

# CMPS 112: Spring 2019

## Comparative Programming Languages

### *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

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“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/avg.html>

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“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/avg.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



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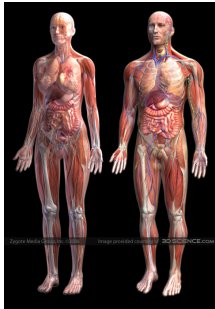
## Goal: How to learn new PLs

No Java (C#) 15 (10) years ago  
AJAX? Python? Ruby? Erlang? F#?...

Learn the **anatomy** of a PL

- Fundamental **building blocks**
- Different guises in different PLs

Re-learn the PLs you already know



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## 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 ...



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## Enables you to choose right PL

“...but isn’t that decided by

- libraries,
- standards,
- and my boss ?”

Yes.



*My goal: educate tomorrow's tech leaders  
& bosses, so you'll make informed choices*

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,...



**John Carmack**  
@ID\_AA\_Carmack

Follow



I am starting to remove op= operator overloads to discourage variable mutation.

39  
RETWEETS

16  
FAVORITES



2:55 PM - 28 Feb 12 via web · Embed this Tweet

[Reply](#) [Retweeted](#) [Favorite](#)

## 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 ?**

The Google logo, consisting of the word "Google" in its characteristic multi-colored font.

**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](https://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 whats 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

## In Class Exercises

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

## In Class Exercises

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

Indoctrination (a test)

\* Required

$x = x + 1$  \*

1 point



☐ This is fine



☐ This is fine.

<http://tiny.cc/cmpps112-trial>

Make your individual choice

## In Class Exercises

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

Indoctrination (a test)

\* Required

$x = x + 1$  \*

1 point



☐ This is fine



☐ This is fine.

<http://tiny.cc/cmpps112-trial>

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
- *TFiH* 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)

CMP5 112 Discussion Alex, Physicscourse Lab			
	Office Hours: Dariah 12:00 - 1:30pm 12, Room 590	CMP5 112 Discussion 3:20 - 4:50pm Physicscourse Lab	Office Hours: Priyanka 12:00 - 1:30pm 12, Room 590
			CMP5 112 10:00 - 11:50am Physicscourse Lab
CMP5 112 Discussion 12:00 - 1:30pm Course Assist 100			
Office Hours: Alex 9:00 - 4:00pm	CMP5 112 2:20 - 4:50pm Garth & Marissa 1100	Office Hours: Benjamin 1:00 - 4:00pm	CMP5 112 2:20 - 4:50pm Garth & Marissa 1100
CMP5 112 staff meeting 4:30pm, 12-549A	Office Hours: Lynn	Office Hours: Lynn	Office Hours: Lynn

## Webcast available

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

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## 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 20<sup>th</sup> century PLs

**Don't complain**  
... that Haskell is hard  
... that Haskell is @!%@#



Immerse yourself in new language

It is not.

Immerse yourself in new language



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>



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