CS 4/510 Compilers and Interpreters – Spring 2021

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Course web page: http://web.cecs.pdx.edu/~apt/cs510comp

Description

This is a course about modern techniques for programming language compilation and interpretation. We will focus on the implementation of higher-order, safe languages such as ML, Java and JavaScript. Topics will include: machine code generation; register allocation; intermediate representations; dataflow analysis and optimization; garbage collection; and efficient interpretation.

Goals

Upon the successful completion of this class, students will be able to:

- Understand the roles of interpretation and compilation.
- Implement and optimize a simple interpreter.
- Implement a machine code generator and simple register allocator.
- Apply dataflow analysis techniques to implement simple code optimizations.
- Implement a simple garbage collector.

Prerequisites

Comfort with low-level programming in C; a good understanding of machine-level architecture (e.g. from CS201); understanding of grammars and abstract syntax (e.g. from CS320 or CS558). Experience with functional language such as ML, Haskell, Elm, or Scala (e.g. from CS4/557 or CS558) will be very helpful, although not required.

Readings

There is no published textbook, but for the bulk of of the course, we will be using a local version of the on-line textbook Essentials of Compilation by Jeremy Siek et al., which will be made available via the course web page. There may also be small number of additional readings, also made available on the course web page.

Requirements

There will be homework exercises involving compiler implementation due each week. The implementation language is OCaml, so you will need to learn the basics of that language. You are strongly encouraged to form teams of 2-4 people to do the homework.

There will also be take-home midterm and final exams. They will primarily used to confirm your understanding of the homework material.

The course grade will be distributed as follows:

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
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<tbody>
<tr>
<td>Homework</td>
<td>70%</td>
</tr>
<tr>
<td>Midterm (take-home)</td>
<td>15%</td>
</tr>
<tr>
<td>Final (take-home)</td>
<td>15%</td>
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</table>

Moreover, you must obtain a certain minimum score (to be determined) on both the midterm and the final in order to obtain a passing grade in the course (B or better for 510 students, C or better for 410 students).

Although it will not be formally assessed, class attendance and participation are strongly encouraged, and may affect borderline grades.

Under the special Covid rules, you may choose to take the course P/NP and still have it count towards any requirements that normally demand graded courses. In this case your letter grade will be computed in the ordinary way, and then converted into a P or NP. Note that no B- or C- grades will be computed, so a P corresponds to a C or better (for 410 students) or B or better (for 510 students). The deadline for finalizing your grading option is Tuesday, June 1.
Computing Facilities

The course will require use of the OCaml language (version 4.08.1 or later) on a unix-like system (Linux, MacOS, etc.), running on an x86-64 machine. You can use the CS Linux lab machines, or (better) install the language on your own computer. The course web page has pointers to the installation instructions.

Individual Work

You are encouraged to work on the homework on a 2-4 person team. Every member of the team is jointly responsible for the team’s submissions, and should be able to explain them on request. In addition, you are welcome to collaborate across teams or use any other resources available on the web or elsewhere to complete the homeworks.

The exams must be completed individually without any collaboration. Plagiarism or collaborating on an exam will result in an automatic zero grade and the initiation of disciplinary action at the University level.

Disabilities

If you are a student with a disability in need of academic accommodations, you should register with Disability Services for Students and notify the instructor immediately to arrange for support services.

Title IX Reporting Obligations

Portland State is committed to fostering a safe, productive learning environment. Title IX and our school policy prohibit gender or sex-based discrimination and sexual misconduct (including harassment, domestic and dating violence, sexual assault, and stalking). We expect a culture of professionalism and mutual respect in our department and class. You may report any incident of discrimination or discriminatory harassment, including sexual harassment, to either the Office of Equity and Compliance (https://www.pdx.edu/diversity/equity-compliance) or the Office of the Dean of Student Life (https://www.pdx.edu/student-life/dean-of-student-life).

Please be aware that members of the faculty have the responsibility to report any instances of sexual harassment, sexual violence and/or other forms of prohibited discrimination to PSU’s Title IX Coordinator, the Office of Equity and Compliance or the Dean of Student Life and cannot keep information confidential. If you would rather share information about sexual harassment or sexual violence to a confidential employee who does not have this reporting responsibility, you can contact a confidential advocate at 503-725-5672 or by scheduling on-line (https://psuwrc.youcanbook.me) or another confidential employee found on the sexual misconduct resource webpage (https://www.pdx.edu/sexual-assault/get-help).

Recording

We will use technology for virtual meetings and recordings in this course. Our use of such technology is governed by FERPA, the Acceptable Use Policy and PSU’s Student Code of Conduct. A record of all meetings and recordings is kept and stored by PSU, in accordance with the Acceptable Use Policy and FERPA. Your instructor will not share recordings of your class activities outside of course participants, which include your fellow students, TAs/GAs/Mentors, and any guest faculty or community based learning partners that we may engage with. You may not share recordings outside of this course. Doing so may result in disciplinary action.