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. Minimum grade of **C-** in COMP 1805 is required in order to take COMP 2804, COMP 3005, COMP 3007, or COMP 4001.

**Course Information**

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Alina Shaikhet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contact</td>
<td><a href="mailto:alina.shaikhet@carleton.ca">alina.shaikhet@carleton.ca</a></td>
</tr>
<tr>
<td>Lecture Hours</td>
<td>Tuesdays &amp; Thursdays 10:05 – 11:25 (online, synchronous on Zoom)</td>
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<tr>
<td>Tutorials</td>
<td>The lectures will be recorded and available for asynchronous study</td>
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<tr>
<td>Office Hours</td>
<td>Instructor and TA office hours can be found on the course website</td>
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<tr>
<td>Course Website</td>
<td><a href="https://brightspace.carleton.ca/">https://brightspace.carleton.ca/</a></td>
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<tr>
<td>Course Forum</td>
<td>Discord server (link is available on the course website)</td>
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</tbody>
</table>

**Course Delivery**

This course will be delivered online. Students of all three sections (A, B, and C) will share the same website and will have access to the same materials, recordings, live links, and so on. All students are welcome to attend the live lectures (delivered via Zoom during Section B class times), but if you are unable to attend for various reasons, the lectures will be recorded and posted on the course website.

This course is hosted on Brightspace. Brightspace is effectively our online classroom, and so you are required to be familiar with everything posted on it. Be sure to check out our course page at least 3 times a week.

The instructor and TAs will be available via Discord during scheduled hours to answer questions about course content and assignments. Students will be required to use an alias that includes their first and last name, as listed on Brightspace, in the course Discord, and any other course meetings or activities (Zoom, etc.).

**Required Textbook and Other Resources**

[Introduction Mathematics Study Center](https://discretemathstudycenter.com) is a free resource, that was specifically designed for our course. It includes course notes, video lectures, numerous exercises with solutions, and a mock exam.

We do not have an assigned textbook for the course. I recommend you use an interactive textbook from zyBooks. Subscription details can be found on the course website.

**Necessary Equipment and Software**

Assignments for this course should be submitted as a PDF document that was typed or coded using software of your choice. The most popular choices, such as Microsoft Office, Google Docs, or LaTeX are all capable of typesetting mathematical symbols and producing a pdf document. Handwritten submissions (including those that have been scanned or photographed) are not acceptable and will receive a mark of zero.

In addition to a desktop or laptop with access to reliable high-speed internet, you will also need a microphone to be able to communicate orally during synchronous components and, preferably, a webcam.

**Learning Outcomes**

By the end of this course, successful students will have demonstrated their ability to:

- Use mathematically correct terminology and notation to define and reason about fundamental mathematical concepts such as sets, relations, functions, and integers.
- Evaluate mathematical arguments and identify fallacious reasoning.
- Construct mathematical proofs using different techniques.
Course Outline – last updated January 1st, 2022

- Use and analyze recursive definitions.
- Perform asymptotic analysis to describe the running time of different algorithms.
- Demonstrate various traversal methods for graphs.
- Apply critical thinking, logical and analytical reasoning to formulate and evaluate possible solutions to a variety of problems.

Assessment Scheme

Your performance in this course will be assessed using several components:

- There are **5 assignments**. The best 4 are worth 36% of your final grade. The lowest assignment grade (out of 5) will be dropped. Late assignments will be accepted for up to 12 hours after the deadline with a penalty of 10 (out of 100) points of the mark. The solutions will be posted within 24 hours after the deadline. No late assignments will be accepted after that. For each assignment, you will be submitting exactly one PDF file typed/encoded using Microsoft Office, Google Docs, or LaTeX. Handwritten submissions (including those that have been scanned or photographed) are not acceptable and will receive a mark of zero. Compressed files (e.g., “zip”, “rar”, “tar”, etc.) or documents in another format (e.g., “doc”, “docx”, “rtf”, “txt”, etc.) will be penalized and may receive a mark of zero. Assignments will be submitted on Brightspace. Do not email your assignments to instructor or TAs.

- **Tutorials** are short lessons where you can practice solving new problems under our guidance. Attending live tutorials is not mandatory but is highly encouraged. Tutorials give you practice solving questions similar to what you will have in your assignments, tests, and final exam. In addition, attending tutorials provides a way to connect with the TAs and classmates. Tutorials are followed by an online activity (aka Tutorial quizzes). There will be **7 tutorials** each followed by a Tutorial quiz. **Tutorial quizzes are mandatory** and should be submitted by a specified deadline. Each tutorial quiz is worth 2% of your final mark (14% total). Tutorial quizzes are not timed and will be open for several days. No lowest grade will be dropped, but you will be given two attempts on each quiz (with your best score being recorded). **Tutorials start Monday, January 17th.**

- There will be **4 tests** worth 30% of your final mark. Tests will be delivered online via Brightspace. You will be given a range of time to start, and once started, a limited time to finish. Tests are mandatory and open-book. Open-book refers to class materials only (including slides, notes, textbooks, and approved websites). Any websites or material not approved are strictly forbidden. **There will be no tutorials during the week a test is offered.**

- The **final exam** will be multiple-choice questions on Brightspace. It will be scheduled by the university. The final exam is cumulative and open-book. It is mandatory, but there is no double-pass rule.

The grades you achieve on these components will be weighted using the following scheme:

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>5 Assignments (4 best are counted – 9% each assignment)</td>
<td>36%</td>
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<tr>
<td>7 Tutorial Quizzes (2% each, 2 attempts with the best score recorded)</td>
<td>14%</td>
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<tr>
<td>4 Tests</td>
<td>30%</td>
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<tr>
<td>Final Exam</td>
<td>20%</td>
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There is an opportunity to receive up to **5% of Bonus Points** that will be added to your final grade. Details are on the course website. Bonus points are optional, - not doing bonus points will not negatively impact your final grade.

Attendance

Attendance is optional for the lectures and tutorials. Note that class times will be opportunities to ask the instructor and the TAs questions and get real-time feedback.

Topics Covered

Below is a summary of topics the course will cover:

- Propositional & Predicate Logic
- Validity of Logical Arguments (including Quantifiers)
- Proof Techniques (including Induction)
Course Outline – last updated January 1st, 2022

• Set Theory
• Functions; Countability
• Sequences & Sums
• Intro to Algorithms (performance issues); Big $O$/$\Omega$/$\Theta$ Notation
• Recursive definitions and Recursion
• Graphs
• Relations

A detailed breakdown of topics together with a tentative calendar is available on the course website.

Important Dates and Deadlines in EST (Ottawa time)

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<tr>
<th></th>
<th>TUTORIAL QUIZ 1</th>
<th>ASSIGNMENT 1, TUTORIAL QUIZ 2</th>
<th>TEST 1</th>
<th>ASSIGNMENT 2, TUTORIAL QUIZ 3</th>
<th>TUTORIAL QUIZ 4</th>
<th>TEST 2</th>
<th>ASSIGNMENT 3, TUTORIAL QUIZ 4</th>
<th>TUTORIAL QUIZ 5</th>
<th>TEST 3</th>
<th>ASSIGNMENT 4, TUTORIAL QUIZ 5</th>
<th>TUTORIAL QUIZ 6</th>
<th>TEST 4</th>
<th>ASSIGNMENT 5, TUTORIAL QUIZ 7</th>
<th>TUTORIAL QUIZ 7</th>
<th>FINAL EXAM</th>
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<tr>
<td></td>
<td>Sunday</td>
<td>January 23</td>
<td>by 23:59</td>
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<td>TUTORIAL QUIZ 1</td>
<td>Sunday</td>
<td>January 30</td>
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<td>ASSIGNMENT 1</td>
<td>Thursday</td>
<td>February 3</td>
<td>1-hour test within range 9:00 – 18:00</td>
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<td>ASSIGNMENT 2</td>
<td>Sunday</td>
<td>February 13</td>
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<td>TEST 1</td>
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<td>February 17</td>
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<td>ASSIGNMENT 3</td>
<td>Sunday</td>
<td>March 6</td>
<td>by 23:59</td>
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<td>Thursday</td>
<td>March 10</td>
<td>1-hour test within range 9:00 – 18:00</td>
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<td>March 20</td>
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<td>Thursday</td>
<td>March 27</td>
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<td>ASSIGNMENT 5</td>
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<td>March 31</td>
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<td>TEST 4</td>
<td>Thursday</td>
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<tr>
<td>FINAL EXAM</td>
<td>scheduled by the University during exam period</td>
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Course Copyright

All materials created for this course (i.e., video recordings, course notes, coding examples, PowerPoint slides, assignments, tutorials, quizzes, tests, and exams) remain the intellectual property of the instructor and are protected by copyright. They are intended for the personal and non-transferable use of students registered in the course. Reproducing, reposting, and/or redistributing any course materials, in part or in whole, without the written consent of the instructor, is a copyright violation and is strictly prohibited.

Communication

Discord (our course forum) will be the primary communication tool between the teaching staff and students. Since Discord is primarily a message board, it offers accessibility in terms of low bandwidth requirements and asynchronous nature (you do not have to be immediately present to benefit from the interactions of others). It also offers flexibility in terms of video and audio chat, desktop sharing, etc.

Do not let the lack of face-to-face contact isolate you. Stay connected! Off-topic rooms on our Discord server will be available, and their use is encouraged. Get to know your fellow students. Collaborate. Discussion of material, problems, and approaches to solving them is highly encouraged. However, do not publicly post complete solutions to anything that will be graded, but do describe techniques, approaches, give hints, etc.

Unacceptable collaboration: “Here is my solution: …”
Acceptable collaboration: “Have you tried using De Morgan’s law here? I found using De Morgan’s law at this part worked for me.”

Academic Integrity

Everything you submit for marks in this course (i.e., assignments, quizzes, examinations, etc.) must be the result of your own work. You are never permitted to copy (or copy and modify) solutions (even if incomplete) from anyone or from the Internet. It is also a serious offense to help someone else commit plagiarism. You are never permitted
to provide another person access to the rough work, assignment specifications, or source code that you or anyone
else has written. If you suspect that someone has been able to acquire a copy of your work, then you must inform
the instructor of the course immediately. Please also note that electronic tools may be used to analyze and compare
submissions to ensure that no instances of academic misconduct have been committed.
If you are unsure of the expectations regarding academic integrity (how to use and cite references, how much
collaboration with classmates is appropriate), ask your instructor. Sharing assignment or quiz/exam specifications or
posting them online (to sites like Chegg, CourseHero, OneClass, etc.) is considered academic misconduct. You are
never permitted to post, share, or upload course materials (including lecture slides and recordings) without explicit
permission from your instructor. Academic integrity offences are reported to the office of the Dean of Science.
Penalties for such offences can be found on the ODS webpage: https://science.carleton.ca/academic-integrity/.

Important Considerations

Late tutorial quizzes, late tests, and late assignments (assignments that are more than 12-hours late) are never
accepted for any reason. All the submissions are handled electronically and there is no "grace period" with respect
to a deadline. Technical problems do not exempt you from this requirement, so if you wait until the last minute and
then have issues with your connection, you will still receive a mark of zero. Consequently, when you work on your
assignments you are advised to:

• periodically submit your progress (assignments consist of several parts and you can receive partial marks
even if some of the parts are incomplete),
• attempt to submit your final submission at least one hour in advance of the due date and time.

If any of the files you submit cannot be opened, you will receive a mark of zero. Consequently, after you upload
your submission to Brightspace you must re-download it immediately and ensure that:

• your submission is the correct type of file and has the correct filename and extension,
• each of your .pdf files can be opened with Adobe Acrobat Reader (for marking purposes)

You are expected to show all your work (i.e., include every step) on everything you submit for marks in this course;
a solution that is technically correct will still receive a mark of zero if it is not accompanied by the work required to
reach it.

All complaints regarding assignment marks should be brought to the attention of the TA who marked it. Only if
the TA does not address the problem to your satisfaction should you bring the matter to the instructor. All appeals
must be done no later than 10 days after the assignment has been graded. There will be no remarking after that.

Students with an illness during the span of time a test or tutorial is offered might be granted an exemption. You
need to contact your instructor right away and provide a copy of the Carleton University Self Declaration Form
reason, be exempted from more than two (2) tutorials or more than two (2) of the tests.
Assignments are posted well in advance of their due dates. Illness does not excuse a student from completing an
assignment. No provision is made for missed assignments, and no extra credit assignments will be available.
However, you can miss one of the five assignments without any reason; you do not need to notify your instructor.

Additional Notes

Including the time spent viewing lectures, completing practice problems, and working on other course material,
students can expect to spend at least ten (10) hours per week on this course. Students are asked to pose all questions
related to course content using the official course Discord server. Students should not email the instructor directly
unless the question contains confidential information or is of a personal nature. All emails regarding the course
should be sent from your Carleton email account. To ensure that all announcements are received, students are
expected to check their Carleton email daily.
Undergraduate Academic Advisor

The Undergraduate Advisor for the School of Computer Science is available in Room 5302C HP; 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.

University Policies

For information about Carleton's academic year, including registration and withdrawal dates, see Carleton’s Academic Calendar.

Pregnancy Obligation. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit Equity Services.

Religious Obligation. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit https://carleton.ca/equity/focus/discrimination-harassment/religious-spiritual-observances/.

Academic Accommodations for Students with Disabilities If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the Paul Menton Centre website.

Survivors of Sexual Violence. As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: carleton.ca/sexual-violence-support

Accommodation for Student Activities. Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the policy.

Student Academic Integrity Policy. Every student should be familiar with the Carleton University student academic integrity policy. A student found in violation of academic integrity standards may be awarded penalties which range from a reprimand to receiving a grade of F in the course or even being expelled from the program or University. Examples of punishable offences include: plagiarism and unauthorized co-operation or collaboration. Information on this policy may be found here.

Plagiarism. As defined by Senate, "plagiarism is presenting, whether intentional or not, the ideas, expression of ideas or work of others as one's own". Such reported offences will be reviewed by the office of the Dean of Science. Standard penalty guidelines can be found here.

Unauthorized Co-operation or Collaboration. Senate policy states that "to ensure fairness and equity in assessment of term work, students shall not co-operate or collaborate in the completion of an academic assignment, in whole or in part, when the instructor has indicated that the assignment is to be completed on an individual basis". Please refer to the course outline statement or the instructor concerning this issue.

Students are invited to discuss any concerns with the instructor at the earliest opportunity.