CS 162 Programming languages

Lecture 1: Hello World!

Yu Feng

Winter 2020

Introducing the cast

Instructor: Yu Feng yufeng@cs.ucsb.edu

Course website: https://github.com/fredfeng/CS162

Research areas: programming languages, program analysis, program synthesis, and security

Introducing the cast

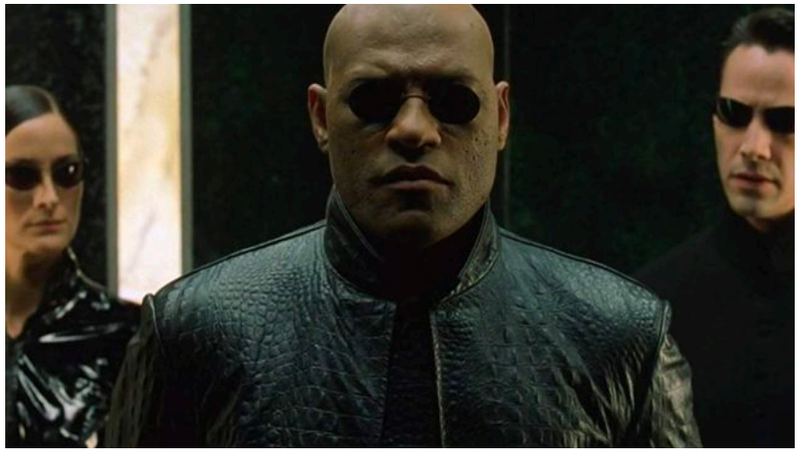
TAs: Yimeng Liu and Yanju Chen

Discussion session: Phelp 3526 Fri 9:00 am

Why study PL?

- "A different language is a different vision of life" — Fellini
- Hypothesis: Programming language shapes programming thought
- Characteristics of a language affect how ideas can be expressed in the language

Course Goal



"Free your mind"
- Morpheus

You will learn several new

- languages and constructs

- ways to describe and organize computation

What does PL buy me?

Enable you to create software that is

- Readable
- Correct
- Extensible
- Reusable
- …

Readability matters!

```
void sort(int arr[], int beg, int end){
  if (end > beg + 1){
    int piv = arr[beg];
    int l = beg + 1;
    int r = end;
    while (l != r-1){
       if(arr[l] <= piv)
          l++;
       else
          swap(&arr[l], &arr[r--]);
    }
    if(arr[l]<=piv && arr[r]<=piv)
       l=r+1;
    else if(arr[l]<=piv && arr[r]>piv)
       {l++; r--;}
    else if (arr[l]>piv && arr[r]<=piv)
       swap(&arr[l++], &arr[r--]);
    else
       r=l-1;
    swap(&arr[r--], &arr[beg]);
    sort(arr, beg, r);
    sort(arr, l, end);
  }
}
```

Quicksort in C

```
let rec sort  l =
  match l with [] -> []
  |(h::t) ->
     let(l,r)= List.partition ((<=) h) t in
     (sort l)@h::(sort r)
```

Quicksort in Ocaml

What does PL buy me?

Will help you learn new languages easily

- No Java (C#) 15 (10) years ago
- Learn the anatomy of PL
- Fundamental building blocks
- Re-visit the languages you already know

What does PL buy me?

Enable you to design new language

Companies develop general purpose PLs

- Google: MapReduce
- Mozilla: Rust
- Nvidia: CUDA
- …

What does PL buy me?

Enable you to choose the right language

Isn't that decided by

- libraries
- standards
- and my boss?

Goal: Educate tomorrow's TL and bosses!

What does PL buy me?

- Make you look at problems in a different way
- Knowing language paradigms other than traditional ones will give you new ways to approach problems, even if you are already a good programmer in Java/Python

Dimension: type model

- Statically typed: Java, C, C++, C#
- Dynamically typed: Lisp, Scheme, Perl
- Strongly typed (Java, OCaml) vs weakly typed (Javascript, C)

Dimension: computation model

- Functional: Lisp, OCaml, Haskell, Racket
- Imperative: Fortran, C, Pascal
- Object-oriented: Smalltalk, Java, C++, C#
- Logical: Prolog, Datalog

Dimension: execution model

- Compiled: Java OCaml, Haskell
- Interpreted: Lisp, Racket
- Hybrid: Smalltalk, Java, C++, C#

Course material

- Functional programming (OCaml)
- Solver-aided programming (Racket)
- Object-oriented (Python)
- Logical programming (Datalog)

Course mechanics

Website: https://github.com/fredfeng/CS162

Q&A: https://piazza.com/ucsb/winter2020/cs162

Grading

- Programming assignments: 50%
  - 6 programming assignments
- Midterm exam (closed book): 20%
- Final exam (closed book): 25%
- Class&Piazza Participation: 5%

No make-up exam

Programming assignments

- Please check the website regularly
- Deadline extension:
  - Four “late days”, used as “whole unite”
  - 5 mins late = 1 late day
  - Plan ahead, no other extensions

Programming assignments

Unfamiliar languages

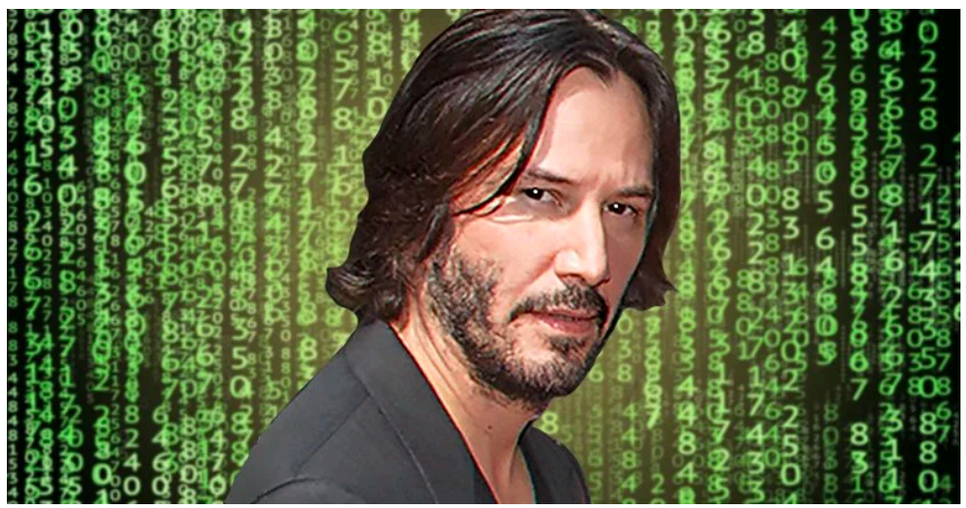
\+ Unfamiliar environments

Start early!

OCaml is hard

\+ Racket is @!#@%

Start early!



Free your mind

Academic integrity

- Programming assignments should be done ALONE
- We use MOSS to detect plagiarism
    - State-of-the-art
    - Have code from public repos
    - Make sure your repo private
    - I am an expert in this domain :-)
- “F” if you violate the honor code

TODOs by next lecture

- Join Piazza for CS162!
- Install OCaml on your laptop