# Syllabus

Help

## *From GPS and Google Maps to Spatial Computing - Fall 2014*

1. Instructors
2. Class meetings/timeframe
3. Course description
4. Three Tracks for Students
5. Prerequisites
6. Important course policies
7. Course structure
8. Course schedule
9. Due dates
10. Assignments
11. Grading and Statement of Accomplishment
12. System requirements
13. Acknowledgments

### Instructors

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### Class Meetings / Timeframe

This is an eight-week course that begins on Tuesday, September 23, 2014 and ends on Monday, November 17, 2014, 12:00 a.m., Central Standard Time. Each week of the course begins on a Tuesday and ends the following Monday. All due dates will be **Monday nights, 11:59 p.m. Central USA Time**. No late work will be accepted.

**All course deadlines are set in local, University of Minnesota time (Central Daylight Time, changing to Central Standard Time on November 3. Coursera will convert to your local time if your timezone is set correctly.**

### Course Description

From Google Maps to consumer global positioning system (GPS) devices, spatial technology shapes many lives in both ordinary and extraordinary ways. Thanks to spatial computing, a hiker in Yellowstone and a taxi driver in Manhattan can know precisely where they are, discover nearby points of interest and learn how to reach their destinations. Spatial computing technology is what powers the Foursquare check-in, the maps app on your smartphone, the devices used by scientists to track endangered

species, the routing directions that help you get from point A to point B, the precision agriculture technology that is revolutionizing farming, and the augmented reality devices like Google Glass that may soon mediate our interaction with the real world.

This course introduces the fundamental ideas underlying spatial computing services, systems, and sciences. Topics covered will include the nature of geospatial information, proper statistical frameworks for working with geospatial data, key algorithms and data structures, spatial data mining, and cartography/geovisualization. We will also address applied topics such as where to find spatial data, how to use powerful open source software to analyze and map spatial data, and frameworks for building location-based services.

## Three Tracks for Different Students

The descriptions below are general. Be sure to review assignments, prerequisites and system requirements for more information.

- **Curiosity Track**: Most of us interact with spatial technologies every day. This track is for students who wish to learn about spatial computing topics, but not commit to an entire course or to doing assignments. Curiosity Track students do not receive a certificate of accomplishment.
- **Concepts Track**: This track is for students who want to learn about spatial computing concepts in order to make informed choices, but who are not programmers and do not have extensive experience with statistical methods. For example, Concepts Track students will learn about Tobler's First Law of geography and map projections, but will not delve into the quantifications of either. Students in the Concepts Track complete Concepts Track problem sets, and students who complete the this track with sufficiently high scores will receive a Statement of Accomplishment.
- **Technical Track**: This track builds on the Concepts Track and adds math and programming. In addition to viewing lectures, doing the reading, and completing problem sets, Technical Track students complete programming assignments. Technical Track students must have access to a compatible computer and the required software. Students who complete the Technical Track with sufficiently high scores will receive a Distinguished Statement of Accomplishment.

Please read the syllabus carefully for additional information about the three tracks. Keep in mind that you will not be able to change to a track with greater requirements after the first week, as deadlines for required work will have passed and the assignments will no longer be available.

## Prerequisites

- **Curiosity Track**: no prerequisites
- **Concepts Track**: basic familiarity with spatial computing technologies such as online and mobile maps.
- **Technical Track**: experience with the Java programming language, a little web development experience, knowledge of basic data structures, pre-calculus level math (e.g. geometry), basic statistics, and -- importantly -- the ability to install and managed sophisticated development tools and libraries. See the "System Requirements" section below for more information.

## Important Course Policies

- Don't send e-mails to the faculty. Because there are so many students enrolled in this course, there are limits on the amount of personal help available. Coursera students are expected to contact the

course staff through the Coursera forums. Issues that receive sufficient votes will be addressed by the course staff. **Direct e-mail or phone communication will not be accepted**.
- Be on time: No late assignments or exams can be accepted.
- Do your own work: Academic integrity is essential to any course. All work submitted is expected to be your own work. **No collaboration on problem sets or assignments is permitted**, though we encourage collaborative studying up to the point of working on specific problems or assignments.

## Course Structure

This course is organized around a set of weekly modules. Each module includes:
- video lectures
- readings
- assignments: problem sets (required for students in **Concepts** and **Technical Tracks**, programming assignments (required for **Technical Track** students)
- discussion forums (optional, but useful for asking questions, reporting issues, and limited collaboration)

We strongly encourage you to spend the beginning of each week on the presented material (video lectures and readings), leaving a good amount of time to complete the problem sets. **Technical Track** students should be sure to leave extra time for programming assignments in weeks when there is an assignment.

Specific readings will be identified to accompany particular lectures or assignments. Links to readings are included in each module. All readings will be available to students online at http://www-users.cs.umn.edu/~bhecht/spatcompmooc/.

## Course Schedule (Overview)

Week 1: Introduction to Spatial Computing and Overview of Course
Week 2: Spatial Query Languages
Week 3: Spatial Networks (e.g. road networks)
Week 4: Spatial Data Mining
Week 5: Volunteered Geographic Information
Week 6: Positioning
Week 7: Cartography and Geographic Human-Computer Interaction
Week 8: Future Directions in Spatial Computing

## Due Dates

Due dates for all assigned work will be on **Mondays, 11:59 p.m. Central USA Time. No late work will be accepted.** You are only allowed one submission per assignment.

**All course deadlines are set in local, University of Minnesota time (Central Daylight Time, changing to Central Standard Time on November 3. Coursera will convert to your local time if your timezone is set correctly.**

## Assignments

**Problem sets:** at the end of each module, students will be evaluated through a problem set consisting of multiple choice or short answer questions. Questions are based on video lectures and course readings.

- **Curiosity Track** students are not required to complete problem sets.
- **Concepts Track** students complete only Concepts Track problem sets.
- **Technical Track** Students complete both Concepts Track problem sets *and* Technical Track problem sets.

Students will only be able submit each problem set **once** and no late problem sets will be accepted. Having been students ourselves at one time, we know that life can sometimes intervene in a student's most ardent educational efforts. As such, in order to allow for unexpected events, **we will drop each student's lowest problem set grade.**

**Programming assignments:** Some modules, particularly those in the second half of the course, will have programming assignments. Only **Technical Track** students are required to complete programming assignments. These assignments will have hard due dates, and no late assignments will be accepted. Additionally, we are unable to make accommodations for students who are unable to run required software due to individual technical issues.

If you have signed up for the course after the September 23 start date, it is your responsibility to complete all assignments on time. Unfortunately, we cannot make any exceptions.

## Grading and Statements of Accomplishment

Students in the **Concepts Track** are required to earn 50% of possible Concepts Track points to receive a Statement of Accomplishment. All of these points will come from the completion of problem sets.

Students in the **Technical Track** are required to earn 50% of possible Technical Track points to receive a Distinguished Statement of Accomplishment. Technical Track points consist of points on Technical Track problem sets and programming assignments. If you do not get 50% of points in the Technical Track, don't worry: you will earn the Concepts Track Statement of Accomplishment if you meet the requirements.

Of course, for those of you in the **Curiosity Track**, there is no grading involved. Feel free to pop in and pop out of the modules you find the most interesting!

## System Requirements

For the **Curiosity Track** and the **Concepts Track**, students simply must be able to run the Coursera platform. **There are no additional requirements**.

For the **Technical Track**, students must have access to a computer on which they can install and develop software that meets the requirements listed below. We have designed our assignments to work well across a number of platforms. However -- and this is critical -- **it is the student's responsibility to ensure that they have access to a compatible computer. Students without access to a compatible computer should take the Concepts Track. Unfortunately, we are unable to offer alternative assignments or extra time due to system requirements issues. We also cannot**

**provide individual technical support on the forum or other platforms**.

Specifically, to successfully complete the programming track, students must have access to a machine that can run the following software:

- TileMill (https://www.mapbox.com/tilemill/)
  - Windows requirements: https://www.mapbox.com/tilemill/docs/win-install/
  - Mac requirements: https://www.mapbox.com/tilemill/docs/mac-install/
  - Ubuntu requirements: https://www.mapbox.com/tilemill/docs/linux-install/
- WikiBrain (http://www.wikibrainapi.org)
  - Requires Java 6, PostGIS, and others
  - See http://shilad.github.io/wikibrain/tutorial/installation.html for more details
- Other basic development software

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