

Introduction to the design and implementation of abstract data types and to complexity analysis of data structures. Topics include: stacks, queues, lists, trees, heaps, hash tables, and graphs. Special attention is given to abstraction, interface specification and hierarchical design using an object-oriented programming language (Java). Precludes additional credit for SYSC 2100. **Prerequisite(s):** (COMP 1006 or COMP 1406 or SYSC 2004) with a minimum grade of C-.

### Course Information

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<b>Instructors</b>	<b>Alina Shaikhet</b> (she/her) <a href="mailto:alina.shaikhet@carleton.ca">alina.shaikhet@carleton.ca</a>	HP 5137
	<b>Ishtiaque Hossain</b> (he/him) <a href="mailto:ishtiaque.hossain@carleton.ca">ishtiaque.hossain@carleton.ca</a>	TBD
<b>Lectures</b>	Section A (in-person): Tuesdays & Thursdays 11:35 – 12:55 Section B (online asynchronous): lecture recordings	
<b>Classroom</b>	Room location is posted on the <a href="#">Public Class Schedule</a>	
<b>Course Website</b>	<a href="https://brightspace.carleton.ca/">https://brightspace.carleton.ca/</a>	
<b>Course Forum</b>	non-anonymous Discord server (link is available on the course website)	

### Course Delivery

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- This course seamlessly integrates both in-person and online asynchronous sections. Students from either section are welcome to attend in-person classes and access recorded lectures at their own pace. In-person classes have proved to be the most efficient method of learning the material. Meanwhile, recorded lectures give you the flexibility to structure your academic commitments around other obligations, enabling a vital balance between family, work, and educational pursuits.
- **Important note:** While almost all of this course may be taken asynchronously, you must be available in-person on campus for our midterm and the final exams scheduled by the university.
- Students of both sections will share the same course website hosted on Brightspace. Students are required to be familiar with everything posted there. It is recommended to check our course website at least three times a week.
- The instructors and TAs will be available during scheduled hours for in-person and online office hours to answer questions about course content and assignments. A list of teaching assistants and their contact/office hours information, together with room locations, will be posted once the course starts.
- We will use Discord as our course forum. The forum is non-anonymous - students will be required to use an alias that includes their first and last name, as listed on Brightspace.

### Required Textbook

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The textbook for the course is Pat Morin's "Open Data Structures". Free PDF and HTML versions of the book are available at [opendatastructures.org](https://opendatastructures.org). We will use the Java version.

### Necessary Equipment and Software

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There will be a lot of Java programming throughout the course. You will need a Java compiler and your favorite editor. If you do not have Java installed on your computer, you can download it for free from [Oracle Java](https://www.oracle.com/in/java/technologies/javase-downloads.html).

**SCS Laptop Requirement:** 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. This includes COMP1001, COMP1005, and COMP1006. For more information, please visit <https://carleton.ca/scs/scs-laptop-requirement/> and then review the requirements at <https://carleton.ca/scs/scs-laptop-requirement/laptop-specs/>.

## Learning Outcomes

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

- Discuss basic types of data structures, their implementation, application, strengths, and weaknesses.
- Analyze the pros and cons of various solutions to a given problem and make educated decisions which code is best for the given situation.
- Design better code (efficient, reliable, fast, and elegant), leading to software that runs faster and consumes less memory.

## Topics Covered

Below is a summary of topics the course will cover:

- Interfaces and Implementation (The Java collections Framework)
- Sequences: lists, stacks, queues, dequeues
- Array-based implementations of sequences
- Linked-list based implementations of sequences
- Unordered sets - hash tables
- Ordered sets - balanced search trees, skiplists
- Priority queues - heaps
- Sorting algorithms
- Applications of data structures
- Graphs
- Performance issues

A detailed breakdown of topics and a tentative calendar are available on the course website.

## Assessment Scheme

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

- There are **5 assignments** (we program in Java). The best 4 are worth 40% of your final grade. The lowest assignment grade will be dropped. The programming components of assignments are marked by an automatic submission server. This means that you will get instant feedback, and you can submit as often as you want - your best grade is recorded. No late assignments are accepted. Do not email your assignments to instructor or TAs.
- **Weekly quizzes** give you high-level practice on the lecture-specific course material. The quizzes mainly consist of multiple-choice questions on Brightspace. They are untimed and will be accessible for several days. You will have one attempt for each quiz. There are 11 quizzes, but you can drop two quizzes with the lowest grade.
- The **midterm** will be held in-person for sections A and B of the course. It will take place on campus, outside of regular class hours. The University will schedule the midterm, which could occur on a Friday evening, Saturday, or Sunday.
- The **final exam** will also be in-person for sections A and B of the course and scheduled by the University during the exam period. The final exam covers all course materials and is cumulative. There is no double-pass rule.

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

<b>5 Assignments (4 best are counted – 10% each assignment)</b>	<b>40%</b>
<b>11 Weekly Quizzes (untimed within range; 1 attempt; 9 best quizzes are counted)</b>	<b>15%</b>
<b>Midterm (in-person, on campus)</b>	<b>15%</b>
<b>Final Exam (in-person, on campus)</b>	<b>30%</b>

### Important Dates and Deadlines in EST (Ottawa time)

ASSIGNMENT 1	Wednesday	September 27	by 23:59
ASSIGNMENT 2	Wednesday	October 11	by 23:59
MIDTERM (SECTIONS A & B)	scheduled by the University		
ASSIGNMENT 3	Wednesday	November 8	by 23:59
ASSIGNMENT 4	Wednesday	November 22	by 23:59
ASSIGNMENT 5	Wednesday	December 6	by 23:59
FINAL EXAM	scheduled by the University during exam period		

Other important dates and deadlines can be found [here](#), including class suspension for fall, winter breaks, and statutory holidays.

### Important Considerations

**Assignments, quizzes, midterm, and final exams must be completed individually. Collaboration between students is strictly disallowed and will be reported to the Dean of Science as an academic integrity offence.** Penalties for such offences can be found on the [ODS web page](#). Students must complete all coursework by themselves.

**Late assignments, quizzes, and exams are never accepted for any reason.** Assignment submissions are handled by an automatic submission server, 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.

For each programming assignment, you will be given a skeleton code and files with very specific names – if you change any of these names or a package your class is in, then the server will not be able to compile your submission. If your submission is improperly packaged, or your code is not compiling for whatever reason, you will get a mark of zero.

Students with an **illness during the span of time a midterm** 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 (<https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf>). The weight of the midterm will then be applied to the final exam mark.

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.

**A student may miss up to 1 assignment and 2 quizzes** for medical, compassionate, or other reasons without penalty. If you miss more than that, a mark of zero will be used for the missed items when the final grade is computed.

If you wish to appeal a mark (assignment, quiz, or midterm) you must **make the appeal within 7 days** of the mark being posted on Brightspace. After that we will not be obliged to accept appeals or change marks.

Students are asked to pose all questions related to course content using the official Discord forum; students should avoid emailing the instructor directly unless the question contains confidential information or is of a personal nature.

### Additional Notes

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Including the time spent attending lectures, completing practice problems, and working on other course material, students can expect to spend at least nine (9) 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 **avoid emailing** 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**.

### Course Copyright

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All materials created for this course (i.e., video recordings, course notes, coding examples, PowerPoint slides, assignments, quizzes, assignment code bases, 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. Many students are eager to post their work on GitHub, but you must be careful not to include copyrighted material.

### Collaboration & Academic Integrity

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Everything you submit for marks in this course (i.e., assignments, quizzes, examinations, etc.) must be the result of your own work and must be completed **individually**. Collaborating on any course work is strictly disallowed and will be reported as an academic integrity offence. 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/quiz 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, if collaboration with lab- or classmates is permitted (and, if so, to what degree), then you must **ASK** your instructor. Sharing assignment or quiz/midterm/exam specifications/solutions or posting them online (to sites like Chegg, CourseHero, OneClass, etc. or even GitHub) is **ALWAYS** considered academic misconduct. You are **NEVER** permitted to post, share, or upload course materials and your course work without explicit permission from your instructor. Academic integrity offences are reported to the office of the Dean of Science. Information, process, and penalties for such offences can be found on the ODS webpage: <https://science.carleton.ca/students/academic-integrity/>.

**Examples of academic integrity offences include:** giving/emailing your solutions (even if incomplete) to other students; posting course materials or solutions to a website (including GitHub) at any time (even after the conclusion of the course); copying solutions from any sources, even cited ones; working with other students; getting help from anyone other than the course TAs or the instructor; submitting solutions (even if incomplete), written by anyone other than the student submitting the work.

All of the assessed activities in this course (including assignments, quizzes, midterm, final exam) are designed to be completed by an individual working alone. Unless it is explicitly stated otherwise, the use of any artificial intelligence tool will be considered academic misconduct. This includes, but is not limited to, ChatGPT, Copilot, etc.

### SCS Computer Laboratory

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SCS students can access one of the designated labs for your course. The lab schedule can be found at: <https://carleton.ca/scs/tech-support/computer-laboratories/>. All SCS computer lab and technical support information can be found at: <https://carleton.ca/scs/technical-support/>. Technical support is available in room HP5161 Monday to Friday from 9:00 until 17:00 or by emailing [SCS.Tech.Support@cunet.carleton.ca](mailto:SCS.Tech.Support@cunet.carleton.ca).

## 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](mailto: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

**Academic Calendar.** For information about Carleton's academic year, including registration and withdrawal dates, see [Carleton's Academic Calendar](#).

**Academic Accommodations.** Carleton is committed to providing academic accessibility for all individuals. Please review the academic accommodation available to students here: <https://students.carleton.ca/course-outline/>.

**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 sanctioned with penalties which range from a reprimand to receiving a grade of F in the course, or even being suspended or expelled from the University. Examples of punishable offences include plagiarism and unauthorized collaboration. Any such reported offences will be reviewed by the office of the Dean of Science. More information on this policy may be found on the ODS Academic Integrity page: <https://carleton.ca/registrar/academic-integrity/>.

**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. More information and standard sanction guidelines can be found here: <https://science.carleton.ca/students/academic-integrity/>.

**Unauthorized 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".

**Use of AI Systems (e.g., ChatGPT, etc.).** Many of the assessed activities in this course were designed to be completed by an individual student working alone. Unless it is explicitly stated otherwise, the use of any AI tool to complete work will be considered academic misconduct. This includes, but is not limited to, chatbots (e.g., ChatGPT, Google Bard, Bing Chat), research assistants (e.g., Elicit), and image generators (e.g., Stable Diffusion, Dall-E), etc.

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