COMP 1805A (Summer, 2025) **Discrete Structures I**

Instructor: Yanan Mao (she/her)

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Office Location: TBD

Best Ways to be in Touch: in class, via email, or during office hours

Class Location: Please check Carleton Central for the room location.

Lecture Times: Wednesday, 16:35 - 19:25 (in-person)

Tutorial Times: Wednesday, 19:35 - 20:35 (in-person)

Course Website: Brightspace-COMP1805A

Important dates and deadlines can be found here: Registration Dates, including class suspension for fall, winter breaks, and statutory holidays.

Course Information

Introduction to discrete mathematics and discrete structures. Topics include: propositional logic, predicate calculus, set theory, complexity of algorithms, mathematical reasoning and proof techniques, recurrences, induction, finite automata and graph theory. Material is illustrated through examples from computing.

Precludes additional credit for MATH 1800.
Prerequisite(s): one Grade 12 university preparation mathematics course.
Postrequisite(s): Minimum grade of C- in COMP 1805 is required in order to take COMP 2804, COMP 3005, COMP 3007, or COMP 4001.

Learning Material(s) and Other Course/Lab-Related Resources

Textbook: Students are **not required** to purchase textbooks or other learning materials for this course. We will use **David Liben-Nowell**'s *Connecting Discrete Mathematics and Computer Science* for this course. **Free** PDF and HTML versions of the book are available here.

Laptop Requirement (School of Computer Science) :
Every student that has been enrolled in a 1000-level (i.e., first year) course offered by the School of Computer Science after the 2020/2021 school year is required to have a laptop. For more information, please visit SCS Laptop Requirement and then review the requirements at Laptop Specifications.

Brightspace: This platform will be used during the course to share materials, post tutorials, weekly updates, and etc.

Topics Covered and Learning Outcomes

Tentative Calendar

Week	Topic/Content	Readings - Textbook
0	Prerequisite Knowledge	2.2
1	Intro to Discrete Math, Propositional, Direct Proofs	1; 3.2.1; 4.3
2	Propositional, Set Operations	4.3; 2.3-2.4; 9.2
3	Proof by Contradiction, Propositional Logic, Proof by Contrapositive	4.3; 3.1-3.3
4	Intro to Predicate Logic, Proofs in Predicate Logic, Introduction to Functions	3.4-3.5; 2.5
5	Functions, Proofs by Construction, Pigeonhole Principle	2.5; 4.3; 9.3
6	Proofs by Induction	5.1-5.2
7-8	No Classes; **Midterm Test**	
9	Proofs by Strong Induction, Intro to Graphs	5.3; 11.1-11.3
10	Paths, Cycles, and Trees	11.2-11.3
11	Intro to Binary Relations	8.1-8.4
12	Intro to Asymptotic analysis, Big O/Ω/Θ	6.1-6.2
13	Intro to Sums of Sequences	2.2.7
14	Intro to Algorithms Analysis	6.3
15	Asymptotic Analysis of Recursive Algorithms	6.4
16	**Final Test**	

Topics Covered

Throughout this course, students will explore foundational topics in discrete mathematics and theoretical computer science, including:

- **Propositional and Predicate Logic**: Understanding logical connectives, quantifiers, and the validity of arguments.
- **Proof Techniques**: Practicing a variety of formal proof strategies such as direct proof, proof by contradiction, contrapositive, induction (weak and strong), proof by construction, and counterexamples.
- **Set Theory and Functions**: Developing fluency with set operations, functions, countability, and universes of discourse.
- **Sequences and Summations**: Working with arithmetic and geometric sequences, sigma notation, and series.
- **Algorithms and Complexity**: Introducing algorithmic thinking, recursive definitions, and analyzing performance using Big-O, Big-Ω, and Big-Θ notation.
- **Relations and Graphs**: Exploring relations, equivalence classes, graph theory, graph representations, traversal techniques, and related properties.

Learning outcomes

By the end of this course, students who actively participate in lectures, tutorials, and assignments will be able to:

- **Comprehend and Use Mathematical Terminology:** Accurately read and write definitions and statements involving sets, functions, logic, graphs, recursion, and relations.
- **Construct and Understand Formal Proofs:** Write precise mathematical arguments using various methods such as, direct and indirect proofs, proof by cases, and etc..
- **Develop and Apply Problem-Solving Skills:** Tackle unfamiliar problems by using a range of strategies, such as breaking them into manageable parts and systematically solving each one.

Assessment Scheme

Grade Breakdown

COMPONENT	GRADE VALUE	DATE
Drill 1-13	10%	**16:00 on Wednesdays**
Tutorial 1-12	10 %	**21:00 on Wednesdays**
Assignment 1-5	60 %	**23:59 on Mondays**
Midterm	10 %	**TBD by Carleton between** June 20-26 (3h)
Final Exam	10 %	**TBD by Carleton between** August 17-23 (3h)
Bonus (optional)	5 %	

Lectures:

This course will be delivered **in person**, no recordings will be posted to Brightspace. You are strongly encouraged to attend lectures regularly, as Prof. Mao believes that in-person learning offers a more engaging and effective way to understand the material. **All relevant course materials**, including lecture slides, solutions, and weekly updates, **will be posted after the lectures.**

Drills:

To prepare you for proof-based assignments, each topic will be accompanied by targeted drills designed to reinforce key vocabulary, notation, and problem-solving approaches. Drills will be made **available on Brightspace** and are due within a few days of the corresponding lecture. Each set consists of a small number of topic-specific questions.

You are **allowed—and encouraged—to make multiple attempts** within the week. Your highest score will be recorded to keep the assessment low-stakes and aligned with the goal of reinforcing learning through repetition.

There are 13 drills in total (1 mark each), but your final drill grade will be calculated out of 10 marks to allow flexibility for emergencies or personal conflicts. **Any additional marks earned beyond 10 will count as bonus points.**

Tutorials:

While drills offer focused practice, they do not involve writing proofs. Tutorials provide TA-guided, hands-on experience in constructing your own proofs. Attendance and active participation are strongly encouraged, and you're welcome to stay and complete the tasks during the session. And you will need to **submit your solutions** electronically on Brightspace before the associated dues to get the marks.

There are 12 tutorials total (1 mark each), but your grade will be based on the best 10. Up to 2 extra marks may count as a bonus.

Assignments:

Assignments are designed to offer you hands-on practice with course topics. Some questions may be challenging, but you are encouraged to make full use of the available resources. Teaching Assistants and Prof. Mao are here to help —please make use of their office hours as needed. While collaboration with peers is welcome, you must formulate and write your solutions independently. Guidance regarding outside sources on **academic integrity.**

Assignments will be announced and available on Brightspace. **They must be submitted electronically before the due date.** Make sure you submit your assignment ahead of the deadline in case of any tech issues with brightspace. You have multiple chances to resubmit the work, and the latest one will be for marks.

It is your responsibility to ensure that your solutions are submitted in a readable format before the deadline. Late submissions will be accepted within 24 hours with a 10% penalty. No submissions will be accepted after 24 hours, as grading will begin. Consequently, you are advised to periodically upload your progress and/or attempt to submit your final submission at least one hour in advance of the due date and time.

Midterm & Final Test:

The midterm will include a combination of multiple-choice-style questions and written proofs, and will take place in person scheduled by Carleton. The final test will consist of multiple-choice-style questions and will be held in person scheduled by Carleton. Additional details about each test will be posted on Brightspace at least one week in advance.

You are **not required to pass the midterm or final test** to pass the course; however, failure to complete them will result in a score of zero.

Marking Issues:

It is your responsibility to ensure that your tutorial, and assignment marks posted to Brightspace are correct, and you must do so within **one week** of the date the marks were released.

1. First, contact the teaching assistant who graded your tutorial, assignment and/or quiz.
2. If there is still an issue, contact the lab coordinator with the student's and TA's documented email history.

3. If you still have a grading dispute, please contact Prof. Mao with the communication history between the student, TA, and lab coordinator. Note that if Prof. Mao needs to regrade your work, the grade may increase or decrease.

After that one week, no further consideration will be offered, and any student requests to correct or revise marks will not be accepted.

Important Considerations:

The grading scheme will remain unchanged under any circumstances, which means Prof. Mao **cannot** shift the weights of tests, tutorials, or assignments. No make-up assignments or tests will be provided. Students are invited to discuss any concerns with Prof. Mao at the earliest opportunity.

Students are responsible for all course materials. All materials created for this course (including, but not limited to, lecture notes, in-class examples, tutorial exercises, assignments, examinations, and posted solutions) remain the intellectual property of Prof. Mao. These materials are intended for the personal and non-transferable use of students registered in the current course offering. Reposting, reproducing, or redistributing any course materials, in part or in whole, without the written consent of the instructor is strictly prohibited.

Students are asked to pose all questions related to course content using Brightspace; students must avoid emailing the instructor directly unless the question contains confidential or personal information. The instructor will attempt to answer every student's email received **within three business days** of receiving the message unless the email requests information already posted on the official discussion boards or as an announcement or in the course outline. To ensure that all announcements are received, students are expected to check their email on a daily basis.

Sharing drills, tutorials, assignments, tests specifications or posting them online (to sites like Chegg, CourseHero, OneClass, etc.) is always considered academic misconduct (at any time, even after the course has concluded). You are only permitted to post, share, or upload course materials (even for portfolio purposes) if you receive explicit permission from your instructor. Academic integrity offenses are reported to the office of the Dean of Science. Information, processes, and penalties for such offenses can be found on the ODS webpage: Academic Integrity

Land Acknowledgement: Here at Carleton University, it is important that we acknowledge that the land on which we gather is the traditional and unceded territory of the Algonquin nation.

Undergraduate Academic Advisors

The Undergraduate Advisors for the School of Computer Science are available in Room 5302HP; or by email at scs.ug.advisor@cunet.carleton.ca. The undergraduate advisors can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisors will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services.

SCS Computer Laboratory

Students taking a COMP course can access the SCS computer labs. The lab schedule and location can be found at: Computer Laboratories. All SCS computer lab and technical support information can be found at: Technic Support. Technical support staff may be contacted in-person or virtually, see this page for details: Contact IT Support.

Mental Health and Wellness

If you are struggling, please do not hesitate to reach out. I am happy to listen, and/or direct you to resources that might help. If you need extra help with course content or happen to miss a class, there's no need to worry—materials will be posted on Brightspace, and I'm happy to arrange additional office hours beyond the scheduled time to help you catch up. Remember that Carleton also offers an array of mental health and well-being resources, which can be found on the Carleton Wellness Website.

Academic Accommodations and Regulations

Academic Accommodation

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website (https://students.carleton.ca/course-outline/).

Chat GPT/Generative AI Usage

As our understanding of the uses of AI and its relationship to student work and academic Integrity continue to evolve, students are required to discuss their use of AI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.

Many of the assessed activities in this course were designed to be completed by an individual working alone. Unless it is explicitly stated otherwise, the use of any AI system will be considered academic misconduct. This includes, but is not limited to, chatbots or code generators (e.g., ChatGPT, Google Gemini, Microsoft Copilot), research assistants (e.g., Elicit), and image generators (e.g., Stable Diffusion, Dall-E), etc. An exception to the above rule is made for automated grammar and punctuation checking tools (such as Grammarly).

Academic Integrity

Students are expected to uphold the values of academic Integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests, unauthorized collaboration on assignments or exams, and using artificial intelligence tools such as ChatGPT when your assessment instructions say it is not permitted.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy. A list of standard sanctions in the Faculty of Science can be found here.

Additional details about this process can be found on the Faculty of Science Academic Integrity website. Students are expected to familiarize themselves with and abide by Carleton University's Academic Integrity Policy.

Student Rights & Responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the 7 Rights and Responsibilities Policy for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.

Student Concerns

If you have any concerns regarding this course, your first point of contact is Prof. Mao. Please email me or visit during my office hours, and I will do my best to address your concerns. If I cannot resolve the issue, the next point of contact is the School of Computer Science at studentconcerns@scs.carleton.ca. If the concern remains unresolved, the final point of contact is the Office of the Dean of Science at ODScience@carleton.ca. Please follow this order of contact.

Note: You can also bring your concerns to Ombuds services.