

COMP 5112/4900G

Algorithms for Data Science

Fall 2025

Instructor: Anil Maheshwari

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Course Webpage: <https://people.scs.carleton.ca/~anil>

- Lectures: Mondays and Wednesday, 10:05 – 11:25 AM
- Classrooms: Check Carleton Central
- All lectures will be in-person, no video-recording.

Teaching assistants: Likely None

Office hours: Monday 08:30-09:45 AM in 5125b HP

Prerequisite: Note that you need a minimum of B+ in COMP 3804 to register in this course. The contents of this course are fairly broad, and will cover a spectrum of techniques from the design and analysis of algorithms. It is assumed that you have a very good grasp on the analysis of algorithms (O-notation, recurrences, and complexity analysis), elementary probability theory including expectation and indicator random variables, the knowledge of algorithmic techniques (divide-and-conquer, dynamic programming, greedy algorithms, linear programming, NP-Hardness, Polynomial-time reducibility, basic graph algorithms), and the knowledge of discrete mathematics (counting, permutations and combinations, proof techniques: induction, contradiction, ..). There will no time to review these material, and to appreciate the contents of this course, you must have a very good grasp on these topics.

Department/Unit: School of Computer Science

Topics covered: To learn some of the algorithmic techniques to handle data science problems. Emphasis is on providing correctness proofs, establishing competitive ratios, and analyzing computational complexity for each of the algorithms discussed during the course. Topics may include:

- Approximation algorithms design techniques
- Dimensionality Reduction
- Online Algorithms (including the role of Primal-Dual LPs in their analysis)

- Finding Similar Items using Locality-Sensitive Hashing
- Nearest Neighbor Searching
- Clustering
- FPT Algorithmic Design Techniques
- Algorithmic Aspects of Social Networks (Graph Partitioning, Searching various substructures)
- Multiplicative-Weight Update Method

These topics may be adjusted based on the background, interests of the students, and the amount of lecture time available.

A tentative week-by-week schedule will be posted on the course webpage.

Learning Materials:

- Anil Maheshwari's Notes on Topics in Algorithm Design (we refer to them as "Notes")
<https://people.scs.carleton.ca/~maheshwa/Notes/DAA/notes.pdf>
- Mining of Massive Datasets (MMDS) by Leskovec, Rajaraman, Ullman
<https://mmds.org>
- Some Journal and Conference Articles.
- For project ideas, look for conferences such as SODA, WWW, KDD, Data Mining and Knowledge Discovery, WSDM, ICLR, ICML.
- Students are not required to purchase textbooks or other learning materials for this course.

Assessment scheme:

- In Class Test (Wednesday October 27): 15%
- Project (with different components spread over the term): 65%
 1. Written Project Proposal (10%): Due by September 28th.
 2. 3-Minute Project Proposal Presentation (5%): Wednesday, Oct 1st Class
 3. End-of-Term presentation on projects (25%): Scheduled within the last 4 weeks of classes.
 4. Project Report (25%): A couple of days before your end-of-term project presentation.
- Final Exam: 20%

Late and Missed Work Policies: Missed class test will be covered by the final exam. No other components of the course can be missed.

Undergraduate Academic Advisors: The Undergraduate Advisors for the School of Computer Science are available in Room 5302HP; or by email at

scs.ug.advisor@cunet.carleton.ca

The undergraduate advisors can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisors will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services.

Academic Accommodations and Regulations: Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website

<https://students.carleton.ca/course-outline/>

Statement on Chat GPT/Generative AI usage:

Since all Tests and Final Exams are in-person, this section does not apply to this component of the course. For the Project, students need to come up with a project. They can use suitable resources from the web and software libraries, and utilize generative AI for implementation, with appropriate citations. They will be making a presentation in the class on the Project, as well as demo their experimental work, write a short report, and hence, they need to be well-versed with all aspects of their projects. The emphasis and the evaluation is based on whether they can incorporate elements of the course in their project design, implementation, and experimentation.

Statement on Academic Integrity: Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy, see

<https://carleton.ca/registrar/academic-integrity/>

A list of standard sanctions in the Faculty of Science can be found at

<https://science.carleton.ca/students/academic-integrity/>

Additional details about this process can be found on the Faculty of Science Academic Integrity website. Students are expected to familiarize themselves with and abide by Carleton University's Academic Integrity Policy.

School of Computer Science Laptop Requirement: Every student that has been enrolled in a 1000-level (i.e., first year) course offered is required to have a laptop. This includes COMP1001, COMP1005, and COMP1006. For more information, please visit

<https://carleton.ca/scs/scs-laptop-requirement/>

and then review the requirements at

<https://carleton.ca/scs/scs-laptop-requirement/laptop-specs/>

SCS Computer Laboratory: Students taking a COMP course can access the SCS computer labs. The lab schedule and location can be found at

<https://carleton.ca/scs/tech-support/computer-laboratories/>

All SCS computer lab and technical support information can be found at

<https://carleton.ca/scs/tech-support/>

Technical support staff may be contacted in-person or virtually, see this page for details:

<https://carleton.ca/scs/tech-support/contact-it-support/>

Student Rights and Responsibilities: Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the 7 Rights and Responsibilities Policy for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.