

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

Spring 2005

4-2-6- (G)

Lectures: Monday & Wednesday, 11 a.m. – 12:30 p.m., Room 4-231
Recitations: Mondays, 10-11 a.m.; Wednesdays, 2:30-3:30 p.m.; Thursdays, 5:30-6:30 p.m.
Computing Labs: Wednesdays, 5-6 p.m.; Thursdays, 5:30-6:30 p.m., Fridays, 9-10 a.m.

Course staff

Dr. Rhonda Ryznar (Instructor)
Office: 9-512
E-mail: ryznar@mit.edu
Office hours: W 1:30-3:00, Th 4-5:30

Prof. Joe Ferreira (Instructor)
Office: 9-532
Email: jf@mit.edu
Office hours: M 2:30-4, Th 10:30-12

Kathy Hoag (assistant to Dr. Ryznar)
Office: 9-545
E-mail: hoag@mit.edu

Sue Delany (assistant to Prof. Ferreira)
Office: 9-530
Email: sld@mit.edu

Jinhua Zhao (TA)
Office: 9-569
Email: jinhua@mit.edu
Office hours: Th 12:30-2:30

Shannon McKay (TA)
Office: 9-569
Email: mckay@mit.edu
Office hours: By appt.

Chris Zegras (TA)
Office: 10-485
Email: czegras@mit.edu
Office hours: Th 9:30-11:30

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, we 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 11.204 and demonstrating the application of programs such as Access, Excel, ArcGIS and SPSS to quantitative and statistical analysis. Students are encouraged to begin practicing their computing skills prior to the start of class and to seek the support they need throughout the term.

Required textbooks: (Available at the Coop and on reserve in Rotch Library; or, check with MCP2s who may be able to loan/sell their copies to you.)

Moore, D. 2000. *Statistics: Concepts and Controversies*. 5th edition. New York: W.H. Freeman.

Meier, K., and J. Brudney. 2001. *Applied Statistics for Public Administration*. 5th edition. New York: Harcourt Brace.

Recommended textbooks:

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

Ormsby, et al. 2001. *Getting to Know ArcGIS Desktop*. Redlands, CA: ESRI Press. ISBN: 1-879102-89-7. (Available at websites such as: gis.esri.com/esripress and 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?” Found at http://www JMP.com/news/jmpcable/06_summer1998/regression.html. 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. *How to Lie with Maps*. Chicago: University of Chicago Press.

Ormsby, et al. 2001. *Getting to Know ArcGIS Desktop*. Redlands, CA: ESRI Press.

Savas, E. 1973. The political properties of crystalline H₂O: 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. *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%
- Homework assignments and quizzes: 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

Note: Indicates that these sessions will feature computing skills development.

Date	Series Title	Lead Instructor	Topic	Material Covered	Readings	Activity Code	Week
Feb. 2 (W)	Lecture 1	RR & JF	Class introduction; Argumentation	Logistics, rationale for the course. Building and analyzing arguments.	Horwitz & Ferleger (reader); http://www2.sjsu.edu/depts/itl/graphics/main.html ; Lecture 1 notes	L	1
Feb. 2/3/4 (W/Th/F)	LAB 1	RR	Software Intro	Intro to 37-312 lab: Access, Excel and SPSS.		C	
Feb. 7 (M)	Issues		Issue sheet of student interests	Due in class.		H	2
Feb. 7 (M)	Lecture 2	RR	Argumentation (cont'd.); Introduction to measurement and data.	Argumentation cont'd: What's a valid argument? Validity and reliability in measurement. Measurement debates in the US Census. Types of variables and scales.	Moore, Ch.8 & 9; Hodge (reader); Wright (reader); M&B, Ch.2; Lecture 2 notes; http://www.thislife.org/ . Click on "04" found under "Episodes/RealAudio by year produced:", then click on the Real Audio icon next to the title "Fake Science". Listen to the segment that occurs from 23:02 to 38:12 in the 58:59 minute show.	L	
Feb. 9 (W)	Lecture 3	RR	Summarizing univariate data	Computing and interpreting means, medians, modes; Constructing frequency and percentage distributions.	M&B, Ch.4 & 5; Moore, Chapter 11 & 13; Lecture 3 notes.	L	
Feb. 9/10/11 (W/Th/F)	LAB 2	RR	Descriptive Stats	Descriptive Statistics using Access and SPSS.		C	
Feb. 14 (M)	Lecture 4	RR	Measures of central tendency and spread	Computing and interpreting range, variance, standard deviation; constructing boxplots; an introduction to outliers. Outliers in maps.	M&B, Ch.6; Moore, Ch.12; Lecture 4 notes.	L	3
Feb. 16 (W)	Lecture 5	RR	Summarizing bivariate data I	Contingency tables and scatterplots. Correlation. The visual presentation of quantitative data. ARCMAP/GeoDa	M&B, Ch.15; Moore, Ch.14; Tufte (reader); Lecture 5 notes	L	
Feb. 16/17/18 (W/Th/F)	LAB 3	RR	Exploratory Spatial Data Analysis	Intro to ArcMap Thematic mapping, joining data, layouts.		C	
Feb. 14/16/17 (M/W/Th)	Recitation 2	SM, JZ, CZ	Recitation	Review session with assigned recitation group.		R	

Feb. 22 Tuesday	HW 1		<u>Homework #1 due</u>	Due in class.		H	4
Feb. 22 Tuesday	Lecture 6	RR	Spatial Analysis I	Interpreting thematic maps and modifiable areal unit issues.	Monmonier, Ch.9 (reader); Orfield, Ch.4 (reader), Ormsby, Ch.1-6; O'Sullivan and Unwin (reader).	L	
Feb. 23 (W)	Lecture 7	RR	Summarizing bivariate data II	Simple linear regression: Terminology & interpretation. Causation <i>versus</i> association, predicted values, r-square.	Moore, Ch.15; M&B, Ch.18 (skip 310-311 and 314-315); Lehman and Sall (reader); Lecture 7 notes.	L	
Feb. 23/24/25 (W/Th/F)	LAB 4	RR	Bivariate data and thematic maps	Access, scatterplots and contingency tables with SPSS, boxplots, outliers and scatterplots in GeoDa.		C	
Feb. 22/23/24 (T/W/Th)	Recitation 3	SM, JZ, CZ	Recitation	Review session with assigned recitation group.		R	
Feb. 28 (M)	Lecture 8	RR	Other descriptive statistics: indices	Using and interpreting indices.	M&B p. 137-140; Moore, Ch. 16; Lecture 8 notes.	L	5
March 2 (W)	Lecture 9	JF	Experimental design I (sampling); probability	Sampling strategies: simple random samples; Definition of probability; simple probability rules.	Moore, Ch.1, 2, 4, 17 & 18; M&B, Ch. 7; Lecture 9 notes.	L	
Feb. 28/March 2/3 (M/W/Th)	Recitation 4	SM, JZ, CZ	Recitation	Review session with assigned recitation group.		R	
March 7 (M)	HW 2	-	<u>Homework #2 due</u>	Due in class.		H	6
March 7 (M)	Lecture 10	JF	Probability distributions I	Probability distributions I: The binomial.	M&B, Ch. 9; Lecture 10 notes.	L	
March 9 (W)	Lecture 11	JF	Probability distributions II	Probability distributions II: The normal distribution; the normal approximation to the binomial.	Moore, Ch. 13; M&B, Ch. 8 & 9; Scanlan (reader); Lecture 11 notes.	L	
March 9/10/11 (W/Th/F)	LAB 5	RR	Bivariate data, regression.	Linear Regression in SPSS. Viewing residuals in ArcMAP.		C	
March 7/9/10 (M/W/Th)	Recitation 5	SM, JZ, CZ	Recitation	Review session with assigned recitation group.		R	
March 14 (M)	Lecture 12	JF	The US census; Paper discussion	US Census SF3 and PUMS data; sampling strengths/weaknesses and geographic aggregation.	http://www.census/prod/cen2000/doc/sf3.pdf ; http://www.census.gov/prod/cen2000/doc/pums.pdf ; Moore, Ch. 4; Lecture 12 notes.	L	7

March 16 (W)	Exam	RR	Midterm exam	In class		E	
March 21-25	No class	N/A	Spring Break	N/A		V	8
March 28 (M)	Paper Proposal		Paper Topic Proposal	Due in class.		H	9
March 28 (M)	Lecture 13	RR	Estimation	Constructing confidence intervals for means & proportions.	Moore, Ch. 3, 21 & 25 (skip p. 490-492); M&B, Ch. 11 & 13; Lecture 13 notes.	L	
March 30 (W)	Lecture 14	RR	Experimental design & measurement	Research design: Experiments and quasi-experiments.	Moore, Ch. 5, 6 & 7; M&B, Ch. 3; Lecture 14 notes.	L	
Mar. 28/30/31 (M/W/Th)	Recitation 6	SM, JZ, CZ	Recitation	Review session with assigned recitation group.		R	
April 4 (M)	Lecture 15	RR	Hypothesis testing - 1	Hypothesis testing with one sample: Means & proportions.	Moore, Ch. 22 & 23; M&B, Ch. 12; Lecture 15 notes.	L	10
April 6 (W)	HW 3		Homework #3 due	Due in class.		H	
April 6 (W)	Lecture 16	RR	Hypothesis testing - 2	Hypothesis testing with two samples: Difference of means & proportions.	M&B, Ch. 14; Lecture 16 notes.	L	
April 11 (M)	Lecture 17	JF	Spatial Analysis - 2	Applications of spatial analysis: buffering, difference between means.	Ormsby, Ch. 8-12; O'Sullivan and Unwin (reader).	L	11
April 13 (W)	Lecture 18	JF	Spatial analysis - 3	Selecting suitable locations; neighborhood statistics and proximity measures, raster methods.	http://www.urban.org/nnip	L	
April 13/14/15 (W/Th/F)	LAB 6	RR	Buffering	Buffering with ArcMAP and hypothesis testing with SPSS.		C	
April 18 (M)	Holiday	N/A	Patriot's Day	Holiday: no class		V	12
April 20 (W)	Paper Prep		Descriptive statistics for final paper	Due in class.		H	
April 20 (W)	Lecture 19	RR	Analyzing ordinal and nominal data	Contingency tables. The chi-square test.	Moore, Ch. 24; M&B, p.237-243; Lecture 19 notes.	L	
April 20/21 (W/Th)	Recitation 7	SM, JZ, CZ	Recitation	Review session with assigned recitation group.		R	
April 25 (M)	Lecture 20	RR	Regression revisited	Multiple regression; Hypothesis testing in regression.	M&B, Ch. 19 & 21 (skip p. 371-375); Lecture 20 notes.	L	13

April 27 (W)	Lecture 21	RR	Regression, cont'd.	Hypothesis testing in regression (cont'd.); Using and interpreting dummy variables.	Same as April 25; Lecture 21 notes.	L	
April 25/27/28 (M/W/Th)	Recitation 8	SM, JZ, CZ	Recitation			R	
May 2 (M)	HW 4	-	<u>Homework #4 due</u>	Due in class.		H	14
May 2 (M)	Lecture 22	JF	Exploring regression models	Multiple regression analysis examples.		L	
May 4 (W)	Lecture 23	RR & JF	Quiz and discussion	In-class quiz on multiple regression, Q&A on final paper		QD	
May 4/5/6 (W/Th/F)	LAB 7	RR	Paper & Regression Analysis	Contingency tables, chi-square, regression with SPSS; final paper analyses.		C	
May 9 (M)	Lecture 24	RR & JF	Discussion	Q&A on final paper		D	15
May 11 (W)	Paper		Final paper due	Must be posted to the class website no later than 5:00 pm EST.		H	
May 11 (W)	Lecture 25	RR	Review and wrap-up: Putting your QR skills to work	Review and summary.		S	

Activity Key:

L = Lecture; H = Homework; U = Ungraded Assignment; C = Computing Lab; R = Recitation; E = Exam; V = Vacation; Q = Quiz; D = Discussion; S = Summary.