

CSCI 2122 – Systems Programming

Sec 01 & 02 – Course Syllabus

Instructor Information

Instructors:	Dr. Nauzer Kalyaniwalla (Sec 01) Dr. Khurram Aziz (Sec 02)	Office:	CS 221 CS 205
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Lecture Time:	(Sec 01) Tue, Thu 13:05 – 14:25 (Sec 02) Tue, Thu 16:05 – 17:25	Room No:	Killam MacMe Tupper Thtr B
Lab B01 Time:	Thu 10:05 – 11:25	Room No:	CS 134
Lab B02 Time:	Thu 10:05 – 11:25	Room No:	CS 143
Lab B03 Time:	Fri 10:05 – 11:25	Room No:	CS 134
Lab B04 Time:	Wed 11:35 – 12:55	Room No:	CS 134
Lab B05 Time:	Fri 10:05 – 11:25	Room No:	MGMT 1011
Course Homepage:	https://dal.brightspace.com/d2l/home/359502	MS Teams:	Code: 7je4295 (CS_2122_W25)
Teaching Assistants	See Brightspace		

Important Dates

- Reading Week (no classes): February 17 - 21, 2025
- Midterm: February 25, 2025
- Final Exam: TBA in the period of April 09 to 26, 2025
- Last day to drop winter term courses with no financial implications: January 20, 2025
- Last day to drop winter term courses without a "W": February 03, 2025
- Last day to drop winter term classes with a "W": March 05, 2025
- Deadlines: Four assignments due at 23:59 on Feb 02, Feb 16, Mar 09 and Mar 23 (subject to minor adjustments in dates), plus a bonus Assignment 0 due on January 26.

Course Description

This course presents tools, techniques, and concepts for systems programming. Students will be exposed to assembly and will be introduced to the C programming language. The course also discusses memory hierarchies, performance measurement, exception control flow, and performance related issues. Students will be involved in significant amount of low-level programming.

Course Rationale

This course has three purposes. First, to expose students to data and code manipulation at the machine level, and discuss how high-level language constructs map to assembly. Second, to provide students with grounding in C programming and debugging at the low-level. Third, to expose students to low-level systems concepts and ideas, including: the memory hierarchy and caching; performance measurement; and exception control flow.

Prerequisites

Pre-req: CSCI 1110 and CSCI 1120

Exclusion: CSCI 2121

High-Level Learning Outcomes

- Manipulate data and code at the machine-level.
- Implement and debug programs of moderate complexity in a low-level language such as C.
- Describe how system-level structures, such as the memory hierarchy and process control, support and affect program execution.

Learning Outcomes

Data Representation and Assembly

- Describe the internal representation of non-numeric data, such as characters, strings, records, and arrays.
- Convert numerical data from one format to another.
- Explain different instruction formats, such as addresses per instruction and variable length vs fixed length formats.
- Explain how subroutine calls are handled at the assembly level.
- Show how fundamental high-level programming constructs are implemented at the machine-language level.

C Programming

- Explain the C build cycle (preprocess, compile, assemble, link).
- Use pointers in C and manage memory.
- Describe the various kinds of software errors that can occur and their causes.
- Write a program in C to solve a problem of moderate complexity given a problem specification.
- Use a debugger to debug an executable program.

Low Level Systems

- Use software tools to profile and measure program performance.
- Describe the structure and types of memory inside a computer.
- Explain the basic concepts of interrupts and I/O operations.
- Explain the basic concepts of processes, system calls, and process control.

Class Format and Course Communication

- Content will be delivered using lectures, labs, and assignments.
- Course announcements will be posted to Brightspace.
- It is the student's responsibility to check their Dal e-mail, Brightspace, and MS Teams on a daily basis. To access your Dal e-mail, see: <https://www.dal.ca/dept/its/o365/services/email.html>
- The instructors can be reached via Email and Microsoft Team: **CS_2122_W25** (join code: **7je4295**)
- Office hours will be posted on Brightspace
- Students must ask the instructor permission before recording class lectures.

Texts and Resources

The text for the course is: Computer Systems: A Programmers Perspective, 3rd Edition, R. Bryant and D. O'Hallaron, Pearson (2016), ISBN 978-0-130409266-9

Evaluation Criteria

- Academic Integrity Module: <https://dal.brightspace.com/d2l/home/178166>
 - **Must be completed by January 31st to pass the course.**
 - **Must receive 75% or better on each of the four quizzes in the module.**
- Weekly Quizzes (10% or 0%)
 - A short quiz to be taken in Brightspace every week.
 - The quiz will cover topics from the previous week.
 - The quiz will be available all day on Wednesday and must be completed before midnight on Wednesday.
 - You may choose to skip the quizzes or do better on the final exam, in which case, your quizzes will be worth 0% and your final will be worth an additional 10%.
- Labs (10%)
 - Labs are due at 11:59pm, on the Sunday after the lab occurs.
 - Late labs will not be accepted.
 - Labs need to be submitted electronically using Git.
 - Attendance will be marked in lab and will constitute 25% of the lab grade.
- Assignments (24%)
 - Assignments are worth 6% each and are due at 23:59 on the following dates:

	Due Date	Description	Weight
Assignment 1	Feb 02	Basic C programming	6%
Assignment 2	Feb 16	Data manipulation in C	6%
Assignment 3	Mar 09	Linked Lists in C	6%
Assignment 4	Mar 23	Low Level Implementation	6%
 - **No late submissions will be accepted.**
 - Assignments need to be submitted electronically via Gitlab using git.
 - No collaboration is permitted on the assignments.
 - Coding must follow guidelines outlined by the style guide on Brightspace.
 - All submitted code will be passed through the Moss Software Similarity Detection System (<https://theory.stanford.edu/~aiken/moss/>) to check for plagiarism. If a student does not wish their assignments to be submitted to Moss, they should contact the instructor.
- Midterm (16% or 0%)
 - The midterm is optional. If you choose not to write the midterm or do better on the final exam, your midterm will be worth 0% and your final will be worth an additional 16%.
- Final Exam (40% or 56% or 66%)
 - The exam will be scheduled by the university.
 - The exam will cover all material in the course.
- Passing Requirements: To achieve a grade of C or better, all of the following are required
 - **FCS Academic Integrity Module:** <https://dal.brightspace.com/d2l/home/178166>
 - **Overall Grade:** Students must achieve at least a 60% average in the course.

Notes

- A minimum grade of C is required in this course if it is core to your FCS degree, or if it will be used as a prerequisite for a subsequent CSCI course.
- Students who receive a grade lower than C in the same required CS course twice, will be dismissed.
- The grade scale in Section 17.1 of the Academic Regulations, Undergraduate Calendar will be used.

Statute of Limitations

Any concerns about grading of assignments, labs, or midterm must be brought to the attention of your course instructor through email within **two weeks** of the return of the graded assessment. Any concerns brought up after two weeks will not be considered.

Midterm and Final Exam Requirements

- Photo ID is required
- Closed book
- No dictionaries, notes, calculators, cell phones, PDAs, talking slide rulers, or other aids allowed.

Use of Generative AI (E.g., ChatGPT)

You may not use generative AI to assist you with your assignments. As we introduce core low level programming skills in this course, it is important that you can demonstrate these skills without the assistance of generative AI. Consequently, while you can use generative AI to assist you in your learning, for example, creation of practice questions for study purposes. You should not use it to generate code for your assignments. Any similarities between students' code from the use of generative AI will be treated as an academic integrity matter.

Tentative Schedule *(Note: Schedule may be subject to minor adjustments along the way)*

Week	Lec	Topics	Assignments
Jan 07	1	Administrivia	
Jan 09	2	Chapter 1 : Introduction	
Jan 14	3	C Basics 1	Lab 1: Unix 101 redux
Jan 16	4	C Basics 2	
Jan 21	5	Information Storage	Lab 2: Simple C programs
Jan 23	6	Integer Representation	Assn 0 due (Jan 26)
Jan 28	7	Bit Manipulation	Lab 3: Data manipulation
Jan 30	8	Pointers and memory allocation	Assn 1 due (Feb 02)
Feb 04	9	Program organization and Makefiles	Lab 4: Allocation & Arrays
Feb 06	10	Linked Lists in C	
Feb 07		Munro Day, University Closed	
Feb 11	11	Program encoding and data access	Lab 5: Linked Lists
Feb 13	12	Inline assembly	Assn 2 due (Feb 16)
Feb 17 – 21		READING WEEK	
Feb 25	13	Midterm Exam	No Labs
Feb 27	14	Inline assembly	
Mar 04	15	Control structure implementation	Lab 6: Assembly with C
Mar 06	16	Procedure implementation	Assn 3 due (Mar 09)
Mar 11	17	Pointer arithmetic + debugging	Lab 7: More assembly
Mar 13	18	File I/O	
Mar 18	19	Storage technology and locality	Lab 8: Debugging C programs
Mar 20	20	Memory hierarchy and caching	Assn 4 due (Mar 23)
Mar 25	21	Caching II & writing cache friendly code	Lab 9: File I/O
Mar 27	22	Exceptions and Interrupts	
Apr 1	23	Processes	Reserved for snow day if a whole lab week is missed
Apr 3	24	Revision	
Exams			

The Show Must Go On (Snow Day) Policy

In case of a university closure of any kind (such as a snow day) following policy will be implemented:

- The cancelled lecture(s) will be moved forward to the next class lecture.
- The cancelled lab(s) will need to be completed that week as per schedule. Students are still responsible for completing the lab and can drop in on any of the other lab sections (if possible) to seek assistance with the lab or seek assistance during Instructor or TA office hours.
- If 3 or more lab sections are cancelled in the same week, that and all subsequent labs will be pushed forward accordingly.

Student Declaration of Absence and Medical Absence Policy

The Student Declaration of Absence policy shall apply. https://www.dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/academic-policies/student-absence.html

- The student has a maximum of two (2) SDAs per course per semester.
- The student **must** notify the instructor of their inability to meet a deadline **before** the deadline by contacting the instructor or submitting the completed SDA to the Medical Absences folder on the course Brightspace. Upon notification the student has 3 days after the deadline to submit the SDA.
- Note that the **SDAs do not apply to assignments and final exams.**
- It is your responsibility to follow up with your instructor or classmates for any class notes/materials that you have missed.
- While there will be no makeup assessments, the following rules will be applied if you submit the “student declaration of absence” within 3 calendar days:
 - For missed quizzes: You will receive either the average of all your remaining quizzes, or the class average for that quiz, whichever is lower.
- For missed midterm: Your marks will be moved to the final examination.
- Please note that the “Student Declaration of Absence” is not valid for the final examination, assignments or lab submissions. However, if you submit an SDA for a missed lab, you will not be penalized for that lab’s attendance.
- Late submissions will result in a zero grade.

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

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.

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 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.

Culture of Respect¹

Every person has a right to respect and safety. We believe inclusiveness is fundamental to education and learning. Misogyny and other disrespectful behaviour in our classrooms, on our campus, on social media, and in our community is unacceptable. As a community, we must stand for equality and hold ourselves to a higher standard.

What we all need to do:

1. **Be Ready to Act:** This starts with promising yourself to speak up to help prevent it from happening again. Whatever it takes, summon your courage to address the issue. Try to approach the issue with open-ended questions like “Why did you say that?” or “How did you develop that belief?”
2. **Identify the Behaviour:** Use reflective listening and avoid labeling, name-calling, or assigning blame to the person. Focus the conversation on the behaviour, not on the person. For example, “The comment you just made sounded racist, is that what you intended?” is a better approach than “You’re a racist if you make comments like that.”
3. **Appeal to Principles:** This can work well if the person is known to you, like a friend, sibling, or co-worker. For example, “I have always thought of you as a fair-minded person, so it shocks me when I hear you say something like that.”
4. **Set Limits:** You cannot control another person’s actions, but you can control what happens in your space. Do not be afraid to ask someone “Please do not tell racist jokes in my presence anymore” or state “This classroom is not a place where I allow homophobia to occur.” After you have set that expectation, make sure you consistently maintain it.
5. **Find or be an Ally:** Seek out like-minded people that support your views, and help support others in their challenges. Leading by example can be a powerful way to inspire others to do the same.
6. **Be Vigilant:** Change can happen slowly, but do not let this deter you. Stay prepared, keep speaking up, and do not let yourself be silenced.

University Statements

This course is governed by the academic rules and regulations set forth in the University Calendar and the Senate. <https://academiccalendar.dal.ca/Catalog/ViewCatalog.aspx?pageid=viewcatalog&catalogid=117&loadusercredits=False>

Territorial Acknowledgement

Dalhousie University is located in Mi’kma’ki, the ancestral and unceded territory of the Mi’kmaq. We are all Treaty people.

Dalhousie acknowledges the histories, contributions, and legacies of the African Nova Scotia people and communities who have been here for over 400 years.

¹ Source: Speak Up! © 2005 Southern Poverty Law Center. First Printing. This publication was produced by Teaching Tolerance, a project of the Southern Poverty Law Center. Full “Speak Up” document found at: <http://www.dal.ca/dept/dalrespect.html>. Revised by Susan Holmes from a document provided April 2015 by Lyndsay Anderson, Manager, Student Dispute Resolution, Dalhousie University, 902.494.4140, lyndsay.anderson@dal.ca www.dal.ca/think.

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)

Accessibility

The Student Accessibility Centre is Dalhousie’s centre of expertise for matters related to student accessibility and accommodation. If there are aspects of the design, instruction, and/or experiences within this course (online or in-person) that result in barriers to your inclusion please contact: https://www.dal.ca/campus_life/academic-support/accessibility.html for all courses offered by Dalhousie with the exception of Truro.

Conduct in the Classroom — Culture of Respect

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 — Culture of Respect

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>)

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)

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)

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)

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.

Learning and Support Resources

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