

CS 162 Programming languages

Lecture 1: Hello World!

Yu Feng
Winter 2022

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

Website: <http://fredfeng.github.io/>

Office hour: Fri 3pm

Zoom (OH): <https://ucsb.zoom.us/my/yufeng>

Introducing the cast

TA: Junrui Liu (junrui@ucsb.edu)

Office hour: Wed 4:00pm

Discussion session: Fri 9:00 am



TA: Mehmet Emre (emre@cs.ucsb.edu)

Office hour: Mon 2:30pm

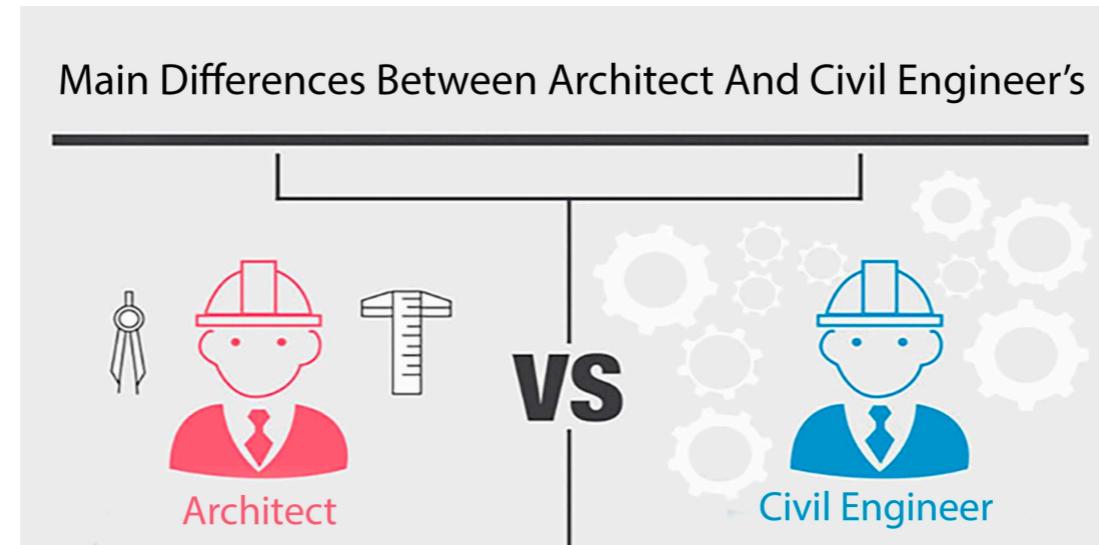
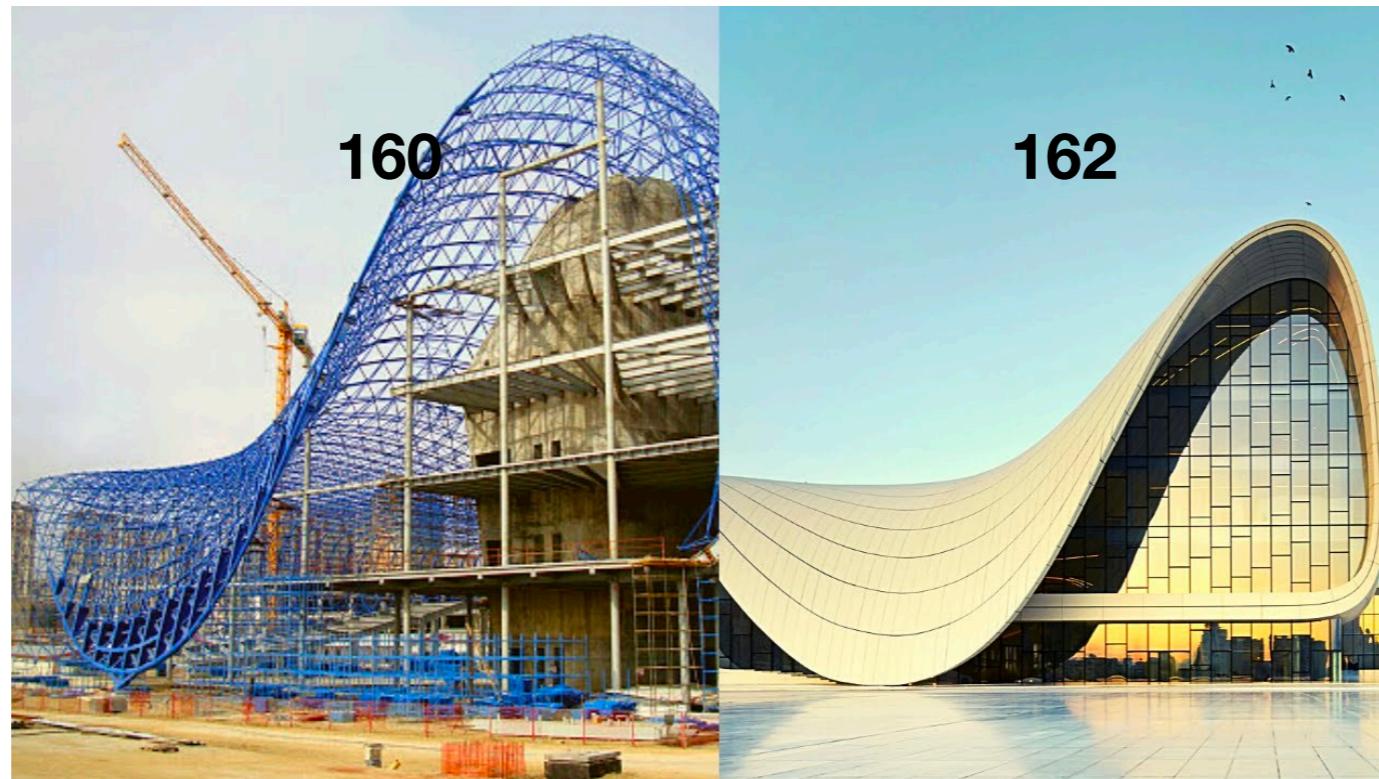
Discussion session: Fri 9:00 am



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

PL (CS162) v.s. Compiler (CS160)



Course goals

You will learn:

- new languages and constructs
- ways to describe and organize computation
- build a programming language (λ^+) from scratch

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
- Key concepts in PL
- Adapt new languages in a week instead of months

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: C, C++
- Interpreted: Perl, Shell script
- Hybrid: Java

Course logistics

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

Q&A: <https://tinyurl.com/4vtmz5p3> (Please join us ASAP)

Zoom: <https://tinyurl.com/wu7ypxzc>

Grading

- Programming assignments: 100%
 - 6 (PA1-PA6) programming assignments

Programming assignments

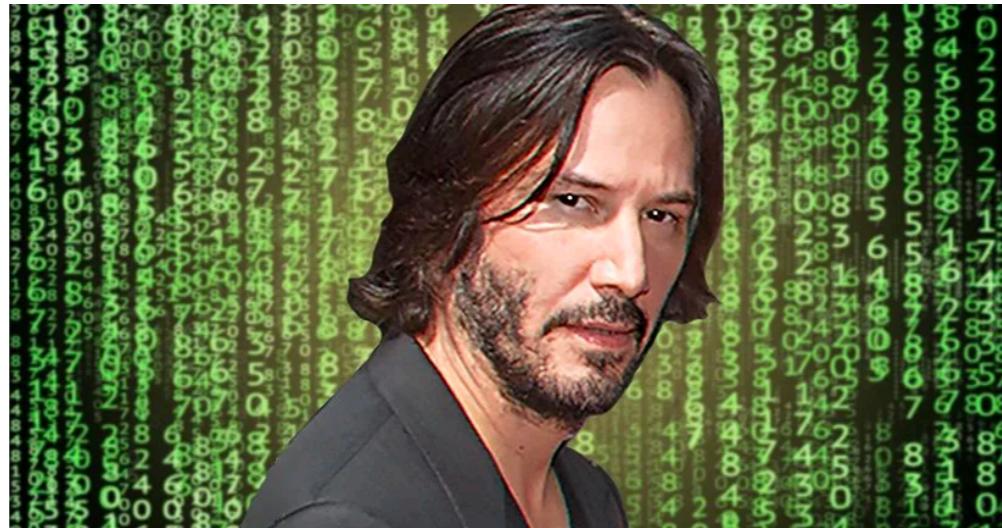
- Please check the website regularly
- Deadline extension:
 - Ten “late days”
 - Plan ahead, no other extensions

Programming assignments

- Unfamiliar languages
 - + Unfamiliar environments
-

- OCaml is hard
 - + Racket is @!#@%
-

Start early!



Free your mind

Start early!

Academic integrity

- All assignments should be done ALONE
- We use MOSS to detect plagiarism
 - Have code from public repos
 - Make sure your repo private
- “F” if you violate the honor code

TODOs by next lecture

- Join Slack for CS162!
- Install/try OCaml on your laptop
- Get familiar with your new friend: Play with λ^+