CSC 431: Programming Languages II

Instructional Information

Professor: Aaron Keen  
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Office: 14-230  
Office hours: M: 3–4pm, W: 3–4pm, R: 2:00–4:00pm, F: 3–4pm  
Course Webpage: http://www.csc.calpoly.edu/~akeen/courses/csc431

Lecture Time and Location

| Lecture: MWF 9:10 am – 10:00 am, 186-C301 | Lab: MWF 10:10 am – 11:00 am, 14-255 |
| Lecture: MWF 11:10 am – 12:00 pm, 14-250 | Lab: MWF 12:10 pm – 1:00 pm, 14-302 |

Course Objectives

- Explore the design and implementation of a compiler.
- Focus on issues related to the “back-end” of a compiler.
- Understand and implement code transformations.
- Gain appreciation for what an optimizing compiler can do and the implications on how you write code.

Prerequisites: CSC 430

Texts

The recommended course textbook is Engineering a Compiler by Cooper and Torczon. Supplemental materials will be linked from the course webpage.

Webpage

Clarifications, changes, etc. regarding the class and assignments will be posted to the course webpage (http://www.csc.calpoly.edu/~akeen/courses/csc431). Read it regularly, especially near when assignments are due. You are responsible for any announcements posted on the course website.

Activities

Class Participation

The lectures are for your benefit. You should ask questions when you have them. Use lecture time to discuss general approaches to the project.

Project

There will be one large project with multiple milestones. The due dates for the milestones are listed on the schedule. You are allowed, but not required, to work with a single partner on the project.

Each milestone will be demonstrated in lab on the day that it is due. Each group must complete a status sheet (linked from the course webpage) and prepare (ahead of time) a simple demonstration of functionality. Milestones are graded based on a somewhat subjective measure of how “complete” the required functionality is.

You must submit your final project by the date specified on the schedule. This submission must include all of your source code, instructions on how to build your project, and instructions on using your compiler.

Exams

There will be no exams.
Paper
Each group will submit a paper detailing the design and implementation of their compiler project. At least half of the grade for the paper will depend on the presentation of some performance analysis of the code generated by the group’s compiler.

This paper must

- Outline the overall architecture of the solution.
- Outline the representation of key data (e.g., control flow graphs and instructions).
- Outline optimizations implemented.
- Provide a section detailing the performance of the code generated for the benchmarks. This section must contain graphs comparing the run-times of the generated code (with and without optimizations) and the C equivalent code compiled using gcc or clang (with and without optimizations).

More specifically, the paper must include analysis and comparison of the performance of generated code under, at minimum, the following configurations.

- Stack-based IR.
- SSA-based IR.
- With optimizations disabled.
- With all optimizations enabled (it is assumed that this will include only SSA-based IR).

Grading
The percentage breakdown for the course grade is as follows.

<table>
<thead>
<tr>
<th>Activity</th>
<th>% per</th>
<th>% total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milestones</td>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>Final Submission</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Paper</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>100</strong></td>
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Collaboration and Cheating
Students may work in pairs on the project. Each student/pair is expected to complete their own project. It is fine to talk with others about general approaches to the project, but each student/pair is to develop their own solution; collaborative efforts beyond a recognized pair are not allowed. Students/pairs are not to view any other student’s code or exchange code in any form (hardcopy or electronically). Sharing pseudo-code is not allowed.
The Last Page

This page is so that I can gather a little information about you at the beginning of the class. Please fill it out, tear it off and leave it with me on the way out.

Who are you?

Name: ________________________________
Section: ______________________________
Major: ________________________________
Email: ________________________________
Enrollment:  
  ___ Enrolled
  ___ Enrolled, thinking about dropping
  ___ Thinking about signing up

Class Expectations?

Please take a minute to write out what your goals and expectations are for CSC 431. What do you want to learn? What do you expect to learn? Are these the same thing?