Fall 2021, GIS 94-802B/12-783 TR 10:20 - 11:50 AM, Room:TBD

Instructor: Corey Harper, PH 118K
Email: cdharper@andrew.cmu.edu

Office Hours: Fridays noon-1:00pm and by appointment.

Course Web: https://canvas.cmu.edu/ Announcements will be posted on Canvas. Discussion board is for you to interact with others in the course. TAs and the instructor will check the discussion board at least once every other day, but please plan your time accordingly so questions can be answered in a timely manner. The best way to communicate with the instructor and TAs is through emails.

Textbook and materials:

Required:

- Lab book: W.L. Gorr, K.S. Kurland (2020), GIS Tutorial for ArcGIS Pro 2.6. Available electronically from Kindle or Vitalsource. Paperback will be released on Amazon on Sep 8.
- Slides: Posted weekly on Canvas
- ArcGIS Pro 2.6:
  Instructions for downloads and online accounts are provided in a separate document. Or you can access it through Virtual Andrew.
  https://www.cmu.edu/computing/services/endpoint/software/virtual-andrew.html

Optional:

- Paul Bolstad, (2012), GIS Fundamentals, 4th Edition
- Other reading materials will be post on Canvas

Teaching assistants (Location TBD):

Zhufeng Feng zhufengf@andrew.cmu.edu
Office Hours TBD
Weiran Yao weiran@cmu.edu
Office Hours TBD.

Prerequisites: 90-728 Introduction to Database Management Systems, equivalent course, or permission of instructor.

Student well-being: The past year was unlike any other. As we make the transition back to in-person teaching, make sure to move regularly, eat well, and reach out to your support system

or the instructor (chdarper@andrew.cmu.edu) if you need to. We can all benefit from support in times of stress, and this semester is no exception.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call 412-268-2922 and visit their website thttp://www.cmu.edu/counseling/. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.

Diversity and Inclusion: We must treat every individual with respect. We are diverse in many ways, and this diversity is fundamental to building and maintaining an equitable and inclusive campus community. Diversity can refer to multiple ways that we identify ourselves, including but not limited to race, color, national origin, language, sex, disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Each of these diverse identities, along with many others not mentioned here, shape the perspectives our students, faculty, and staff bring to our campus. We, at CMU, will work to promote diversity, equity and inclusion not only because diversity fuels excellence and innovation, but because we want to pursue justice. We acknowledge our imperfections while we also fully commit to the work, inside and outside of our classrooms, of building and sustaining a campus community that increasingly embraces these core values.

Each of us is responsible for creating a safer, more inclusive environment.

Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the university. Therefore, the university encourages anyone who experiences or observes unfair or hostile treatment on the basis of identity to speak out for justice and support, within the moment of the incident or after the incident has passed. Anyone can share these experiences using the following resources:

- Center for Student Diversity and Inclusion: csdi@andrew.cmu.edu, (412) 268-2150
- Report-It online anonymous reporting platform: reportit.net username: tartans password: plaid

All reports will be documented and deliberated to determine if there should be any following actions. Regardless of incident type, the university will use all shared experiences to transform our campus climate to be more equitable and just.

Course Objectives: Geographic Information Systems (GIS) are information systems specifically designed to store and analyze geographic data. GIS represents almost all elements on the earth, such as roadways, rivers, utilities, cities, mountains, natural resources, energy infrastructure and so forth. GIS is used to visualize, analyze and compute the data about the world and human activities. What makes GIS different from other IS is that the data is stored and visualized on a map. The spatial analysis on the map reveals unique patterns in the geographic scope, which is the main advantage over table or text based data representation.

This course will,

- develop an understanding of basic world coordinate systems and projections used to build GIS;

- describe various geospatial data types and sources;
- develop an understanding of GIS data visualization and analytics using ArcGIS Pro;
- illustrate how to manage objects in geographic space, including digitzing, georeferencing and geocoding addresses;
- illustrate GIS-based transportation network analysis
- introduce briefly web GIS, such as Google MyMaps, ArcGIS Online.
- introduce briefly open-source GIS tools, such as QGIS, MapWindows.

Computer labs familiarize students with the leading GIS software, ArcGIS Pro 2.6. Students will be working with GIS to address problems in urban planning, housing and neighborhood planning, transportation, environment, and public health. By the end of the course, students are expected to have sufficient experience to locate, download and prepare GIS data for mapping projects, use effective ways to visualize information, and discover patterns and trends in the GIS data.

Those learning objectives can be achieved in a completely remote or hybrid learning context.

Technology requirements: A personal computer that runs ArcGIS Pro 2.6 or CMU Virtual Andrew. Running ArcGIS Pro 2.6 on your own computer (Windows system only) is highly recommended since ArcGIS Pro 2.6 can be computationally heavy and require significant storage at times. The computer requirements for ArcGIS Pro 2.6 can be found: https://pro.arcgis.com/en/pro-app/get-started/arcgis-pro-system-requirements.htm

Grades:

Homework	45% (the best 9 of 10 assignments, 5% each)
Term Project	25%
Call participation and discussion	5%
Midterm (written)	10%
Final Exam (written)	15%

Grading:

Homework: Gradesheets containing part of solutions as well as feedback and scores will be returned to you in the following two weeks of submission. If you would like to have it re-graded, please contact the TA who graded it to resolve this issue. Please ask for re-grading of an assignment within *one* week after it is returned to you in the first place.

Midterm and final exam: If you would like to have the midterm or final to be re-graded, please bring it to me during my office hours (or set an appointment with me). Please ask for re-grading of a midterm or final exam within *one* week after it is returned to you.

Homework submission policy: No late homework will be accepted after the due time unless previously arranged with me 48 hours prior to the deadline.

Academic Honesty: As a CMU student, you have agreed to abide by CMU 's policies on ethics and discipline, which can be found in http://www.cmu.edu/academic-integrity/ . No cheating and plagiarism will be tolerated.

Using information directly from websites, books, papers and other literary sources without appropriate attribution is plagiarism. Assignments submitted for this class will be reviewed by the instructor and TAs and may be scanned through web-based academic integrity software. Occurrences of cheating or plagiarism will be handled according to the university policy on Cheating and Plagiarism, https://www.cmu.edu/policies/student-and-student-life/academic-integrity.html. Students are expected to have read this policy and conform to the highest standards of academic integrity. For incidents of academic misconduct, the University Academic Disciplinary Actions Policy, found at https://www.cmu.edu/student-affairs/theword/academic-discipline/index.html, will be followed.

Homework: Homework must be **individual** work unless otherwise stated. Discussions with other students about concepts and overall approaches to completing individual assignments are permitted, but you must do individual problem solving and derive your own solutions, including your own computer work.

You are not permitted to be in possession of any assignments from another student or other source either from the current semester or from past semesters whether they are electronic or paper. Possession of or sharing such files constitutes an infraction of the academic integrity policies of this course.

Midterm and final exam:: You are not allowed to discuss any part of the midterm or final exam with others for any reason. The exams will be administered at the beginning of class and will take the duration of a class session (1.5 hours).

Course Outline:

Week 1, ArcGIS platform

Lecture 1 ..... 08/31
Housekeeping; history; definition; map navigation; applications
Assignment 1 out 08/31
Lab session 09/02
GIS tutorial book, chapter 1 (The ArcGIS Platform)

Week 2, Map design

Lecture 2 ..... 09/07
Visualization; design principles; symbolizing features
Assignment 2 out 09/07
Assignment 1 due 11:59pm 09/08
Lab session 09/09
GIS tutorial book, chapter 2 (Map design)

Week 3, GIS outputs

Lecture 3 ..... 09/14
Data model; map layouts; interactive maps
Assignment 3 out 09/14
Assignment 2 due 11:59pm 09/15
Lab session 09/16
GIS tutorial book, chapter 3 (GIS outputs)

Week 4, Geodatabases

Lecture 4 ..... 09/21
Geodatabases; geocodes; attribute table; vector data files
Assignment 4 out 09/21
Assignment 3 due 11:59pm 09/22
Lab session 09/23
GIS tutorial book, chapter 4 (Geodatabases)

Week 5, Spatial data

Lecture 5 ..... 09/28
Coordinate systems; projections; metadata; Census data
Assignment 5 out 09/28
Assignment 4 due 11:59pm 09/29
Lab session 09/30
GIS tutorial book, chapter 5 (Spatial data)

Week 6, Geoprocessing

Lecture 6 ..... 10/05
Extraction; geoprocessing; macros
Assignment 6 out 10/05
Assignment 5 due 11:59pm 10/06
Lab session 10/07
GIS tutorial book, chapter 6 (Geoprocessing)

Week 7, Geocoding

Lecture 7 ..... 10/12
Street address data; geocoding
Assignment 7 out 10/12
Assignment 6 due 11:59pm 10/13
Lab session 10/14
GIS tutorial book, chapter 8 (Geocoding)

Week 8, Midterm exam and digitizing

Lecture 8 and lab session 10/19
Digitizing tools; spatial adjustments
GIS tutorial book, chapter 7 (Digitizing)
Assignment 8 out 10/19
Assignment 7 due 11:59pm 10/20
Midterm, no lab session 10/21

Week 9, Spatial analysis

Lecture 9 ..... 10/26
Buffers; network analyst; cluster analysis
Assignment 9 out 10/26
Lab session 10/28
GIS tutorial book, chapter 9 (Spatial analysis)

Week 10, Raster GIS

Lecture 10 ..... 11/02
Raster format data; Kernel density smoothing
Assignment 10 out 11/02
Assignment 8 due 11:59pm 11/03
Lab session 11/04
GIS tutorial book, chapter 10 (Raster GIS)

Week 11, Google MyMaps, Open-source GIS

Lecture 11 ..... 11/09
Google MyMaps; Open-source GIS
Assignment 9 due 11:59pm 11/10
Lab session 11/11
Term project
Term project proposal due at the beginning of class 11/11

Week 12, GIS in transportation

Lecture 12 ..... 11/16
GIS-T; transportation demand models; final exam review
Assignment 10 due 11:59pm 11/17
Lecture 13 ..... 11/18
Intro to QGIS and Guest lecture by Zhufeng Fan: analyzing micromobility impacts on traffic

Week 13, Final exam

Final exam (written) 11/23
Thanksgiving holiday, no class 11/25

Week 14, Guest lectures

Lecture 14 ..... 11/30
Guest lecture: TBD
Lecture 15 ..... 12/02
Guest lecture: TBD

Week 15, Term project

Lab, work on project 12/07
Lab, work on project 12/09
Term project due 11:59pm 12/10