McGill

Course Outline

Course Name: Programming Challenges
                     COMP 321 Fall 2023

Instructors: Section 1 - David Becerra
                           Lecture1: W: 16:05 - 17:25
                           Lecture2: F: 16:05 - 17:25
                     Office Hour: T 9:30 - 10:30
                           F 9:30 - 10:30
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                     Office: TR 3107

Welcome to COMP-321! Please read this document carefully and keep it for reference throughout the term.

Course Format:

This course consists of eighteen 1.5-hour lectures and three 3-hour programming contests. In addition to the ~40 hours of in-class work, the students will be given weekly training problems to exercise their skills at home. The student will need to invest time (~80 hours) to work on the assignments and study/review the topics covered in class. Then, all the activities bring the total amount of work for the course to approximately 120 hours.

- Lectures (17): Wednesday 16:05pm - 17:25pm
                 Fridays 16:05pm - 17:25pm

- Laboratories (3): TBD

Course Goals:

- Give students the opportunity to test their algorithm design and programming skills on tricky problems and puzzles.
  - Given a problem, we want to:
    - Solve it efficiently by using algorithms and data structures.
    - Convert our solution into a program.
    - Do it as quickly as possible (under pressure)
    - And do it correctly (without bugs)
- Encourage students to join the McGill team for the programming contest.
- To have **FUN!**

Comp321 is right for you if:

- You are looking for a fun course that puts a fresh face on standard topics in programming and algorithms. OR
- You are planning to apply soon for a job interview in a big company. OR
- You are interested in joining the McGill team to participate in diverse programming contest competitions. OR
- You are simply motivated by the thrill of competition and learning.

Pre-requisites:

- COMP-250, and COMP-206

Co-requisites:

- COMP-251

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

Course Outline:

Week	Activity	Date	Topic
1	**Lecture 1**	Aug-30	Introduction - Presentation of Comp321
2	**Lecture 2**	Sep-6	Data Structures I
	Lecture 3	Sep-8	Data Structures II
	Assig. 1 due	Sep-8	Ad - Hoc Problems
3	**Lecture 4**	Sep-13	Problem Solving Paradigms (Brute Force)
	Lecture 5	Sep-15	Problem Solving Paradigms (Divide & Conquer)
	Assig. 2 due	Sep-15	Data Structures Problems
4	**Lecture 6**	Sep-20	Problem Solving Paradigms (DP)
	Lecture 7	Sep-22	Problem Solving Paradigms (DP)
	Assig. 3 due	Sep-22	Brute Force Problems
5	**Lecture 8**	Sep-27	Problem Solving Paradigms (DP + Greedy)
	Lecture 9	Sep-29	Problem Solving Paradigms (Greedy)
	Assig. 4 due	Sep-29	DP Problems
6		Oct-4	No Lecture (contest week)*
		Oct-6	Reading Week
7		Oct-11	Reading Week
	Contest 1	Oct-13	180 mins Contest (Lecture 1 - Lecture 9)
	Assig. 5 due	Oct-13	Greedy Problems
8	**Lecture 10**	Oct-18	Graph Theory I
	Lecture 11	Oct-20	Graph Theory II

	Assig. 6 due	Oct-21	Postmortem Contest 1 problems
9	**Lecture 12**	Oct-25	Strings I
	Lecture 13	Oct-27	Strings II
	Assig. 7 due	Oct-27	Graph Theory Problems
10	**Lecture 14**	Nov-1	No Lecture (contest week)*
	Lecture 15	Nov-3	No Lecture (contest week)*
	Assig. 8 due	Nov-3	String Problems
11	**Contest 2**	Nov-6	180 mins Contest (Lecture 10 - Lecture 12)
		Nov-8	Computational Geometry
		Nov-10	Computational Geometry
	Assig. 9 due	Nov-13	Postmortem Contest 3 problems
12	**Lecture 16**	Nov-15	Algebra, number theory and combinatorics I
	Lecture 17	Nov-17	Algebra, number theory and combinatorics II
	Assig. 10 due	Nov-17	Computational Geometry Problems
13	**Contest 3**	Nov-22	180 mins Contest (Lecture 14 - Lecture 17)
	Workshop	Nov-24	How to prepare CS technical interviews
	Assig. 11 due	Nov-24	Algebra, number theory and combinatorics problems

**The week of the contest there is no lecture (because ideally the contest lasts 3hours)

Course Grading:

- **55%** for 11 assignments [5% each]. (9 home training problem sets + 2 postmortem contests).
- **45%** for 3 programming contests. (15% each contest).

The grading will be given by the online judges. Judging is relentlessly strict and the grading will be based on the online judge acceptance criteria. There is no re-grading for this course.

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 2021 COMP 321 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.
- **Office Hours**: Please take a look at all posted office hours. Come (i.e., connect via zoom) 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.

Assignments & Programming Contests:

- **Assignments**:
    - All assignments are submitted to and picked-up from kattis.
    - After the lecture, you get a set of problems about that topic.
        - Each set has approximately 8 problems.
        - Each problem has a varying difficulty.
        - Each problem is assigned some amount of points based on its difficulty.

- To get a perfect score you need to get at least a certain amount of points. Usually representing the solution of 2 to 4 problems.
- The grade follows linearly from the number of points you get.
- The deadline of a problem set is the following class (Friday next week).
- Late submissions will not be accepted.
- Individual solutions will not be partially graded (i.e., they must be accepted by the judge).

- **Late Policy**: Due date/time, location/mode for returning your solutions, and accepted formats are announced for each assignment. Failure to return your assignment in time will result in penalties or even absence of grading.
- **Programming Contests:**
  - The programming contests sessions allow the students to apply their problem solving skills on a set of problems and puzzles using either C, C++, Java or Python.
    - The lab sessions will consist of approximately 13 problems of varying difficulty. The idea of the contest is to solve as many problems as possible during 3 hours.
    - To get full marks you do not have to solve ALL the questions. This number will be defined later in the course when the instructor has more information regarding the current programming level of the registered students. Sometimes, this number is defined once the contest has passed. The grade DOES NOT follow linearly from the number of exercises you solve.
- **Cheating/Collaboration**: I greatly encourage you to discuss the assignment with each other student in the class (except during the programming contests). However, these discussions should not so far be that you are sharing code or giving away the answer. A rule of thumb is that your discussions should be considered public in the sense that anything you share with a friend should be sharable with any student in the class. It is highly possible that you will find solutions to the contests on-line. Please do not copy the answers. You are registered in this course to train your problem solving skills and copying code from others does not help you in this goal.
- **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 organizations that publish standard citation formats are now providing information on citing generative AI (e.g., MLA: https://style.mla.org/citing-generative-ai/).

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 lecture attendance should be considered essential.

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).

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 .