

Course Introduction

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DEPARTMENT OF COMPUTER SCIENCE

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); Philosophy; Evolution; Meditation; Kerbal Space Program; Home-brewing; ... and many many more ...

Activities

- ▶ This is a **flipped** classroom!
 - ▶ Please watch the lecture video *before* coming to class!
- ▶ In class activities (TPS or POGIL) to reinforce learning. Worth 5% of your grade.
- ▶ Prairielearn activities to consolidate/apply learning. Worth 5% of your grade.
- ▶ There is not necessarily a post-class activity for each day.

Machine Problems

- ▶ Machine Problems – collectively worth 25%
- ▶ Designed to help you study for the exams, and to achieve major course objectives
- ▶ You are allowed one partner for the programming part, but **you must cite your sources!** (Place partner netids in a comment at the top.)
- ▶ 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.

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!
- ▶ Four midterms: 10% 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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- ▶ 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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1. Functional Programming

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You will learn some of the mathematical theory that lets us reason about programming languages and the programs written in them.

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You will learn how text becomes a data structure we can use to represent a program.
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>.