

# CAS 702: Data Structures & Algorithms

**Instructor:** [George Karakostas](#)

**Office hours:** By appointment

**Textbook:** "Introduction to Algorithms", 3rd Ed., by T. Cormen, C. Leiserson, R. Rivest, and C. Stein.

## **Study material:**

- More information about the expansion of **matroids** to **greedoids** can be found in the references of the Wikipedia article [here](#). Especially interesting are the articles by Bjorner & Ziegler, and Helman et al.
- [DP slides](#)
- A very nice recent survey on Max Flow [here](#).

## **Course description:**

The course will cover data structures and algorithms topics *at a graduate level*. This means that this course will **not** be a repetition of an undergraduate course on the subject, such as, e.g., CAS CS 2C03, but it will rather cover more advanced topics, or known material at a more advanced /deeper level of understanding. For example, Kruskal's algorithm for the minimum spanning tree problem should already be known, but we will examine it under a general framework for greedy algorithms called matroid theory. Therefore it is assumed that the students already know the material of Chapters 1-5 (Foundations) of the text (**note:** students who are not familiar with this material must cover it as soon as possible).

A tentative list of topics we will try to cover follows.

## **Topics**

1. Binomial heaps, an example of worst-case analysis (Problem 19-2)
2. Amortized analysis (Ch. 17)
3. Fibonacci heaps, an example of amortized analysis (Ch. 19)

4. Hash tables, an example of randomized analysis (Ch. 11)
5. Greedy algorithms and matroids (Ch. 16)
6. Dynamic programming and all-pairs shortest paths (Ch. 15, 25)
7. Maximum flow (Ch. 26)
8. Linear Programming and Duality (Ch. 29)
9. Primal-Dual schema as an algorithmic design tool
10. NP-completeness (Ch. 34)
11. Approximation algorithms (Ch. 35)

### **Student evaluation:**

40% Midterm exam

60% Final exam

### **Problem sets**

TBA

### **McMaster Course Policies**

The instructor and university reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

### **Academic Dishonesty**

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various kinds of academic dishonesty

please refer to the Academic Integrity Policy, specifically Appendix 3, located at [http://www.mcmaster.ca/senate/academic/ac\\_integrity.htm](http://www.mcmaster.ca/senate/academic/ac_integrity.htm)

The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained. (e.g. submitting a copy of someone else's writeup for an assignment)
2. Improper collaboration in group work. (e.g. collaboration between groups in an assignment)
3. Copying or using unauthorized aids in tests and examinations.

## **CONDUCT EXPECTATIONS**

As a McMaster graduate student, you have the right to experience, and the responsibility to demonstrate, respectful and dignified interactions within all of our living, learning and working communities. These expectations are described in the [Code of Student Rights & Responsibilities](#) (the “Code”). All students share the responsibility of maintaining a positive environment for the academic and personal growth of all McMaster community members, **whether in person or online.**

It is essential that students be mindful of their interactions online, as the Code remains in effect in virtual learning environments. The Code applies to any interactions that adversely affect, disrupt, or interfere with reasonable participation in University activities. Student disruptions or behaviours that interfere with university functions on online platforms (e.g. use of Avenue 2 Learn, WebEx or Zoom for delivery), will be taken very seriously and will be investigated. Outcomes may include restriction or removal of the involved students’ access to these platforms.

## **ACADEMIC ACCOMMODATION OF STUDENTS WITH DISABILITIES**

Students with disabilities who require academic accommodation must contact [Student Accessibility Services](#) (SAS) at 905-525-9140 ext. 28652 or [sas@mcmaster.ca](mailto:sas@mcmaster.ca) to make arrangements with a Program Coordinator. For further information, consult McMaster University’s [Academic Accommodation of Students with Disabilities](#) policy.

## **ACADEMIC ACCOMMODATION FOR RELIGIOUS, INDIGENOUS OR SPIRITUAL OBSERVANCES (RISO)**

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the [RISO](#) policy. Students should submit their request to their Faculty Office **normally within 10 working days** of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations.

Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

### **COPYRIGHT AND RECORDING**

Students are advised that lectures, demonstrations, performances, and any other course material provided by an instructor include copyright protected works. The Copyright Act and copyright law protect every original literary, dramatic, musical and artistic work, **including lectures** by University instructors

The recording of lectures, tutorials, or other methods of instruction may occur during a course. Recording may be done by either the instructor for the purpose of authorized distribution, or by a student for the purpose of personal study. Students should be aware that their voice and/or image may be recorded by others during the class. Please speak with the instructor if this is a concern for you.

### **EXTREME CIRCUMSTANCES**

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

### **Faculty Notices**

"The Faculty of Engineering is concerned with ensuring an environment that is free of all discrimination. If there is a problem, individuals are reminded that they should contact the Department Chair, the Sexual Harrassment Officer or the Human Rights Consultant, as the problem occurs."