

Comp 5204/ crosslisted with 4202 and CSI 5124
Computational Aspects
of Geographic Information Systems

Motivation: Many aspects of our daily lives are effected by GIS and its commercial impact/potential is tremendous. Through recent advances in technology such as vehicle navigation systems, GPS (global positioning systems), wireless/mobile devices, ... GIS is dramatically changing and once again on the forefront of active research and commercial development. This course lays the foundations to understand, use and further GIS technology with particular focus on algorithmic/computational aspects.

Topics include: overview of GIS, GIS data and their representations, operations, multi-resolution models, efficient algorithms for solving key GIS problems such as computing contour lines, visibility queries, distance and geometric shortest path problems, point location, current R&D topics including the use of context in GIS, time&space, High Performance GIS and GIS on mobile devices.

Prerequisite: Data Structures and Algorithms (e.g., Computer Science 3804* or equivalent).

Coursework and evaluation:

- *2 Assignments* 15% each: total 30%
- *Class participation* : total 10%
- *Class presentation*: total 20%
- *Project* including write-up and demonstration: 20%
- *Test*: 20%
- Some accommoations are made for undergraduate students attending this course.

Place, time: Mondays and Wednesdays Time: 10:05 - 11:25 Building: Southam Hall Room: 402

- **Assignments** are due before class on the due date. **No late assignments can be accepted.** Graduate students may get slightly modified assignments.
- **Class presentations** are tentatively scheduled for the following days: October 21st, 23rd, November 4th, and possibly November 6th. The proposals for presentations are due September 30th. The exact dates depends on the number of students. The presentations need to be handed in (via email as powerpoint or pdf) as part of the evaluation.
Note: Depending on the number of class participants, class presentations may vary in length. Unless otherwise stated, it will be 20 minutes + 5 minute discussion.
- **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.** The proposals for projects are also due September 30th.

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.

You will get a chance to demonstrate your projects to me and your class mates in a special demonstration class. We will find a mutually convenient time on December 6th, or around that. Please let me know, as soon as possible, if the 6th would not work for you.

Theory Projects: 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.

The *Deadlines* are given in Table 1. If December 6th does not work for you, we can make a special arrangement.

Project write-ups (theory or implementation) must contain a survey of related work, a motivation for, and a detailed discussion of the work carried out. The write-up is due December 4th.

- **Test** will be centrally scheduled.
- **Scheduling**

The project demonstration class on, or around, December 6th replaces the class on Tuesday October 30th. (So, no class on that day.)

Students with disabilities requiring academic accommodations in this course must register with the Paul Menton Centre for Students with Disabilities for a formal evaluation of disability-related needs. Registered PMC students are required to contact the Centre, 613-520-6608, every term to ensure that I receive your Letter of Accommodation, no later than two weeks before the first assignment is due or the first in-class test/midterm requiring accommodations. Please consult Carleton's calendar for all general dates and regulations.

Table 1: Dates

Date	For
September 30 th	Project and Class presentation proposals
October 21 st , 23 rd , November 4 th , 6 th	Class presentations (tentative)
October 30 th	No class
December 4 th	Final deadline for project write-up
December 6 th	Project demos (replaces October 30 th class)
December	Test (centrally scheduled)