

MIT Department of Urban Studies & Planning  
11.220: Quantitative Reasoning and Statistical Methods for Planning I

Spring 2007

4-2-6- (G)

Lectures: Monday & Wednesday, 11 a.m. – 12:30 p.m., Room 37-212  
Recitations: W 5:30-6:30 p.m., Th 3-4 p.m., F 10-11 a.m. in rooms 1-246, 1-277 & 1-246 respectively  
Computing Labs: Same as recitations except all are in Room 37-312

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Course staff

Dr. Rhonda Ryznar (Instructor)

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Office hours: M 1:30-3:00, T 10:00-11:30

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Office hours: W 2:30-5:30

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Recitation time: W 5:30-6:30 (1-246)

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Recitation time: Th 3:00-4:00 (1-277)

Mi Diao (TA)

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Recitation time: F 10:00-11:00 (1-246)

Course description:

Many, if not most, planners frequently work with quantitative data. Some summarize, analyze, and present data they have collected themselves or have obtained from secondary sources; others must review quantitative analyses and assess the validity of arguments made therein. This course is designed to prepare you to critically review analyses prepared by others, as well as to conduct basic statistical analysis of data yourself.

Using numerous examples of “real world” quantitative analysis related to the planning profession, you will become familiar with a variety of tools for describing and comparing sets of data, as well as those used to generate estimates and test hypotheses. We will also emphasize the development of sound arguments and research design, such that students appreciate both the power and limits of quantitative analysis in argumentation. Unlike many other statistics classes, 11.220 gives particular attention to developing the skill of expressing statistical ideas in clear, simple language. We view these skills as essential for effective planning practice.

We will use a variety of software packages in this class, building on students’ experience in 11.913 and demonstrating the application of programs such as Access, Excel, ArcGIS and SPSS for quantitative and statistical analysis. In addition to lecture there is a required 2 hour session each week that will alternate between a laboratory session for hands-on practice with the software and a classroom recitation consisting of problem solving using statistical methods and equations.

Required textbook: (Available at the Coop and on reserve in Rotch Library.)

Meier, K., J. Brudney and J. Bohte. 2006. *Applied Statistics for Public and Nonprofit Administration*. 6th edition. Belmont, CA: Thomson Wadsworth.

### Recommended textbooks:

Davis, J., R. Ryznar, C. Zegras, and J. Ferriera. *Lecture Notes for 11.220*. Many past lecture notes will be available on the web; additional materials will be on reserve in the Rotch Library.

Ormsby, et al. 2004. *Getting to Know ArcGIS Desktop, Second Edition*. Redlands, CA: ESRI Press. ISBN: 1-58948-083-X. (Available at websites such as: [gis.esri.com/esripress](http://gis.esri.com/esripress) and [www.amazon.com](http://www.amazon.com)).

### Articles, book chapters, etc.: (Available in course reader and on reserve in Rotch Library.)

Horwitz, L., and L. Ferleger. 1980. Statistics and logic. In *Statistics for Social Change*. Boston: South End Press.

Hodge, G. 1963. The use and mis-use of measurement scales in city planning. *Journal of the American Institute of Planners*.

Lehman, Ann and John Sall. Excerpts from “Why is it Called Regression?” Also found at [http://www JMP.com/about/newsletters/jmpcable/pdf/06\\_summer\\_1998.pdf](http://www JMP.com/about/newsletters/jmpcable/pdf/06_summer_1998.pdf). SAS Institute, Inc.

Marsh, C. 1979. Opinion polls—social science or political manoeuvre? In *Demystifying Social Statistics*. J. Irvine, I. Miles, and J. Evans, eds. London: Pluto Press.

Monmonier, Mark. 1991. Data maps: making nonsense of the census. Chapter 9 in *How to Lie with Maps*. Chicago: University of Chicago Press.

Moore, D. and W. I. Notz. 2006. Chapters 1 – 4 in *Statistics: Concepts and Controversies*. 6th edition. New York: W.H. Freeman.

Moore, David S. 2004. Scatterplots and correlation. Chapter 4 in *The Basic Practice of Statistics*. 3<sup>rd</sup> edition. New York: W.H. Freeman.

Orfield, Myron. 1998. Affordable housing and the tax base. Chapter 4 in *Metropolitics: A Regional Agenda for Community and Stability*. Brookings Institute Press and Lincoln Institute of Land Policy.

O’Sullivan, David and David Unwin. 2003. Chapters 1 and 2 in *Geographic Information Analysis*. Hoboken, NJ: Wiley.

Savas, E. 1973. The political properties of crystalline H<sub>2</sub>O: planning for snow emergencies in New York. *Management Science* **20**(2).

Scanlan, J. 1991. The perils of provocative statistics. *Public Interest* **120**: 3-14.

Tufte, E. 1983. Chapter 2 in *The Visual Display of Quantitative Information*. Cheshire, CT: Graphics Press. Pages 53-78.

### Grading:

Your grade in this course will be determined by the following formula:

Attendance and preparedness (completing reading assignments before class) = 5%

Six homework assignments (6% each = 36%) plus quiz (9%) = 45%

Mid-term exam = 20%

Final paper = 30%

Please note that no homework assignments will be accepted past the date that solutions are posted on the class web site (which is generally 48 hours after assignments are handed in). Moreover, any assignment that is submitted past its due date will be penalized one full letter grade for every two days it is late. For example, a homework assignment that reflects “A-” level work but is submitted two days beyond the due date will receive a “B-”. No make-up exams will be given except in extraordinary (i.e., emergency)

circumstances. In order to maintain fairness among students and a smoothly running course for all of us, **these guidelines will be strictly followed.**

In determining a final course grade we may also take into account trends in a student's work and the level of his/her participation in class and recitation, which may also raise a grade at the margin (thus "counting" for somewhat more than 5% of the final grade). Also, be aware that students who have not achieved a sufficient level of command of the material will not receive a passing grade in the course. These students will have to take the course over again, or take an equivalent course in another department or at Harvard.

**11.220: Quantitative Reasoning and Statistical Methods for Planning I**  
Course schedule

Week	Date	Instructor	Topic	Subtopics	Reading
1	Feb. 7 (W)	Ryznar & Zegras	Introduction to course	Introduce instructors; how the course is set up; describe “Peer Instruction” and expectations; divide into groups for recitations or labs. Give first assignment requesting areas of interest and the reading for next lecture on arguments. What is statistics? The three parts of statistics: collection, evaluation, and drawing conclusions. Administer in-class survey.	n.a.
2	Feb. 12 (M)	Ryznar	What is an argument?	Types of arguments; deductive vs. inductive; characteristics and components of an argument; evaluating arguments; falsehoods and fallacies.	From WBEZ in Chicago   This American Life – <a href="http://www.thislife.org/">http://www.thislife.org/</a> . Click on "04" found under “Episodes/audio by year originally produced:”. Then click on the “speaker” icon next to the title “Fake Science.” Listen to the segment that occurs from 23:02 to 38:12 in the 58:59 show. Read “Get the lead hysteria out” at <a href="http://www.junkscience.com/foxnews/fn031601.html">http://www.junkscience.com/foxnews/fn031601.html</a> Recommended regarding logic and statistics: Horwitz and Ferleger (reader). Also helpful is: <a href="http://www2.sjsu.edu/depts/itl/graphics/main.html">http://www2.sjsu.edu/depts/itl/graphics/main.html</a> .
3	Feb. 14 (W)	Zegras	Research Design	Research design and its implications for analysis; dependent vs. independent variables; developing an hypothesis to test; finding causal relationships; lurking and confounding variables; internal vs. external validity; scientific method; experimental vs. control groups; advantages of quasi-experimental designs	M&B Chapter 3.
	Assigned on Feb. 14 and due on Feb. 20	<i>Kumar</i>	Homework 1	Read a paper and discuss the argument, measurements, etc.	
			Recitation	Logic and reasoning; sources of data.	
	Feb. 20 (Tuesday)	Zegras	Measurement		M&B Chapter 2; Hodge (reader).
	Feb. 21 (W)	Ryznar	Measures of Central Tendency, Measures of Dispersion	Frequency distributions; percentage distributions; summarizing and presenting univariate data; stem and leaf plots; relative frequency; cumulative frequency; ogives; histograms; mean; median; mode; measures for grouped data and different data types; boxplots; the Five Number Summary; variance and standard deviation, also for grouped data; distribution shapes.	M&B, Chapter 4, 5 & 6; Tufte (reader).
	Assigned	<i>Kassens</i>	Homework 2	Use SPSS to analyze with descriptive statistics	

Week	Date	Instructor	Topic	Subtopics	Reading
	on Feb. 21 and due on Feb. 26				
		<i>Kassens</i>	Lab 1	Descriptive statistics using SPSS.	
4	Feb. 26 (M)	Zegras	Introduction to Probability	Basics of probability theory; general rules of probability logic.	M&B Chapter 7.
	Feb. 28 (W)	Zegras	The Normal and Binomial Distributions	Characteristics of the normal distribution; z-scores; binomial probabilities.	M&B Chapter 8-9.
			Recitation	Frequency Distributions, Probability	
5	Mar. 5 (M)	Ryznar	Sampling	Sampling and probability; bias in sampling; strategies of sampling – random, systematic, stratified, cluster, quota, self-selected, purposive; sampling in the U.S. census; sampling strengths and weaknesses; margin of error.	Moore, “Concepts and Controversies,” Chapters 1-4. <a href="http://media.gallup.com/PDF/FAQ/HowArePolls.pdf">http://media.gallup.com/PDF/FAQ/HowArePolls.pdf</a> Marsh (reader).
	Mar. 7 (W)	Ryznar	Basics of Confidence Intervals and Tests of Significance	Introduction to inference and basics of hypothesis testing; estimating a population mean; the standard error	M&B Chapter 11.
	Assigned on Mar. 7 and due on Mar. 12.	<i>Diao</i>	Homework 3	Sampling, Probability, Normal and Binomial Distributions (Excel example), Hypothesis testing and CIs with one sample t tests for means.	
			Recitation	Sampling, estimation, confidence intervals	
6	Mar. 12 (M)	Zegras	Distributions, t and z, intervals,	Proportions: estimating for population, confidence intervals. Hypothesis testing: the null and alternative hypotheses; hypothesis testing with samples; one and two tailed tests; determining sample size; p-values.	M&B Chapter 12-13.
	Mar. 14 (W)	Zegras	Two Sample t Tests	Proportions: estimating for population, confidence intervals. Hypothesis testing: the null and alternative hypotheses; hypothesis testing with samples; one and two tailed tests; determining sample size; p-values.	M&B Chapter 13.
	Assigned on Mar. 14 and due on Mar. 19.	<i>Kassens</i>	Homework 4	Constructing hypotheses and testing- one and two-samples; means and proportions; confidence intervals	
			Recitation	Hypothesis testing	
7	Mar. 19	Ryznar	Review for	Review of all major concepts to be covered on the mid-term	

Week	Date	Instructor	Topic	Subtopics	Reading
	(M)	& Zegras	Mid-Term	exam.	
	Mar. 21 (W)	Ryznar & Zegras		Midterm Exam	
8	Mar. 26-30 (M-F)		SPRING BREAK		
9	Apr. 2 (M)	Ryznar	Testing the Difference Between Two Groups	Difference of means procedure; difference of proportions; equal vs. unequal variances.	M&B Chapter 14.
	Assigned on April 2 and due on <b>April 23</b>			Final paper descriptive analysis.	
	Apr. 4 (W)	Ryznar	Testing the Difference Between Two Groups	Continuation of difference of means and proportions. How to write a research paper	M&B Chapter 14.
10	Apr. 9 (M)	Zegras		Constructing contingency tables – 2 way; marginals; percentage difference; larger contingency tables; Chi-square statistical significance; measures of association.	M&B Chapter 15-16.
	Apr. 11 (W)	Zegras	Scatterplots and Correlation	Exploring bivariate relationships; r.	M&B Chapter 18, Moore “Basic Practice” Chapter 4; Lehman (reader).
	Assigned on April 11 and due on April 18	<i>Diao</i>	Homework 5	Difference of means and proportions, contingency tables, correlation	
		<i>Kumar</i>	Lab 2	Hypothesis testing, difference of means, and chi-square with SPSS	
11	Apr. 18 (W)	Ryznar	Simple Linear Regression	Introduction to Simple Linear Regression. Graphs, scatter plots; Cartesian coordinates; x-axis; y-axis; linearity; linear equation; variable; y-intercept; slope; positive vs. negative relationship; least squares method; y-hat, error.	M&B Chapter 18.
			Recitation	Regression analysis	
12	Apr. 23 (M)	Zegras	Linear Regression continued	The Assumptions of Linear Regression	M&B Chapter 19.
	Apr. 23		Paper Prep	Descriptive statistics for final paper due.	
	Apr. 25	Zegras	Multiple	Partial slopes, adjusted $R^2$ , assumptions for multiple	M&B Chapter 21.

Week	Date	Instructor	Topic	Subtopics	Reading
	(W)		Regression	regression	
	Assigned on April 25 and due on April 30.	<i>Kumar</i>	Homework 6	Regression problems on paper and Regression with SPSS	
		<i>Kassens</i>	Lab 3	Regression with SPSS	
13	April 30 (M)	Ryznar	Multiple Regression	Constructing predictive models; Regression Output and Data Management.	M&B Chapter 23.
	May 2 (W)	Ryznar	Spatial Data Analysis	GIS; Geoda; modifiable areal unit problem; spatial autocorrelation.	Monmonier, Ch.9 (reader); O'Sullivan and Unwin (reader). Recommended: Ormsby.
		<i>Diao</i>	Lab 4	GIS	
14	May 7 (M)	Guest	Research Design and Regression Analysis	Example application of research involving regression technique applied to a contemporary urban topic.	Paper to be disseminated.
	May 9 (W)	Ryznar & Zegras		Regression quiz and Q&A on final paper.	
			Recitation	Final paper	
15	May 14 (M)	Guest	Research Design and Regression Analysis	Example application of research involving regression technique applied to a contemporary urban topic.	Paper to be disseminated.
	May 16 (W)	Ryznar & Zegras	Final paper due; Wrap-up	Review and wrap-up; putting your QR skills to work.	