Principles of Programming Languages

CS496

Teachers

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About this Course

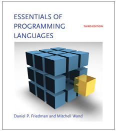
- Programming Languages as objects of study
- We study de principles on which PL are erected
- We do so by implementing these concepts in our own PLs
- This is a hands-on course

Ask questions!

- Feel free to interrupt and ask questions at any time
  - Your questions also help me better understand the topics
  - It also helps classmates who might have similar doubts
- Contact me by email
- Come see me during office hours
- See the CAs during their office hours

Bibliography

- The book we follow (these slides are a complement)



- However, we do not use Scheme
- Relevant additional texts
  - Structure and Interpretation of Computer Programs (H. Abelson and G. J. Sussman with J.Sussman, MIT Press, 1984)
  - Types and Programming Languages (B. Pierce, MIT Press, 2002)

Important Information in the Syllabus – Homework

- Policy for late submissions: 2 points off for every hour past the deadline.
- 0 if code does not compile or submission is empty

Quizzes

- On Wednesdays
- 0 if absent
- Solved in class immediately after handing it in
- You receive two copies of a quiz
  - One copy is handed in (this is not returned)
  - The other copy is for writing down feedback

Exams

- Three
  - Midterm
  - Endterm
  - Final
- The final exam is cumulative.
- Midterm and endterm exam dates are listed in the tentative course schedule available in Canvas.
- If, after the grades for all quizzes, assignments and midterm and endterm are in, your average is 90 or over, you may opt out of the final.

Weight of Grading Categories

Homework	(30%)
Quizzes	(10%)
Midterm	(20%)
Endterm	(20%)
Final Exam	(20%)

The Interpreter Approach

- Fundamental concepts in PL studied by
  - Defining a representative language
  - Defining the concepts required to execute a program in this language
  - Defining an interpreter that executes such programs
- Interpreters allow for a deep understanding of PL concepts

Some Concepts we shall Study

- Foundations of expressions: inductive sets, recursion, induction
- Functional Programming: expression, value, closure, environment, substitution, type checking, type inference
- Imperative Programming: Command, effect, mutable variable, state
- Object Oriented Programming: class, object, class hierarchy, inheritence, dynamic method dispatch, static method dispatch, super, self

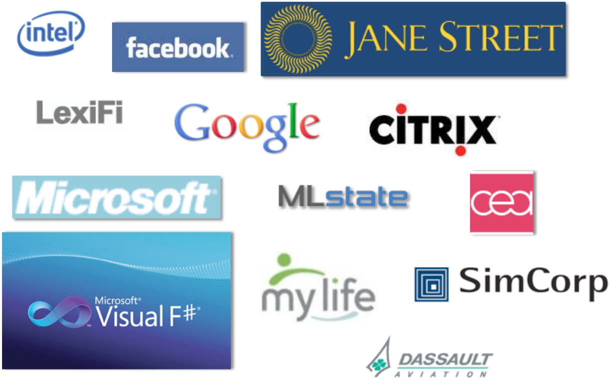
Our Host Language

- Hands-on approach to these concepts
  - We'll write interpreters for simple PLs that build on them
- We'll use a functional language for writing interpeters
  - They are declarative
  - Provide a high-level of abstraction
    - Programs considered "executable specifications"
- Examples:
  - OCaml (we'll use this one)
  - Haskell
  - ML
  - Erlang
  - Scheme
  - F#, etc.

OCaml

- Industrial-strength, statically-typed functional programming language
- Lightweight, approachable setting for learning about program design

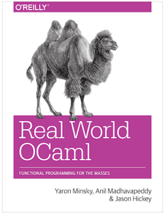
Who else uses OCaml?[1]



[1] Source: `www.seas.upenn.edu/~cis120`

Bibliography

- We will mainly follow *Introduction to Objective Caml*, a set of notes by Jason Hickey `courses.cms.caltech.edu/cs134/cs134b/book.pdf`
- A great reference to continue learning (`https://realworldocaml.org`)


O'REILLY
Real World OCaml
FUNCTIONAL PROGRAMMING FOR THE MASSES
Yaron Minsky, Anil Madhavapeddy & Jason Hickey

Installing OCaml

- Document will be provided through Canvas