Course Introduction

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Welcome to CS 421!

Topics for discussion:

- Logisitics – instructor, course objectives
- Why study languages?
- Major themes for the course

Me!

Name Mattox Beckman

History PhD, Fall 2003, University of Illinois at Urbana-Champaign
Lecturer 2003–2015 Illinois Institute of Technology

Research Areas CS Education, Programming Languages, Mathematical Foundations of Computer Science

Specialty Partial Evaluation, Functional Programming

Professional Interests Teaching; Computer Science Education; Functional Programming; Semantics and Types; Category Theory

Personal Interests Cooking; Go (Baduk, Wei-Qi, Igo); Theology and Philosophy; Evolution; Meditation; Kerbal Space Program; Home-brewing; ... and many many more ...

Machine Problems

- Machine Problems – collectively worth 15%
- Designed to help you study for the exams, and to achieve major course objectives
- Full collaboration allowed for the programming part, but **you must cite your sources!**
- There will be a followup Machine Lab for many of these.
- Don't use the "perturbation method" of solving machine problems! We expect you to *understand* the solution and the process very well.
- See the syllabus for more details.

Machine Labs

- Collectively worth 15%
- There are one of these for each MP.
- We give you an MP solution with some interesting bits deleted.
  - We may give you something *similar* to your MP …
- You get one hour to complete the solution.
- Idea: testing if you learned the material on the MP

Exams/Quizzes

- The purpose of an exam is to measure mastery of material.
  - Exams are subdivided into proficiency units.
  - The final exam will retest many of the proficiency units. If you improve your score, we update your midterm score with it!
- Two midterms: 20% each
- Final exam: 25%

Why Study Languages?

- *Pai sei*
- Blub – see *Beating the Averages* by Paul Graham. [Gra03]
- Language families

Pai Sei

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- A story from human languages: *pai sei*

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- Languages and cultures grow together to shape each other.
- It's difficult to reason about something without vocabulary!
- See *Politics and the English Language* by George Orwell. [Orw46]

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- From *Beating the Averages* by Paul Graham
- The difference between a known powerful language to a less powerful language is easy to see.
- The difference between a known less powerful language to a more powerful language is not easy to see!

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3. Mathematical Foundations
   You will learn some of the mathematical theory that lets us reason about programming languages and the programs written in them.
4. Pragmatics
   You will learn some of the design decisions available to you when choosing (or creating!) a language.

So, what should you learn?

- Understand major classes of programming languages: techniques, features, styles.
- How to select an appropriate language for a given task.
- How to read a formal specification of a language and implement it.
- How to write a formal specification of a language.
- Some Powerful Ideas:
  1. Recursion
  2. Abstraction
  3. Transformation
  4. Unification

The emphasis is on learning the theory, knowing why the theory is valuable, and using it to implement a language.

Bibliography

[Bac97] John Backus. "Can Programming Be Liberated from the von Neumann Style? A functional Style and Its Algebra of Programs." In: ACM Turing Award Lecture (1997).

[Gra03] Paul Graham. *Beating the Averages*. Apr. 2003. URL: http://www.paulgraham.com/avg.html.

[Orw46] George Orwell. "Politics and the English Language." In: *Horizon* 13.76 (Apr. 1946), pp. 252–265. URL: http://www.resort.com/~prime8/Orwell/patee.html.