Comp 5204
Computational Aspects of Geographic Information Systems

Many aspects of our daily lives are effected by GIS (route planning, fleet management, traffic control, …) the commercial impact/potential of GIS is tremendous, and novel algorithmic and applied problems need to be solved.

Learning Modality

In Winter 2021/22, the content for this course will be delivered online. The plan is to do it as ZOOM Live Stream from a set-up I created at my home that includes a whiteboard. Students can tune into at the scheduled time (see the lecture schedule below). Lectures will be recorded but attendance during class times is highly recommended.

Prerequisite: A 3rd year course in Data Structures and Algorithms or the equivalent.

Course Objectives

This is a newly revamped Graduate Course on this topic. You will learn about Geographic Information, its principles, techniques used and analysis of geographic/spatial data. You will be able to understand what is inside a GIS, and several of the underlying algorithms. Having taking this course, you will be able to answer e.g., how do they visualize disease spread, how Google determines the best route algorithmically. This course provides you with insights into how a Geographic Information System works, how geographic or spatial data differ from other data, what the techniques are to store, access and manipulate algorithmically such data. You will also be able to explore some aspect of GIS yourself through a project of your choosing (with my help). Depending on the class size, we might focus on modern digital cities: challenging and solutions.

Lecture Schedule

Jan 11th – April 12th

Days	Time	Location
Tuesdays	10:05 -11:25	Lecture
Thursdays	10:05 -11:25	Lecture

I anticipate to make the lectures available via Brightspace for subsequent viewing.

My office Hours Schedule

Days	Time	Location
Mondays	10:00 -11:00	Online

Important Dates

Date	Due
February 1	Project and Class presentation proposal
March 1 and 3	Class presentations
April 5	Project write-up
April 7	(Brief) project demos
April 12	Final

Grading Scheme

2 Assignments (each 10%)	20%
1 Tutorial	5%
Class participation and presentations including write-up	25%
Project including write-up	30%
Final exam	20%

Textbooks

There is no textbook as such. A good intro into the field is provided in: Geographic Information Science and Systems by Longley et al. Fourth edition, Wiley.

Assignments

Assignments will be posted as they become available.

Please note the following rules and requirements about assignments:

- Late assignments will not be accepted.
- Assignments emailed to me will not be accepted.
- I will not respond to emails sent shortly before or after assignment deadlines asking for exceptions to the preceding two rules.
- You can type your solutions, or write them by hand and scan them (for example, using a scan app on your phone or using a real scanner).
- Solutions written-up in LaTeX are preferred, but not strictly required. In case you want to learn LaTeX, here is a tutorial. Learning LaTeX is a useful exercise, since many programs (including Microsoft Word) now use LaTeX for typesetting formulas.
- Each assignment must be submitted as one single PDF file through Brightspace.

Project

This is the nicest part of the course. Students are almost always finding some project that they like. It would be great if the projects could be in the domain of digital cities, but not required. Projects can be implementation-oriented or theory-based. In almost all cases, I would recommend an implementation-oriented projects. **The class presentation and the topic of the project need to be distinct to allow for maximal learning.**

- ## Implementation Projects

For implementation projects you would typically implement different data structures or algorithms. Then, their performance is established through rigorous experimental testing. The write-up contains a description of the data structures algorithms implemented and tested, the tests carried out and the results of the experiments. Should the results show interesting behaviours, they must be explored and discussed. Projects are e.g., finding "best" bicycle routes inside Ottawa, improving the OCTranspo system …You will get a chance to demonstrate your projects to me and your class mates in a special demonstration class.

- ## Theory Projects

Don't choose this if you are not very research-oriented. You are encouraged to work on an open problem mentioned in class or stated in the literature. It may happen that you cannot solve the open problem proposed. In this case, you should describe the approaches attempted and the reasons why they did not work. Marking then focuses on the write-up, including the survey depth, and the strength of the approaches attempted.

Class presentations

The class presentations give you a great opportunity to practice giving a talk. Here, the objective is for you to learn to speak talk in front of people. This will be useful

if you are in academia or industry. Then, the stakes are higher and it is nice to practice in front of equals. I will give you feedback how to improve. Depending on the class size, we might get 20-30 minutes per talk.

Tutorials (new for this year)

ESRI has developed some tutorials to learn how to use its products. We are choosing a sample tutorial that you go through, make snapshots of how you did and then add likely some additional tasks (which we will specify). This is a new item and has been added since students told me that they like a hand-on experience of GIS.

Exams

The final exam will take place online. At the scheduled exam time, the exam will proceed as follows:

- You will login to Zoom with your camera turned and using your full real name.
- The Zoom session will have instructions on how to access the online exam
- If you have a question during the exam, you can "raise your hand" (a Zoom feature) and an exam proctor will contact you through Zoom chat.
- At some point during the exam, a proctor will check your student id (sign in).
- When you have completed and submitted your online exam, you will "raise your hand" and an exam proctor will contact you through Zoom chat to give you permission to leave (sign out).

Any online exams completed by a student who did not properly sign in and sign out will be discarded.

Academic Integrity

As of 2020, there are new penalties in place for academic integrity violations. These will be issued by the Associate Dean (Undergraduate Affairs) of Science to students who copy, in whole or in part, work they submit for assignments.

- First offence: F in the course

- Second offence: One-year suspension from program
- Third offence: Expulsion from the University

These are standard penalties. More-severe penalties will be applied in cases of egregious offences. Failure to inform yourself of the expectations regarding academic integrity is not a valid excuse for violations of the policy. When in doubt, ASK your instructor or TA. For more information check the ODS website

Accommodation Statement

Carleton University is committed to providing access to the educational experience in order to promote academic accessibility for all individuals. Here is information on how to apply for academic accommodation.