Assignment 5: Proposal for Lab 5++ or Lab 6

15-411/611: Course Staff

Draft Proposal Due: Thursday, November 18, 2021 at 11:59 PM
Feedback Returned: Saturday, November 20, 2021 at 11:59 PM
Final Proposal Due: Tuesday, November 23, 2021 at 11:59 PM

Note: Please complete this written assignment with your compiler partner. You should complete this assignment regardless of whether you intend to pursue Lab 5++ (Extra Optimization) or Lab 6 (Create Your Own Adventure).

A Project Proposal

Lab 6: Create Your Own Adventure

For teams choosing to do Lab 6, each team is asked to choose one of a set of options for their project; these options include (among others TBD):

- extending the source language of your compiler to `C1` (and beyond),
- implementing garbage collection, or
- defining and implementing your own project ("create your own adventure").

To prepare for Lab 6, we ask you to provide a thorough written description of a possible "choose your own adventure" project. **You should complete this written description of a new, unique project even if you intend to implement one of the preset options for Lab 6.** Ideas that have been pursued in the past include:

- OOP Features (Inheritance, Polymorphism, Interfaces)
- Functional Programming Features (ADTs, Generics, Closures)
- Concurrency and Parallelism (Threads, Coroutines, Channels, Mutexes)
- Rust-style variable lifetimes
- Control flow integrity (protections against buffer overflows and similar exploits)
- Exception handling à la `try-catch` in Python or Java

Lab 5++: Extra Optimization

For teams choosing to do Lab 5++, propose a significant optimization that is not covered in class (e.g. an optimization for loops or a whole program optimization). Give us details on a couple of benchmarks that show the usefulness of the optimization proposed. Some ideas:

- Vectorization: optimizations using SIMD instructions
- Profile directed optimizations
- Integrated scheduling and register allocation
- Locality Optimizations (e.g. SRP, blocking)
- Better analysis for traditional optimizations (e.g. using SSA for memory or alias analysis)

Requirements

In 1–2 pages (single-spaced, 12pt font), tell us about a project that you think would be interesting and fun to implement by augmenting your compiler. This project should involve a reasonable amount of work but be something you think you can achieve in the allotted amount of time for the Lab 5++ or Lab 6 assignment.

You should propose a project that has not been covered in class and is not one of the predefined ones. In your proposal, you should be sure to include:

- A description of what you plan to do. This should be about 1/3 of the proposal.
- A brief motivation of why it is interesting.
- How you plan to implement it: what changes do you need to make to the high level structure of your compiler? Are there phases that you would like to add, and how do they interact with the end goal? This should be about 1/3 of the proposal.
- How you plan to test it: how do you know if your project is successful? What sort of testing suite would you provide? What are the types of programs that would demonstrate its usefulness?
- A bibliography

To reiterate for teams completing Lab 6: even if you are planning to extend your compiler to `C1` or implement garbage collection, please explore a novel idea for this proposal. This is meant to get you thinking about ways to extend your compiler beyond what people have done in the past, and beyond the standard ways presented in the preset options for Lab 6. However, it should be comparable in difficulty to the other labs. The topic you explore in your writeup should be reasonable to complete within the roughly 2 weeks allotted for the assignment.

Have fun! If you have any questions about this assignment (or would like to talk out if something is a "reasonable" amount of work), please post on Piazza or talk to the course staff at office hours.

Grading

You can earn 30 points for this assignment. We will roughly divide the points as follows: 5 points for the general idea, 5 points for the motivation, 10 points for the description, 5 points for the implementation plan, and 5 points for testing.

What to Hand In

Submit before the deadline a 1-2 page, single spaced, 12pt font PDF file with your proposal to Gradescope. Make sure that the PDF contains a header with the following information:

Team name:	YOUR TEAM
Title:	YOUR TITLE
Project:	Lab 5++ OR Lab 6

We will activate team submissions so that either team member is able to submit.