Geography / Planning 387
Spatial Data and Spatial Databases

Dr. Rob Feick
EV3-3237, Ext. 35493
rdfeick@uwaterloo.ca

TAs: Alison Curtis - ampcurtis@uwaterloo.ca
John McLean - jsmclean@uwaterloo.ca
Stephen Connors - s6connors@uwaterloo.ca

Overview

Geographic Information Systems (GIS) are used increasingly to organise, display, and analyse data pertinent to a host of land / resource management and planning activities. To make effective use of the specialised capabilities of GIS, an in-depth understanding is required of the procedures that are used to create and maintain spatial databases and the broader social and managerial issues associated with spatial information technology use. This course is a prerequisite to the Geography / Planning 481 and 487 courses and part of the requirements for the Diploma of Excellence in GIS.

Prerequisite: Successful completion of Geography or Planning 281.

Class Meetings

Lectures will be held in the Student Teaching Complex (STC 0020) on Thursdays from 8:30-11:20.
All lab sessions will take place in the John Geddes GIS lab (EV2-1002A) as follows by section: 101 (Wed. 4:30 – 6:20), 102 (Wed. 6:30 - 8:20), 103 (Thurs. 4:30 to 6:20), 104 (Thurs. 6:30 – 8:20), and 105 (Fri. 6:30 - 8:20).

Objectives

The objectives of this course centre on providing students with:
1) a strong foundation of spatial database design principles,
2) experience creating and editing a spatial database,
3) knowledge of fundamental spatial data quality and error measures,
4) experience using a variety of GIS and spatial database software (ArcGIS, PostgreSQL/PostGIS, QGIS),
5) an introduction to ArcGIS' commonly-used spatial analysis and database query procedures.

Upon completing this course, students will be able to:

- create, edit and document spatial datasets,
- develop and document a conceptual design of a spatial database for a specific applied problem,
- populate a spatial database through a variety of means (e.g. heads-up digitizing, GPS, geocoding, etc.),
- build and use key spatial database components (e.g. attribute domains, topology rules, relationship classes) to maintain data integrity and facilitate database queries.

Learning modes and course format

This course builds upon the understanding of GIS concepts you gained in Geog / Plan 281 through a series of compulsory lectures, lab sessions and tutorials. On most days, we will use the first two hours of the class to discuss concepts related to spatial data construction, database design and spatial data use. The third hour will be used to cover additional lecture material, provide demonstrations of lab materials or for you to work on your assignments.

The lab assignments are designed to build your skills in using GIS software and to strengthen your understanding of how GIS can be applied properly to real world problems. You are required to attend your assigned lab sessions starting in the second week of classes.

Developing a strong understanding of GIS database concepts and the practical skills needed to complete the assignments requires a significant investment of time. In addition to the scheduled class and lab time, you should expect to spend at least 5 hours per week working on course assignments. These time requirements will vary from student-to-student. If you are not able to make this time commitment, you should consider seriously other courses.

Course Resources

People

I will be available in my office during the hours posted on my office door (EV3-3237) or by appointment. In addition, our Teaching Assistants will have contact hours outside of regular lab hours to help you with the hands-on component of the course. See the class Learn site for more details.

Course Learn site

The course web site on Learn will be used to distribute lecture notes, class news, lab assignment updates and data and readings. You will also use this site to deposit digital copies of your lab reports. Check this site regularly.

Email Communication Notes:

I am happy to accept email from students concerning any aspect of the course. Since the email system built into Learn can only send, but not receive, messages, **all course-related emails to me or our TAs will need to use the uwaterloo system and include "GP387" as part of the email subject line**. Note that emails sent during the weekend will not be responded to until the following Monday, except in emergencies, and emails sent at night will not be responded to until the following day.

Cell phones

Students using cell phones during class distract themselves, their fellow students and the instructor. Please mute and put away your cell phone while in class.

Readings

You are not required to purchase a textbook for this course. However, you are expected to complete readings that are in the form of: a) selected chapters in texts that are on reserve in the Dana Porter Library, b) digital files (e.g. Web links, pdfs. Word documents, etc.) that have been posted to our UW-Learn site and, c) software help and other associated web pages – See Learn. These readings will complement the lectures and help you to develop well-rounded answers to lab assignment questions and to prepare for the end-of-term test.

Evaluation

Evaluation will be based on four lab assignments and a test. The test will focus on class materials, discussions and assigned readings. Your assignment grades will be based on the results of your lab work (i.e. quality of the data and maps you make) and, more importantly, the quality of your written answers. See the attached Class Schedule for the dates when assignments are due. Any changes to due dates will be announced on UW-Learn and in class.

Course component	Description	Value	Due
Assignment 1	Building spatial data	20%	Sept. 29
Assignment 2	Designing, populating and using a spatial	20%	Oct. 13
Assignment 3	Working with PostgreSQL/PostGIS	20%	Nov. 10
Assignment 4	Surface and temporal data	20%	Nov. 24
Final test	**In-class test on November 29**	20%	

The Teaching Assistants are responsible for marking lab assignments based on my marking outlines. If you have questions concerning your lab marks, see the TA that is assigned to your lab section. Note that the TAs cannot modify the marking schemes or grant extensions to due dates. The TAs and I will mark the test together.

Assignment due dates:

Both printed and digital copy of your lab assignment reports are required. Submit the digital copy (and any required data) to the appropriate Learn dropbox. Make sure to name your digital files (e.g. Word docs, datasets) with your given name and surname (e.g. RobFeick_Lab1.doc).

The due dates listed above fall on Saturdays. You can give your printed lab report to your TA in the lab session preceding the due date if you have completed your before the due date. Alternatively, you can submit your hard copy to the physical drop box located in the Planning students' lounge area in the northwest corner of the 3rd floor of EV3.

Requirements, Grade Penalties and Special Considerations:

1. All lab reports are to be completed individually.
2. Backup your work (data, reports) more frequently than you think you should.
3. The lab assignments have been crafted to parallel "real" problems that are challenging in thought and time. Do not wait until the "last minute" to complete your assignments.
4. A printed hardcopy of your completed lab report must be submitted to your TA at the start of your lab sessions by the dates indicated in the assignment scripts (see Course Schedule). For example, Assignment 1 is due on Sept. 26 (Labs 101, 102), Sept. 27 (Labs 103, 104) and Sept. 28 (Lab 105). A digital copy of your document must also be copied to the appropriate Learn dropbox. Name your digital files (e.g. Word docs, datasets) appropriately (e.g. YourName_Lab1.doc).
5. Students are expected to present well organized, and properly written work. Penalties of up to 20% may be applied in cases where readability and/or clarity are inadequate.
6. A late penalty of 10% per day is assessed for late lab reports except where documentation is provided of, for example, a notice or certificate of death in the event of bereavement or a University Illness verification form. Assignments that are more than 5 days late will not be accepted and will be graded as zero. Teaching Assistants cannot change due dates.
7. Requests for compassionate considerations are to be discussed with the professor in advance.
8. All students are required to be in class for the end-of-term test. **If you do not attend class on November 29, a grade of 0 will be assigned for the test unless verification of illness is provided.** In that case, alternative arrangements for the test will be made.
9. See #2.

To pass the course, students are expected, but not required, to pass each graded course component. The professor will examine each student's achievements and may adjust their final grade in light of extenuating and compassionate circumstances as well as the student's general pattern of achievement in the course.

Important notes:

♦ 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).

♦ **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

♦ **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/Schools 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 http://www.uwaterloo.ca/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.

♦ **Religious Observances:** Students need 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. See Policy 70 - Student Petitions and Grievances, Section 4, 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

♦ **Unclaimed assignments:** Unclaimed assignments will be retained for until three months after term grades become official in quest. After that time, they will be destroyed in compliance with UW's confidential shredding procedures.

♦ **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.

♦ **Turnitin:** Text matching software (Turnitin®) may be used to screen assignments in this course. Turnitin® is used to verify that all materials and sources in assignments are documented. Students' submissions are stored on a U.S. server, and are subject to the USA PATRIOT ACT, 2001; therefore, students must be given an alternative (e.g., scaffolded assignment or annotated bibliography) if they are concerned about their privacy and/or security. Students will be given due notice, in the first week of the term and/or at the time assignment details are provided, about arrangements and alternatives for the use of Turnitin® in this course.

♦ **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.

Class Schedule

Week	Lecture and tutorial topics	Assignments
Sept. 6	Course overview Nature of spatial data, database and spatial database concepts	Heads-up digitizing tutorial (not marked)
Sept. 13	Spatial data and representation Lab 1 – Vector spatial data creation methods, geodatabase introduction	Lab 1 out
Sept. 20	Spatial databases, SQL introduction Lab 1 – Part 2	
Sept. 27	Conceptual database design methods Lab 2 – Part 1	**Lab 1 due - Sept. 29** Lab 2 out
Oct. 4	Spatial database design tools and methods Lab 2 – Part 2	
Oct. 11	No Class this week – Fall break Tuesday make-up day.	**Lab 2 due – Oct. 13**
Oct. 18	Analysis using Spatial SQL Lab 3 – Introduction to PostresSQL / PostGIS	Lab 3 out
Oct. 25	Spatial database administration, data quality, documentation Lab 3 – Working with PostgreSQL / PostGIS Spatial DB design tools	
Nov. 1	No class this week (Prof. Feick on field work). Labs run as usual	
Nov. 8	Going beyond 2D: 3D surfaces and temporal data Lab 4 – Part 1	**Lab 3 due – Nov. 10** Lab 4 out
Nov. 15	OpenStreetMap / Volunteered Geographic Information workshop Lab 4 – Part 2	
Nov. 22	Geospatial data on the web - data structures, sources, and sharing	**Lab 4 due – Nov. 24**
Nov. 29	**Final test (in class)**	

Notes:

1. Changes to the lecture topic sequence and content are not anticipated, but may be required. Any changes will be announced in class and/or posted on the GP387 Learn site.