Welcome to CS 421!

Course Introduction

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Topics for discussion:

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



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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%



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Why Study Languages?

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

Pai Sei

Different languages can express different concepts efficiently!

A story from human languages: pai sei





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- A story from human languages: pai sei
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Different languages can express different concepts efficiently!

- A story from human languages: pai sei
- 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]

Blubs

From Beating the Averages by Paul Graham





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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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Themes

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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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- 2. Parsing 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.



