CSCI 2120 – Data Structures and Algorithms
Course Syllabus

Instructor Information

Instructor:	Juliano Franz	**Office:**	
E-mail:	csci2110@dal.ca	**Office Hours:**	Tue 10:30-11:30
Class Meeting Time:	TR 8:35-9:55	**Room No:**	CHEB C170
Lab Meeting Time	Consult Timetable	**Room No:**	Consult Timetable
Course Homepage:	https://dal.brightspace.com/		

Important Dates

- Reading Week (no classes): February 20 – 24, 2023
- Munro Day (University is closed): February 03, 2023
- Nova Scotia Heritage Day (University is closed): February 20, 2023
- Good Friday (University is closed): April 07, 2023
- Final Withdrawal Date without academic penalty: January 20, 2023
- Final Withdrawal Date with financial penalty: February 06, 2023
- Final Withdraw Date With a "W": March 13, 2013
- Midterm Exam: February 16, 2023
- Final Exam: TBA in the period of April 13 to 25, 2023
- Deadlines:
    - Assignment 01: January 29 at 11pm
    - Assignment 02: February 12 at 11pm
    - Assignment 03: March 05 at 11pm
    - Assignment 04: March 13 at 11pm
    - Assignment 05: April 09 at 11pm

Course Description

This course provides a comprehensive introduction to data structures and algorithms, including their design, analysis, and implementation. In discussing design and analysis there is a strong emphasis on abstraction. In discussing implementation, general approaches that are applicable in a wide range of procedural programming languages are emphasized, in addition to a focus on the details of implementations.

Topics include an introduction to asymptotic analysis and a review of basic data structures (stacks,queues, lists, vectors), trees, priority queues, dictionaries, hashing, search trees, sorting (Mergesort, QuickSort, RadixSort) and sets, and graphs (traversals, spanning trees, shortest paths).

Learning Outcomes

- Determine the number of primitive operations of an algorithm in terms of instance size.
- Determine the asymptotic complexity (Big-O) of simple functions such as polynomial, polylogarithmic, and exponential functions.
- Determine the asymptotic complexity of some simple iterative and recursive algorithms.
- Implement lists and linear abstract data types, such as stacks and queues, using arrays and linked-lists.

- Implement recursive search and state-space exploration algorithms.
- Implement a tree data structure and implement depth-first and breadth-first traversals.
- Implement a binary tree data structure and implement pre-order, in-order, and post-order traversals.
- Implement the priority-queue ADT using lists and heaps.
- Implement the map, dictionary, and set ADTs using lists, binary search trees, and hash tables.
- Implement mechanisms to deal with collisions in a hash-table.
- Understand, compare, and implement various sorting algorithms, including: selection sort, insertion sort, quicksort, merge sort, heap sort, and radix sort.
- Describe basic concepts in Graph Theory.
- Describe the graph ADT, as well as depth-first and breadth first traversals.
- Compare and implement various minimum spanning tree algorithms.
- Compare and implement various shortest path algorithms.
- Implement simple iterative and recursive algorithms to solve moderately simple tasks.
- Select the appropriate data structure to implement a given ADT under a given set of constraints.
- Select and use appropriate abstract data types, data structures, and algorithms to solve moderately complex problems.

Course Rationale

This core course follows on CSCI 1110 to provide a foundation in the basic understanding of data structures and algorithms that are used in follow-on core and elective courses.

Class Format and Course Communication

- Content will be delivered using lectures, labs, and assignments.
- Attendance at labs is expected and assessments may occur at labs.
- **Lectures or labs in this course might** be recorded and may be posted on Brightspace.
- Communication with the instructor or TAs **must be** through the course's e-mail: csci2110@dal.ca
- Students must ask the instructor permission before recording class lectures.
- Course announcements will be posted to Brightspace. It is the student's responsibility to check both their Dal e-mail and Brigthspace on a daily basis. To access your Dal e-mail account please see: https://www.dal.ca/dept/its/o365/services/email.html

Evaluation Criteria
- Problems of the Week (5%)
  - Each week students will be provided with a series of small problems that can be done in the weekly lab and will be graded automatically by Codio. Students should bring their laptops to the lab to work on the problems, with TAs being present to help.
- Assignments (20%)
  - **Best 4 of 5** Assignments
  - Late assignments will not be accepted.
  - Assignments submitted via e-mail **will not be accepted**
  - Coding must follow the guidelines outlined in: https://web.cs.dal.ca/~franz/CodingStyle.html
  - Assignments are **individual** assessments.
  - Assignments are due at 11pm on the following dates:

	Due Date	Description
Assignment 1	January 29 at 11pm	Coding and Testing Refresher

Assignment 2	February 12 at 11pm	Algorithmic Complexity
Assignment 3	March 05 at 11pm	Linear Abstract Data Types
Assignment 4	March 13 at 11pm	Trees and Recursion
Assignment 5	April 09 at 11pm	Graphs

- o All submitted code will be passed through the Moss Software Similarity Detection System (https://theory.stanford.edu/ aiken/moss/) to check for plagiarism. If a student does not wish their assignments to be submitted to Moss, they should contact the instructor.
- Midterm Exam (25% or 0%)
  - o To be held during class on February 16, 2023.
- Final Exam (55% or 75%)
  - o The exam will be scheduled by the university.
  - o The exam will cover all material in the course.

Notes

- Students must pass the exam (60%) and have an overall passing grade in the course to pass the course.
- The instructor reserves the right to adjust a student's evaluation criteria, with the student's consent, if the instructor deems that an adjustment is warranted.
- A minimum grade of C is required in this course if it is core to your FCS degree, or if it will be used as a prerequisite for a subsequent CSCI course.
- As of 2019, students who receive a grade lower than C in the same required CS course twice, will be dismissed.
- The grade conversion scale in Section 17.1 of the Academic Regulations, Undergraduate Calendar will be used. https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&chapterid=7302&topicgroupid=32188&loaduseredits=False

Student Declaration of Absence

The Student Declaration of Absence (SDA) **is not accepted for assignments and PoWs**. SDAs are not tools for extensions and shall not be used as such.

For the midterm and final exam, the Student Declaration of Absence policy shall apply. https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/academic-policies/student-absence.html The student has a maximum of two (2) SDAs per course per semester. The student **must** notify the instructor of their inability to meet a deadline **before** the deadline by contacting the instructor or submitting the completed SDA. Upon notification the student has 3 days after the deadline to submit the SDA.

Midterm and Final Exam Requirements

- Photo ID is required
- Closed book
- No dictionaries, notes, calculators, cell phones, PDAs, talking slide rulers, or other electronic aids allowed.

Course Policies

Late Submissions: There are no late submissions; you may not ask for extra work to improve your grade.

Technology Use: You are computer science students and are expected to be comfortable and proficient with technology. Please use your laptops, tablets, and other devices responsibly and in a manner that does not disrupt or harm academic integrity or the learning environment. Also, ensure you back your work up to protect it against loss. **Hardware failure is not justification for late submission.**

Proctoring: In the event that we transition online, it is up to the discretion of the instructor to use remote proctoring in online testing. Students may be required to download proctoring software onto their devices. Students who cannot meet system requirements for remote proctoring should contact the instructor for an alternate assessment. Typical system requirements are: (i) Mac OS or Windows, (ii) a web-cam, and (iii) an internet connection.

Academic Standards

Failure to properly attribute sources in your work will be treated as an academic standards issue and points may be deducted for not following citation requirements. For example, forgetting to quote text taken from other sources, failure to include in-text citations, or a failure to include required information in the citations or references. Please see the resources on proper citation provided by the Dalhousie Writing Center (https://dal.ca.libguides.com/c.php?g=257176&p=5001261).

Please note that if it appears that the error was made with intent to claim other people's work as your own such as a lack of both citations and references, an allegation of plagiarism will be submitted to the Faculty Academic Integrity Officer, which could result in consequences such as a course failure.

Recommended Texts and Resources
- S. Venugopal, "Data Structures Outside In with Java",Prentice Hall,2007, ISBN-10: 0-13-198619-8.
- The lecture slides will be posted on the learning management system (Brightspace).
- Additional assistance is available from the Student Learning Centre (2nd floor, Goldberg CS Bldg.).

Prerequisites
CSCI-1110 or CSCI 1101

Tentative List of Topics

Available on Brightspace alongside with this syllabus

Responsible Computing Policy
Usage of all computing resources in the Faculty of Computer Science must be within the Dalhousie Acceptable Use Policies (https://www.dal.ca/dept/university_secretariat/policies/information-management-and-technology/acceptable-use-policy-.html) and the Faculty of Computer Science Responsible Computing Policy. For more information please see https://www.dal.ca/content/dam/dalhousie/pdf/faculty/computerscience/policies-procedures/fcs_policy_local.pdf

Use of Plagiarism Detection Software

All submitted code may be passed through a plagiarism detection software, such as the plagiarism detector embedded in Codio, the Moss (https://theory.stanford.edu/~aiken/moss/) Software Similarity Detection System, or similar systems. If a student does not wish to have their assignments passed through plagiarism detection software, they should contact the instructor for an alternative. Please note, that code not passed through plagiarism detection software will necessarily receive closer scrutiny. https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university_secretariat/policy-repository/OriginalitySoftwarePolicy.pdf

Student Health and Wellness

Taking care of your health is important. As a Dalhousie student, you have access to a wide range of resources to support your health and wellbeing. Students looking to access physical or mental health & wellness services at Dalhousie can go to the Student Health & Wellness Centre in the LeMarchant Building. The team includes: registered nurses, doctors, counsellors and a social worker. Visit **dal.ca/studenthealth** to learn more and book an appointment today.

Students also have access to a variety of online mental health resources, including telephone/texting counselling and workshops/training programs. Learn more and access these resources at d**al.ca/mentalhealth**.

Culture of Respect[1]

Every person has a right to respect and safety. We believe inclusiveness is fundamental to education and learning. Misogyny and other disrespectful behaviour in our classrooms, on our campus, on social media, and in our community is unacceptable. As a community, we must stand for equality and hold ourselves to a higher standard.

What we all need to do:
1. **Be Ready to Act:** This starts with promising yourself to speak up to help prevent it from happening again. Whatever it takes, summon your courage to address the issue. Try to approach the issue with open-ended questions like "Why did you say that?" or "How did you develop that belief?"
2. **Identify the Behaviour:** Use reflective listening and avoid labeling, name-calling, or assigning blame to the person. Focus the conversation on the behaviour, not on the person. For example, "The comment you just made sounded racist, is that what you intended?" is a better approach than "You're a racist if you make comments like that."
3. A**ppeal to Principles:** This can work well if the person is known to you, like a friend, sibling, or co-worker. For example, "I have always thought of you as a fair-minded person, so it shocks me when I hear you say something like that."
4. **Set Limits:** You cannot control another person's actions, but you can control what happens in your space. Do not be afraid to ask someone "Please do not tell racist jokes in my presence anymore" or state "This classroom is not a place where I allow homophobia to occur." After you have set that expectation, make sure you consistently maintain it.
5. **Find or be an Ally:** Seek out like-minded people that support your views, and help support others in their challenges. Leading by example can be a powerful way to inspire others to do the same.
6. **Be Vigilant:** Change can happen slowly, but do not let this deter you. Stay prepared, keep speaking up, and do not let yourself be silenced.

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[1] Source: Speak Up! © 2005 Southern Poverty Law Center. First Printing. This publication was produced by Teaching Tolerance, a project of the Southern Poverty Law Center. Full "Speak Up" document found at: http://www.dal.ca/dept/dalrespect.html. Revised by Susan Holmes from a document provided April 2015 by Lyndsay Anderson, Manager, Student Dispute Resolution, Dalhousie University, 902.494.4140, lyndsay.anderson@dal.ca www.dal.ca/think.

University Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and the Senate. https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&loaduseredits=False

Territorial Acknowledgement

Dalhousie University is located in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq. We are all Treaty people.

Dalhousie acknowledges the histories, contributions, and legacies of the African Nova Scotia people and communities who have been here for over 400 years.

Internationalization

At Dalhousie, 'thinking and acting globally' enhances the quality and impact of education, supporting learning that is "interdisciplinary, cross-cultural, global in reach, and orientated toward solving problems that extend across national borders." https://www.dal.ca/about-dal/internationalization.html

Academic Integrity

At Dalhousie University, we are guided in all of our work by the values of academic integrity: honesty, trust, fairness, responsibility and respect. As a student, you are required to demonstrate these values in all of the work you do. The University provides policies and procedures that every member of the university community is required to follow to ensure academic integrity. (read more: http://www.dal.ca/dept/university_secretariat/academic-integrity.html)

Accessibility

The Student Accessibility Centre is Dalhousie's centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion please contact: https://www.dal.ca/campus_life/academic-support/accessibility.html for all courses offered by Dalhousie with the exception of Truro.

Conduct in the Classroom — Culture of Respect

Substantial and constructive dialogue on challenging issues is an important part of academic inquiry and exchange. It requires willingness to listen and tolerance of opposing points of view. Consideration of individual differences and alternative viewpoints is required of all class members, towards each other, towards instructors, and towards guest speakers. While expressions of differing perspectives are welcome and encouraged, the words and language used should remain within acceptable bounds of civility and respect.

Diversity and Inclusion — Culture of Respect

Every person at Dalhousie has a right to be respected and safe. We believe inclusiveness is fundamental to education. We stand for equality. Dalhousie is strengthened in our diversity. We are a respectful and inclusive community. We are committed to being a place where everyone feels welcome and supported, which is why our Strategic Direction prioritizes fostering a culture of diversity and inclusiveness (Strategic Priority 5.2). (read more: http://www.dal.ca/cultureofrespect.html)

Student Code of Conduct

Everyone at Dalhousie is expected to treat others with dignity and respect. The Code of Student Conduct allows Dalhousie to take disciplinary action if students don't follow this community expectation.

When appropriate, violations of the code can be resolved in a reasonable and informal manner—perhaps through a restorative justice process. If an informal resolution can't be reached, or would be inappropriate, procedures exist for formal dispute resolution. (read more: https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university_secretariat/policy-repository/Code%20of%20Student%20Conduct%20rev%20Sept%202021.pdf)

Fair Dealing Policy

The Dalhousie University Fair Dealing Policy provides guidance for the limited use of copyright protected material without the risk of infringement and without having to seek the permission of copyright owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. (read more: https://www.dal.ca/dept/university_secretariat/policies/academic/fair-dealing-policy-.html)

Originality Checking Software

The course instructor may use Dalhousie's approved originality checking software and Google to check the originality of any work submitted for credit, in accordance with the Student Submission of Assignments and Use of Originality Checking Software Policy. Students are free, without penalty of grade, to choose an alternative method of attesting to the authenticity of their work, and must inform the instructor no later than the last day to add/drop classes of their intent to choose an alternate method. (read more: https://cdn.dal.ca/content/dam/dalhousie/pdf/dept/university_secretariat/policy-repository/OriginalitySoftwarePolicy.pdf)

Student Use of Course Materials

These course materials are designed for use as part of the CSCI courses at Dalhousie University and are the property of the instructor unless otherwise stated. Third party copyrighted materials (such as books, journal articles, music, videos, etc.) have either been licensed for use in this course or fall under an exception or limitation in Canadian Copyright law. Copying this course material for distribution (e.g. uploading material to a commercial third party website) may lead to a violation of Copyright law.

Learning and Support Resources

Please see https://www.dal.ca/campus_life/academic-support.html