

# Geography/Planning 387: Spatial Databases

## Contact Information

**Instructor:** Grant Gunn, Assistant Professor, Department of Geography and Environmental Management

**Office:** EV1-307

**Office Hours:** Thursdays, 1:00 – 2:00PM. If you need to schedule an appointment outside of these drop-in hours, please contact me.

**Phone:** ext. 32019

**E-mail:** [g2gunn@uwaterloo.ca](mailto:g2gunn@uwaterloo.ca)

(email sent on a weekday will normally be answered within 24 hours. Email sent on the weekend will normally be answered on Monday).

## Teaching Assistants

Zihao Yang [zh2yang@uwaterloo.ca](mailto:zh2yang@uwaterloo.ca)

## Course Description

This course focuses on design and development of GIS databases. It addresses theoretical issues regarding data models used in GIS and data modeling techniques used in designing spatial databases. It considers the processing required to input data from a variety of sources and clean and edit a multi-theme database and introduces students to creation and use of internet map services.

## Course Objectives

Geographic Information Systems (GIS) are being used in a wide variety of planning, facilities management, business, resource management, and applied research applications. In order to use GIS effectively, it is necessary to have a good understanding of the data structures used to store spatial data, the methods used to associate attribute data with spatial features, and the techniques used to query the spatial database and perform specialized spatial analyses.

This course focuses on the design and development of spatial databases. Particular emphasis will be placed on the use of data modeling techniques to design a GIS database for a specific application. Students undertake tasks related to the development of a conceptual design for a GIS database. They will also build a database based on a conceptual design using digital data available through a variety of sources, including digitized data. The resulting database will be used to perform some basic spatial analysis.

The goals of this course are to enable students to develop a good understanding of the principles and techniques of relational database design as they apply to spatial databases; apply these principles and techniques in building spatial databases; and use spatial databases to perform common types of queries and spatial analyses. Upon completing this course, students will be able to:

1. develop a conceptual design for a spatial database.
2. document a spatial database design
3. populate a spatial database by importing existing digital data, digitizing features from maps or imagery, and generating feature data using address locators (geocoding)
4. define and use attribute domains and topology rules in editing and maintaining a spatial database

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5. define and use relationships and relationship classes to query a spatial database

## **Course Presentation**

### **Lecture:**

Tuesdays 2:30 to 5:20 in Rod Coutts Hall, room 204 (RCH 204).

### **Lecture Materials on Powerpoint**

The powerpoint presentations used in the lecture will be provided on the Learn website, prior to the lecture.

**Please Note:** The powerpoint files are provided to simplify the note taking process and to ensure that diagrams are copied correctly. The powerpoint files do not replace the lectures. For copyright reasons, some powerpoint materials presented in class may be included in the files provided on Learn. You are responsible for all materials presented in lecture.

### **Lab:**

Thursday 2:30 – 4:20 pm                      EV1-240 (Galileo Lab)  
Friday 11:30 am – 1:30 pm

### **The Galileo Lab**

Most labs required for this course will be held in the Galileo Lab (EV1 - 240). Access to the lab is gained by entering a code in the keypad combination lock on the door of the lab. Do not give the combination to anyone else. We are trying to limit access to this lab to those who need to use it for course work and for those that need to use the specialised software only available on these computers. This will provide you with greater access to the computers in this lab when you need them to complete assignments.

**Please note: No food or drink is to be brought into this lab.**

## **Additional Course Resources**

### **Reference Books**

There is no text for this course. Selected course notes and slides used in lecture presentations will be provided as electronic documents on the course web site ([learn.uwaterloo.ca](http://learn.uwaterloo.ca)). The following reference materials provide a useful resource.

- Arctur, D. and Zeiler, M. (2004) *Designing Geodatabases: Case Studies in GIS Data Modeling*, (ESRI, Redlands, California)

This text provides an introduction to GIS data modeling methods and presents several examples of geodatabase designs related to different applied problem domains..

- Shekhar, S and Chawla, S (2003) *Spatial Databases: A Tour*, (Prentice-Hall: Pearson Education Inc., Upper Saddle River, New Jersey)

In addition to the above materials, students are expected to make extensive use of the on-line help files for the ArcGIS software that will be used in this course. The entire contents of the

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ArcGIS manuals are available through the on-line help. Most help files provide examples that walk you through a process.

## Evaluation

Final grades for the course will be assigned as follows:

- 4 Lab Assignments 80%
  - Test (March 31 - in class) 20%
- 100%

## Deadlines

Lab assignments are due in your lab session on the day specified at the top of the lab. Lab assignments must be handed in on or before the due date. **Late labs will not be accepted.** If for some reason you are unable to hand in your lab at the due date, contact me as soon as possible to make appropriate arrangements.

## Lecture and Lab Schedule\*

Week of	Lecture Topic(s)	Lab Assignment
6 - January	Course Overview The growth of spatial databases	Digitizing Tutorial (not graded)
13 - January	Spatial data representation Spatial databases	Lab 1 begins
20 - January	Database design Conceptual Design of a Database	
27 - January	Database design tools Representing Relationships	Lab 1 Due Lab 2 begins
3 - February	Queries and SQL	
10 - February	Analysis with SQL	Lab 2 due
17 February	<b>Study Break Week</b>	
24 February	Database Management, documentation, accuracy standards	Lab 3 begins
2 - March	3D surface representation and analysis	
9 - March	Network representation and analysis	Lab 3 due Lab 4 begins
16 - March	Modelling the built environment The geospatial web	
23 - March	Spatial modelling and simulation	Lab 4 due
30 - March	<b>Test in class (March 31st)</b>	

\* The instructor reserves the right to make alterations to the class schedule if necessary

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## **Academic Integrity.**

In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. The University's guiding principles on academic integrity can be found here:

<http://uwaterloo.ca/academicintegrity>. ENV students are strongly encouraged to review the material provided by the university's Academic Integrity office specifically for students: <http://uwaterloo.ca/academicintegrity/Students/index.html>

Students are also expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for their actions. Students who are unsure whether an action constitutes an offense, or who need help in learning how to avoid offenses (e.g., plagiarism, cheating) or about "rules" for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. Students may also complete the following tutorial: <https://uwaterloo.ca/library/get-assignment-and-research-help/academic-integrity/academic-integrity-tutorial>

When misconduct has been found to have occurred, disciplinary penalties will be imposed under Policy 71 – Student Discipline. For information on categories of offenses and types of penalties, students should refer to Policy 71 - Student Discipline:

<https://uwaterloo.ca/secretariat-general-counsel/policies-procedures-guidelines/policy-71>. Students who believe that they have been wrongfully or unjustly penalized have the right to grieve; refer to Policy #70, Student Grievance: <https://uwaterloo.ca/secretariat-general-counsel/policies-procedures-guidelines/policy-70>

## **Unclaimed assignments**

Unclaimed assignments will be retained for one year after final grades are posted to Quest. After that time, they will be destroyed in compliance with UW's [confidential shredding procedures](#).

## **Note for students with disabilities:**

[AccessAbility Services](#), located in Needles Hall, Room 1401, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with [AccessAbility Services](#) at the beginning of each academic term.

## **Mental Health:**

The University of Waterloo, the Faculty of Environment and our Departments consider students' well-being to be extremely important. We recognize that throughout the term students may face health challenges - physical and / or emotional. **Please note that help is available.** Mental health is a serious issue for everyone and can affect your ability to do your best work. Counselling Services <https://uwaterloo.ca/campus-wellness/counselling-services> is an inclusive, non-judgmental, and confidential space for anyone to seek support. They offer confidential counselling for a variety of areas including anxiety, stress management, depression, grief, substance use, sexuality, relationship issues, and much more.

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## ***Religious Observances:***

Student needs to inform the instructor at the beginning of term if special accommodation needs to be made for religious observances that are not otherwise accounted for in the scheduling of classes and assignments.

## ***Grievance:***

A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read Policy 70 - Student Petitions and Grievances, Section 4, [www.adm.uwaterloo.ca/infosec/Policies/policy70.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy70.htm). When in doubt please contact your Undergraduate Advisor for details.

## ***Appeals:***

A decision made or penalty imposed under Policy 70 - Student Petitions and Grievances (other than a petition) or Policy 71 – (Student Discipline) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to Policy 72 (Student Appeals)

[www.adm.uwaterloo.ca/infosec/Policies/policy72.htm](http://www.adm.uwaterloo.ca/infosec/Policies/policy72.htm)

## ***Intellectual Property:***

Students should be aware that this course contains the intellectual property of their instructor, TA, and/or the University of Waterloo. Intellectual property includes items such as:

- Lecture content, spoken and written (and any audio/video recording thereof);
- Lecture handouts, presentations, and other materials prepared for the course (e.g., PowerPoint slides);
- Questions or solution sets from various types of assessments (e.g., assignments, quizzes, tests, final exams); and
- Work protected by copyright (e.g., any work authored by the instructor or TA or used by the instructor or TA with permission of the copyright owner).

Course materials and the intellectual property contained therein, are used to enhance a student's educational experience. However, sharing this intellectual property without the intellectual property owner's permission is a violation of intellectual property rights. For this reason, it is necessary to ask the instructor, TA and/or the University of Waterloo for permission before uploading and sharing the intellectual property of others online (e.g., to an online repository).

Permission from an instructor, TA or the University is also necessary before sharing the intellectual property of others from completed courses with students taking the same/similar courses in subsequent terms/years. In many cases, instructors might be happy to allow distribution of certain materials. However, doing so without expressed permission is considered a violation of intellectual property rights.

Please alert the instructor if you become aware of intellectual property belonging to others (past or present) circulating, either through the student body or online. The intellectual property rights owner deserves to know (and may have already given their consent).

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## ***Communications with Instructor and Teaching Assistants:***

All communication with students must be through either the student's University of Waterloo email account or via Learn. If a student emails the instructor or TA from a personal account they will be requested to resend the email using their personal University of Waterloo email account.

## ***Recording lectures:***

Use of recording devices during lectures is only allowed with explicit permission of the instructor of the course.

If allowed, video recordings may only include images of the instructor and not fellow classmates. Posting of videos or links to the video to any website, including but not limited to social media sites such as: facebook, twitter, etc., is strictly prohibited.

## ***Co-op interviews and class attendance***

Co-op students are encouraged to try and choose interview time slots that result in the least amount of disruption to class schedules. When this is challenging, or not possible, a student may miss a portion of a class meeting for an interview. Instructors are asked for leniency in these situations; but, a co-op interview does not relieve the student of any requirements associated with that class meeting.

When a co-op interview conflicts with an in-class evaluation mechanism (e.g., test, quiz, presentation, critique), class attendance takes precedence and the onus is on the student to reschedule the interview. CECA provides an interview conflict procedure to manage these situations.

Students will be required to provide copies of their interview schedules (they may be printed from WaterlooWorks) should there be a need to verify class absence due to co-op interviews.