Preliminary version of 1 June 2025

Course Information

General

This course counts for 3 credits. Undergraduate students should register for CS 454. Graduate students should register for CS 554. Students outside CS should consult the instructor beforehand.

Course objectives

At the completion of this course students will be able to:

1. Apply compiler algorithms to symbolic input data processing in various application domains.
2. Measure and evaluate program performance.
3. Design and program an optimizing compiler for an imperative programming language.

Lectures

times to be announced

Instructor

Darko Stefanovic, office hours to be announced

Teaching assistant

to be announced

Course topics

The course covers introductory topics in compiler construction, including computer organization and architecture, code and data layout, intermediate representation, program analysis and

optimization, generation of executable code, as well as syntactic analysis. Students will implement several components of a compiler, ranging from parsing to native code generation. The course will focus on the implementation of imperative languages; special techniques for functional, object-oriented, and logic languages will be left out.

Course format

The course will consist of lectures, homework assignments, implementation projects, and exams (mid-term and final). Students enrolled in CS 554 will be assigned additional work.

Written homework assignments

Homework assignments will be carried out individually. Detailed submission instructions will be given with each assignment.

Projects

Each project will be an implementation of an algorithm or phase in a compiler, or an algorithm or tool used to automatically generate a phase in a compiler. Projects will be carried out in teams. Teams will give oral presentations on their work in scheduled class meetings. Detailed submission instructions will be given with each project.

Textbook

Keith D. Cooper and Linda Torczon, *Engineering a Compiler*, Morgan Kaufmann, 3rd Edition, 2023.

Other assigned reading materials will be provided free of charge.

Grading

You are expected to attend class regularly, read the assigned reading before class, and participate in class discussion. The grade will be determined as follows: Homeworks 15%; Programming projects 50%; Midterm exam 15%; Final exam 20%.

Homework and programming project hand-in policy

Late work will be penalized $2n^2\%$, where n is the number of days late.

Lecture Plan (tentative)

- Week 1: Course organization. Translation and interpretation. Code generation. Register allocation.
- Week 2: Lexical analysis. Regular expressions. Finite automata. Theory, pragmatic issues, tools.
- Week 3-4: Syntax analysis. Parsing algorithms, top-down, bottom-up, pragmatics, tools.
- Week 5: Names, scope, and binding. Types. Semantic elaboration.
- Week 6: Intermediate representations.
- Week 7: Representing data types. Representing control flow.
- Week 8: Representing the procedure abstraction.
- Week 9: Code generation. Instruction scheduling. Register allocation.
- Week 10-14: Program analysis. Code optimization.

UNM statement of compliance with ADA

Every instructor should include an official statement in their course syllabus. The suggested syllabus statement should include the following text:

"In accordance with University Policy 2310 and the Americans with Disabilities Act (ADA), academic accommodations may be made for any student who notifies the instructor of the need for an accommodation. It is imperative that you take the initiative to bring such needs to the instructor's attention, as I am not legally permitted to inquire. Students who may require assistance in emergency evacuations should contact the instructor as to the most appropriate procedures to follow. Contact Accessibility Resource Center at 277-3506 for additional information.
If you need an accommodation based on how course requirement[s] interact with the impact of a disability, you should contact me to arrange an appointment as soon as possible. At the appointment we can discuss the course format and requirements, anticipate the need for adjustments and explore potential accommodations. I rely on the Disability Services Office for assistance in developing strategies and verifying accommodation needs. If you have not previously contacted them I encourage you to do so."