NRM 5302
Seminar: Data Management

Instructor: Maya Vaughn
Spring 2026

RAS 126
Tuesday 12:30-1:45pm
Thursday 12:30-1:45pm

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

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. Understand relational database concepts and terminology
2. Design and implement databases that include spatial data
3. Write SQL queries for data retrieval and manipulation
4. Apply data normalization techniques
5. Input and update data into databases

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.

Assignments

Students will be assigned courses to complete in DataCamp, an online learning platform, that will complement the lessons. Other assignments will be done in R, integrated with LaTeX. R is the most rapidly growing tool in our field and will soon be an essential skill, likely replacing ESRI's ArcGIS. 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. DataCamp assignments will be due on the DataCamp website. Scripting assignments will be submitted via Blackboard assignment.

Grading Policy

Grades are based on weekly assignments (40%), a semester project (40%), participation (10%), and a presentation (10%).

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

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.

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.

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 Grace Knight 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: 432-837-8203. E-mail: gak20wv@sulross.edu.

Course Schedule (Tentative)

- **Week 1 (1/13 & 1/15):** Introduction to Data Management
  - Overview of Data Management; Importance and applications

- **Week 2 (1/20 & 1/22):** Relational Database Concepts
  - Relational model: tables, rows, columns, keys

- **Week 3 (1/27 & 1/29):** Data Import/Export
  - Importing data into PostgreSQL; exporting query results

- **Week 4 (2/3 & 2/5):** Data Modeling
  - Introduction to data modeling; ER (Entity-Relationship) diagrams

- **Week 5 (2/10 & 2/12):** Intro to Normalization
  - Normalization basics: first and second normal forms (1NF & 2NF)

- **Week 6 (2/17 & 2/19):** More Normalization
  - Third normal form (3NF)

- **Week 7 (2/24 & 2/26):** Introduction to SQL
  - Basic SQL commands: SELECT, INSERT, UPDATE, DELETE

- **Week 8 (3/3 & 3/5):** Joining Data in SQL
  - Types of Joins; write queries with joins

- **Week 9 (3/3 & 3/5):** Spring Break – no class!

- **Week 10 (3/10 & 3/12):** Spatial Data
  - Spatial operations as queries

- **Week 11 (3/17 & 3/19):** Advanced SQL Queries
  - Complex joins; subqueries and nested queries

- **Week 12 (3/24 & 3/26):** Data Cleaning and Manipulation
  - Data cleaning techniques in R and SQL

- **Week 13 (3/31 & 4/2):** Data Management Best Practices
  - Data governance, security, backup strategies

- **Week 14 (4/7 & 4/9):** Project Presentations
  - Tuesday and Thursday: Project presentations

- **Week 15 (4/14 & 4/16):** Wrap up: Open Lab - work on projects

- **Week 16 (4/21 & 4/23):** Wrap up: Open Lab - work on projects

- **Week 17 (4/12 & 4/14**): **Semester project due at 5:00pm of Final Exam Day**

Semester Project Steps and Deadlines (a guide, due Sundays)

- Identify questions and goals   2/2
- Map out tables, fields, data types   2/9
- Script to create schema, tables, relationships   2/23
- Write descriptions for tables, fields, relationships   3/9
- Write data import process   3/16
- Write queries to get data for analysis   3/30
- Finalize and write up findings – Semester Project Due at 5:00pm   4/12