvas

We will use HKS's Canvas platform for this course. You will be able to find announcements, online readings, assignments, pre-class exercises, and other course materials on our Canvas site. Please visit the site on a regular basis.

GRADING

The class grade will be based on the following criteria:

10% - Problem sets	25% - Midterm
15% - Class participation and engagement	35% - Final Exam
15% - Final Exercise	

Problem Sets (10%)

> Problem sets will be assigned almost every week. They will give you hands-on experience with the analytic techniques introduced in class. You should plan to spend approximately 6-8 hours on each problem set. Problem sets (and, eventually, suggested solutions) will be posted on the course website. They will be graded on check-plus/check/check-minus basis.

> Problem sets not received before the deadline will be considered late. There will be no credit for late assignments. The lowest problem set grade will be dropped when calculating the average grade for the problem sets.

> Under the Harvard Kennedy School Academic Code, the problem sets for this course are "Type II" assignments unless indicated otherwise. You are encouraged to work in a study group, but **must submit your own solutions**. Examples of assignments that are not in accordance with the HKS academic code include reprints of substantially identical assignments, printouts of substantially identical Excel tables, and copies of solutions from previous years. Violations of the Academic Code are a serious violation of academic and professional standards and can lead to a failing grade in the course, failure to graduate, and even expulsion from the University. We take this issue seriously. If you have questions about the degree of collaboration allowed or about any other aspect of the Academic Code, please ask your instructor for guidance. The Kennedy School Academic Code is available here.

> ***Instructions for submitting problem sets:***
> - Turn them in electronically via the Canvas course page.
> - Submit them by 10:00 am on the day they are due.
> - Indicate on the cover page the names of the classmates with whom you worked.

Class participation and engagement (15%)

We believe that student participation can substantially enrich the learning experience for both the students and the instructor. In this spirit, we strongly encourage class participation. Effective class participation requires that you complete the pre-class exercise and do any assigned readings *before* coming to class. We encourage you to ask questions and to share with the class any relevant insights you may have from your work experience or from previous exposure to these topics. We only ask that the questions and comments be brief and related to the topic at hand. Given that this is a large class, we will sometimes need to defer questions for a future class or office hours.

Before most classes, we will ask that you complete an online exercise. The pre-class online exercises are designed to help you prepare for class so you can learn optimally in each class session. The assessment results will give us information about overall performance of the class that we will use to prepare class; your individual performance in the quiz will be registered in the system but will not count towards your grade in any way. Completing the pre-class exercises will count towards your grade.

Pre-class online exercises are due by 5:00 AM the morning of class.

The class participation and engagement grade will depend on three things: (1) your participation and engagement in class, (2) your engagement with the course outside class, (3) your completion of the pre-class online exercises. For all of these, both quantity and quality will count. Attending class regularly and punctually, engaging actively in both classwide and small group activities, and in general contributing to a positive learning atmosphere in the classroom all contribute to a strong participation and engagement grade.

Final Exercise (15%)

The final exercise will require applying some of the statistical tools learned in class using a real data set. More details will be provided later in the course.

Exams (60%)

There will be one midterm and a final exam. The exams will be closed book and closed notes. Calculators may be used, but statistical functions on them may not. Calculators that allow text storage are not permitted.

> Note: The midterm exam will be on **Friday, Oct. 14 from 8:00 AM to 10:00 AM.** There will be no review sessions that day. The final exam will be on **Friday, Dec. 9 from 9:00 AM to 12:00 PM.** Please plan your schedule accordingly.

All students are expected to be present on exam days. We will adhere to the Registrar's policy regarding rescheduling of exams (i.e. only to be done in case of documented health-related or personal emergencies).

Two-stage exams: The midterm and final exams will be two-stage exams. During Stage 1, you will be asked to complete the exam individually. This stage will take about 2/3 of the total exam time and will be worth 90% of your exam grade. After Stage 1, the exams will be collected and you will be given a second exam that will contain mostly a subset of the questions from the original exam. During Stage 2, you will be asked to work with a group, reach consensus answers, and submit one copy of the exam for the whole group. This portion of the exam will be worth 10% of your exam grade. If your group grade is lower than your individual grade, we will use your individual grade

Profs. Borck, Levy, and Svoronos
Quantitative Analysis and Empirical Methods I (API-201)

Harvard Kennedy School
Harvard University

as your Stage 2 grade. In other words, your Stage 2 grade can increase your overall exam score, but it cannot lower it.

The main reason we conduct a second stage of the exam is to allow you to learn more during the exam. Traditional exams tend to be summative rather than formative, and two-stage exams represent an opportunity to redress this imbalance. The process of discussing your answers with your teammates is a significant learning opportunity and supports the kind of collaborative learning that we encourage in this course.

Regrade Policy

Requests for reconsideration of grades on exams are not encouraged and will be accepted only in writing, with a clear statement of what has been incorrectly graded, within one week of receiving your graded exam. Please submit your full exam so grading on all questions can be reconsidered.

All course activities, including class meetings, homework assignments, and exams, are subject to the HKS Academic Code and Code of Conduct.

Final Letter Grades

Grades for each exam and for each component of the course (problem sets, final exercise, and class participation and engagement) will be standardized (i.e. curved) and an overall score for the course will be calculated for each student. This overall score will be translated into a final course letter grade using the Dean's Recommended Grade Distribution (available at http://www.hks.harvard.edu/degrees/registrar/faculty/exams-and-grading/grades).

Other items:

Recording Classes
Classes will be video-recorded, and recordings will be available for two purposes. First, to provide you with the option of reviewing the class so you can clarify or deepen your understanding of a particular concept. Second, to help us improve our teaching. The recordings will be kept in a protected page that is accessible to you only via the course site. As a member of our learning community and to stimulate risk-taking and vigorous debate in class, you are expected to never make any recordings available outside of our learning community. If you are uncomfortable with classes being recorded, please come and speak with us.

Use of Data
Data will be collected in various forms in this course. Some forms of data collection will be obvious to you (such as when responding to a question on a survey) but others might not be (such as someone from our teaching team recording class participation or the Canvas course website system recording activity while you are logged in). Whatever the form of data collection, we pledge to use the data to help improve my teaching and ultimately your learning. This includes using your responses to online quizzes to tailor a class better to the backgrounds and learning needs of students in the class, conducting research about the effectiveness of a particular teaching approach, etc. We also pledge to keep your data confidential so that it can only be used for the purposes of improving teaching and learning or to help you and other students connect with future professional opportunities. The university-wide policy on use of Canvas data can be found here.

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Quantitative Analysis and Empirical Methods I (API-201)

Harvard Kennedy School
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COURSE SCHEDULE

This schedule is subject to (modest) change. Please see the Canvas course website for updates.

#	Date	Topic	Assignments Due	Readings (Required readings are marked *)
I. DESCRIBING DATA				
1	9/1	Introduction and Descriptive Statistics #1		An Economist's Guide to Visualizing Data MMC: 1.1, 1.2, 2.1, 2.2 OIS: 1.1, 1.2, 1.6, 1.7
2	9/6	Descriptive Statistics #2	PS #1	MMC: 1.3, 2.3, 2.7 OIS: 1.6, 7.1.4
II. PROBABILITY				
3	9/8	Basic Probability		MMC: 4.1, 4.2, 4.5 (– p. 286) OIS: 2.1 (except 2.1.4)
4	9/13	Conditional Probability	PS #2	MMC: 4.5 (pp. 286-end) OIS: 2.2.1-2.2.6
5	9/15	Bayes' Rule		* New York Times (2016) and *Oster (2014) MMC: 4.5 (pp. 292-293) OIS: 2.2.7
6	9/20	Application: Public Pensions in Mexico	PS #3	* Mexico pensions case
7	9/22	Probability Distributions		MMC: 4.3 (– p. 256), 4.4 OIS: 2.1.4, 2.4, 3.3
8	9/27	Joint and Conditional Distributions; Conditional Expectations	PS #4	MMC: 2.6
9	9/29	Continuous Distributions		MMC: 1.4, 4.3 (pp. 256 – end) OIS: 2.5, 3.1, 3.2
III. DECISION ANALYSIS				
10	10/4	Decision Analysis #1: Overview	PS #5	Stokey and Zeckhauser
11	10/6	Decision Analysis #2: Multi-Attribute Decision-Making		*Hammond, Keeney and Raiffa
12	10/11	Behavioral Biases and Midterm Review	PS #6	
13	10/13	Decision Analysis #3: Pandemic Simulation		
	10/14	**MIDTERM (8:00 AM – 10:00 AM)**		

IV. STATISTICAL INFERENCE

14	10/18	Introduction to Statistical Inference	Final Exercise Selection	MMC: 3.4 OIS: Chapter 4 intro, 4.1
15	10/20	Sampling Distributions for Proportions		MMC: 5.2 (pp. 320-335), 6.2 (pp. 372-381) OIS: 4.3.1, 4.3.4, 4.3.5, 6.1.1, 6.1.3, 6.1.4
16	10/25	Confidence Intervals for Proportions	PS #7	MMC: 6.1 (pp. 353-357) and 8.1 (pp. 488-493, 495-end) OIS: 4.2, 6.1.2
17	10/27	Linking Conf. Intervals and Hypothesis Tests		MMC: 6.2 (pp. 386-end) OIS: 4.3.2
18	11/1	Statistical Inference for Means	PS #8	MMC: 5.1, 6.1 (pp. 358-end), 6.2 (pp. 382-end), 7.1 OIS: 4.1, 4.2, 5.3
19	11/3	Statistical Inference for Differences		MMC: 7.2, 8.2 OIS: 5.2, 5.4, 6.2, 6.6.1
20	11/8	Chi-squared Tests	PS #9	MMC: 9.1, 9.2 OIS: 6.3, 6.4
21	11/10	Significance, Power, and Other Key Concepts		MMC: 6.3, 6.4 OIS: 4.3.3, 4.3.6, 4.6
22	11/15	Application: Critical Assessment of Evidence	PS #10	* Oregon health care experiment

V. REGRESSION

23	11/17	Regression Analysis I		MMC: 2.4, 2.5, 10.1 (pp. 563-573) OIS: 7.1, 7.2, 7.3
24	11/22	Regression Analysis II	PS #11	MMC: 10.1 (pp. 574-576) OIS: 7.4
	11/24	*No Class (Thanksgiving)*		
25	11/29	Application: Critical Assessment of Evidence	PS #12	TBD
26	12/1	Final Review / Exercise Presentations	Final Exercise	
	12/9	**FINAL EXAM (9:00 AM – 12:00 PM)**		

Profs. Borck, Levy, and Svoronos
Quantitative Analysis and Empirical Methods I (API-201)

Harvard Kennedy School
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READINGS

Baicker et al. "The Oregon Experiment — Effects of Medicaid on Clinical Outcomes" The New England Journal of Medicine. May 2, 2013.

Hammond, John; Ralph Keeney and Howard Raiffa. 1999. "Smart Choices: A Practical Guide to Making Better Decisions" Chapter 8 (Risk Tolerance)

HKS Case 2011.0: "Providing Pensions for the Poor: Targeting Cash Transfers for the Elderly in Mexico"

Oster, Emily. 2014. "Are Mammograms Worth It?" Five ThirtyEight.

Schwabish, Jonathan. "An Economist's Guide to Visualizing Data" Journal of Economic Perspectives—Volume 28, Number 1—Winter 2014—Pages 209–234

Stokey and Zeckhauser, A Primer for Policy Analysis, Chapter 12.

The New York Times. "Panel Reasserts Mammogram Advice That Triggered Breast Cancer Debate". By Denise Gradyjan. Jan. 11, 2016