

NRM 5302

Seminar: Foundations of Data Management

Instructor: Alex Hettena

Summer I 2023

RAS 126

Tuesday 9:00-11:30am

Wednesday 9:00-11:30am

Thursday 9:00-11:30am

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Office Hours: Wednesdays 2:00-4:00pm or by appointment

1 Course Overview

This course is intended to give the student a thorough introduction to programming-based database management. We will utilize open source software including R and PostgreSQL/PostGIS and will learn Structured Query Language (SQL), the most widely used programming language for creating, querying, and updating relational databases. We will briefly cover the nuts and bolts of spatial data objects and associated packages in R. We will then transition to data management with spatially enabled relational databases, focusing in PostGIS.

This course assumes you have at least a working familiarity with R. If you do not have at least some familiarity with R objects (i.e. vectors, matrices, data frames, and lists), looping, and apply statements, this course will be exceedingly difficult.

By the end of this class you should be able to:

1. Design and maintain spatial databases
2. Interact with web-based platforms to obtain data

2 Suggested Text

Zhao, A. 2021. SQL Pocket Guide: A Guide to SQL Usage. 4th Edition. O'Reilly Media Inc., Sebastopol, CA, USA.

Obe, R. O. and L. S. Hsu. 2015. PostGIS in Action. 2nd Edition. Manning Publications Co., Shelter Island, NY, USA.

3 Assignments

All assignments in this class will be done in R, integrated with \LaTeX is the most rapidly growing tool in our field and will soon be an essential skill, likely replacing ESRI's ArgGIS. It is best that you install both R and R Studio, which is a convenient interface. They are available for free download at:

- **R:** <https://cloud.r-project.org/>
- **R Studio:** <https://rstudio.com/products/rstudio/download/>

Appropriate \LaTeX distributions depend on your operating system. Windows users should use Tiny-Tex. Mac users may be better served with MacTeX. Both are easy to find with a quick Google search. There are nuances to using each, which I am glad to assist with.

Each regular assignment will be made available on Tuesday of the week it is assigned and will be due the following Tuesday. Late submissions will not be accepted unless prior arrangements are made (implying there was a good, foreseen reason to be late), except under reasonable extenuating circumstances.

4 Grading Policy

Grades are based on weekly assignments and a semester project. Assignments and the project will each contribute 50% of your final grade.

Letter grades follow: 100 > A 90 > B 80 > C 70 > D 60 > F. There is no curve.

5 Attendance

Showing up is the only way to get the material you need. If you don't come to class, your grade will reflect it with no penalty needed from me. In the event of an excused absence, make arrangements with me to go over material ahead of time.

6 Academic Dishonesty

Academic dishonesty includes copying, sharing, or obtaining information from an unauthorized source, attempting to take credit for the intellectual work of another person, falsifying information, and giving or receiving information about a test, quiz, or assignment to other students. Any student involved in academic dishonesty will receive no credit (0) for work done and/or may be penalized in accordance with published University Rules.

7 Counseling and Accessibility Services

Sul Ross State University is committed to equal access in compliance with the Americans with Disabilities Act of 1973. It is the student's responsibility to initiate a request for accessibility

services. Students seeking accessibility services must contact Mary Schwartz, M. Ed., L.P.C., in Counseling and Accessibility Services, Ferguson Hall, Room 112. The mailing address is P.O. Box C-122, Sul Ross State University, Alpine, Texas 79832. Telephone: 432-837-8691. E-mail: mschwartz@sulross.edu.

8 Course Schedule (Tentative)

- **Week 1 (6/1):** Introduction to Spatial Objects and Coordinate Reference Systems
Lecture: Introduction to Simple Features and the `sf` package and CRSs in R
Lab: Simple features in R and Manipulating CRSs
Semester Project: Schedule a time to meet with me about your project

- **Week 2 (6/5 - 6/9):** Database Concepts 1
Lecture: Fundamentals - Spatial ain't special
Lab: Building and querying a PostGIS database
Semester Project: Identify questions and goals, transition vector data to a database

- **Week 3 (6/12 - 6/16):** Database Concepts 2
Lecture: Spatial operations as queries
Lab: Efficient cartography with spatial queries
Semester Project: Finalize questions and objectives

- **Week 4 (6/19 - 6/23):** Raster Data and Spatial Databases
Lecture: Scaling concerns, in- and out-of-DB options
Lab: Manipulating rasters in R
Semester Project: Identify needed raster data, transition vector data to a database

- **Week 5 (6/26 - 6/30):** Data Interoperability and Out-of-Database Curation
Lecture: Working with non-DB users and backward compatibility
Lab: Clean I/O when converting data types
Semester Project: Finalize and write up findings

- **Week 6 (7/3 - 7/7):** Final Exam Week
Tuesday 7/4: Holiday! No class.
Wednesday 7/5: Project presentations
Thursday 7/6: Project presentations
Semester Project Due: 2023-07-06 17:00:00