CMSC 430

Introduction to ~~Compilers~~ Programming Language Design and Implementation

Introduction

Fall 2016

Why take this course?

- Programming languages matter
  - In theory, almost all languages are equivalent (Turing complete)
  - In practice, languages make it easier/harder to do different things
- At some point in your career, the language you are working in may not be good enough
- (Name some languages you know or have heard of, and describe what they're good for)

Course goals

- At the end of this course, you should be able to
  - Understand the design and implementation of existing languages
  - Design and implement a small programming language
  - Extend an existing language

Warning

- A little knowledge is a dangerous thing

  Domain-specific languages tend to evolve into badly designed general purpose languages

  — (paraphrased) Paul Hudak

  - Examples?

- Moral:
  - Don’t design a new language when an existing one will do
  - Some languages let you create new domain-specific languages internally, to a greater or lesser extent

Topics

- Lexing and parsing
- Operational semantics and Interpreters
- Intermediate representations
- Code generation
- Dataflow analysis
- Optimization
- Type systems
- Register allocation
- Advanced topics

Course overview

- Project 1: OCaml warmup
- Project 2: Develop a parser
- Project 3: Build a VM
- Project 4: Compile a small language
- Project 5: Compile a small language (part 2)
- Project 6: Build a type checker

- Meet your professor!

Grading

- 6 programming projects (42%)
- 2 Midterms (34%)
- Final (23%)
- Meet your professor (1%)

Textbook

- None

- There is simply no book available that covers the right set of topics
  - Use these lecture notes as a reference
  - Take your own notes

Other administrivia

- Will use submit and grade server
  - Programs *must* work on the submit server
- Announcements and discussions on Piazza
  - Do not post code or test cases on Piazza
  - Do not give away answers on Piazza
- GRACE accounts
- Projects due at midnight on due date
- Homework due at **start** of class on due date
  - Unless otherwise specified
- Let me know as soon as possible if you have an excused absence
- Avoid academic dishonesty