MIT

11.188: Urban Planning and Social Science Laboratory

11.205: Intro to Spatial Analysis (1st half-semester)
11.520: Workshop on GIS (2nd half-semester)

Spring 2020 SYLLABUS

INSTRUCTOR

Prof. Joseph Ferreira, Jr., Room 9-532, jf@mit.edu
Office hours: Thursday 10:30 - Noon in 9-219

COURSE STAFF

Teaching Assistant: Rida Qadri, rqadri@mit.edu
Office hours : TBA

MEETINGS

Monday: Lab prep and Lab exercises 2:30- 5:00 PM in Room W31-301
[Lab prep and start of exercise are the key parts. Students can leave for other classes beginning at 4 and finish the exercises later on their own.]

Additional supervised lab time (with no new material): Friday, most likely 12:30pm-2:00pm in the Building 9 fifth floor computing lab (9-554)

Wednesday: 2:30- 4:00 PM in the City Arena (Room 9-255)

Website: Lab exercises, lecture notes, and other class materials for both 11.188 and the 11.205+11.520 modules are available in the one class locker at: http://web.mit.edu/11.188. In addition, lab, homework exercises, and some readings will be available via Stellar at: http://stellar.mit.edu/S/course/11/sp19/11.188.

CREDITS

11.188 is an undergraduate subject that will satisfy both the Department and the Institute lab requirement and earns 3-6-3 units of undergraduate credit.

11.205 and 11.520 are graduate subjects and 11.205 satisfies the GIS and Spatial Analysis requirement of the MCP degree program.

GOALS

This class uses lab exercises and a workshop setting to help students develop an in-depth understanding of the planning and public management uses of geographic information systems. The goals are to help students:

- Learn *spatial analysis* methods and acquire *technical skills* in the use of

geographic information system (GIS) software and database management tools through

- lab exercises and homework using small (but real) local datasets, and
- project work involving the shared use of larger datasets and the mixing and matching of data from different sources.
- Acquire *qualitative methods skills* by:
  - gathering data and documentation
  - analyzing information, and
  - presenting results effectively.
- Investigate the *potential and practicality of GIS* technologies in a typical planning setting and evaluate possible applications.

- *Understand* basic principles underlying the growth of web mapping, geospatial services, and location-aware computing.

The first half of the semester covers basic thematic mapping and the buffering and overlay operations (using vector and raster data) that are involved in basic 'site suitability' assessments. The content meets the 'spatial analysis' requirement for the MCP degree and includes a bit more database management (using MS-Access) than is covered in the Fall version of 11.205. The second half of the semester includes additional work with model building tools (Model Builder), and web mapping (CartoDB) plus a small, individual project that exercises the concepts and tools learned earlier in the semester.

We try to teach GIS methods and techniques with some attention to open-ended planning questions that invite spatial analysis but will

- Require judgment and exploration to select relevant data and mapping techniques;
- Involve mixing and matching new, local data with extracts from official records(such as census data, parcel data and regional employment and population forecasts);
- Utilize spatial analysis techniques such as buffering, address matching, and overlays;
- Use other modeling and visualization techniques beyond thematic mapping (e.g., map mashups);
- Raise questions about the skills, strategy, and organizational support needed to sustain such analytic capability within a variety of local regional planning settings.

PREREQUISITES

The prerequisites for the course are:

- A working familiarity with personal computing, spreadsheets, and the MIT Athena CRON computing environments.
- A basic familiarity with elementary data analysis that most undergrads acquire via general Institute requirements, and most graduate students have already acquired via undergrad methods and analysis classes. The Fall class, 11.220 (Quantitative Reasoning I), is a suitable analytic prerequisite for graduate students.

REQUIREMENTS

Students will be expected to complete weekly lab exercises plus three

homework sets covering readings and basic GIS skills. Students will also complete one in-class test and a small project of the student's choosing that draws on the skills taught in the class. This project will be presented to the class in an oral presentation and a brief written report. The project should require about the same effort as one of the homework sets. Due dates for these requirements are given in the schedule below. The GIS exercises will use ArcGIS software on WinAthena workstations.

GRADING

Content	11.205	11.520	11.188
Six Lab Exercises (collectively)	30%		15%
Two Homework Sets (collectively)	32%		16%
In-Class, Open-Book Test	32%		16%
Third Homework & last 2 labs		44%	22%
Small Project		50%	25%
Class Participation	6%	6%	6%

Please include your **name** and **Athena username** on *all* assignments, tests, etc., including those turned in electronically. We need this information to identify your work easily.

LATENESS POLICY

All assignments with be submitted online using the Stellar website for the class. Turning in assignments promptly is important both for keeping current with the subject matter, which is cumulative, and to keep all students on a level playing field. Hence, we have adopted a *strict* policy towards credit for assignments that are turned in late. We will consider requests for extensions due to extenuating circumstances on a case-by-case basis, but please do not count on such requests being granted.

Lab exercises are typically due one week after the corresponding lab. A late lab exercise will be accepted up until one week after the original due date for a loss of one grade (e.g., a "check" becomes a "check-minus"). After that, late assignments will receive *no* credit and will *not* be accepted.

Late problem sets will have two points deducted for each day (weekends and holidays count for a single day) that it is turned in after the due date. Hence, a problem set turned in three days late would lose 6 points. If it would have earned 90 points if turned in on time, it would receive only 84 points under these conditions. Regardless, after two weeks, no problem sets will be accepted if the answers have been posted.

Final project write-ups are due on the last day of classes, May 17. Write-ups turned in after Friday, May 18 will lose 5 points. No project write-ups will be accepted after Tuesday, May 22.

ACADEMIC INTEGRITY

Plagiarism and cheating are both academic crimes. For this class, it is helpful and okay to discuss lab exercises and problem sets (but not tests) with other classmates, but the results and discussion that you turn in should be your own work and not anything copied from another person or paper. Never (1) turn in an assignment that you did not write yourself, (2) turn in an assignment for this class that you previously turned in for another class, or (3) cheat on an exam. If you do so, it may result in a failing grade for the class, and possibly even suspension from the college. Please see me if you have any questions about what constitutes plagiarism. Anyone caught cheating on an exam will be reported to the provost in line with recognized university procedures.

TEXTS

There is no required-purchase text. Texts marked with an asterisk (*) will be held on reserve at Rotch Library. We are currently working on placing these on reserve and you will be notified once they are available. The books may be purchased from online retailers such esripress.esri.com, amazon.com, barnesandnoble.com ,Wiley, and from various used book sites.

- Law, Michael, and Amy Collins, Getting to Know ArcGIS (4th Edition), ESRI Press, Redlands, CA, 2013, ISBN-13: 978-1589483828. This edition covers up to version 10.3. An older version of the book is basically the same and still a useful alternative:
    - *Ormsby, Tim, et at. Getting to Know ArcGIS Desktop (for ArcGIS 10). ESRI Press, Redlands, CA, 2010, 2nd edition. (ISBN-13: 978-1589482609). Both books are available directly from esripress.esri.com for ~$80 and at Amazon, et al. for less than $50 - even less for used version.
- Monmonier, Mark. *How to Lie with Maps*. Second Edition. Chicago: University of Chicago Press, 1996. Hardcover: ISBN 0-226-53420-0. Paperback: ISBN 0-226-53421-9. The paperback is now under $15 at Amazon. (The 1991 first edition, ISBN 0-226-53415-4, is also fine.)
- (*) Longley, Goodchild, Maguire and Rhind, *Geographic Information Systems and Science, Third Edition*, 2010. ISBN: 978-0-470-72144-5. Available for ~$100 from Wiley. The earlier edition from 2001 (ISBN: 0-471-89275-0) is adequate, and is in the Library.
- NCGIA Core Curriculum in GIScience: online on U. of California eScholarship website: http://escholarship.org/uc/item/3g1217wg?query=ncgia%20giscience#page-1
- (*) Peng and Tsou, *Internet GIS: Distributed Geographic Information Services for the Internet and Wireless Networks*, John Wiley, New York, 2003, ISBN: 0-471-35923-8. Paper version available from Wiley.
- (*) OSullivan, David, and David Unwin, *Geographic Information Analysis*, 2nd edition, John Wiley Sons, New Jersey (2010) ISBN: 978-0-470-28857-3. (Available for ~$115 from Wiley. The earlier 2003 edition (ISBN: 0471211761)(in Library) is adequate.
- Arctur, David and Michael Zeiler, *Designing Geodatabases: Case Studies in GIS Data Modeling,* ESRI Press, Redlands, CA, 2004, ISBN: 9781589480216 (Available for ~$28 from Amazon.)
- Zeiler, *Modeling our world: the ESRI guide to geodatabase design*. 2010 ESRI Press.ISBN: 9781589482784 (Available for ~$29 from Amazon.)

SCHEDULE

Lab Mon., Feb. 3	Lab 1: GIS Introduction Exercise ArcGIS basics *Reading:* - Law (Parts 2,3) or Ormsby (Sections 2,3) - Monmonier, Chapter 2: "Elements of the Map."
Lecture Wed., Feb. 5	Introduction to the Class and GIS; GIS Principles & methods, GIS Models plus GIS at MIT on WinAthena computers *Reading:* - *http://escholarship.org/uc/item/3g1217wg?query=ncgia%20giscience#page-1* - *Law (Part 1) or Ormsby (Section 1)* - *Zeiler, Chapter 1* - *Introduction to GeoProcessing Presentation (Lecture notes by Lisa Sweeney, MIT GIS Services, during MCP Orientation, Sept. 1, 2010)* - Law (Part 5) or Ormsby (Section 4) - Monmonier, Chapter 3: "Map Generalization: Little White Lies and Lots of Them." - Longley, et al, Chapter 4: Georeferencing. - Longley, et al, Chapter 3: Representing Geography
Lab Mon., Feb 10	Lab 2: Thematic Mapping in ArcMap (symbolization and exploratory vs. explanatory mapping) Database Operations in ArcGIS (spatial selection, query selection, tabular joins, spatial joins) **Lab Exercise 1 due** *Homework Set 1 posted online* *Reading:* - Ferreira, J. Jr., 1990. "Database Management Tools for Planning", Journal of the American Planning Association, Winter, pp.78-84. *[on Stellar]* Law (Part 4, chapter 11, and Part 5) or Ormsby (Section 4; Section 6, chapter 14)
Lecture Wed., Feb. 12	GIS Data Manipulation and Querying, Relational Databases (with MS-Access) and Coordinate Systems *Reading:* - Ferreira, J. Jr., 1990. "Database Management Tools for Planning", Journal of the American Planning Association, Winter, pp.78-84. *[on Stellar]* - Modeling our world, 4 & Chp 5 - Law (Part 3, chapter 6) or Ormsby (Chapter 13)

	- Longley et al, Chapter 9: "Geographic Modeling." - Longley et al, Chapter 11: "Creating and Maintaining Geospatial Databases."
Mon., Feb. 17	<<< no Lab, President's Day >>>
Lecture Wed., Feb 19	Making Sense of the Census **Homework Set 1 due** *Homework Set 2 distributed* *Reading:* - Monmonier, Chapter 10 (Chapter 9 in the first edition): "Data Maps: Making Nonsense of the Census."
Lab Mon., Feb. 24	Lab 3: Working with 2010 Census Data **Lab Exercise 2 due**
Lecture Wed, Feb. 26	More Census Data, Queries, and Spatial Analysis Examples **Homework Set 2 (Part 1) due** *Reading:* - [Prof. Peter Dana's notes (U. of Colorado)](#)
Lab Mon., March 2	Lab 4: Database Aggregation, SQL, and Charts **Lab Exercise 3 due**
Lecture Wed., March 5	Spatial Analysis (Vector Analysis). *Reading:* - Law (Part 6, chapters 18,19) - *or* Ormsby (Sec. 4, chapters 11,12)
Lab Mon., March 9	Lab 5: Vector Spatial Analysis (buffers, polygon overlay, area allocation, using ArcTools) **Lab Exercise 4 due** *Reading:* - Law (Part 6, chapters 18,19) - *or* Ormsby (Sec. 4, chapters 11,12)
Lecture	Spatial Data Models and Spatial Analysis II (Raster)

Wed., March 11	
Friday, March 13	**Lab Exercise 5 due**
Lab Mon., March 16	**In-class Test** (in lab, open book)
Lecture Wed., March 18	Intro to Web Mapping and Geoprocessing Services **Homework Set 2 (Part 2) due** _Reading:_ • Peng and Tsou, [Chapter 1](#) [Chapter 4](#) <<< End of 11.205 >>>
Mar. 23-27	<<< Spring Break >>>
Lab Mon., March 30	<<< Start of 11.520 >>> Lab 6: Raster Spatial Analysis (Interpolation, Raster Operations, Spatial Analyst) and Model Builder **Preliminary Project Proposal due**
Lecture Wed., April 1	GIS Data Creation, Advanced Raster Operations, and Model Building _Homework Set 3 distributed_ _Reading:_ • Law (Part 4) or Ormsby (Sections 6,8)
Lab Mon., April 6	Lab 7: GPS Data Gathering **Lab Exercise 6 due**
Lecture Wed., April 8	**Homework Set 3 part 1 due** Model Builder, Online Data, and Web Mapping
Lab Mon., April 13	Lab 8: Introduction to Web Services **Lab Exercise 7 due** _Reading: to be distributed_
Lecture Wed., April 15	Project Work **Revised Project Proposal due**

	Homework Set 3 part 2 due
Mon., April 20	*<<< Patriot's Day Holiday >>>*
Lecture Wed., April 22	*Tips on Project Presentation and Writeup, plus Project Work* **Lab Exercise 8 due** *Reading:* • Notes by Cherie Abbanat, DUSP Writing Specialist, on "Creating Your 11.188/11.520 Presentation and Report"
Lab Mon., April 27	*Project Work* Project Proposal Feedback
Lecture Wed., April 29	*Project Work*
Lab Mon., May 4	**Project Work**
Lecture Wed., May 6	*Project work & Presentation Preparation*
Mon., May 11	**Project presentations**

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Back to the [11.188 Home Page](#)**.**
Back to the [CRON Home Page](#)**.**