Class Description:

The best way to learn about Geographic Information Systems (GIS) is to apply them to a spatial question that is important to you. This class focuses on teaching students who have basic knowledge of GIS to (1) develop a spatial research question, (2) find the data and tools needed to answer that research question, and (3) implement a research project, and (4) present their findings. Over the course of the semester, students will also learn how to scrape, find, digitize and plot their own data using tools as simple as their cell phone.

Students who complete this course will have the ability to both analyze and visualize spatial research, and, most importantly, they will know how to use GIS as a research method.

What's a Spatial Question?

A spatial research question is one where geography is a variable to answering the question. A simple question might be... "Sandy Recovery money is meant to address issues in communities that house vulnerable populations and are within the Sandy inundation areas. Regional authorities want to determine whether federal funds did in fact go to these areas and whether funds spatially clustered in some neighborhoods and not others. Furthermore they would like to determine the underlying reasons for clustering if it appears."

Prerequisites:

The course assumes that you have some prior knowledge of GIS. This means you have either taken the companion Introduction to Spatial Analysis (11.205) course, tested out of 11.205, or can prove that you have had significant Introduction to GIS course work in the past. MIT Master’s in City Planning candidates must have tested out or passed 11.205 to take this course.

Course Objectives:

- Learn how to ask spatial research questions.
- Develop skills needed to work through a project that uses GIS as a management or visualization tool.
- Learn how to find publicly accessible data sets.
- Learn how to create GIS files using a variety of methods including GPS units.
- Learn about open source GIS
- Learn basic web data visualization.

Class Structure: Lecture, Class Critique, Lab:

The best way to learn GIS is through practice, hands-on interaction, and critique.

The course has a lecture and lab component. Lectures are held on Monday and Wednesday. In addition to learning GIS, we will use the lectures to review homework as a group student will critique other students’ work. Labs will be held on Tuesdays and Wednesdays. Labs are mandatory. During labs we will go through, step by step, an exercise that will be essential for you to finish your homework. Labs are intertwined with instruction and students who do not attend will miss information both important to complete the take home exercises and...
problem sets and key concepts covered in the course. You will select a preferred lab session (Tuesday and Wednesday, we may add Thursday depending on size of class) at the beginning of the semester. Staff will make then make lab assignments based on student preference and lab capacity considerations. Once you are assigned to a lab, you will stay in that lab for the entire course.

Assignment & Grading:

<table>
<thead>
<tr>
<th>11.520 Grading</th>
<th>% of TOTAL</th>
<th>DUE</th>
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</thead>
<tbody>
<tr>
<td>EXERCISE A</td>
<td>10%</td>
<td>11/5</td>
</tr>
<tr>
<td>EXERCISE B</td>
<td>10%</td>
<td>11/12</td>
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<tr>
<td>EXERCISE C</td>
<td>10%</td>
<td>11/26</td>
</tr>
<tr>
<td>Final Projects</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Paragraph (P1)</td>
<td>5%</td>
<td>11/2</td>
</tr>
<tr>
<td>Project Proposals (P2)</td>
<td>15%</td>
<td>11/19</td>
</tr>
<tr>
<td>Draft Presentation</td>
<td>5%</td>
<td>12/2, 12/3</td>
</tr>
<tr>
<td>Presentation &amp; Poster</td>
<td>35%</td>
<td>12/7, 12/8, 12/9, 12/10</td>
</tr>
<tr>
<td>Class Participation</td>
<td>10%</td>
<td>NA</td>
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No late assignments will be accepted!! I cannot accept late assignments because the class is too short. If I allowed late assignments, it would hold up grading and impact when other students get their assignments returned to them.

All assignments will be posted on the stellar website and you will submit your assignment through Stellar as well.

Final Project:

The final project consists of a poster and a presentation and is worth 60% of your grade. The total grade for the project includes your development of a proposal and a topic idea that has a spatial question. There are a series of assignments that help you ask your spatial questions and each add up to your total grade; a paragraph that gets you started with your spatial question (5%), a project proposal (15%), and draft presentation (5%)

Materials:

**Hard Drive:** It is recommended that everyone get an external hard drive to hold data for your assignment and final project. I suggest a minimum of a 40 GB hard drive, but even the cheapest mobile drive comes at 1TB. The “WD My Passport 1 TB” costs roughly $69.99 on Amazon, which is an amazing amount of data. This drive will be useful for this class and beyond.

**Book:** I have scanned most of “GIS for the Urban Environment” by Julie Maantay and John Ziegler, but you might be interested in purchasing as most of the readings come from that book. Amazon often has great prices.

**Readings:** Any articles and book chapters assigned are provided on the Stellar site.

**HELP!!**: There are various ways to get help for this class.

**Discussion Forum on Stellar:** If you have a question, it is likely that others might have that question too, or have already found a solution to the same issue. I encourage you to post questions to the discussion forum on Stellar first. Both the TA’s and lab instructors will be answering questions posted
to the discussion forum, before we answer questions received via our personal email. So please try to use the discussion board first.

**Teaching Assistants and Office Hours:** The Teaching Assistants will have office hours. This will be time in which you can work on assignments and ask the TA’s for help - I strongly suggest taking advantage of the TA during their office hours.

**GIS Laboratory in the Libraries:** Located in Rotch library, this is a great resource for GIS data and technical questions. The GIS Laboratory collects GIS data and might have data you need for your final project. The GIS lab also has technical consultants available for questions regarding the acquisition of data as well as the technical questions related to performing certain GIS operations. Seek them out. The can be researched by contacting gishelp@mit.edu.

**ESRI GeoNet and User Forums:** There are two websites that are great resources for technical GIS software questions. The old ESRI user forums and the new GeoNet set are found at https://geonet.esri.com

**General Comment about Email:**

I will not always be able to respond to email right away. Therefore it is very important that you try to use the other resources you have available such as the discussion forum on Stellar, the TA’s, and our office hours. There are a lot of ways to find help for this class, please don’t let an unanswered email hold you back. If I have not answered and email by the next time I see you in class please be sure to remind me at class. It is likely I did not see you email yet.

**ABBREVIATED WEEKLY SCHEDULE:**

<table>
<thead>
<tr>
<th>WEEK</th>
<th>Monday Lecture</th>
<th>Wednesday Lecture</th>
<th>Exercise Given</th>
<th>Exercise Due</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1: Map Projections / Data Creation / Digitizing / Proposals</td>
<td>10/26</td>
<td>10/28 - Past Projects</td>
<td>Project Paragraphs / Exercise A</td>
<td>Exercise 3 (if in 11.205)</td>
</tr>
<tr>
<td>Week 2: GPS Exercise Adding Coordinate Data To A Map</td>
<td>11/2</td>
<td>11/4</td>
<td>Project Proposals / Exercise B</td>
<td>Exercise A / Project Paragraphs</td>
</tr>
<tr>
<td>Week 3: No Class : Work on GPS Assignments and Proposal in Lab (lab held Wednesday – Thursday this week)</td>
<td>11/9</td>
<td>Veterans Day – No Class</td>
<td>Exercise B</td>
<td></td>
</tr>
<tr>
<td>Week 4: Open Source GIS and Web Mapping</td>
<td>11/16</td>
<td>11/18</td>
<td>Exercise C</td>
<td>Project Proposals</td>
</tr>
<tr>
<td>Week 5: Work on Finals</td>
<td>11/23</td>
<td>Thanksgiving - No Class</td>
<td>Exercise C</td>
<td></td>
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<tr>
<td>Week 6: Work on Finals</td>
<td>11/30</td>
<td>12/2</td>
<td></td>
<td>Draft Presentation</td>
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<tr>
<td>Week 7: Presentations during class and lab (depending on class size)</td>
<td>12/7</td>
<td>12/9</td>
<td></td>
<td>Finals</td>
</tr>
</tbody>
</table>
WEEKLY SCHEDULE:

WEEK 1: OCTOBER 26th: MAP PROJECTIONS / DATA CREATION / DIGITIZING / INTRODUCTION TO PROJECTS

LECTURE:

- Projections (when do you use one over the other)
- Datums
- Reference Systems
- State Plane Coordinate and UTM
- Peters projection, Buckminster Fuller, Mercator
- Geo-referencing
- Digitizing and Data Creation.
- Introduction to Final Projects.

READINGS:


Optional:


EXERCISE #3 DUE (IF IN 11.205)
EXERCISE A ASSIGNED
PROJECT PARAGRAPH ASSIGNED

WEEK 2: NOVEMBER 2nd: GPS EXERCISE ADDING COORDINATE DATA TO A MAP

LECTURE:

- GPS Units
- Cell Phone Triangulation
- Adding X & Y Data
- Mobile Technologies that use GPS
- Metadata Creation

READINGS:

- FGDC Metadata Guide (don’t need to read reference for your project)

Look at these Web Sites:

- www.GPS.gov
EXERCISE B ASSIGNED
PARAGRAPH ASSIGNMENT: Due November 2nd in class
EXERCISE A: Due Midnight November 5th

WEEK 3: NOVEMBER 9th: NO WEDNESDAY CLASS WORK ON GPS EXERCISE & PROPOSALS DURING LAB

LECTURE: Jennie Murack, MIT Libraries – GIS Data Finding Workshop

EXERCISE B: Due November 12th at Midnight

WEEK 4: NOVEMBER 16th: OPEN SOURCE GIS and WEB MAPPING

• QGIS (Free and Open Source Desktop GIS Software)
• Online Mapping Tools (Google API, Mapbox, CartoDB, Tilemill)

READING:


Optional

• Pinde Fu and Jiulin Sun, Web GIS : Principles and Applications, ESRI Press 2011 – Chapter 1
• Martin Dodge, Rob Kitchin and Chris Perkins, Rethinking Maps: New Frontiers in Cartographic Theory, Routledge 2009 – Chapter 4

EXERCISE C ASSIGNED
PROPOSALS: Due Midnight November 19th

WEEK 5: NOVEMBER 23rd: Network Analysts Demo in Class and Mandatory Labs to see your progress on finals.

EXERCISE C: Due Midnight November 26th

WEEK 6: NOVEMBER 30th: WORK ON FINALS: Mandatory Labs to see your progress on finals.

LABS MANDATORY INSTRUCTORS WILL REVIEW YOUR WORK

DRAFT PRESENTATIONS: Due during your lab session this week

WEEK 14: DECEMBER 7th, 8th, 9th, 10th: CLASS FINALS TO BE HELD DURING CLASS AND LAB TIME

FINAL PROJECT: Due at time of presentation