Preliminary version of 23 May 2023

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

Tuesdays and Thursdays, 2:00–3:15, room TBA.

Instructor

Darko Stefanovic, office hours Tuesdays and Wednesdays 1:00-2:00, in FEC2020.

Teaching assistant

TBA

Course topics

The course covers introductory topics in compiler construction, including computer organization and architecture, operating system support, code and data layout, memory management, generation of executable code, intermediate representations, simple code optimizations, as well

as the traditional topics of syntax analysis. Students will implement several components of a compiler, ranging from parsing to native code generation, with an emphasis on tools for automated translation. The course will focus on the implementation of imperative languages; special techniques for functional, object-oriented, and logic languages will be left out. The course will treat simple program analysis and code optimization techniques.

Course format

The course will consist of lectures, written homework assignments, and projects.

Assignments

Midterm exam, 1–3 short written homework assignments to consolidate lecture material, 3–4 programming projects.

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.

Textbook

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

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 70%; Midterm exam 15%.

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. Attribute grammars.
- 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: Code optimization. Program analysis.

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."