# GGS 664 Spatial Data Structure – Spring 2020

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| Instructor | Dr. Chaowei Yang (Phil) | Classroom | Exploratory Hall 2103 |
| Office | Exploratory Hall 2211 | Class time | Wednesdays: 7:20 pm - 10:00 pm |
| Office Hours | Wednesdays 4:00 – 6:00 pm | E-mail | cyang3@gmu.edu |

### Course Description:

This course explores spatial/spatiotemporal data models and structures used to effectively represent, store and index geospatial data. Emphasis is on core data models, structures and tools. Specific topics include database theory, spatial indexing, and geospatial data examples including shapefiles, social media, climate, land use, and big data. The class will be project-centered and will involve significant programming effort to complete the course project.

### Prerequisite:

GGS 650 or a working knowledge of any programming language. This is a high level graduate course introducing research examples, therefore, first-year graduate students are not encouraged to take this course.

### References:

There is no required text for this course. Students are encouraged to read at least ***five external sources*** (e.g. journal articles, news articles, blogs, etc.) to enhance the understanding of course contents.

### Grading:

The components of the final grade are as follows:1

Class Participation: 10%

4 Homework: 60% (15% each)

Individual Project: 30%

Class Participation

All students are expected to keep up with assigned readings, complete in-class exercises and participate in class discussion. You may be asked to demonstrate data models, structures and algorithms during class.

Homework Assignments

Four homework assignments will entail creation or handling of specific spatial/spatiotemporal data models, structures or related algorithms. Pseudocode may be used for the assignments. All assignments should be submitted before class on the due date, and each one is due two weeks after assignment. Late assignment credit will be reduced on a basis of 10% (1st day), 30% (2nd day), 50 % (3rd day), and no credit will be given with more than three days late.

You are encouraged to discuss assignments with other students, but all work must be your own. Violation of this rule will result in both students receiving zero credit.

You may use any programming language for your assignment and final project. No programming assistance will be given.

Project

Each student must complete an original research project that involves a spatial or spatiotemporal data structure or modeling technique. Past projects have addressed issues such as climate, spatial indexing and spatial search, social media, uncertainty and interoperability. You are encouraged to explore existing software libraries and their component object models for your final project. All use of such libraries must be properly documented.

Two types of projects are acceptable:

1. Research oriented: Ph.D. students are encouraged to propose a research project and document the project results in the format of a research article. The objective is to publish the article (either in conference proceedings or peer-reviewed articles) with the help of the instructor.
2. Technique oriented: M.S. students are encouraged to propose a technique-based project and document the manipulation of data structure, analysis, and visualization in the format of a project report. The objective is to utilize the understanding and exploration of spatial/spatiotemporal data structure, model, and algorithms to assist your work or thesis.

### Computer Hardware and Software:

Please be sure to transfer all of your work to a portable medium such as a USB Flash Drive at the end of each class. To complete assignments and projects outside of class, you may work in the GIS Lab.

### Course Schedule:

| Week | Topic | Homework |
| --- | --- | --- |
| Jan 22 | Course introduction  Spatial data structures: raster and vector |  |
| Jan 29 | Database with Postgres/PostGIS I | Homework 1 |
| Feb 5 | Vector data models and structures |  |
| Feb 12 | Indexing structures and performance I | Homework 2 |
| Feb 19 | Raster data models and structures |  |
| Feb 26 | Indexing structures and performance II |  |
| Mar 4 | Spatial database with Postgres/PostGIS II  Project introduction: topic discussion | Homework 3 |
| Mar 11 | **Spring Break** |  |
| Mar 18 | **Extended Spring Break** |  |
| Mar 25 | Research example I: Social media analysis | Homework 3 due |
| Apr 1 | Research example II: Dust storm prediction and analysis | Homework 4 given  Project proposal due (one-page email to cyang3@gmu.edu) |
| Apr 8 | Research example III: Log mining analyses |  |
| Apr 15 | Research example IV: COVID-19 Data & Analytics | Homework 4 due |
| Apr 22 | Big Data: Management, Processing, and Visualization |  |
| Apr 29 | Project presentation I | Project report due |
| May 6 | Project presentation II |  |

### Feedback: Throughout the semester you will have plenty of opportunities to give feedback on the topics covered in the class and what you would like covered/changed.