CSCI-3901.06 – Software Development Concepts
Course Syllabus

Instructor Information

Instructor:	Mike McAllister	**Office:**	Goldberg 431
E-mail:	mike.mcallister@dal.ca		
Class Meeting Time:	TR 10:05 – 11:25	**Room:**	Goldberg 143
Lab Meeting Time:	F 10:05 – 11:25	**Room:**	Goldberg 143
3 Course Quizzes:	F 10:00 – 10:40	**Location:**	Online
Course Homepage:	dal.ca/brightspace		
Discussions:	Microsoft Teams channel: FCS CSCI 3901 winter 2023		
	Join code: 5arzilr		
Announcements:	Posted to Microsoft Teams and Brightspace		
Office hours:	WF 14:00 – 15:00 online or in person		

Important Dates

- Munro Day (no classes): February 3, 2023
- Winter study break (no classes): February 20 – 24, 2023
- Good Friday (no classes): April 7, 2023
- Last day of classes: April 11, 2023
- The course project will be due during the exam period in lieu of an exam

- Final Withdrawal Date: February 2, 2023
- Final Withdrawal Date without academic penalty: March 13, 2023

See dal.ca/dates for a further list of university dates.

Course Description

This course covers the (i) application of standard abstract data types, fundamental data structures, and commonly used algorithms; (ii) design and implementation of databases; and (iii) the fundamental practice of software engineering. Students reinforce the skills and concepts covered in lectures through assignments and a project that integrates all three components.

NOTES: This course is intended to fill in the knowledge gaps that incoming graduate students may have. Students must receive a B- or higher in this course.

RESTRICTIONS: Inclusive GR Level Restriction

Learning Outcomes

Data Structures and Algorithms

- Use abstract data types (ADTs), including lists, stacks, queues, maps, dictionaries.
- Implement fundamental data structures, such as linked lists, trees, graphs, and hash tables.
- Implement traversals, recursive search and state-space exploration algorithms.
- Implement simple iterative and recursive algorithms to solve moderately simple tasks.
- Select the appropriate data structure to implement a given ADT under a given set of constraints.
- Select and use appropriate abstract data types, data structures, and algorithms to solve real-world problems.

Databases

- Describe the properties of multiuser database transactions (ACID).
- Describe the purpose, function, evolution, classification, and building blocks of data models and data modeling.
- Describe the basic components of a relational model and how relations are implemented.
- Derive business rules from requirements' specifications and translate these rules into database table and relationship designs.
- Use SQL data definition and manipulation operations.
- Construct an entity relationship diagram (ERD).
- Describe normalization and denormalization, and their role in database design.
- Perform normalization and denormalization on a database.

Software Engineering

- Design a software system and prepare detailed design documentation.
- Implement moderate-sized programs.
- Create unit tests for a software development project.
- Effectively debug a program.
- Understand and apply the concepts of code coverage in testing.
- Apply standard software processes for version control.
- Create readable and maintainable code
- Apply standards of good program design through the SOLID principles.
- Identify code smells and know how to remedy them.

Course Rationale

This course is assigned to students in the Master of Applied Computer Science whose admission interview suggests a gap in a student's knowledge or whose familiarity with background material doesn't have them fully prepared for the MACS graduate courses. Rather than assign full undergraduate courses to these MACS students, this course con-

denses the fundamental second year CS concepts into one course to prepare these MACS students in a single course.

Class Format and Course Communication

- Content will be delivered via a combination of lectures and interactive group exercises.
- If the university moves to online courses only, then the courses will be held synchronously online and recordings of the sessions will be posted for access throughout the term.
- Labs will be in person.
- Students must ask the instructor permission before separately recording class lectures.
- The course is a 6 credit hour course offered in one term. Course workload and expectation of work out of class will match the credit hour count.
- Students will be expected to do advance readings of some lectures and will be expected to learn some supporting tools independently.
- During group exercises, students will be expected to share their work with other students and to provide respectful and constructive feedback to other students.
- Course announcements will be posted to the Microsoft Teams channel for the course and, as applicable, to the course we page.

Evaluation Criteria

- Assignments (40%)
  - Late assignments will not be accepted.
  - No collaboration is permitted on the assignments unless otherwise indicated on the assignment.
  - The course instructor may submit assignments to an automated comparison tool for a preliminary assessment of similarity.
  - The course instructor may ask you to meet to demonstrate your understanding of the work before awarding a final grade for any assignment.
- Module Quizzes (20%)
- Class Labs (10%)
  - Not every class lab will be graded. Lab descriptions will indicate if the lab will not be graded.
- Participation (10%)
  - 2% for completion of the Faculty's academic integrity module by January 22, 2023.
  - 8% based on visible engagement in the course with peers, the TA, and the instructor. Attendance is not the same as engagement.
- Final Project (20%)
  - Meeting intermediate milestones (10%)
  - Documentation (10%)
  - Overall design and coding style (15%)
  - Working implementation (50%)
  - Unit testing (15%)

Student Declaration of Absence

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. Upon notification the student has 3 days after the deadline to submit the SDA.

With the student declaration of absence (SDA) policy, students can submit up to two SDAs for the course. Each SDA covers a maximum of 3 contiguous days of absence. SDAs are not available for the final project. Once an SDA has been submitted, you cannot withdraw it later in the term to apply to a different part of the course material.

An SDA submitted for a lab will have that lab not be graded and its weight in the final grade distributed to the other labs. An SDA submitted for an assignment will provide for a 3 calendar day extension to the assignment. No SDA can be submitted for the quizzes or final project.

Circumstances beyond the scope of an SDA should be discussed with the instructor if you are seeking alternate accommodations.

Notes

- Some of the assigned work, like labs, will be assessed with letter grades.
- Grades for individual pieces of work in the course can use any of the grades available for undergraduate courses: F, D, C-, C, C+, B-, B, B+, A-, A, A+
- A final grade below B- in this course will be recorded as an F for graduate students.
- The course will use the grade conversion scale in Section 7.6.2 of the Faculty of Graduate Studies Regulations, Graduate Calendar when combining letter and percentage grades.
- It is up to the discretion of the instructor to use remote proctoring in online testing. Students may be required to download proctoring software onto their devices. Students who cannot meet system requirements for remote proctoring should contact the instructor for an alternate assessment. (Typical system requirements are: (i) Mac OS or Windows, (ii) a web-cam, and (iii) an internet connection.)

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.

Required Texts and Resources

Course material be posted on the course web site.

Course Software

Students are encouraged to install copies of the following software on their own computers for the course and the labs:

- Some integrated development environment (IDE) that includes a debugger. An IDE that integrates with Git will be useful. Examples of IDEs include
  - Eclipse – eclipse.org
  - IntelliJ IDEA – jetbrains.com/idea
  - NetBeans – netbeans.org
- A secure shell program like putty (putty.org).
- A file transfer program like winscp (winscp.net) and filezilla (filezilla-project.org).
- The university VPN software – wireless.dal.ca/vpnsoftware.php
- MySQL Workbench – mysql.com/products/workbench
- Some students may find it useful to have MySQL server running on their own computers to develop with their own database. Available at dev.mysql.com/downloads/mysql

In the case of any disputes on whether or how a student's assignment submission is working, the assessment will be judged by the submission's operation on timberlea.cs.dal.ca. It is the students' responsibility to ensure that their programs work on that computer.

Prerequisite Knowledge

Preliminary exposure to the material in csci 2110, csci 2132, csci 2141, and csci 3130.

Tentative List of Topics

- Abstract data types (lists, stacks, queues, maps, dictionaries)
- Fundamental data structures (linked lists, trees, graphs, hash tables)
- Recursion, traversals, and backtracking
- Database transactions and ACID properties
- Entity-relation models
- SQL for data management and queries
- Database normalization
- Software development lifecycle
- Software design steps
- Software testing
- Development tools (version control, debuggers, test scripts, …)

Tentative Schedule

Dates below are best-estimate dates for the material and due dates. Delays in covering material can result in due dates of deliverables shifting.

Date (week start)	Topic	Lab (due Tuesdays)	Assignment (due Thursdays)	Project milestone (due Friday)	Module Quiz
Jan 9	Administration, problem solving	Problem solving			
Jan 16	ADT, data structures	Debugging		Complete Academic integrity module	
Jan 23	Data structures, Graphs	Testing	A1 due		
Jan 30	Graphs, interfaces	No lab (Munro day)			
Feb 6	Call stack, recursion	Version control	A2 due		
Feb 13	Exceptions, software development lifecycle	Defensive programming			Data structures
Feb 6	Study week	No lab			
Feb 27	Class design	Code smells and refactoring	A3 due	Breakdown analysis of the problem	
Mar 6	Coherence and coupling, SOLID, Agile development	Software design			
Mar 13	Database basics, insert, database query	Database connections		Opaque unit tests, bi-weekly plan of feature development	Software engineering
Mar 20	Database joins, subqueries	Database queries	A4 due	External documentation of data structures, code design, and key algorithms. Transparent unit test update	
Mar 27	CRUD, database views , transactions, ACID properties	Transactions			

Apr 3	Database design, database normalization	No lab		Implementation report in relation to earlier plan, including Git submission showing non-trivial project development	
Apr 10		Database design	A5 due		Databases
Apr 17				Project due	

Responsible Computing Policy

Usage of all computing resources in the Faculty of Computer Science must be within the Dalhousie Acceptable Use Policies (its.dal.ca/policies/) and the Faculty of Computer Science Responsible Computing Policy. For more information please see www.cs.dal.ca/downloads/fcs_policy_local.pdf

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

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 d**al.ca/mentalhealth**.

Culture of Respect[1]

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.
dal.ca/calendar
dal.ca/dept/university_secretariat/policies.html#

Territorial Acknowledgement

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

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[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. 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, http://www.dal.ca/think

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

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 (The Center for Academic Integrity, Duke University, 1999). 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.
dal.ca/dept/university_secretariat/academic-integrity.html

Accessibility

The Advising and Access Services Centre is Dalhousie's centre of expertise for student accessibility and accommodation. The advising team works with students who request accommodation as a result of: a disability, religious obligation, or any barrier related to any other characteristic protected under Human Rights legislation (NS, NB, PEI, NFLD).
dal.ca/campus_life/academic-support/accessibility.html

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.
dal.ca/campus_life/safety-respect/student-rights-and-responsibilities/student-life-policies/code-of-student-conduct.html

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).
dal.ca/cultureofrespect.html

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