CSE341: Programming Languages

Lecture 26
Course Victory Lap

Dan Grossman

Winter 2013

Final Exam

As also indicated in class-list email:

- Next Thursday, 8:30-10:20
- Intention is to focus primarily on material since the midterm
  - Including topics on homeworks and not on homeworks
  - May also have a little ML, just like the course has had
- You will need to write code and English

- I hope you will pick up your exams when available
  - Probably early Spring Quarter

Victory Lap

A victory lap is an extra trip
around the track
- – By the exhausted victors (us) ☺

Review course goals
- – Slides from Introduction and Course-Motivation

Some big themes and perspectives
- – Stuff for five years from now more than for the final

You might be curious about that Coursera thing ☺

Course evaluations: please do take some time

Thank you!

- **Huge** thank-you to your TAs
  - Unbelievable grading scripts
  - Section taken to the next level
  - Great team effort putting 341 students first
    - Even after we mostly lost Eric to illness

- Seriously, an epic dream team: thank you Cody, Eric, Rachel, Sean, Sunjay!!

Thank you!

- And a huge thank you to all of **you**
  - Great attitude about a very different view of software
  - Good class attendance and questions
  - Zero (!) lonely office hours
  - Occasionally laughed at stuff ☺

- Computer science ought to be challenging and fun!

A Word on Coursera

- My 341 goal: Coursera benefits outweigh costs
  - Videos, reading notes, large staff

    > huge other time commitment

- What happened "out there":
  - Same homeworks, different exams
  - > 900,000 video views; 30,000 clicked play on at least 1
  - 5000 turned in first homework
  - 2200 turned in MUPL interpreter
  - More challenging than most online courses
    - Then again, more challenging than most UW courses ☺

- Questions? Thoughts?
- Want to help make it better?

[From Lecture 1]

- Many essential concepts relevant in any programming language
  - And how these pieces fit together

- Use ML, Racket, and Ruby languages:
  - They let many of the concepts "shine"
  - Using multiple languages shows how the same concept can "look different" or actually be slightly different
  - In many ways simpler than Java

- Big focus on *functional programming*
  - Not using *mutation* (assignment statements) (!)
  - Using *first-class functions* (can't explain that yet)
  - But many other topics too

[From Lecture 1]

Learning to think about software in this "PL" way will make you a better programmer even if/when you go back to old ways

It will also give you the mental tools and experience you need for a lifetime of confidently picking up new languages and ideas

[Somewhat in the style of *The Karate Kid* movies (1984, 2010)]
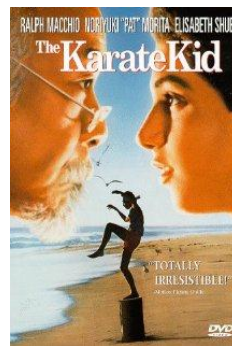
[From Course Motivation]

- No such thing as a "best" PL

- Fundamental concepts easier to teach in some (multiple) PLs

- A good PL is a relevant, elegant interface for writing software
  - There is no substitute for precise understanding of PL semantics

- Functional languages have been on the leading edge for decades
  - Ideas have been absorbed by the mainstream, but very slowly
  - First-class functions and avoiding mutation increasingly essential
  - Meanwhile, use the ideas to be a better C/Java/PHP hacker

- Many great alternatives to ML, Racket, and Ruby, but each was chosen for a reason and for how they complement each other

[From Course Motivation]

SML, Racket, and Ruby are a useful *combination* for us

	dynamically typed	statically typed
functional	Racket	SML
object-oriented	Ruby	Java

ML: polymorphic types, pattern-matching, abstract types & modules

Racket: dynamic typing, "good" macros, minimalist syntax, eval

Ruby: classes but not types, very OOP, mixins

   [and much more]

Really wish we had more time:

Haskell: laziness, purity, type classes, monads

Prolog: unification and backtracking

[and much more]

Benefits of No Mutation

[An incomplete list]

1. Can freely alias or copy values/objects: Unit 1

2. More functions/modules are equivalent: Unit 4

3. No need to make local copies of data: Unit 5

4. Depth subtyping is sound: Unit 8

State updates are appropriate when you are modeling a phenomenon that is inherently state-based
  – A fold over a collection (e.g., summing a list) is not!

Some other highlights

- Function closures are *really* powerful and convenient…
    - … and implementing them is not magic

- Datatypes and pattern-matching are really convenient…
    - … and exactly the opposite of OOP decomposition

- Sound static typing prevents certain errors…
    - … and is inherently approximate

- Subtyping and generics allow different kinds of code reuse…
    - … and combine synergistically

- Modularity is really important; languages can help

From the syllabus

Successful course participants will:

- Internalize an accurate understanding of what functional and object-oriented programs mean

- Develop the skills necessary to learn new programming languages quickly

- Master specific language concepts such that they can recognize them in strange guises

- Learn to evaluate the power and elegance of programming languages and their constructs

- Attain reasonable proficiency in the ML, Racket, and Ruby languages and, as a by-product, become more proficient in languages they already know

The End

This really is my favorite course and it probably always will be

☺

Don't be a stranger!