Lecture 1: Course Overview.
Owen Arden
UC Santa Cruz

A Programming Language

- Two variables
  - x, y
- Three operations
  - x++
  - x--
  - (x=0) ? L1 : L2

L1: x++;
    y--;
    (y=0) ? L2 : L1
L2: ...

Fact: This is “equivalent to” to every PL!
Good luck writing quicksort
... or Windows, Google, Spotify!

So why study PL?

Programming language shapes
Programming thought
“programming languages are not merely technologies, but habits of mind as well, and nothing changes slower”

Paul Graham (co-founder of Y Combinator)
http://paulgraham.com/xxa.html

“You can’t trust the opinions of the others, they’re satisfied with whatever language they happen to use, because it dictates the way they think about programs.”

Paul Graham (co-founder of Y Combinator)
http://paulgraham.com/xxa.html

So why study PL?

Language affects how:
• Ideas are expressed
• Computation is expressed
Course Goals

“Free your mind”
-Morpheus

Learn New Languages/Constructs

New ways to:
- describe
- organize
- think about computation

Goal: Enable you to Program

- Readable
- Correct
- Extendable
- Modifiable
- Reusable
#goals

## Learn How To Learn

**Goal: How to learn new PLs**

No Java (C#) 15 (10) years ago

Learn the **anatomy** of a PL
- Fundamental **building blocks**
- Different guises in different PLs

Re-learn the PLs you already know

## Design new languages
Goal: How to design new PLs

...“who, me?”

Buried in every extensible system is a PL
- Emacs, Android: Lisp
- Word, Powerpoint: Macros, VBScript
- Unreal: UnrealScript (Game Scripting)
- Facebook: FBML, FBJS
- SQL, Renderman, LaTeX, XML ...
Speaking of Right and Wrong...

Imperative Programming

x = x+1
WTF?

\[ x = x + 1 \]

Imperative = Mutation

Imperative = Mutation

Bad!
Don’t take my word for it

John Carmack
Creator of FPS: Doom, Quake,…

Don’t take my word for it

Tim Sweeney (Epic, Creator of UNREAL)

“In a concurrent world, imperative is the wrong default”

Functional Programming
Functional Programming?

No Assignment.
No Mutation.
No Loops.

OMG! Who uses FP?!

So, Who Uses FP?

Google

MapReduce
So, Who Uses FP?

Microsoft
Linq, F#

So, Who Uses FP?

facebook
Erlang

So, Who Uses FP?

twitter
Scala
So, Who Uses FP?

Wall Street
(all of the above)

So, Who Uses FP?

...CMPS 112

Course Mechanics
Mechanics

Course website: users.soe.ucsc.edu/~owen/courses/cmps112/spr19

Course text: *Thinking Functionally in Haskell*, Richard Bird
(Online copies available through library)

---

Peer Instruction (ish)

---

Peer Instruction

- Make class interactive
  - Help YOU and ME understand what's tricky

- Respond to in-class quizzes
  - 5% of your grade
  - Respond to 75% questions

- Seating in groups (details soon)

- Bring laptop if you have one
1. Solo Vote: Think for yourself, select answer

2. Discuss: Analyze Problem in Groups of 3
   - Practice analyzing, talking about tricky notions
   - Reach consensus
   - Have questions, raise your hand!

3. Group Vote: Everyone in group votes
   - Must have same vote to get points

4. Class-wide Discussion:
   - What did you find easy/hard?
   - Questions from here show up in exams

Let’s try it out (if you have a device):

http://tiny.cc/cmps112-trial

Make your individual choice

Now “confer” with a neighbor and agree on a choice for your “group”
Requirements and Grading

- In-Class Exercises: 5%
- Midterm: 30%
- Programming Assignments (~7): 30%
- Final: 35%

Two hints/rumors:
1. Lot of work
2. Don’t worry (too much) about grade

Note: Regrades must be requested in person within two weeks of receiving grade

Resources

- Online lecture notes
- TFfH readings and exercises
- Webcasts:
  - User: cmps-112-1
  - Pass: lambda
- Pay attention to lecture and section!
- Do assignments yourself (+partner)!

Ask for help!

- Lots of help available M-Th, will be adding more soon. (watch website)
Webcast available

- User: cmps-112-1
- Pass: lambda

Suggested Homeworks

- Typically on webpage after Thursday lecture
- Based on lectures and/or suggested readings
- Recommended, ungraded, HW problems are sample exam questions
- Webpage will have first samples soon

Programming Assignments

Schedule up on webpage. May be done in groups of two, if desired. See link on website.

Code in GitLab (sign up!). Submit on Canvas
- You must push your submitted code.

Deadline Extension:
- Four “late days”, used as “whole unit”
- 5 mins late = 1 late day
- Plan ahead, no other extensions

HW #0 online, due 4/12, 11:59 PM
Programming Assignments

Unfamiliar languages
+ Unfamiliar environments

Start Early!

Weekly Programming Assignments

Scoring = Style + Test suite

No Compile, No Score

Weekly Programming Assignments

Forget Java, C, C++ ...
... other 20th century PLs

Don’t complain
... that Haskell is hard
... that Haskell is @$%#@
Immerse yourself in new language

It is not.

#goals

FREE YOUR MIND

Word from our sponsor ...

- Programming Assignments done ALONE or in (official) groups of two
- We use plagiarism detection software
  - MOSS is fantastic, plagiarize at your own risk
- Zero Tolerance
  - offenders punished ruthlessly
- Please see academic integrity statement:
  - https://ue.ucsc.edu/academic-misconduct.html