McGill University

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Course Outline - Draft

Course Name: Advanced algorithms, data structures, and techniques for competitive programming
COMP 480 Winter 2024

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Course Objectives:

Welcome to COMP-480! Please read this document carefully and keep it for reference throughout the term. COMP-480 Independent Studies in Computer Science (3 credits) is a reading course permitting independent study under the supervision of a faculty member who specialises in a subject where no course is available. This course is a 3-credit course and all the activities bring the total amount of work for the course to approximately 130 hours.
This version of Comp-480 will cover advanced algorithms, data structures, and techniques with a focus on competitive programming. The course is intended for those with a solid background in algorithms and it is designed to help students specialise in specific techniques and algorithms that are commonly encountered in programming competitions. The main objective of the course is to make students better at competitive programming. Please notice that complete attendance is essential and expected.

Required Software:

- You can solve the proposed exercises in any of the following programming languages: Java, Python and/or C/C++.

Textbook:

There is no required material; however, I recommend the following material:

BOOKS

- Skienna, S; Revilla, M., Programming Challenges, Springer Verlag, 2003. ISBN: 0-387-00163-8.n
- T. H. Cormen, C. E. Leiserson, R. L. Rivest, and C. Stein, Introduction to Algorithms (Third Edition), MIT Press, Cambridge, MA, 2009
- Principles of Algorithmic Problem Solving. Johan Sannemo, 2018.
- Competitive Programming by Steven Halim (https://sites.google.com/site/stevenhalim/)
- Any other good textbook on algorithms and C++, Java and/or Python reference

ONLINE CONTESTS:

- TopCoder
- Google Code Jam
- CodeChef

TRAINING PROGRAMS:

- USACO training program.

ONLINE JUDGES:

- https://open.kattis.com/
- http://www.spoj.com/
- https://uva.onlinejudge.org/

COLLEGIATE CONTESTS:

- https://icpc.baylor.edu/
- http://www.ioinformatics.org/index.shtml

Teaching Method / Course Delivery:

This course will be run following a seminar based format. In particular, each student will be assigned a topic per week. The student is expected to complete readings before the class, such that the student can present to the classmates the topic. The student is also expected to prepare a set of exercises (where the number of exercises will depend on their difficulty) that will constitute the homework for the assigned week.

Course Outline:

Week	Responsible	Date	Topic
1	David	Jan-12	Introduction - Presentation of Comp480
2	Josh	Jan-19	Topic 1: Strings and Stuff
3	Alex	Jan-26	Topic 2: ICPC World Finals/IOI problems Assig. 1 due
4	Roland	Feb-2	Heavy Light Decomposition Assig. 2 due
5	Fraser	Feb-9	Topic 4: Simulated Annealing Assig. 3 due
6	Roland	Feb-16	Topic 5: Combinatorics Assig. 4 due
7	Nikola	Feb-23	Topic 6: Biconnected Components Assig. 5 due
8	Tian	Mar-1	Topic 7: Advanced Data Structures Assig. 6 due

9	**READING WEEK**		
10	**Tian**	Mar-15	**Topic 8: Advanced Algorithms** **Assig. 7 due**
11	**Fraser**	Mar-22	**Topic 9: Algorithms & Data Structures from Garbage Collection** **Assig. 8 due**
12	**Josh**	Mar-28 Thursday	**Topic 10: Geometry and Stuff** **Assig. 9 due**
13	**Nikola**	Apr-05	**Topic 11: XOR Hashing** **Assig. 10 due**
14	**Alex**	Apr-12	**Topic 12: Codeforces 2600 Problems** **Assig. 11 due**

Grading

Work	Weight	Comment
Presentation (2)	46%	Each student presents twice during the term. The presentation will be peer-grading by all the members of the class. Each presentation is worth 23%
Assignments (9)	54%	There are 11 assignments; however, during the weeks after the presentations, the student will not have to take the assignment. The student is expected to answer the questions of the classmates. Each assignment is worth 6%

General Information

Communication:

- **General Policy:** The University is committed to maintaining teaching and learning spaces that are respectful and inclusive for all. To this end, offensive, violent, or harmful language arising in course contexts may be cause for disciplinary action under the Article 10 of the Code of Student Conduct and Disciplinary Procedures and Section 2.7 of the Policy on Harassment, Sexual Harassment, and Discrimination Prohibited by Law.
- **My Courses**: All official communication, including announcements, lecture material, assignments, grades will be found on My Courses.

- **Course Discussions**: The online tool, edstem.org, is used as our course discussion board. Please make sure to enroll in the Fall 2023 COMP 204 course on edstem. Use this as your primary communication medium, since your questions are public and can help other students.
- **Private Email**: The professor and TA have private email accounts that you may also use, however these communication channels are for personal queries. For example: if you have a problem with your grade then email the TA who graded you directly, do not email the prof and do not use the course email address.
- **Appointments**: Please email directly the one you want to communicate with to book an appointment outside office hours.
- **Office Hours**: Please take a look at all posted office hours. Come to those times without appointment.
- **After lecture**: Some optional time will be available just after class to ask questions. I do not guarantee the length of this time since other constraints may interfere.
- **Email Policy**: E-mail is one of the official means of communication between McGill University and its students. As with all official University communications, it is the student's responsibility to ensure that time-critical e-mail is accessed, read, and acted upon in a timely fashion. If a student chooses to forward University e-mail to another e-mail mailbox, it is that student's responsibility to ensure that the alternate account is viable. Please note that to protect the privacy of the students, the University will only reply to the students on their McGill e-mail account.

```
CommunicationAlgorithm() :
    if (public) edstem(); // all will benefit
    else if (about marks) emailTAPrivately();
    else if (medical or special) emailProfPrivately();
```

Assignments & Tests:

- **Assignments Delivery**: All assignments are picked-up from myCourses and edstem.
- **Late Policy**: You will be notified in advance of assignment due dates. All assignments are due on myCourses or edstem at the indicated time and date. Late assignments will lose 20% of its grade per day. Assignments beyond 1 day late will not be accepted. You may not submit assignments via e-mail without the permission of the instructor.
- **Additional Work**: Students (regardless the grades) will not be given the opportunity to complete additional work to upgrade their grade.
- **Grading Policy**: No make-up tests or make-up assignments are allowed in this course. If you are not satisfied with the grading of an assignment or test, you may request a review within 7 days of return. Indicate in writing or during a meeting with the TA where and why you feel the marks are unjustified and give it back to your TA for re-grading. Note that the entire assignment or mid-term test will be re-graded, and your grade can go up or down (or stay the same) accordingly. The TA may forward the issue to the instructor.
- **Re-grading**: Mistakes can occur when grading. Not surprisingly, requests for re-grading always involve those mistakes in which the student received fewer points than they deserved, rather than more points than they deserved. With that in mind: if you wish me to re-grade a question on an exam or assignment, I will do so. I reserve the right to re-grade other questions as well.
- **Cheating/Collaboration**: Collaboration is encouraged but your discussions should be public in the sense that anyone including the professor should be allowed to listen in. Assignments are original works created by the student alone. You are permitted and encouraged to have conversations with other students

concerning the contents of the assignments and how to do them, but your work must be original. It is completely forbidden to show or share your code. If two or more assignments are found to be identical (or portions of assignments) then all parties will lose points. This includes the student who permitted their assignment to be copied. This includes written solutions and software source code.

- **Use of Generative AI**: Students are not encouraged, unless otherwise stated, to make use of artificial intelligence tools, including generative AI, to help produce assignments. We believe that working through the assignments on your own will help you gain a better understanding of the course material and will better prepare you not only for the other course examinations, but also for the subsequent CS courses, internships, research opportunities, and jobs. However, students are ultimately accountable for the work they submit. Any content produced by an artificial intelligence tool must be cited appropriately. Many organisations that publish standard citation formats are now providing information on citing generative AI (e.g., MLA: https://style.mla.org/citing-generative-ai/).
- **Exam Policy**: Students are responsible for all materials for the tests and exams. Exams will be a combination of all types of questions based on all sources, and students may be required to integrate theoretical concepts from the text to substantiate their arguments. Crib sheets, calculators, dictionaries are not permitted during an exam or test unless specifically stated by the professor.
- **A supplemental exam** is possible to replace the grade of your final exam.
- **Calculators:** Only non-programmable, no-tape, noiseless calculators are permitted. Calculators capable of storing text are not permitted in tests and examinations.
- **Dictionaries:** Dictionaries are not permitted, but translation dictionaries are.
- **Handheld Devices:** Handheld devices capable of storing text and having calculator functionality (e.g. Palm, etc.) are not permitted.

Additional Information:

The course slides are not meant as a complete set of notes or a substitute for a textbook, but simply constitute the focus of the lecture. Important gaps are left in the slides that are filled in during class, thus **l**ecture attendance should be considered essential.

The material covered in the classroom will be used to supplement textbook readings.

Every chapter should be read twice. The first reading should be done prior to attending class and the second reading should be done after the class discussion of the chapter. The questions at the back of each chapter follow directly from the reading. Students should be able to answer these questions after a thorough reading of the material.

Right to submit in English or French written work that is to be graded.

In accord 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.

Academic Integrity: *Code of Student Conduct*

McGill University values academic integrity. Therefore all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures (see www.mcgill.ca/integrity for more information).

L'université McGill attache une haute importance à l'honnêteté académique. Il incombe par conséquent à tous les étudiants de comprendre ce que l'on entend par tricherie, plagiat et autres infractions académiques, ainsi que les conséquences que peuvent avoir de telles actions, selon le Code de conduite de l'étudiant et des procédures disciplinaires (pour de plus amples reseignements, veuillez consulter le site www.mcgill.ca/integrity).

Final Exam Policy: *Regulations*

Students should not make other commitments during the final exam period. Vacation plans do not constitute valid grounds for the deferral or the rescheduling of examinations. See the Centre Calendar for the regulations governing Examinations: https://www.mcgill.ca/exams/regulations

Students are required to present their I.D. Card (with photo) for entrance to their examination.

Final Exam Policy: *Conflicts*

If you are unable to write your final examination due to scheduling conflicts, you must submit a Final Exam Conflict Form with supporting documentation at least **one month** before the start of the final examination period. Late submissions will not be accepted. For details, *https://www.mcgill.ca/exams/dates/conflicts*

Final Exam Policy: *Exam Timetable*

Examination schedules are posted at the Centre and on the following page approximately 6-8 weeks before the examination period commences https://www.mcgill.ca/exams/dates

The Centre cannot provide examination dates over the telephone.

Student Rights and Responsibilities:

Regulations and policies governing students at McGill University can be downloaded from the website: https://www.mcgill.ca/students/srr/

Students Services and Resources:

Various services and resources, such as email access, walksafe, library access, etc., are available to McGill students: https://www.mcgill.ca/studentservices/

Various services and resources are offered to computer science students: https://mcgill-csus.ca/

Minerva for Students: http://www.mcgill.ca/minerva-students/

Important Note:

In the event of extraordinary circumstances beyond the University's control, the evaluation scheme in a Course is subject to change, provided that there be timely communications to the students regarding the change.

Land acknowledgement:

McGill University is on land which has long served as a site of meeting and exchange amongst Indigenous peoples, including the Haudenosaunee and Anishinabeg nations. We acknowledge and thank the diverse Indigenous people whose footsteps have marked this territory on which people of the world now gather. Please see here for more details: https://www.mcgill.ca/edu4all/other-equity-resources/traditional-territories .