Course Introduction

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Department of Computer Science
Welcome to CS 421!

Topics for discussion:

- Logistics — instructor, course objectives
- Why study languages?
- Major themes for the course
# Me!

<table>
<thead>
<tr>
<th>Name</th>
<th>Mattox Beckman</th>
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<tbody>
<tr>
<td>History</td>
<td>PhD, Fall 2003, University of Illinois at Urbana-Champaign Lecturer 2003–2015 Illinois Institute of Technology</td>
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<tr>
<td>Research Areas</td>
<td>CS Education, Programming Languages, Mathematical Foundations of Computer Science</td>
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<tr>
<td>Specialty</td>
<td>Partial Evaluation, Functional Programming</td>
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<tr>
<td>Professional Interests</td>
<td>Teaching; Computer Science Education; Functional Programming; Semantics and Types; Category Theory</td>
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<tr>
<td>Personal Interests</td>
<td>Cooking; Go (Baduk, Wei-Qi, Igo); Philosophy; Evolution; Meditation; Kerbal Space Program; Home-brewing; ... and many many more ...</td>
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Mastery Grading

- The first thing: your grade is not based on points in this course!
- We use Mastery Grading.
  - Your ability to demonstrate mastery of a concept is what counts.
  - 20 (ish) Learning Modules
  - Each module has some objectives

- Advantages:
  - Once you have the LM, you’re done with it.
  - You will know precisely what to study for on the final!
  - You will know precisely what you need to do for a particular grade!
Activities

- This is a **flipped** classroom!
  - Please watch the lecture video *before* coming to class!
- In class activities (TPS or POGIL) to reinforce learning.
- Post-class prairielearn activities to consolidate/apply learning.
  - These often fulfill part of an LM.
- There is not necessarily a post-class activity for each day.
Machine Problems

- 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 that correspond to LMs.
  - Exams are "second chanced". Midterm 2 will have all of midterm 1 for a retry.
- We expect three midterms.
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
Pai Sei

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- A story from human languages: pai sei
- Languages and cultures grow together to shape each other.
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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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Blubs

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- The difference between a known powerful language to a less powerful language is easy to see.
Blubs

- 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!
Themes

The course has four major parts:

1. Functional Programming
   You will learn functional programming by learning how to build interpreters in HASKELL.
Introduction and Logistics

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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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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

