COMP 520: Compiler Design
Course Outline
Winter 2026

January 3, 2026

1 General information

- Course title: Compiler Design
- Course code: COMP 520
- Credits: 4
- Contact hours: 3 hours, 1 hour consultation
- Course prerequisite(s):
  - COMP 273/ECSE 324
  - COMP 302
- Course corequisite(s): N/A
- Course description: The structure of a compiler. Lexical analysis. Parsing techniques. Syntax directed translation. Run-time implementation of various programming language constructs. Introduction to code generation for an idealized machine. Students will implement parts of a compiler.

2 Introduction

This course is an introduction to the full pipeline of modern compilers

- it covers all aspects of the compiler pipeline for modern languages (C, Java, Python, etc.)
- touches on advanced topics related to optimization
- will present how real-world compilers are built

By the end of this class you will have a working knowledge of compilers that allows you to:

- produce fully functional compilers for general-purpose languages targetting real machine assembly.

3 Format and Schedule

The course has three hours of weekly lectures. This course has no exam and the mark entirely depends on coursework.

The schedule of the lectures and coursework deadlines are available on the course webpage.

4 Staff

4.1 Instructor

Prof. Christophe Dubach (Dept. of Electrical and Compute Engineering / School of Computer Science)

- Office: McConnell Engineering Building, Room 758
- Email: christophe dot dubach at mcgill dot ca

4.2 TAs

- Abd-El-Aziz Zayed
- Jonathan Van der Cruysse
- Paul Teng

5 Communication

All communications with the instructors or TAs must be done via the online forum or during the office hours. No email should be sent to any of the TAs. The instructor will only reply to emails that contain information that cannot be shared with the TAs for privacy/personal reasons.

5.1 Office hours

The location and time of the office hours held by the instructor and TAs are available on the course webpage.

5.2 Online forum response time

Response times on the online forum may vary. No guaranteed response time is provided. Questions submitted less than 48 hours before a deadline will not be answered.

6 Course Material

The course materials will be made available on the course webpage throughout the term.

6.1 Instructor generated course materials

7 Lecture Syllabus

- Overview
- Core topics
  - Scanning
  - Parsing
  - Abstract Syntax Tree
  - Semantic analysis
  - Code generation for machine assembly
  - SSA form & Dataflow analysis
  - Register allocation
  - Compiling object oriented languages
  - Garbage collection
- Extra topics (if time allows)
  - Instruction selection
  - Instruction scheduling
  - Real-world IR (*e.g.* LLVM, WebAssembly)
  - Equality Saturation

8 Evaluation

- Coursework (5 parts, each worth 20%): 100%
- Demo: Pass/Fail **Warning**: You must pass the demo to pass the course.
- Participation Bonus: 2%

8.1 Cumulative grading

This project uses a cumulative grading scheme. Each deadline evaluates both new functionality and previously introduced features. Performance improvements on earlier components are credited retroactively.

The compiler project is developed in five parts. Each part introduces new functionality and a corresponding set of tests. At each deadline, your submission is evaluated against:

- the tests associated with the current part, and
- all tests from previous parts.

If your compiler scores better on an earlier part than it did at the original deadline, your grade for that earlier part is automatically increased. Grades for earlier parts never decrease.

Note that the exact grading scheme, including how grades are calculated based on the number of tests passed, is part-dependent and will be explained on the coursework description page.

8.2 Demo

The demo will take place at the end of the term. During the demo, you will be asked to demonstrate your compiler implementation and answer questions about *your own* code. Failing to answer such questions will be deemed a failed demo, and you will fail the course.

8.3 Participation bonus

A participation bonus worth 2% can be obtained for participating in the class (*i.e.* attending lectures in person). Attendance will be *sampled* in class at random intervals. If you are present for at least 80% of the sampled attendance checks, you will receive the full 2% bonus. If you are present at least 60% of the sampled checks, you will receive a 1% bonus.

9 Evaluation Policies

9.1 Late policy

Deadlines will be strictly enforced. Given the cumulative grading scheme, they will be no extensions given. If you are unable to meet a deadline, your work for the specific part you have missed will simply be evaluated at the next deadline.

9.2 Academic Integrity

McGill University values academic integrity. Therefore, all students must understand the meaning and consequences of cheating, plagiarism and other academic offences under the Code of Student Conduct and Disciplinary Procedures. (approved by Senate on 29 January 2003)

Warning:

Cheating is a serious offense and all suspected cases will be reported to the faculty. Even if we detect cheating in a single part of the coursework, your entire coursework (100% of your grade) will be considered void.

For this course:

- Never share your code or text.
- Never use someone else code or text in your solutions (even if you change it).
- Never consult project code or text that might be on the Internet.
- Always write your own code.
- Do not use automatically generated code (*e.g.* ChatGPT-generated code), unless you wrote the generator yourself and you submit it together with your code.

On the other hand, you are allowed to:

- Share ideas.
- Help someone else debug their code if they have run into a wall (you can point out at the error they are making, but never write code for them!).

If you obtain help of any kind, always write the name(s) of your sources and explicitly state how you were helped in your submission.

9.3 Special accommodations

Students who may require disability-related accommodations, as well as those experiencing mental or physical health challenges, should advise the Office for Students with Disabilities as early in the term as possible so that we can provide appropriate accommodation to support your success.

9.4 Submission language

In accord with McGill University's Charter of Students' Rights, students in this course have the right to submit in English or in French any written work that is to be graded. (approved by Senate on 21 January 2009)

9.5 Grading policy

Letter grades will be assigned according to the standard McGill grading scheme (*e.g.* 85% or above = A).

If you notice any marking issues with your assignment:

- you should raise the issue on ED (in a private post) immediately and
- this must be done within 7 days of receiving the grade.

The final caculated grade will be rounded to the closest integer, for instance:

- 64.4% $\Rightarrow$ 64%
- 64.5% $\Rightarrow$ 65%

9.6 Changes to content/evaluation scheme

In the event of extraordinary circumstances beyond the University's control, the content and/or evaluation scheme in this course is subject to change.

9.7 Student-submitted work

Any work submitted by a student must be kept private and not shared with anyone, without the explicit approval of the course instructor. **Warning**: This policy applies even after the course has finished.