COMP251: Algorithms & Data Structures

Fall 2022
School of Computer Science
McGill University

Introduction to algorithm design and analysis. Graph algorithms, greedy algorithms, data structures, dynamic programming, maximum flows.

GENERAL INFORMATION

Instructors: Giulia Alberini () and Prof. Jérôme Waldispühl (="http://www.cs.mcgill.ca/~jeromew/").

Teaching Assistants:

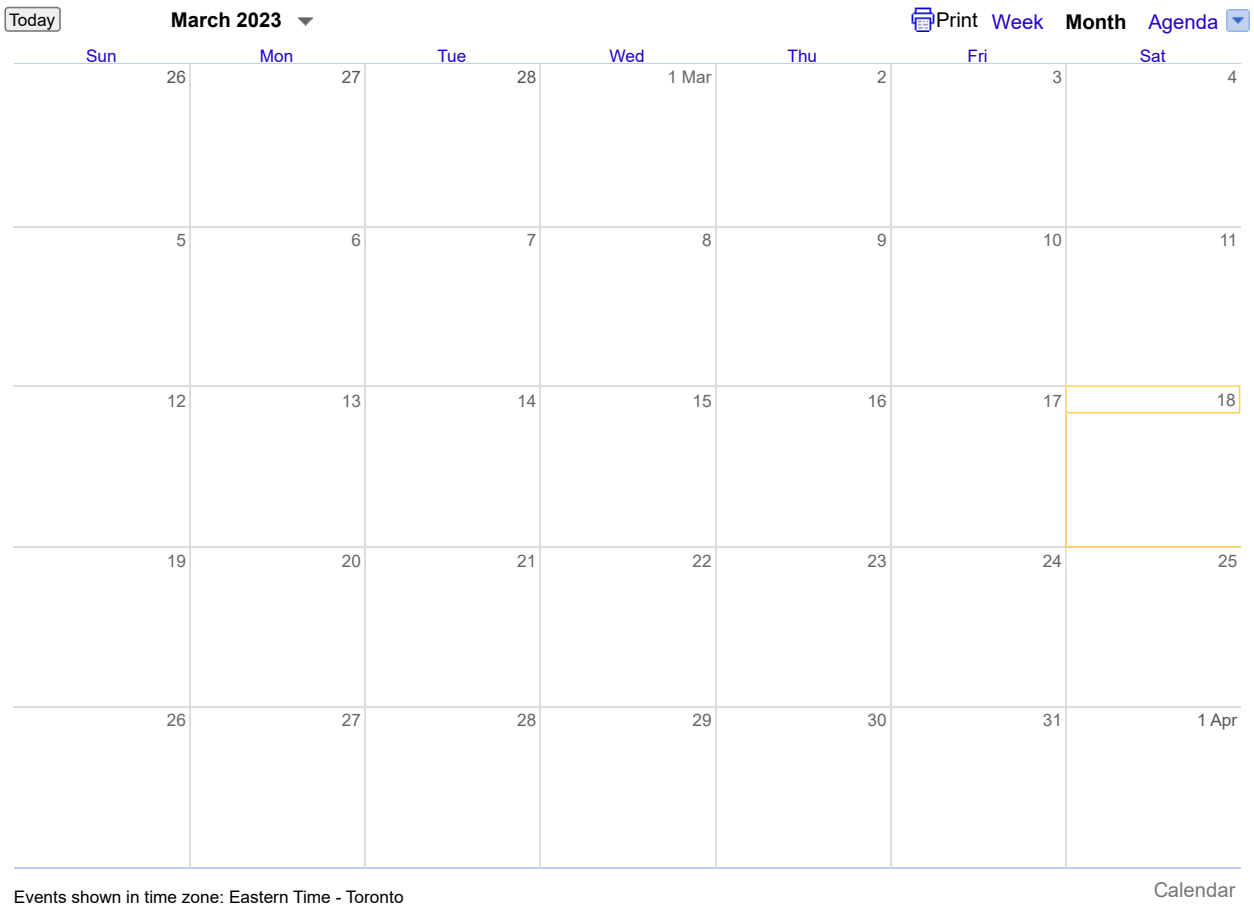
- TBD

Lectures: Adams Auditorium on Tuesday & Thursday at 10am (EDT). The lecture will be recorded and available on MyCourses.

Contact: All course-related email should be sent to cs251@cs.mcgill.ca (mailto:cs251@cs.mcgill.ca). Emails sent to personal addresses will not likely be seen.

Office hours:
Please consult the COMP251 calendar below for the most up-to-date schedule including office hours and other important dates.

COMP 251 schedule



Course Webpage: http://www.cs.mcgill.ca/~jeromew/comp251.html (http://www.cs.mcgill.ca/~jeromew/comp251.html)

Course Material:
All the material needed for this class will be available on the public course web page. There is no required textbook. However, we recommend the following textbooks from which most lectures will be based upon:

- [CLRS2009] Cormen, Leiserson, Rivest, & Stein, *Introduction to Algorithms*. (E-book (http://www.books24x7.com/marc.asp?bookid=49924))
- [KT2006] Kleinberg & Tardos, *Algorithm Design*.

Lecture slides will be made available in PDF form on the course web page. Lectures will be recorded and available on MyCourse (You must login into MyCourses. Download is not enabled). Instructions to borrow a E-book online are available at http://www.mcgill.ca/library/find/ebooks/borrowing-ebooks/ (http://www.mcgill.ca/library/find/ebooks/borrowing-ebooks/).

Discussion Board:
We are using Ed for class discussion. The system is highly catered to getting you help fast and efficiently from classmates, the TAs, and instructors. Rather than emailing questions to the teaching staff, we encourage you to post your questions there. The official discussion board for this class is Ed (https://edstem.org/us/). **You must Login to the platform via MyCourses.**

Evaluation
Your final grade will be calculated as follows:

- 30% for 3 assignments
- 20% for the midterm exam
- 50% for the final exam

ANNOUNCES

Release Date	Due Date	Announce
Nov 18	Dec 5, 2022 (11h59am)	Assignment 3 is now released! You can download the problem set here. (teachings/251/F2022/COMP251_HW3.pdf) You will have to submit your answers on Crowdmark. **Note: The deadline has been extended to Dec. 5 at 11h59pm.**
Oct 24	Nov 14, 2022 (11h59am)	Assignment 2 is now released! You can download the problem set here. (teachings/251/F2022/COMP251_HW2.pdf) You will have to submit your answers on Crowdmark. **Note: The deadline has been extended from Nov. 10 to Nov. 14 noon.**
Sep 23	Oct 15, 2022 (11h55pm)	Assignment 1 is now released! You can download the problem set here. (teachings/251/F2022/COMP251_HW1.pdf) You will have to submit your answers on Crowdmark.
Sep 1		Welcome in COMP 251! A link is available on MyCourses. The class will be recorded and available of streaming later. Online office hours will be arranged and announced in due time.

SCHEDULE

	Date	Topic	Material	References	Instructor
Lecture 0	Sep 1	Introduction	[SLIDES] (teachings/251/F2022/COMP251_Intro_F2022.pdf)		J. Waldispühl
Lecture 1	Sep 6	Recurrences	[SLIDES] (teachings/251/F2022/COMP251_Lecture1_F2022.pdf)	Chapter 4 of [CLRS2009]	J. Waldispühl
Lecture 2	Sep 8	Big Oh notation	[SLIDES] (teachings/251/F2022/COMP251_Lecture2_F2022.pdf)	Chapter 3 of [CLRS2009]	J. Waldispühl

	Date	Topic	Material	References	Instructor
Lecture 3	Sep 13	Proofs by induction and loop invariants	[SLIDES] (teachings/251/F2022/COMP251_Lecture3_F2022.pdf)		J. Waldispühl
Lecture 4	Sep 15	Graphs, Probability and Binary numbers	[SLIDES] (teachings/251/F2022/COMP251_Lecture4_F2022.pdf)		G. Alberini
Lecture 5	Sep 20	Heaps & Heapsort	[SLIDES] (teachings/251/F2022/COMP251_Lecture5_F2022.pdf)	Chapter 6 of [CLRS2009]	G. Alberini
Lecture 6	Sep 22	BST and AVL trees	[SLIDES] (teachings/251/F2022/COMP251_Lecture6_F2022.pdf)		G. Alberini
Lecture 7	Sep 27	Red-black trees	[SLIDES] (teachings/251/F2022/COMP251_Lecture7_F2022.pdf)	Chapter 13 of [CLRS2009]	J. Waldispühl
Lecture 8	Sep 29	Hashing	[SLIDES] (teachings/251/F2022/COMP251_Lecture8_F2022.pdf)	Chapter 11 of [CLRS2009]	J. Waldispühl
Lecture 9	Oct 4	Disjoint sets	[SLIDES] (teachings/251/F2022/COMP251_Lecture9_F2022.pdf)	Chapter 21 of [CLRS2009]	J. Waldispühl
Lecture 10	Oct 6	Greedy algorithms (Scheduling, Huffman coding)	[SLIDES] (teachings/251/F2022/COMP251_Lecture10_F2022.pdf)	Chapter 16 of [CLRS2009]	J. Waldispühl
Reading Break	Oct 11				
Lecture 11	Oct 14	Elementary graph algorithms	[SLIDES] (teachings/251/F2022/COMP251_Lecture11_F2022.pdf)	Chapter 22 of [CLRS2009]	G. Alberini
Lecture 12	Oct 18	Topological sort and strongly connected components	[SLIDES] (teachings/251/F2022/COMP251_Lecture12_F2022.pdf)	Chapter 22 of [CLRS2009]	G. Alberini

	Date	Topic	Material	References	Instructor
Lecture 13	Oct 20	Single source shortest path	[SLIDES] (teachings/251/F2022/COMP251_Lecture13_F2022.pdf)	Chapter 24 of [CLRS2009]	G. Alberini
Lecture 14	Oct 25	Minimum Spanning Tree	[SLIDES] (teachings/251/F2022/COMP251_Lecture14_F2022.pdf)	Chapter 23 of [CLRS2009]	G. Alberini
Lecture 15	Oct 27	Bipartite graphs	[SLIDES] (teachings/251/F2022/COMP251_Lecture15_F2022.pdf)	Chapter 1.1 of [KT2006]	G. Alberini
Midterm Exam	Nov 1	Mid-term Examination	**Online** during the regular class hours (10am-11:30am EDT)		
Lecture 16	Nov 3	Network flow 1	[SLIDES] (teachings/251/F2022/COMP251_Lecture16_F2022.pdf)	Chapter 26 of [CLRS2009]	J. Waldispühl
Lecture 17	Nov 8	Network flow 2	[SLIDES] (teachings/251/F2022/COMP251_Lecture17_F2022.pdf)	Chapter 26 of [CLRS2009]	J. Waldispühl
Lecture 18	Nov 10	Dynamic Programming 1 (weighted interval scheduling)	[SLIDES] (teachings/251/F2022/COMP251_Lecture18_F2022.pdf)	Chapter 6 of [KT2006]	J. Waldispühl
Lecture 19	Nov 15	Dynamic Programming 2 (Bellman Ford, knapsack problem)	[SLIDES] (teachings/251/F2022/COMP251_Lecture19_F2022.pdf)	Chapter 6 of [KT2006]	J. Waldispühl
Lecture 20	Nov 17	Amortized analysis	[SLIDES] (teachings/251/F2022/COMP251_Lecture20_F2022.pdf)	Chapter 17 of [CLRS2009]	J. Waldispühl
Lecture 21	Nov 22	Divide-and-conquer 1 (Merge sort & integer multiplication)	[SLIDES] (teachings/251/F2022/COMP251_Lecture21_F2022.pdf)	Chapter 5 of [KT2006]	G. Alberini
Lecture 22	Nov 24	Divide-and-conquer 2 (Master Theorem)	[SLIDES] (teachings/251/F2022/COMP251_Lecture22_F2022.pdf)	Chapter 4 of [CLRS2009]	G. Alberini

	Date	Topic	Material	References	Instructor
Lecture 23	Nov 29	Randomized algorithms (Global min-cut, randomized quick sort)	[SLIDES] (teachings/251/F2022/COMP251_Lecture23_F2022.pdf)	Chapter 13 of [KT2006]	G. Alberini
Lecture 24	Dec 1	Probabilistic analysis	[SLIDES] (teachings/251/F2022/COMP251_Lecture24_F2022.pdf)	Chapter 5 of [CLRS2009]	G. Alberini
Final Exam	TBD	Final Examination	In-person formal exam (Full details available at the Exam office)		

RULES & POLICIES

Prerequisites
The official prerequisites for this course are COMP 250 (Introduction to Computer Science) and MATH 240 (Discrete Structures) or MATH 235 (Algebra 1). We recommend the students to review the material covered in this class. The students must also be familiar with basic concepts and techniques in probability.

Policy on discussion Board
The official discussion board is accessible on Ed (https://edstem.org/us/). Please follow common sense rules and etiquette for discussion board postings: be polite, avoid texting shorthand ("ur" instead of "you are", ...), choose a suitable subject line for your posting and use multiple postings for multiple subjects, keep your postings brief, etc.

Policy on collaborations
We encourage you to discuss the assignment problems with each other. However, these discussions should not so far that you are sharing code or giving away the answer. A rule of thumb is that your discussions should considered public in the sense that anything you share with a friend should be sharable with any student in the class.
Importantly, we ask you to indicate on your assignments (as a comment in the header of your source code if it is a programming question) the names of the persons with who you collaborated or discussed your assignments (including the TA's and the instructor). Failure to comply to this rule may affect your grading.

Policy on re-grading
When justified, we can re-grade a question on an exam (or assignment). However, to avoid grade ratcheting, we reserve us the right to re-grade other questions on your exam as well. Please, note that regrading may also eventually result in a lower grade.

Policy on grading
We will use the same formula for calculating your final grade for everyone. We understand that your performances may be influenced by many factors, possibly out of your control. However, that is the only way we can be fair. Yet, we will release the evaluation material (e.g., assignments) ahead of time to allow you to organize your schedule. It is your responsability to

accomodate the deadlines.
The only exceptions will be medical exceptions. When appropriate, we might ask a medical note. It is important to inform the instructors as early as possible. Failure to do so, may result in the impossibility to invoke a medical exception.

Policy on Assignments
Due date/time, location/mode for returning your solutions, and accepted formats will be announced in class and indicated on the course web page.
Failure to return your assignment in time will results in penalties and possibly absence of grading. **Late submission of 24h or less will receive a penalty of 20%. In all other cases, your assignment will not be graded.**
Assignments may include guidelines and require particular formatting procedures. **Solutions that do not follow the required format may not be graded.**
The quality of the presentation of your answers is important. Unreadable material, cryptic notations, or bad organization of the material may result in absence of grading. Clarity of your explanations will be an integral part of your final grade.

Use of French in assignments and exams
In accordance with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded.

Other rules
Additional information and rules may be found in the slides of the first lecture (teachings/251/F2022/COMP251_Intro_F2022.pdf). In case of doubt, please contact the instructors at cs251@cs.mcgill.ca (mailto:cs251@cs.mcgill.ca).

McGill policies
McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offenses under the Code of Student Conduct and Disciplinary Procedures (https://www.mcgill.ca/secretariat/files/secretariat/code_of_student_conduct_and_disciplinary_procedures.pdf).

CONTACT

All request should be sent at:

(E-mail) cs251@cs.mcgill.ca (mailto:cs251@cs.mcgill.ca)

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