

Course Title: Software Maintenance & Evolution

Course Section: 1

Class Day & Time: Mon/Wed **16:05-17:25 PM**

Credit Value: 3.00

Pre-requisites: CSCI 3130, equivalent course, or permission of instructor

Instructor: Dr. Masud Rahman

Email: masud.rahman@dal.ca

Course Number: CSCI 6308

Semester & Year: Winter 2026

Location: Studley McCain Arts & SS 2132

Office Location: Mona Campbell 4204

Office Hours: by appointment

TA/Marker: TBA

Course Website: on Brightspace

Course Mailing List: all-cs6308@cs.dal.ca

CALENDAR DESCRIPTION

Software products are modified even after their release to address concerns from customers, testers, and users (e.g., software bugs, crashes, failures, feature requests, performance regressions). Activities addressing these concerns are known as software maintenance and evolution. They include many challenging tasks, such as bug resolution, feature enhancement, reverse engineering, traceability link recovery, code reuse, mining software repositories, and quality control mechanisms, including code review and refactoring. This course will not only discuss these important process-oriented concepts but also introduce students to state-of-the-art practices, tools, and cutting-edge AI technologies (e.g., Large Language Models, Deep Learning, Agentic AI), supporting those activities.

LEARNING OUTCOMES

- Students will be able to maintain and evolve medium-sized software systems, including AI-powered software systems, competently and efficiently.
- They will be able to conduct a graduate-level course project from its ideation to prototype development and replication.
- Students will be able to triage, localize, reproduce, and solve software bugs using state-of-the-art tools and technologies from the literature.
- They will be able to comprehend existing code, locate software features using appropriate tools, and incorporate new features within a codebase.
- They will be able to review code, detect code smells, and refactor smelly code using state-of-the-art tools and technologies from the literature.
- Students will be able to perform reverse engineering, recover traceability links, reuse existing code, and mine large-scale software repositories.
- They will gain hands-on experience in the best practices, methods, and innovate novel tools and techniques to support software maintenance and evolution as a part of the course project.
- Students will gain hands-on experience developing tools and solutions using cutting-edge AI technologies (e.g., Large Language Models, Deep Learning, Agentic AI).

COURSE RATIONALE

This is a fundamental course discussing the challenges of software maintenance and evolution, which can claim up to 80% of the total software budget. For example, the US economy lost **\$2.41 trillion** in 2022 due to low quality software. Read more about the cost of low-quality software from [here](#).

TEXTBOOK

There is no required textbook for this course. All the course materials have been prepared from recently published papers, journal articles, and various online resources. Students should be able to access them from the digital collection of Dalhousie University Library. The required resources for the course can also be found in several major publication databases such as IEEE Explore, ACM Digital Library, Springer Link, Science Direct, Scopus, and Wiley Online Library.

Additional materials will be made available on the course website and/or in class as necessary.

COURSE EVALUATION

Assignments (3)	25% (8%, 8%, and 9% respectively)
Paper critiques & presentation (3)	15% (3.5%, 3.5%, and 8% respectively)
Midterm exam	10%
Course project	45%
Attendance & Formative assessment	5%

Important Notes

- A student **must score 50%** or above in assignments, midterm, and project work to pass this course.
- Grades will be set based on Dalhousie's Grading Policy. The lowest passing grade in the course is a **B-** as it is a graduate-level course.
- It is up to the discretion of the instructor to use **remote proctoring** in online testing (e.g., quizzes, midterm). 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: (a) Mac OS or Windows, (b) a web-cam, and (c) an Internet connection.)

MIDTERM AND FINAL EXAMINATION

There is a midterm exam but no final exam in this course.

COURSE PROJECT

The course project (**45%**) will be divided into multiple milestones and deliverable: (a) project proposal (10%), (b) progress report (5%), (c) final project demonstration (10%), (d) project prototype (5%), and (e) final project report (15%).

POLICY ON LATE ASSIGNMENTS & PROJECT DELIVERABLE

Unless otherwise specified, assignments, critiques, and project submissions are expected by **11:59 PM** on the day in which they are due. There is a **24-hour grace period** past due date/time for assignments to accommodate any issues that the students may encounter with learning under extra-ordinary circumstances (e.g., COVID-19 pandemic, Blackout due to winter storm).

A deduction of **10%** per day late will be applied to assignments that are submitted up to **72 hours** past this grace period. Assignments submitted more than **4 days** after the posted deadline **will not be accepted**. There is **no grace period** for project deliverable submission. It is the responsibility of each group to ensure that contributions are collected and submitted on time, and that individual absences are managed. Late submission of the project deliverable will be **penalized similarly**.

WORKING COLLABORATIVELY

Working in groups is a major focus of this course. Discussing and brainstorming project ideas among the group members are highly encouraged. Part of working in a successful project group is managing and capitalizing on individual strengths so that everyone can make a meaningful contribution. Disproportionate contributions by individual group members do not constitute a reason for a higher individual mark. However, there may be cases where a student **falls far short of their responsibilities** to the group. Such cases will be determined through *peer testimonials*, *TA feedback*, and if necessary, a subsequent oral examination, and can lead to a **significant reduction** in a student's project grade.

STUDENT DECLARATION OF ABSENCE

The Student Declaration of Absence policy shall apply for this course. Please check the policy carefully before submitting your declaration. Each student has a maximum of **two** SDAs per course per semester. The student **must** notify the course instructor of their inability to meet a deadline **on the deadline** by contacting the instructor through an **e-mail**. Upon notification the student has **03 days** after the deadline to submit their SDA through an **e-mail**. **SDA** should not be submitted through Brightspace. Students should start their assignments on time and must show **solid evidence of progress** before coming up with any request for a deadline extension. Any arrangements of alternate coursework or deadline extension are at the **discretion of the course instructor**.

TENTATIVE SCHEDULES (subject to change – Brightspace provides definitive schedule)

Week of	Topics	Assessments/Events
Jan 05 (W1)	Course introduction. Software maintenance & evolution.	Project groups creation
Jan 12 (W2)	Software bugs and failures, AI faults, and Fault taxonomies	
Jan 19 (W3)	Issue report classification, Embedding vector search, Duplicate bug detection, and Bug triage	Project proposal due
Jan 26 (W4)	Bug localization, AI fault detection & diagnosis, Retrieval Augmented Generation, and Bug reproduction	
Feb 02 (W5)	Large Language Models and Automated program repair	Assignment 1 due
Feb 09 (W6)	Code comprehension and Concept location	
Reading Week (Winter Break)		
Feb 23 (W8)	SOLID principles and Design patterns	Assignment 2 due
Mar 02 (W9)	Code review, Code smells, and Refactoring	Project update due
Mar 09 (W10)	Rethink software systems with Agentic AI	Midterm exam
Mar 16 (W11)	Mining software repositories and Reverse engineering	
Mar 23 (W12)	Course project demonstration	Assignment 3 due
Mar 30 (W13)	Course project demonstration	
Apr 06 (W14)	Recap and Course project demonstration	Final project report due

Note: This is a tentative schedule and is subject to change.

Important Dates: Last day to add/drop courses without a financial penalty: **Jan 22, 2026**, Last day to change Winter term courses from audit to credit: **Feb 05, 2026**. Check more dates

CLASS FORMAT AND COURSE COMMUNICATIONS

- Content will be delivered via a combination of in-person lectures and online course materials at Brightspace.
- Lecture sessions **might be recorded** if appropriate equipment is available in the classroom.
- Students must ask the instructor permission before recording any class lectures.
- Course announcements will be posted at **Brightspace, MS Teams channel**, and/or to the course mailing list, which comprises the instructor's and students' CS email accounts. It is the **student's responsibility** to check Brightspace, MS Teams Channel, and their CS e-mail account on a **regular basis (e.g., once a day)**. If you do not know how to access your CS e-mail account or Brightspace, please contact the CS help desk or read the information located at the student service page.
- Students will be expected to use the **MS Forms** and **Kahoot!** Student Response System (Join URL: <https://kahoot.it/<GAME PIN>>). They will be used to capture attendance and to conduct tiny, formative quizzes during the lectures, respectively.

ACCEPTABLE USE OF AI-DRIVEN TOOLS

- You may use Generative AI tools (e.g., ChatGPT, Gemini) to assist you in learning but remember that your objective is to understand, achieve, and apply the course competencies and outcomes.
- While you may use tools for learning, specific assessments in this course (assignments, quizzes, critiques) will disallow the use of any AI-driven tools to assert that you have attained course learning outcomes. This is because a graduate must be able to analyze, assess and produce work unassisted by AI technology.
- Where tools are allowed: you must acknowledge all tools used to assist you. If applicable, you must provide links to chat logs.
- Using AI-driven tools where prohibited constitutes an *academic offense*.

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 guidelines provided by the Dalhousie Writing Center.

Please note that if it appears that the error was made with an 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.

STUDENT HEALTH & 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 student health 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 mental health

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:

- **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?”
- **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.”
- **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.”
- **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.
- **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.
- **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.

RESPONSIBLE COMPUTING POLICY

Usage of all computing resources in the Faculty of Computer Science must be within the Dalhousie Acceptable Use Policies and the Faculty of Computer Science Responsible Computing Policy.

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 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. Please check more on plagiarism and penalties.

UNIVERSITY STATEMENTS

This course is governed by the academic rules and regulations set forth in the University Calendar and the Senate.

Territorial Acknowledgement

Dalhousie University would like to acknowledge that the University is on Traditional Mi'kmaq Territory. The Elders in Residence program provides students with access to First Nations elders for guidance, counsel and support. Visit the office in the McCain Building (room 3037) or contact the programs at elders@dal.ca or 902-494-6803 (leave a message).

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." Please check more on internationalization.

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. Please check more on academic integrity.

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 accessibility 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 feel 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). Please check more on culture of respect.

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 do not 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 cannot be reached, or would be inappropriate, procedures exist for formal dispute resolution. Please check more on code of conduct.

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 copy-right owners. It is intended to provide a balance between the rights of creators and the rights of users at Dalhousie. (Read more on fair dealing policy.)

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.

Student Use of Course Materials

The course materials are designed for use as part of the CSCI courses at Dalhousie University and are the **property of the instructors** unless otherwise stated. Third-party copyrighted materials (such as books, journal articles, music, videos, images, etc.) have either been licensed for use in this course or fall under an *exception or limitation* in Canadian Copyright law (e.g., fair use for education). Copying this course material for distribution (e.g. **uploading material** to a third-party website) may lead to a **violation of Copyright law** and may result into penalties.

¹Source: 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 Student Rights & Responsibilities page. 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.

Learning and Support Resources

- General Academic Support – Advising.
- Dalhousie University Library.