CSE130: Programming Languages

Winter 2018

Tue&Thur 6:30-7:50 PM

Deian Stefan

Your instructor

- Assistant Professor in CSE
- Research: building secure systems
  - Security + PL + Systems
- Industry: startup building secure runtime for Node.js
  - Lots of PL ideas appear in daily work

Your TAs

- Abdulrahman Alkhelaifi
- Nadah Feteih
- Purag Moumdjian
- Kaiser Pister
- Sanjeev T Reddy

What is CSE 130 about?

What this course is **not** about?

- Learning how to write...
  - JavaScript in January
  - Haskell in February
  - C++ in March
  - etc.
- Learning C++, JavaScript, etc. to spec

What this course **is** about

- Concepts in programming languages
  - Fundamentals and core features and building blocks
  - Different programming paradigms and their use
- Design and implementation of languages
  - Goals and trade-offs (with historical context)
  - The cost of a language feature

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- Design and implementation of languages
  - Goals and trade-offs (with historical context)
  - The cost of a language feature

Why?

- Concepts in programming languages
  - Language shapes your thinking! Language features dictate how we express ideas and computation
  - E.g., think of error handling in C vs. Java
- Design and implementation of languages
  - Nothing is free: understand what you're giving up and what you're gaining when choosing a language
  - E.g., exception handling, garbage collection, etc.

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This program prints “Hello World!”:

```
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https://en.wikipedia.org/wiki/Brainfuck

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Why else?

- You can learn any of those languages… once you have a grasp of the fundamentals and understand features

- You'll usually want to use the right lang for the job… this ultimately comes down to what features you need

- You will be able to think about programs differently… since you will understand what's going on underneath

- You will be in better shape to design and implement new languages… great features ➠ great language!

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I'll be working on languages?

- Lots of systems have their own languages or have a language runtime system at their core:
  - Editors (Lisp for Emacs, JavaScript for Atom)
  - DBs (SQL, MongoDB's JavaScript, ...)
  - PDF viewers (JavaScript!?)
- PL is hot! Likely to work on something new in industry

Flow, React @ Facebook Rust, Emscripten @ Mozilla,
TypeScript @ Microsoft Swift @ Apple CUDA @ NVIDIA

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TypeScript @ Microsoft Swift @ Apple CUDA @ NVIDIA

If nothing else...

You can put Haskell and Rust on your resume!

Syllabus: The great ideas [Ramsey]

Expressive power (say more with less)

First-class functions

Pattern matching

Type inference

Exception handling

Monads

Continuations

Reliability and reuse

Type polymorphism

Type classes

Modules

Objects & inheritance

Cross-cutting concerns

Memory management

Concurrency

The great ideas [JavaScript]

Expressive power (say more with less)

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Week of	Tuesday	Thursday	Friday (section)
Jan 09 Jan 11	Intro and JavaScript crash course	High-order functions	
Jan 16 Jan 18	Lambda calculus	Lambda calculus (cont)	
Jan 23 Jan 25	Scope, storage management, function implementation	Haskell crash course	Haskell crash course (cont)
Jan 30 Feb 01	Type polymorphism and type inference	Type polymorphism and type inference (cont)	Midterm review
Feb 06 Feb 08	**Midterm**	Type classes	
Feb 13 Feb 15	Type classes (cont)	Objects	
Feb 20 Feb 22	Objects (cont)	vtables, subtyping, inheritance	
Feb 27 Mar 01	Control flow, continuations, monads	Control flow, continuations, monads (cont)	
Mar 06 Mar 08	Rust crash course	Concurrency (cont)	Rust crash course (cont)
Mar 13 Mar 15	Concurrency (cont)	Concurrency (cont)	

Logistics & course mechanics

Contact information

- Course website: http://cse130.programming.systems
  - Goto place for links and resources
- Piazza: https://piazza.com/ucsd/winter2018/cse130
  - Use this for general discussions and questions
- Staff email: ucsd-cse130-winter18@googlegroups.com
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Logistics: Lectures & Section

- Lectures: Mondays and Wednesdays
  - We will assign reading before every class
  - Come prepared, bring clickers: we will ask questions during lecture
- Section: Fridays
  - Come to section with questions!
  - Goal: go over course material and problems similar to those assigned for homework

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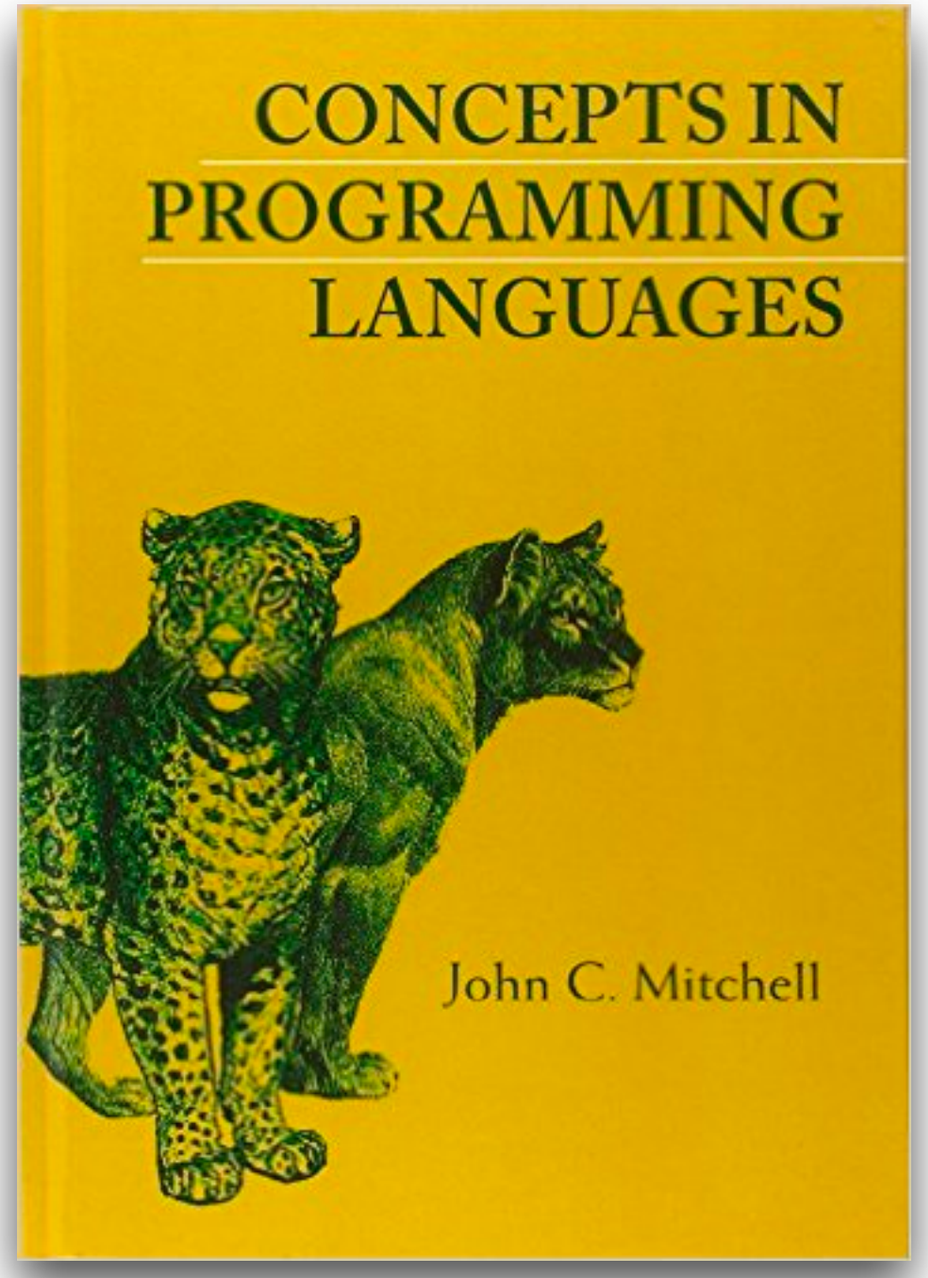
Reading from:

- Optional course textbook
  - Concepts in Programming Languages by John Mitchell
  - Renting: cheaper option
  - We'll be distributing new Chapters
- Papers & online resources



Logistics: Participation [5%]

- In class: answer questions, ask questions
- OH: ask questions, answer questions
- Online: ask questions, answer questions
  - I've give an **additional 5%** to the students who really put in the effort to help on Piazza

Logistics: Assignments [35%]

- Homework: roughly every week
  - Work in **groups of 3** (but try to do it on your own first!), submit using gradescope
  - Will be released Wednesdays
  - Early deadline: following Tuesday night
    - You get 10% of your grade if you turn it in early!
  - Hard deadline: following Friday night

Logistics: Assignments [35%]

- Programming labs: roughly one every 2 weeks
  - Submit solution **by yourself** using gradescope
  - Will be released Fridays
  - Hard deadline: 2 weeks from the release date on Friday night

Exams [60%]

- Midterm exam: Feb 06, in class [25%]
  - Can screw up; we'll compute your score as:

```
midterm > 0 ?  max(final, midterm) : 0
```

  - Will reflect assignments, pretty straight forward
- Final exam: March 20, location and time TBA [35%]
  - Will test you in new setting, expect to learn!

Summary: grading breakdown

- Participation: 5%
- Assignments: 35%
- Exams: 60%

Collaboration policy

- Talk with each other, talk on Piazza, use resources
  - Collaboration is a good thing! Just credit the person or resource in you submission
- That said: I expect you to turn in your own work
  - Don’t discuss particularities of a solution with others
  - Don’t ask for a solution on StackOverflow and the like
  - See academic integrity statement

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Academic integrity, conduct, etc.

- Goal: welcoming class where all can learn and feel included, safe, healthy
  - I don't want to run the class like a police state, but these two rules will be enforced: these matter even once you graduate!
  - Eat, sleep, take care of your health
  - Talk to me if you're concerned

Feedback wanted!

- How's the pace?
- Are there particular topics you want to spend more time on?
- What can I do to make your learning experience better?

Questions?