DALHOUSIE UNIVERSITY

Faculty of Computer Science

CSCI 1315 - Discrete Mathematics for Computer Science

Dalhousie University sits on the ancestral and unceded territory of the Mi'kmaq nation. We are all Treaty people

Winter 2024

Course Syllabus

We acknowledge the histories, contributions, and legacies of the African Nova Scotian people and communities who have been here for over 400 years

Course Delivery Details:

Lectures				
Section	**Time**	**Location**	**Instructor**	**Email**
1	MWF 1:35PM – 2:25PM	Dunn 117	Dr. DeGagné	DeGagne@dal.ca
2	MWF 10:35AM - 11:25AM	MacMechan Aud.		
Labs				
T01	M 4:35PM - 5:55PM	Dentistry 4117	**Head TA**	**Email**
T02	M 4:05PM - 5:25PM	Mona Campbell 1201	Sherlock	br225405@dal.ca
T03	T 2:35PM - 3:55PM	Mona Campbell 1201		
T04	F 4:05PM - 5:25PM	Rowe 1016		
T05	T 4:05PM - 5:25PM	LSC C244		

Student Support:

Course Support:

Students are always welcome to ask their instructor questions about the course. This can be done by:

- Asking general questions on the Brightspace discussion forum
- Emailing private or personal questions to CSCI1315@dal.ca.
- Going to office hours which will be held on Mondays from 3:00PM - 4:00PM in Goldberg 226 or via Collaborate Ultra.

Learning Centre:

The Faculty of Computer Science's Learning Centre is located in Goldberg 233 and will be operating in-person and remotely. Support is available Monday through Friday except on University closures and unplanned Storm closures. You can find more information online on their Brightspace page https://dal.brightspace.com/d2l/home/210118

Student Accommodations:

Students may request accommodation as a result of barriers related to disability, religious obligation, or any characteristic under the Nova Scotia Human Rights Act. Students who require academic accommodation for either classroom participation or the writing of tests, quizzes and exams should make their request to the Office of Student Accessibility & Accommodation (OSAA) prior to or at the outset of each academic term. Please visit https://www.dal.ca/campus_life/academic-support/accessibility.html for more information and to obtain Form A - Request for Accommodation. A note taker may be required to assist a classmate. There is an honorarium provided for the note taker of $75-100/course/term. If you are interested, please contact OSAA at access@dal.ca or 494-2836 for more information.

Student Health and Wellness:

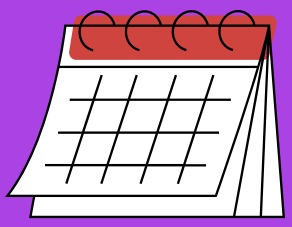
Taking care of your health is important. As a Dalhousie student, you have access to a wide range of resources to support your health and wellbeing. Students looking to access physical or mental health & wellness services at Dalhousie can go to the Student Health & Wellness Centre in the LeMarchant Building. 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 **dal.ca/mentalhealth**.

Learning and Support Resources:

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

About the Course:



Important Dates:

- January 22nd: Last day to change and add classes
- February 2nd: Munro Day - No Classes
- February 6th: Module 1 Test
- February 6th: Last day to drop without a "W"
- February 16th: Module 2 Test
- February 19th - February 23rd: Winter Study Break - No Classes
- March 5th: Module 3 Test
- March 6th: Last day to drop with a "W"
- March 27th - Module 4 Test
- March 29th - Good Friday - No Classes
- April 9th - Module 5 Summative Test
- The exam schedule will be posted on October 1st. See https://www.dal.ca/academics/exam_schedule.html

Course Description:

This course is an introduction to formal reasoning and discrete mathematics with applications to computer science. Students will be introduced to formal notation and reasoning about problems and algorithms. Topics include sets, logic, sequences and summations, simple proof techniques, counting, induction, back-of-the-envelope approximations, and program correctness. Applications and relevance of these concepts in computer science will be emphasized.

Students will be exposed to examples from cryptography, security, gaming, software development, and other areas of computer science.

Prerequisites: NS Mathematics 11 or 12 (or equivalent)

Exclusions: CSCI/MATH 2112

Course Rationale: This is a foundational course in discrete mathematics on which courses like Systems Programming, Algorithms, and Theory of Computer Science are built.

Class Format:

This class will be taught using a flipped classroom teaching style. That means that students will be expected to watch pre-recorded videos on Brightspace before attending class. During class we will be using Kahoot quizzes to do a quick formative check to see where your understanding is on the material and go over more examples. Then the remainder of the class will be an opportunity to do worksheets individually or as a group with solutions given at the end of the class.

Learning Outcomes

A student MUST demonstrate minimum competency in ALL learning outcomes.

- Describe the importance and applications of discrete mathematics in computer science;
- Apply simple proof techniques (direct, contrapositive, contradiction, induction) to evaluate correctness of proofs, prove simple properties and reason formally about the correctness of simple algorithms; and
- Apply set theory, counting methods, and manipulate series and summations to solve simple problems in computer science.
- Describe areas or problems in computer science where discrete math is used;
- Use first-order logic, set, and sequence notation to write a mathematical statement;
- Determine closed forms of common summations (arithmetic, geometric, etc.);
- Perform computations in modular arithmetic;
- Apply standard proof techniques such as direct proof, induction, contradiction, pigeonhole principle, induction, etc.;
- Determine if a simple proof is correct;
- Perform a "back-of-the-envelope" analysis to estimate the size of a combinatorial object;
- Count the number of items in a combinatorial object such as a set, sequence, tree, or graph;
- Apply, manipulate, and simplify basic permutations and combinations to solve a problem;
- Summarize the contents of a short reading on a topic in discrete mathematics; and
- Explain how to argue the correctness of simple algorithms using invariants and pre/post conditions.

Required Texts and Resources:

- The course has a major presence on Brightspace (you may login at https://dal.brightspace.com/d2l/login or go through the OWL link on the Dalhousie Homepage (http://www.dal.ca).
- For additional reading and practice exercises, students are encouraged to use the following books:
  - “Connecting Discrete Mathematics and Computer Science”, David Liben-Nowell available at: https://cs.carleton.edu/faculty/dln/book/
  - “The Book of Proof”, Richard Hammack, available at: https://www.people.vcu.edu/~rhammack/BookOfProof/

Class Content Outline and Dates

Dates	Module
January 7th	Classes and Tutorials start
January 10th – January 22nd	Module 1: Set Theory, Relations, and Functions
January 22nd	Last Day to Change and Add Classes
January 24th	Module 1 Experience Point Assessments Due
January 24th – January 31st	Module 2: Logic
January 29th – February 2nd	No Tutorials
February 2nd	No Classes – Munro Day
February 2nd	Module 2 Experience Point Assessments Due
February 6th	Last Day to Drop Without a W
February 6th	Module 1 Summative Test (20%)
February 7th – February 16th	Module 3: Proof
February 16th	Module 1 Summative Test (10%)
February 19th	Module 3 Experience Point Assessments Due
February 19th – February 23rd	Winter Study Break – No Classes, No Tutorials
February 26th – March 8th	Module 4: Combinatorics
March 5th	Module 3 Summative Test (20%)
March 6th	Last Day to Drop With a W
March 11th	Module 4 Experience Point Assessments Due
March 11th – March 22nd	Module 5: Number Theory
March 25th – March 29th	No Tutorials
March 27th	Module 4 Summative Test (20%)
March 29th	Good Friday - No Classes
April 9th	Module 5 Summative Test (20%)
To Be Determined	Exam

Course Assessment Components:

Component	Weight (% of Final Grade)	Date
Tutorial Tasks	5%	Weekly
Experience Points	5%	By Module
Module 1 - Set Theory, Relations, and Functions	20%	Best of Test (Feb. 6th) or Final Exam (Part 1)
Module 2 - Logic	10%	Best of Test (Feb. 16th) or Final Exam (Part 2)
Module 3 - Proof	20%	Best of Test (March 5th) or Final Exam (Part 3)
Module 4 - Combinatorics	20%	Best of Test (March 27th) or Final Exam (Part 4)
Module 5 - Number Theory	20%	Best of Test (April 9th) or Final Exam (Part 5)

Conversion of Numerical Grades to Final Letter Grades

The grading scheme for this course will follow the standard scale set by Dalhousie University. https://www.dal.ca/campus_life/academic-support/grades-and-student-records/grade-scale-and-definitions.html

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

Assessment Notes

Experience Points

Students will have access to a multitude of formative assessments to gauge how they are learning without any substantive pressure of a grade. The 5% allocated to this is split evenly over the 5 modules – 1% per module. To get the 1%, students will be able to use worksheets, Webwork Practice Questions, and Formative Assignments. Each portion will be considered "100%" of the grade, so students will be able to pick and choose how they make up the 1%.

Worksheets are available for students to complete either on their own time or in class if time permits. This gives students the opportunity to test their understanding of the lecture and ask questions to the instructor.

For the Formative Assessment Grade: Students will submit all completed worksheets on Crowdmark on the last day of the module at 11:59PM. Each question completed will be worth 1 mark (was it completed or not). The solutions of the worksheets will be covered at the end of the lecture (if time permits), and will be posted on Brightspace the day after the worksheets are submitted.

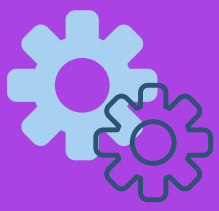
Each module will have an associated set of practice questions on Webwork (on Brightspace) relating to the content from the lectures. The practice questions are done on Webwork and students have an unlimited number of attempts to answer each question. Webwork will automatically grade the questions and will give immediate feedback on whether the answer is correct. This gives students the opportunity to hone in on any areas of uncertainty and shows them where they need to focus their studying. Students are strongly encouraged to do these questions after each lecture, and then once they have the understanding, do the associated question on the formative assignment.

For the Formative Assessment Grade: Students get 1 grade per correct blank. Note that Webwork initializes the grade as 0, and then the grade goes up on completion.

Formative Assignments will be submitted on Crowdmark using Brightspace. Assignments will open with the module and will be due at 11:59PM on the last day of the module (the same time as the worksheets and webwork problems). Assignments will then be graded and will typically be returned within one week. Solutions to the assignments, as well as a feedback form summarizing common mistakes, will be posted on Brightspace after they are graded.

For the Formative Assessment Grade: Students will receive both formative feedback on Crowdmark, as well as grading scheme comments that would mimic how those types of questions would have been graded on the tests. However, for the actual Formative Grade, each completed question (regardless of correctness) will be given one mark.

Throughout the course, students are encouraged to work and collaborate with their peers on all formative assignments (but not on tests or the exam). However, the

	work submitted must still be your own work (i.e. not submitting the exact same document as someone else). Students who receive 100% in **ALL** formative assessments in **ALL** modules will be awarded a 2% bonus added onto their final grade. Students who receive 100% in **ALL** formative assessments in **THREE** modules will be awarded a 1% bonus added onto their final grade, and if they complete **ALL** formative assessments in **FOUR** modules then they will be awarded a 1.5% bonus added onto their final grade. As past students have said: “to do well on the assignments, you have to do the worksheets, and to do well on the tests you have to do the assignments.” Students are strongly encouraged to complete the assignments even though they are not worth any marks. Doing so increases the chances of being successful on the tests.
Tutorials 	Tutorials will take place throughout the week **starting on January 8th**. These tutorials will be a place for students to work in groups to solve more interactive and hands-on problem sets that will take the knowledge they’ve learned in class and apply it to computer science. Students are encouraged to work in groups. Tutorial grades will be worth 10 marks each (see Brightspace for the grading scheme). Each week there will be an assigned task which will be given during the tutorial. **Students are required to get at least 60% in the tutorials to pass the course.**
WeAreAllCS **Biographies** 	Many of the names of computer scientists and mathematicians you will encounter during your degree are not from marginalized communities (BIPOC, LGBTQIA+, etc.). Here we take the opportunity to highlight everyone’s contributions to the field. First, try to find someone in Computer Science or Mathematics for whom you relate to or someone in a marginalized community (try to use someone that has not already been done). Once you have the name of someone, write a short biography (one or two paragraphs) highlighting their contributions to the field. Then, go to Brightspace and under "Assessments" -> "Quizzes", you will be able to submit your biography (include their name, dates active, their major contributions, their identities (if known), and the references you used). Periodically, submissions will be posted on Brightspace for other students to learn about additional people in Computer Science and Mathematics. You can submit at any point during the term up until April 9th at 11:59 PM. Submitting a biography will reward you with having two of your lowest tutorial tasks dropped. Please note that though you may use LLMs, such as ChatGPT, to help you find your person, **the biography should be your own**. All academic integrity policies will be enforced. You **must** include your references in your biography.

Summative Tests

Each module will have a summative test on all the material in that module. A non-programmable/non-graphing calculator may be permitted during the test, but no other aids will be allowed (i.e. no study document). The tests will be split into two portions. The first portion will be an independent test worth 100% of the grade, and the second portion will be a collaborative test worth bonus marks. The first portion must be done independently. However, for the second portion, students may work in groups.

The dates, times, locations, and weight of the tests are as follows:

Module	Date	Time	Place	Weight
Sets, Relations, and Functions	Tuesday Feb 6th	6:30PM -8:00PM (individual) 8:15PM - 8:45PM (collaborative)	Ondaatje Auditorium	20%
Logic	Friday Feb 16th	6:30PM -8:00PM (individual) 8:15PM - 8:45PM (collaborative)	Ondaatje Auditorium	10%
Proof	Tuesday Mar 5th	6:30PM -8:00PM (individual) 8:15PM - 8:45PM (collaborative)	Ondaatje Auditorium	20%
Combinatorics	Wednesday Mar 27th	6:30PM -8:00PM (individual) 8:15PM - 8:45PM (collaborative)	Ondaatje Auditorium	20%
Number Theory	Tuesday Apr 9th	6:30PM -8:00PM (individual) 8:15PM - 8:45PM (collaborative)	Ondaatje Auditorium	20%

Exam

For the final exam, students will be allowed a one-page (double sided) study document and a non-programmable/non-graphing calculator, but no other resources may be used. The exam will be split into 5 Portions, one portion for each of the modules (the collaborative portion is not a part of the exam).

The final grade for each of the module sections (20%, 10%, 20%, 20%,20%) will be the highest grade between the test and the final exam portion.

In order to write the exam, students must have written at least three summative tests. Students missing three or more summative tests, regardless of the reason, will not be permitted to write the final exam unless explicit permission is granted by the instructor prior to the exam.

Course Policies

- This course requires that students be on campus when Public Health and Dalhousie allows it. All tests, tutorials, and the exam will require students to be on campus and write in person.
- Missed Summative Tests will be counted as zero, unless prior permission is made.
- Since each module grade is the better grade between the summative test and the exam, no SDAs (Student Declaration of Absence) may be used in this course.
- It will not be possible to write the final exam early and there will only be a make-up of the final exam in case of illness or family emergencies.
- All questions regarding this course must be asked on the Brightspace discussions threads. Please read all previously asked questions before you post. No questions asked via email will be answered unless they are private or personal.
- Any concerns about grading of assignments or tests must be brought to the attention of the course instructor within **two weeks** of the return of the graded assessment. Any concerns brought up after two weeks will not be considered. Such concerns may only be submitted by completing the **Assessment Regrade Form** on Brightspace.

Important Notes

- A minimum grade of C (60+) is required in this course if you are a BSC student.
- As of 2019, students who receive a grade lower than a C in the same required CS course twice, will be dismissed.
- **A student must achieve a grade of 60% in all modules and the tutorials of the course to pass the course (C or greater)**
- In the case of an Academic Integrity allegation where the student is found to have violated the Academic Integrity policy and the penalty is a 0 on the test, the student must write the corresponding portion of the exam and achieve at least a 60% on that portion to pass the course. The student will then receive the grade for the exam but it will only account for 50% of the module weight. For example, if there is an Academic Integrity violation during Module 1 Summative Test, the student will:
  a. be required to write the Module 1 portion of the final exam;
  b. be required to achieve a grade of 60% on that portion of the final exam in order to pass the course;
  c. be given 50% of their exam grade for the Module 1 portion of the final grade.

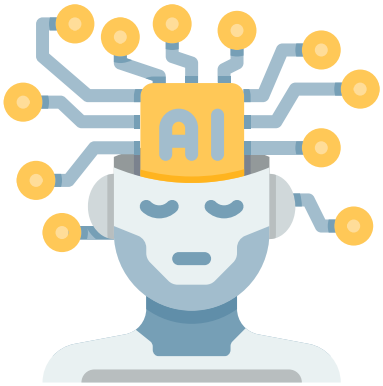
Use of Artificial Intelligence

You may use AI-driven tools to assist you in learning but remember that your objective is to understand, achieve, and apply the course competencies and outcomes.

While you may use tools for learning, summative tests and exams in this course will disallow the use of AI-driven tools to assert that you have attained course learning outcomes. This is because a graduate must be able to analyze, assess, and produce work unassisted by AI technology.

Where tools are allowed, you must acknowledge all tools used to assist you. If applicable, you must provide links to chat logs.

Using AI-driven tools where prohibited constitutes an academic offense.



Student Expectations:

Culture of Respect

Conduct in the Classroom:

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:

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)

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)

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.

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)

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

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)

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.

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

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)