Department of Mathematics and Statistics
CSCI/MATH 2113: DISCRETE STRUCTURES II
Winter 2024

Dalhousie University acknowledges that we are in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq People and pays respect to the Indigenous knowledges held by the Mi'kmaq People, and to the wisdom of their Elders past and present. The Mi'kmaq People signed Peace and Friendship Treaties with the Crown, and section 35 of the Constitution Act, 1982 recognizes and affirms Aboriginal and Treaty rights. We are all Treaty people.

Dalhousie University also acknowledges the histories, contributions, and legacies of African Nova Scotians, who have been here for over 400 years.

Instructor: Fahimeh Bayeh
- **Email:**   Fahimeh.Bayeh@dal.ca
- **Office Hours:** MW 10:30 – 12:00, Chase 312 (3rd floor) or by appointment

Lectures: MWF 12:35 – 1:25, Studley LSC-COMMON AREA C242 (In person)

Laboratories: N/A

Tutorials: N/A

Course Homepage: Brightspace: CSCI 2113 & MATH 2113 – Discrete Structures II

- Announcements and course information will primarily be posted there, and I assume that you will be checking the course page every day.

Textbook: Discrete and Combinatorial Mathematics: An Applied Introduction by Ralph P. Grimaldi (Available on Brightspace)

Grading Scheme:

Grade Item	Count	Each	Total
Assignments	6 (best 5 out of 6)	8%	40%
Quizzes	5	2%	10%
Midterm	1	20%	20%
Final Examination	1	30%	30%

The final grade is out of 100%. Conversion of numerical grades to Final Letter Grades follows the Dalhousie Common Grade Scale.

Course Description:

This course continues CSCI 2112.03/MATH 2112.03. This course covers some basic concepts in discrete mathematics which are of particular relevance to students of computer science, engineering, and mathematics. The topics to be covered will include solution of recurrence relations, generating functions, number theory, Chinese remainder theorem, trees and graphs, finite state machines, abstract algorithms, Boolean algebra.

Course Prerequisites: MATH 1315.03 or MATH 2110.03 or MATH 2112.03

Course Exclusions: N/A

Course Assessment:

Assignments: There will be 6 assignments throughout the term. In addition, there will be a "dummy" assignment whose purpose is to ensure that the assignment submission process functions smoothly. Solutions to the assignments will be posted on Brightspace after they are graded. The best 5 out of 6 assignments are counted. Support is available through office hours.

Dates for the assignments are as follows.

- Assignment 0 (dummy): posted on January 12th, due on January 19th, 11:59pm.
- Assignment 1: posted on January 19th, due on February 16th, 11:59pm.
- Assignment 2: posted on February 2nd, due on February 12th, 11:59pm.
- Assignment 3: posted on February 16th, due on March 1st, 11:59pm.
- Assignment 4: posted on March 1st, due on March 15th, 11:59pm.
- Assignment 5: posted on March 15th, due on March 29th, 11:59pm.
- Assignment 6: posted on March 29th, due on April 9th, 11:59pm.

Assignments will be posted on Brightspace. However, they must be submitted by the due date through Crowdmark. Assignments must be submitted as pdf or image files and the answer to each question is uploaded in the allocated part for that question. Incorrectly uploaded answers might not get marked.

Quizzes: There will be 5 quizzes throughout the term. The quizzes will have one question and will be held in the last five minutes of some of the Friday classes. The material covered in the quiz will be from material covered in the Monday and Wednesday lectures of that week.

Dates for the quizzes are as follows.

- Quiz 1: on January 26th.
- Quiz 2: on February 9th.
- Quiz 3: on March 15th.
- Quiz 4: on March 22st.
- Quiz 5: on April 5th.

Midterm: The midterm will take place on February 26th during class time. The midterm is worth 20%. It is to be done individually (no communication of any kind with classmates).

Final Exam: The final exam is worth 30% and will take place during the exam period.

Conversion of numerical grades to final letter grades follows the Dalhousie Grade Scale

A+ (90-100)	B+ (77-79)	C+ (65-69)	D (50-54)
A (85-89)	B (73-76)	C (60-64)	F (0-49)
A- (80-84)	B- (70-72)	C- (55-59)	

Course Policies related to Academic Integrity:

- The questions must be directed to the instructor's email (Fahimeh.bayeh@dal.ca).
- Make sure to include "CSCI 2113" or "MATH 2113" in the subject line, otherwise, your email might get missed.

Course General Policies:

- A student must pass (50%) both the assignment component and the final exam to pass the course.
- There are no make-up assessments.
- Missed assessments will be counted as zero, unless prior permission is granted.
- There is no retroactive accommodation. Students must notify in advance of any assessment deadline if they cannot attend the exam or quiz or are unable to submit the assignment. Valid reasons for accommodation are typically medical or family related. An alternate arrangement will then be agreed upon between the instructor and the student.
- A student must submit a Self-Declaration of Absence form if they are unable to write a test, a quiz, or submit an assignment due to illness or family emergency.
- Students are encouraged to review the marking of their work and to challenge it when appropriate. Grade changes, however, will only be granted if an issue is raised within 2 weeks of the posting of grades.
- If there are any technical issues with submitting the assignment in Crowdmark, email the instructor with your assignment files before the deadline. Late submissions will not be accepted.

Course Policies related to Academic Integrity:

- Students are allowed to work together on assignments, but all work submitted must be written and done individually. Explicitly, all work must be written in your own words and understanding.
- The students should not consult any generative AI or large language models, such as ChatGPT, for their assignments.

Learning Objectives:

- Become familiar with recurrence relations and know what it means to solve a recurrence relation.
- Know some basic recurrence relations such as the Fibonacci sequence and its recurrence relation.
- Become familiar with generating series and functions.
- Use generating series and generating functions to solve recurrence relations.
- Know the definition of divisibility for the integers and what it means for two integers to be congruent modulo a number n.
- Know how to perform arithmetic modulo n and calculate residues with the Extended Euclidean Algorithm.
- Know the statement of the Chinese Remainder Theorem.
- Know the definition of simple graphs and trees. Be able to provide examples of each and separating examples.
- Be able to distinguish between forests and trees.
- Be able to discuss paths in graphs.
- Know how to find spanning trees of graphs and to be able to determine uniqueness and non-uniqueness of paths in graphs.
- Know the difference between directed graphs and simple graphs.
- Know the Dijkstra's algorithm and how to use it.
- Know the definition of finite state machines.
- Be able to represent finite state machines as both algebraic information and as directed graphs.
- Know the definition of an algorithm at three different levels of abstraction and know what it means for an algorithm to terminate.

Tentative Course Content:

Here is a list, together with approximate schedule, of lecture topics.

- January 8 – 12, 2024: Relations and functions.
- January 15 – 19, 2024: Counting principles and combinatorial proofs.
- January 22 – 26, 2024: Inclusion/exclusion principle and derangements.
- January 29 – February 2, 2024: Catalan numbers and countable sets. No class on February 2.
- February 5 – 9, 2024: Sequences and recurrence relations.
- February 12 – 16, 2024: Generating functions number theory, and CRT.
- February 19 – 23, 2024: Reading week. No classes this week, so enjoy!
- February 26 – March 1, 2024: Graphs and trees. Midterm Monday in class.
- March 4 – 8, 2024: Graph coloring problem and Dijkstra's algorithm.
- March 11 – 15, 2024: Binary search tree and finite state machines.
- March 18 – 22, 2024: Probability theory.
- March 25 – 29, 2024: Random variables and tree diagrams. No class on Mach 29.
- April 1 – 5, 2024: Expectation and Cliques.
- April 8, 9, 2024: Information theory and review (how behind we are).

University Policies and Statements

Recognition of Mi'kmaq Territory

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel, and support. Visit or e-mail the Indigenous Student Centre at 1321 Edward St or elders@dal.ca. Additional information regarding the Indigenous Student Centre can be found at: https://www.dal.ca/campus_life/communities/indigenous.html

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." Additional internationalization information can be found at: https://www.dal.ca/about-dal/internationalization.html

Academic Integrity

At Dalhousie University, we are guided in all 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 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. Additional academic integrity information can be found at: https://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 the Student Accessibility Centre (https://www.dal.ca/campus_life/academic-support/accessibility.html) for all courses offered by Dalhousie with the exception of Truro. For courses offered by the Faculty of Agriculture, please contact the Student Success Centre in Truro (https://www.dal.ca/about-dal/agricultural-campus/student-success-centre.html)

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). Additional diversity and inclusion information can be found at: 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. The full Code of Student Conduct can be found at: https://www.dal.ca/dept/university_secretariat/policies/student-life/code-of-student-conduct.html

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. Additional information regarding the Fair Dealing Policy can be found at: 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. Additional information regarding Originality Checking Software can be found at: https://www.dal.ca/dept/university_secretariat/policies/academic/student-submission-of-assignments-and-use-of-originality-checking-software-policy-.html

Student Use of Course Materials

Course materials are designed for use as part of this course 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 to a commercial third-party website) may lead to a violation of Copyright law.