

CMSC 430

~~Introduction to Compilers~~

Programming Language Design and Implementation

Introduction

Spring 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
- Type systems
- Dataflow analysis
- Register allocation and optimization
- Advanced topics

Course overview

- Project 1: OCaml warmup
- Project 2: Unit calculator
 - “42 furlongs per fortnight in m/s” \rightarrow 0.006985 m/s
- Project 3: Interpret a small language
- Project 4: Compile a small language
- Project 5: Compile a small language (part 2)
- Project 6: Build a type checker

- Meet your professor!

Grading

- 5-6 programming projects (40%)
- 2 Midterms (35%)
- Final (24%)
- 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 administrvia

- 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**