COMP 6651 – Algorithm Design Techniques (4 credits)
Winter 2022
* Department of Computer Science and Software Engineering
* Gina Cody School of Engineering and Computer Science

1. General Information

Instructor:	Yaqiao Li*
Lectures:	Sec. NN on F 17:45–20:15
Lectures room:	FG C070 SGW
Office Hours:	TBA on Moodle
Email:	yaqiao.li@concordia.ca

2. Course Description

Calendar Course Description

Mathematical preliminaries; Empirical and theoretical measures of algorithm efficiencies; Optimization and combinatorial techniques and algorithms including greedy algorithms, dynamic programming, branch-and-bound techniques and graph network algorithms; Amortized complexity analysis; String matching algorithms; NP-complete problems and approximate solutions; Probabilistic algorithms. A project is required.

Prerequisites

COMP 5361, COMP 5511.

This course requires a good understanding of concepts and techniques in discrete mathematics. We recommend, in particular, that you refresh your knowledge of the following topics: sets, functions, relations, graphs, and proof techniques.

Notes:

- *This course is being offered in campus.*
- *Students are responsible for visiting Moodle frequently for course materials, postings, and updates.*

3. Course Materials

Required: T. H. Cormen; C. E. Leiserson; R. L. Rivest; C. Stein. **Introduction to Algorithms**, 3rd Edition, 2009.

Not required: S. Dasgupta; C. H. Papadimitriou; U. Vazirani. **Algorithms**, 2006.

Not required: J. Kleinberg; E. Tardos. **Algorithm Design**, 2005.

4. Grading

Course Component	% of Total Course Weight
Assignments (5)	20
Quizzes (4)	16
Project	14
Midterm Exam	20
Final Exam	30

Note: *The default grade is 0 for any missing course component, i.e., assignment, quiz, project, exam. There is no a priori, fixed relationship between the total percentage obtained and the final letter grade assigned, except that a higher percentage will not be assigned a lower letter grade.*

Assignments

There will be 5 Assignments each worth 4.0%. Solution to assignments must be submitted through Moodle. While we encourage collaborative learning in this course, in particular you are encouraged to discuss the assignments, however each student should write his/her solutions independently.

Quizzes

There will be 4 in-class quizzes each worth 4.0%. Further instructions will be given in class and posted on Moodle.

Exams

The midterm and final will be in-person exams. The midterm will be during the lecture time slot. The final exam will be scheduled by the Exam Office. To pass the course, students must obtain a passing grade in the final exam and the total, which is normally 50%.

Note: *The instructor reserves the right to conduct an individual oral examination after each exam to verify the students response to specific questions.*

Project

There will be 1 project worth 14%. Further instructions will be given in class and posted on Moodle.

5. Objectives

   The learning objectives of this course are to:

   - introduce students to the foundations of algorithmic thinking;
   - develop abilities and skills of students to design and analyze algorithms for various computational problems, write pseudocode, and carry out rigorous arguments and proofs.

   After successfully completing this course, students will be able to:

   - design divide-and-conquer algorithms;
   - design greedy algorithms;
   - design dynamic programming algorithms;
   - design linear programming algorithms;
   - design approximation algorithms;
   - design graph algorithms;
   - design flow network algorithms;
   - analyze time complexity of algorithms;
   - classify computational problems as belonging to classes $\mathcal{P}$, $\mathcal{NPC}$, etc.

6. Schedule (may be subject to change)

Weeks	Date	Chapters	Topics
1	Jan. 13	1, 2, 3	Introduction and mathematical preliminaries.
2	Jan. 20	4	Divide and conquer algorithms.
3	Jan. 27	16	Greedy algorithms.
4	Feb. 3	15	Dynamic programming-(1).
5	Feb. 10	15	Dynamic programming-(2).
6	Feb. 17	22 $\sim$ 26	Graph algorithms-(1).
7	Feb. 24		**Midterm**. in class
8			**BREAK**
9	Mar. 10	22 $\sim$ 26	Graph algorithms-(2).
10	Mar. 17	29	Linear programming.
11	Mar. 24	34	Complexity theory-(1).
12	Mar. 31	34	Complexity theory-(2).
13	Apr. 7		Missing lecture due to Easter holidays
14	Apr. 14	35	Approximation algorithms-(1).
15	Apr. 18	35	Make-up for week 13: Approximation algorithms-(2).

Attendance

Students are encouraged to attend the lectures regularly and are responsible for all the materials discussed, covered, and assigned.

7. Behaviour

   All individuals participating in courses are expected to be professional and constructive throughout the course, including in their communications. Concordia students are subject to the Code of Rights and Responsibilities which applies both when students are physically and virtually engaged in any University activity, including classes, seminars, meetings, etc. Students engaged in University activities must respect this Code when engaging with any members of the Concordia community, including faculty, staff, and students, whether such interactions are verbal or in writing, face to face or online/virtual. Failing to comply with the Code may result in charges and sanctions, as outlined in the Code.

8. IP

   Content belonging to instructors shared in online courses, including, but not limited to, online lectures, course notes, and video recordings of classes remain the intellectual property of the faculty member. It may not be distributed, published or broadcast, in whole or in part, without the express permission of the faculty member. Students are also forbidden to use their own means of recording any elements of an online class or lecture without express permission of the instructor. Any unauthorized sharing of course content may constitute a breach of the Academic Code of Conduct and/or the Code of Rights and Responsibilities. As specified in the Policy on Intellectual Property, the University does not claim any ownership of or interest in any student IP. All university members retain copyright over their work.

9. Extraordinary Circumstances

   In the event of extraordinary circumstances and pursuant to the Academic Regulations, the University may modify the delivery, content, structure, forum, location and/or evaluation

scheme. In the event of such extraordinary circumstances, students will be informed of the changes.

10. Ethical Behaviour

Plagiarism:

The most common offense under the Academic Code of Conduct is plagiarism, which the Code defines as the presentation of the work of another person as ones own or without proper acknowledgement. This includes material copied word for word from books, journals, Internet sites, professors course notes, etc. It refers to material that is paraphrased but closely resembles the original source. It also includes for example the work of a fellow student, an answer on a quiz, data for a lab report, a paper or assignment completed by another student. It might be a paper purchased from any source. Plagiarism does not refer to words alone it can refer to copying images, graphs, tables and ideas. Presentation is not limited to written work. It includes oral presentations, computer assignments and artistic works. Finally, if you translate the work of another person into any other language and do not cite the source, this is also plagiarism.

In Simple Words:

Do not copy, paraphrase or translate anything from anywhere without saying where you obtained it.

(Source: The Academic Integrity Website: concordia.ca/students/academic-integrity)

Accessibility

Instructor will strive to make learning experience as accessible and inclusive as possible. If you have accessibility needs that require academic accommodations, please meet with an advisor from the Access Centre for Students with Disabilities (ACSD) as soon as possible to set up an accommodation plan. I welcome meeting with all students to discuss their accessibility needs. concordia.ca/students/accessibility

Sexual Violence

Sexual violence, including sexual harassment and sexual assault, is not tolerated at Concordia. Please see Concordias policy on sexual violence for more information about awareness and prevention, support for survivors/ victims, responding to disclosures and procedures for reports and complaints. You can also contact the Sexual Assault Resource Centre for information and support. More information and support are available at the Sexual Assault Resource Centre concordia.ca/students/sexual-assault, by email sarc@concordia.ca or phone 514 848-2424 x 3353