

Programming Language Concepts

Introduction and Overview

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April 4, 2023

Course Description

This course is a study of the syntax and semantics of a diverse set of high-level programming languages. The languages chosen are compared and contrasted in order to demonstrate general principles of programming language design and implementation. The course emphasizes the concepts underpinning modern languages rather than the mastery of particular language details. Programming projects will be required.

Course Goals

Widen perspective and understanding of PLs.

- Alternative programming paradigms and languages
- Theory that underlies language mechanisms
- Implementation choices for implementing languages
- Become a much better programmer
 - (in any language, even languages we won't study)

Why not study programming languages?

- “I only need to know C++ (or C# or Java or Python or ...) to get a job.”
- “I already know how to program.”
- “I will never need to design (or implement) a programming language.”

Course Motivation

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- How many have been on co-op? and used a programming language that had not been introduced in a course?
- Are you ever done learning how to paint? dance? build?
- How many have used a non-trivial library API (e.g., OpenGL)?

Course Motivation

Why study programming languages?

Languages influence way of thinking:

- Learn to learn languages
 - Use more than one language in your career
- Learn to more effectively use languages
 - Understand features and implementations
- Learn to design languages
 - Use a language to solve a problem

Can't cover everything about programming languages; focus on some of the great features (that are repeated in many languages).

Course Motivation

How not to study programming languages concepts:

- Java in January
- Forth in February
- Modula-3 in March
- Ada in April
- ...

Course is titled “Programming Language Concepts” and not “Programming Languages” for a reason.

Course Motivation

How we will study programming language concepts:

- use “micro” languages based on “real” languages
 - focus on the essential great features
- introduce intellectual tools to define languages
 - precision to understand great features
 - starting point for PL research

Introductions and Icebreaker

Who am I?

- Arthur Azevedo de Amorim
- discovered the field in undergrad (lambda calculus, logic, formal verification)
- Studied PL in graduate school and beyond
 - Fuzz language for differential privacy
 - Gradual typing for information flow control
 - C with compartments

Introductions and Icebreaker

Who are you?

Give your name and name a programming language (no repeats).