CS 6110 — Advanced Programming Languages

Lecture 1
Introduction

27 January 2016

Programming Languages

One of the oldest fields in Computer Science...

- λ-calculus – Church (1936)
- FORTRAN – Backus (1957)
- LISP – McCarthy (1958)
- ALGOL 60 – Backus, Naur, Perlis, & others (1960)
- Pascal – Wirth (1970)
- C – Ritchie (1972)
- Smalltalk – Kay & others (1972)
- ML – Milner and others (1978)
- C++ – Stroustrup (1982)
- Haskell – Hudak, Peyton Jones, Wadler, & others (1989)
- Java – Gosling (1995)
- C# – Microsoft (2001)
- Scala – Odersky (2003)
- F# – Syme (2005)

Programming Languages

...and one of the most vibrant areas today!

PL intersects with many other areas

Current trends

- Domain-specific languages
- Static analysis and types
- Language-based security
- Formal verification
- Concurrency

Both theoretically and practically “meaty”

Syllabus

Course Goals

- Learn techniques for modeling programs*
  - Formal semantics (operational, axiomatic, denotational)
  - Modeling to advanced language features
  - Develop reasoning principles (induction, co-induction)
- Explore applications of these techniques
  - Optimization
  - Static analysis
  - Verification
- PhD students: cover material for PL qualifying exam
- Have fun :-)

*and whole languages!

Prerequisites

Programming Experience

- e.g., C, Java, Prolog, OCaml, Haskell, Scheme/Racket
- Comfortable with a functional language
- For undergrads: CS 3110 or 4110 or equivalent

Mathematical Maturity

- e.g., set theory, rigorous proofs, induction
- Much of this class will involve formal reasoning
- Hardest topic: denotational semantics

Interest (having fun is a goal! :-)

If you don't meet these prerequisites, get in touch.

Course Work

Participation (5%)

- Lectures, recitations, and office hours
- Email list discussions

Homework (30%)

- 6 assignments, roughly every other week
- Mostly theoretical, some programming
- *Strongly* encouraged to work with a partner
- Two "slip" days: automatic 48-hour extension

Preliminary Exam (25%)

- March 22nd + take-home problems.

Final Exam (40%)

- Date and time TBA
- Cumulative, with focus on the material from 2^{nd} half

Academic Integrity

Two simple requests:

1. Most of you are here training to become members of the research community. Conduct yourself with integrity.

2. If you aren't sure what is allowed and what isn't, please ask!

Special Needs and Wellness

- I will provide reasonable accommodations to students who have a documented disability (e.g., physical, learning, psychiatric, vision, hearing, or systemic).

- If you are experiencing undue personal or academic stress at any time during the semester (or if you notice that a fellow student is), contact me, Engineering Advising, or Gannett.

Course Staff

Instructor

Nate Foster
Office: Gates 432
Hours: Mondays 4am-5pm

Teaching Assistant

Eric Perdew
Hours: TBA

(office hours start next week)

Web Page

`http://www.cs.cornell.edu/Courses/cs6110/2016sp`