COMP2401A (Winter 2025)
Introduction to Systems Programming

Instructor: Connor Hillen

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Office Location: 5370 Herzberg

Best Ways to be in Touch: In class, during student hours, Brightspace forums. Private concerns via email or student hours, include [COMP2401] in the subject line.

Teaching Assistant: A list of teaching assistants and their contact/student hours information will be posted once the course starts along with our Lab Coordinator who primarily handles TA-related concerns.

Class Location: Zoom Link will be posted to Brightspace prior to first lecture.

Lecture Times: Mon. Wed. 13:05 – 14:25

Tutorial Times:

- A1: Tuesday 11:35-12:55
- A2: Thursday 14:35-15:55
- A3: Wednesday 10:05-11:25
- **Tutorials begin Monday, Jan. 13th**

Course Website:
https://brightspace.carleton.ca/d2l/home/283295

Important dates and deadlines can be found here:
https://carleton.ca/registrar/registration/dates/academic-dates/, including class suspension for fall, winter breaks, and statutory holidays.

Course Calendar Description
Introduction to system-level programming with fundamental OS concepts, procedures, primitive data types, user-defined types. Topics may include process management, memory management, process coordination and synchronisation, inter-process communication, file systems, networking, pointers, heap and stack memory management, and system/library calls.

Precludes: SYSC 2006

Prerequisite(s): (COMP 1006 or COMP 1406 or SYSC 2004) with a minimum grade of C-.

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

Learning Material	Options for Purchasing *(e.g., Bookstore, Used, etc.)*	Approximate Cost
Course Notes	Available on Brightspace under the "Course Notes" module	$0
Course Virtual Machine	https://carleton.ca/scs/tech-support/virtual-machines/	$0

Technology: You must be using the Winter 2025 COMP2401 official virtual machine using either Virtual Box running on your own PC or OpenStack which remotely connects you to the SCS servers. Tutorial 1 will provide aid with getting setup with the course software.

Microphone & Webcam: A microphone is **required** for participation in tutorials. Use of a webcam is not mandatory but **strongly encouraged** in both tutorials and lectures.

Topics Covered and Learning Outcomes

Topics are subject to change. Additional reading and preparations may be added to the weekly course notes section of Brightspace.

Week	Topic/Content	Readings/Prep for Class
1	Intros and Computing	Read outline and policies
2	Representing Values	Read Chapter 1, try to run Chapter 1 code on VM
3	Memory Locations	Optional: Read Chapter 2 to refresh on Week 2
4	Compound Data	TBA
5	Dynamic Data	TBA
6	Quiz & Review	Prepare questions to ask in-class!
7	Winter Break	TBA
8	Building and Processes	TBA
9	Concurrency	TBA
10	Sockets & Scope	TBA
11	Files & Quiz	TBA
12	Linking and Extras	TBA
13	Review	Prepare questions to ask in-class!
14	Extra: Curses, Shell	Prepare questions to ask in-class!

This course is here to introduce you to the C programming language and the introductory concepts of systems programming which underlie your computer programming and computer use. The objective is to introduce you to the principles behind systems programming, gain some proficiency working in the C programming language and building C programs and be comfortable writing and designing programs which work at a lower level and necessitate working with memory directly.

If a student attends every lecture and completes every assignment and tutorial, then by the end of this course that student should be able to:
- Implement basic coding practices in the C language (e.g., loops, conditions),
- Selecting appropriate data types to solve problems in C,
- Design and implement static and dynamic data structures in C, such as linked lists,
- Execute builds of C programs using command line and Makefiles,
- Organise program structure to follow clean coding practices in C,
- Perform file input/output tasks,
- Implement concurrent programming techniques, including process management and threads,

I believe that all students can reach these goals. This content can be challenging for many folks and if you feel you are alone in falling behind, please know that many different people are facing challenges and you are encouraged to reach out for support during student hours for help getting back on track. Even experienced professionals, a lot of programming can involve things not working, confusing and frustrating errors, and unexpected gaps in knowledge. Ask questions in class, attend student hours, and try to use each error as a learning opportunity.

I am a big proponent of feedback informed teaching, and there will be multiple anonymous surveys throughout the class that I will encourage you to fill out. I do my best to review these to understand how everyone is doing and to identify areas the course can be improved. My goal is helping you learn the material and feel prepared for your future courses and careers.

Assessment Scheme
***All assignments are projects are due at 23:59.

COMPONENT	GRADE VALUE	DATE
Assignment 1	1 %	Due Tue. January 21
Assignment 2	1 %	Due Tue. January 28
Assignment 3	1 %	Due Tue. February 04
Assignment 4	1 %	Due Tue. February 11
Assignment 5	1 %	Due Tue. March 04
Assignment 6	1 %	Due Tue. March 11
Project 1	15 %	Due Sun. March 02
Project 2	15 %	Due Sun. March 30
Quiz 1 (**Online Asynchronous**)	7 %	Feb 12 at 08:00 – Feb 13 at 18:00
Quiz 2 (**Online Asynchronous**)	7 %	Mar 19 at 08:00 – Mar 20 at 18:00
Final Exam (**In-Person**)	40 %	Scheduled by Registrar
Side Quest Engagement	10 %	**Varies**, April 04 latest.

Note about 1% Assignments
An important part of my teaching philosophy is that you have a chance to practice course material and receive feedback before finalizing your grade on the topic. 1% assignments may not seem worthwhile, but the assignments are setup to provide you with **vital** practice and feedback to support you in your work on the projects. Assignments will closely resemble the work on your projects, will be discussed and reviewed during tutorials, and provide necessary hands-on practice with the applied outcomes of this course.

The course assessments are divided into two categories: **Summative** elements and **Formative** elements. Summative elements assess your understanding of the material for final marks while formative elements are intended to provide you with learning opportunities to practice and receive feedback. **I understand** it can be tough to be motivated by low-weight assessments, but remember that this important practice using the assignments will lead to better and less stressful performance on the other summative assessments.

Assessment Scheme Automatic Re-Weighting
- **Assignments & Projects:** Assignments are designed to be formative, giving you practice and feedback, while projects are summative and let us know if you understand the material well enough to progress. **Project 1** covers the material for Assignments 1, 2, and 3 and if Project 1 has a higher mark than your A1, 2, and/or 3, their mark will be replaced by your Project 1 mark. Project 2 covers the material for Assignments 4, 5, and 6, and will replace their grades automatically if the grade is higher.
- **Quizzes & Exam:** The two quizzes are somewhat formative tools to assess your understanding of the more conceptual material of the course. The **final exam** will cover all of this material as well as some material from the final weeks, and so a higher grade on the final exam will automatically replace your Quiz 1 and/or Quiz 2 score.
- **Side Quest Engagement:** The side quests, described later, are designed to motivate you to engage in the course in ways that will benefit your understanding of the material. If you do not complete all of the side quest marks, the remaining weight of your side quests will be proportionally distributed across the summative elements – both of your projects and your final exam. While there is no penalty for not completing side quests, it can guarantee marks for regular engagement which might be missed in projects or the exam, and can even receive a bonus of up to 1.5% if you complete extra credit quests in addition to your 10% requirement.

Assignment Submissions
- **Gradescope:** Submissions will be made to Gradescope, which is linked to from Brightspace. Grades and feedback will be visible on Gradescope and may not always correctly synchronize to Brightspace right away.
- **Late Submissions:** You can submit assignments and projects **up to 10 hours late** with a penalty of **5%** per hour, rounded down. This means that you can incur up to a -45% grade penalty for a 9+ hour late submission before you will no longer be able to submit.
- **Verify:** It is your responsibility to **download and test** your work after submitting, to verify it meets all requirements (e.g., filenames, allowed functions). **Make sure** the work runs on the course virtual machine.
- **Feedback and Disputes:** Hopefully, feedback for assignments will be posted within **one week** with an announcement made on Brightspace. You will have **one week** following this announcement to submit a regrade request on Gradescope along with information about how you think you were marked incorrectly.
- **Technical Issues:** Technical issues will **not** constitute accommodations beyond the existing accommodation policies and are not considered extenuating circumstances. If you are experiencing computer difficulties preventing access to working on the assignment, you can utilize the computers in the School of Computer Science laboratories. You are expected to start assignments early and submit progress frequently to receive part-marks if there are any issues with submission near the deadline.
- **Misconduct:** Projects will be automatically reviewed using code review tools and then manually reviewed to detect suspected plagiarism; make sure to read and review the course plagiarism policies carefully.

Quiz Submission

- Classes will be **cancelled** during the dates of the quizzes to provide you with this time to write if desired; questions will not be answered relating to the quiz.
- Quizzes will be written online asynchronously on Brightspace.
- Quizzes are **open-book**, must be worked on **individually**, and without the use of **AI.**
- **NOTE:** While quizzes are open-book, you are advised to use these quizzes as practice for the final exam and really test your knowledge and understanding of the material so that you can receive appropriate support before the final exam.
- Support for content relating to quizzes will not be provided during the period that the quiz is open.
- It is your responsibility to ensure that you have a stable internet connection and at least two up-to-date web browsers installed to deal with any technical issues that might occur.
- It is your responsibility to follow the procedures in the quiz instructions to immediately report any technical issues with the quiz to receive support.
- Reminder that the **final exam is written in-person**.

Side Quests and Tutorial Engagement

Side Quests are a feature of the course designed to help you engage in class activities that will benefit your learning and understanding of the material. Each "quest" will provide a certain number of marks if you complete it satisfactorily. You are free to choose whichever quests best suit you, and if you would like to earn bonus marks, you can complete an additional 1.5% worth of quests on top of your 10% requirement.

A full table of quests will be available on Brightspace, but a few have been selected here for demonstration purposes. Note that the exact weights and requirements may change from here, and you should review the quest board on Brightspace for full, up-to-date information.

- **Tutorials:** Attending tutorials and correctly submitting the code provided by the teaching assistants will provide up to 4% of your side quest mark, 1% for every 2 tutorials that you complete. Tutorials are **highly** suggested as a way to learn about the essential core technologies and discuss the previously submitted assignments with classmates and TAs.
- **Say Hello:** Instructions are posted to the "Say Hello!" forum on Brightspace. If you make a post which follows the requirements and respond to another classmate in a meaningful way, you can receive up to 0.5% toward your side quest mark.
- **In-Class Polls:** There will be Wooclap polls held in almost every lecture. If you attend and respond to approximately 80% (may reduce) of polls while signed in with your Carleton account, you can receive up to 4% of your side quest marks, with 2% given per half of the term (i.e., completing 80% of polls before Winter Break will give 2%, 80% of polls after the break provides another 2%).
- **Weekly Quizzes:** There will be weekly quizzes designed to give you feedback on your understanding of the week's material. Receiving a mark >50% after three attempts can provide you up to 3% of your side quest marks. Every three quizzes successfully completed and submitted will receive 1%. To receive 3%, you must complete 9 quizzes.

- **Project & Assignment Bonuses:** If you would like to do a bit extra on assignments and projects, each assignment will have a bonus requirement worth 0.5% of your side quest mark (3% for all bonuses combined). Projects will have a 1% component for coming up with a plan for your project within the first week of the release of the specification and a 0.5% component for using Git or similar version control tools on each project.
- **More:** Additional quests might be posted later.

Submission

Weekly quizzes, in-class engagement polls, say hello, and tutorial quizzes do not require any additional submission beyond the submission of the quizzes, polls, or tutorial codes.

Other submissions, such as assignment bonuses or project bonuses, will require submission to a private "Side Quest Submissions" forum on Brightspace. Submission requirements for each quest are listed on the quest board posted to Brightspace.

If a submission is marked UNSAT / receives a grade of zero, you can resubmit before the final cut-off period to try to update your mark.

Missed Work Policies

Missed Work

Assignments are automatically accommodated by being replaced by the appropriate project and do not need to be requested. For long-term accommodation, quizzes will automatically be replaced by the final exam score. A second version of the quiz may briefly open up for practice after the grades for the quizzes are released but will not be graded.

If accommodations are requested late, it is possible the extended time will be shorter than anticipated. Review the [Academic Accommodations for Coursework Policy](#) for information.

Note: Doctor's notes and reasons for incapacitation are not necessary. Review the policies to make sure your ailment falls under the appropriate circumstances for a short-term / long-term accommodation and contact the instructor stating the date of incapacitation and number of days needed for accommodation. You will be asked to fill out the appropriate form from the accommodation links in the policy above.

Short-term (5 days or less): **Project & Quiz:** Reach out as soon as possible – within 24 hours of the original cut-off – to request a short-term extension. Extensions will only be provided for 5 days or less from the originally posted deadline.

Long-term (> 5 days): **Projects:** If you are experiencing a long-term incapacitation or anticipate a long-term incapacitation, you may email the instructor to discuss alternative arrangements. Make sure to review the long-term accommodation policy in the policy linked above and prepare to fill out the request form when asked to by the instructor. Long-term accommodation will generally require you to complete the project to a SAT level determined by the instructor before **April 09** and submit according to the instructor's instructions. A SAT submission will have its weight re-distributed evenly across the other formative elements. Only a single project ca have this SAT/UNSAT accommodation applied.

Course Modality

This course involves in-class activities, graded quizzes, and discussions, and thus must be **synchronous**, or live-streamed. We will be meeting on Zoom for lectures and tutorials; tutorial software is subject to change.

We will primarily use Brightspace forums for conversations, and you are strongly encouraged to make use of them to chat and discuss with peers. **Why not Discord?** Discord requires a level of moderation we are unfortunately not able to provide. It opens the opportunity for students to be hacked and requires some students to start new accounts with third-party companies. I want to encourage fun, professional, and courteous conversations – but we will keep this to the Brightspace forums for now. I am always open to suggestions to improve the experience and keep the class collaborative.

You are expected to attend **every class**. Class recordings will be posted up to **one week later**, but you may miss out on important in-class activities and discussions and recordings should not be relied upon as a consistent replacement for attendance.

While you are not strictly required to have a camera on, the lecture will be in "Focus Mode", meaning that only the instructor can see your camera and it should not appear in recordings, but technical issues could potentially mean cameras could appear temporarily. You are requested to turn a camera on to help gauge engagement and build familiarity during lectures, and it is **very highly requested** to have a camera on in tutorials to help with group conversations. You **must** have a working microphone to interact with each other. **Please be aware:** if you turn on your camera or speak during lectures (which is both allowed and encouraged), you may appear in the recording that is posted to Brightspace, though camera is unlikely due to the focus mode setup. You are **not** permitted to share these recordings to help maintain privacy.

Please note that by participating in these lectures that you may be included in these recordings. When attending on Zoom, Zoom will always notify meeting participants that a meeting is being recorded. It is not possible to disable this notification.

*These recordings will only be available to the members of this class, and **I ask that everyone be respectful and not allow others to view the recordings**. At the end of the course, the recordings will be deleted.*

Please note that recordings are protected by copyright. The recordings are for your educational use, and you are not permitted to publish to third party sites. **If you have concerns about being recorded**, please email the instructor directly so we can discuss these.

Please note that modality may change if necessary - for example, courses may be pre-recorded if the instructor falls ill.

Communication Policy

In order to reduce the volume of emails and expedite responses, the only emails that should be sent to the instructor, teaching assistants, or lab coordinators should **require confidentiality** or is personal in nature and be handled via direct email from a Carleton email address. Your first point of contact for support about course support or other information should be the Brightspace forums or student hours with TAs and the instructor.

Students are expected to **check their Carleton email addresses <u>daily</u> for announcements.** Reminders for upcoming assignment deadlines will be handled using the default Brightspace notifications system, so if you require reminders, check that your Brightspace settings will send notifications.

Students should only **expect responses within 3 business days** during **business hours (8:30AM - 5:30PM, Monday - Friday)**. <u>Plan ahead</u> - questions asked over the weekends may go unanswered until the following week. Email communication may be delayed if there is a high volume of emails, so any messages which can be answered in the syllabus, recent course announcements, or could be asked on the course forums as it does not require exposing personal information may be low-priority and you are encouraged to attend student hours.

To make sure communication is handled in a timely manner, follow these guidelines:

1. Any **email communication** must include **your name, student ID, and course code** and must be sent from an official Carleton email address. As I teach multiple courses, please include **the course code in the subject line.**
2. **Assignment questions** should *first* be dealt with by discussing with a TA during student hours or via the Brightspace forums. If you have concerns about grading and cannot contact your TA, or if you have concerns about the TAs, please contact our lab coordinator.
3. **Course material assistance** can be handled via Brightspace forums, TA student hours, or instructor student hours.
4. **For technical issues,** first look on the Brightspace forums or the course resources, then check the [SCS technical support page](), then inquire with teaching assistants who may forward your concern to the instructor.

Students <u>must</u> behave in a professional manner in all communications. Any communication that is seen as abusive, discourteous, or unprofessional may be moderated, ignored, or reported to the university for disciplinary action.

School of Computer Science Laptop Requirement (only applies to on-campus courses)
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/.

Undergraduate Academic Advisors (only for UG course)

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: https://carleton.ca/scs/tech-support/computer-laboratories/. All SCS computer lab and technical support information can be found at: https://carleton.ca/scs/tech-support/. Technical support staff may be contacted in-person or virtually, see this page for details: https://carleton.ca/scs/tech-support/contact-it-support/.

Mental Health and Wellness

Carleton offers a wide range of wellness services that I highly recommend reviewing. Whether it is because you are in a rough place, are having a difficult time keeping up with your studies, or would just like to bolster your skills for mental, physical, or academic well-being, check out the Carleton Wellness Website for information about the services offered. Most are free and confidential. If you ever feel unsafe or are having an emergency on campus, you can contact campus safety from any Carleton phone by dialing 4444 or from your own phone at 613-520-4444. If you would like help navigating supports or would like help connecting with a member of the wellness team who can help identify the resources to help you get through a distressing situation, you can review the resources or reach out to me and I am happy to help connect you with people who can help.

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

Generative AI is a new tool which has been shown to be relatively effective at many tasks relating to this course – I am aware of the value these can have in producing work; however, I must stress that the goal here is not to have you producing output, but to **understand**, to **reflect**, to be **adaptable**. Personally, I believe AI can be a helpful tool for learning, but it is very challenging to use in an effective way that does not interfere with learning, particularly in courses teaching foundational information such as this. It is **vital** to your understanding of the material that you build up the **recognition** skills earned by taking time to get stuck in

understanding and overcome it; to build up **translation** skills by being the one to compare possible solutions and select the best ones; to build a **muscle memory** for writing out certain patterns of code in different circumstances to help rapidly recall your tools. Our goal is for you to have an foundational understanding, not a dependence on a specific tool.

As such, use of generative AI – including but not limited to chat based solutions like ChatGPT or code generation tools like GitHub Co-Pilot are **banned** from use for completing formative elements (Project, Exam) and quizzes.

While it may not be conducive to your learning without the appropriate approach, use of generative AI **is** permitted for Assignments 1-6 and tutorial exercises, but you **must** cite any usage of AI in your submitted files (comments and/or README) based on the policies laid out in our plagiarism policy posted to Brightspace. **Note:** Incorrect use of AI – e.g., generating an entire function or entire file in an assignment – can severely hinder your performance on Projects where AI is not permitted and hinder your understanding of the underlying concepts tested on the Final Exam.

No assignment specification information should be sent to any of these online AI services. Use of a Generative Chat AI such as ChatGPT **is** permitted purely to clarify material, to produce practice exercises to help you with a particular topic, to provide explanations for provided example code; **however,** please be aware that these AI tools are **not** consistently using real information to inform their responses! As such, they can provide very clever and realistic-sounding misinformation which can easily mislead newcomers to the field. As such, if you do choose to use these to help bolster your understanding by generating practice exercises, providing clarifying examples of topics, or re-explaining a topic, it is highly recommended that you follow-up with a teaching assistant or the instructor via the Brightspace forums or during student hours to verify your understanding and make sure you have not received misinformation.

As someone who has taken some time to research AI to help bolster creativity and support learning, I am happy to discuss appropriate ways and techniques to use AI to support your learning in a way that is less likely to hinder your learning experience and hold back your understanding for future courses.

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.

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. If you are unsure of the expectations regarding academic Integrity (if unauthorized collaboration with lab- or classmates is permitted and, if so, to what degree), then you must ASK your instructor. Sharing assignment or quiz specifications or posting them online (to sites like Chegg, CourseHero, OneClass, etc.) is

ALWAYS considered academic misconduct. You are NEVER permitted to post, share, or upload course materials without explicit permission from your instructor.

For more information, you are required to review the **plagiarism policy** which will be available on Brightspace prior to the first assessment for more information. Collaboration is not permitted on assignments to make sure that you have your understanding of the material assessed and can receive personal practice and feedback and contribute experiences during tutorial discussions. Quizzes are meant to be completed alone and only with the resources discussed in the quiz instructions. Projects have an optional pair component, and you are permitted to work with one other student, but both students must be active participants in the project and both students must be cited as authors in the included README file and the instructor notified of the group as per the instructions on the Project specifications.

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.

Personal Note on Integrity: The goal of this class is to learn – both for you and for me as the instructor. If there is too much work or if topics are too unclear, this is either a sign that you need a bit of support to catch up or that the course needs some refinement. If students are doing well due to misconduct, I will have little indication that there are issues with the course presentation. It is unfair to students that do not commit misconduct, it is unfair to the teaching team to spend time crafting and assessing materials that are not providing you with feedback on your own progress, and it is unfair to yourself to risk severe academic penalties and to miss out on opportunities to learn and grow and set yourself up for success later in the course and in future terms. If you struggle to complete the material early on and feel unable to progress, **please** know that you are not alone, both in terms of this struggle and in terms of support and come to TA and instructor student hours for support to get on track. If you are struggling with academic skills like retaining information or time management, please explore the wellness services offered by Carleton or reach out to the instructor via student hours for help.

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 me. Please email me or visit during my student 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.