Programming Languages

Lec 0: Overview

김재호

튜터 소개

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About

I am an undergraduated student at Department of Computer Science and Engineering, Korea University. I am Currently interning in Programming Systems Lab in KAIST advised by Kihong Heo.

Research Interests

My research interests are related to improving programming systems using program analysis, synthesis, verification methods based on programming language theory. In particular,

- **Program Analysis** for automatically detecting software bugs and vulnerabilies
- **Type Safety** of object-oriented imperative programming languages
- **Program Verification** for automatically reasoning correctmess of program
- Scalable **Program Synthesis** in specific domains

Education

- Master Student (Soon)
- B.S. Dept. of Computer Science and Engineering, Korea University, Mar. 2018 - Aug. 2022
- Korea Science Academy of KAIST, Mar. 2015 - Feb. 2018

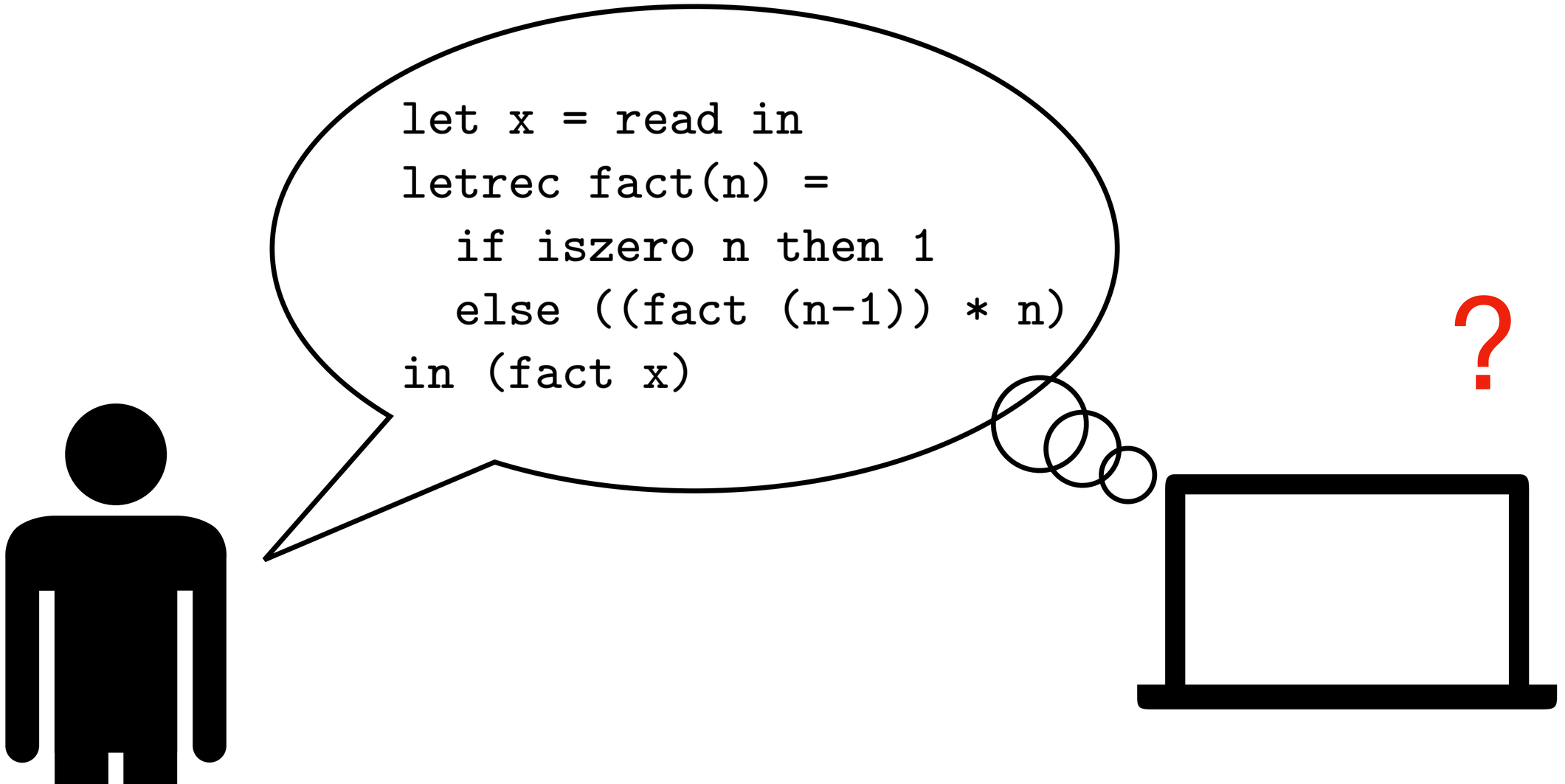
- 김재호
- 고려대학교 컴퓨터학과 18학번
- 개인 홈페이지: https://oojahooo.github.io

프로그래밍 언어란?

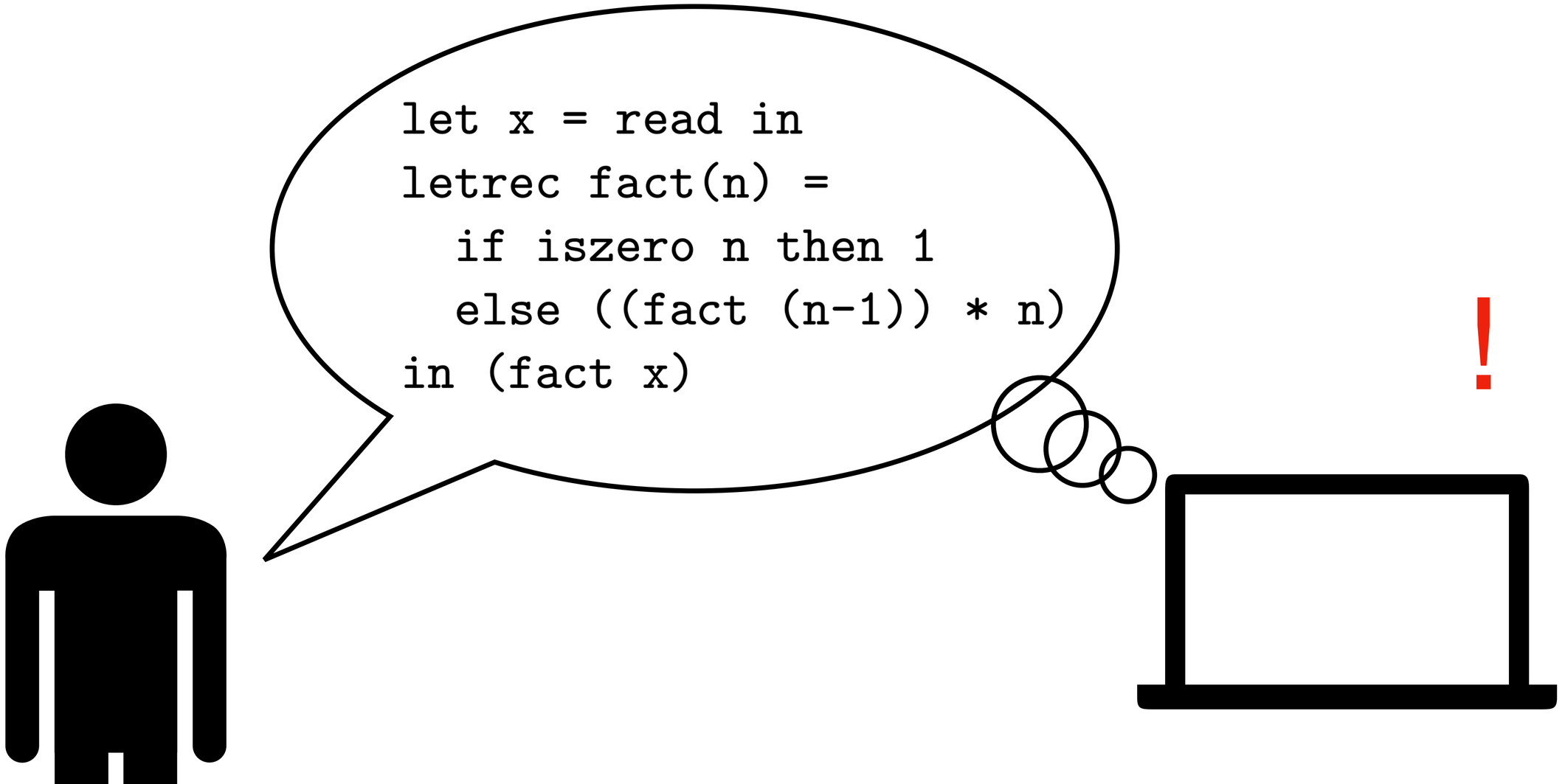
Worldwide, Jun 2022 compared to a year ago:

Rank	Change	Language	Share	Trend
1		Python	27.61 %	-2.8 %
2		Java	17.64 %	-0.7 %
3		JavaScript	9.21 %	+0.4 %
4		C#	7.79 %	+0.8 %
5		C/C++	7.01 %	+0.4 %
6		PHP	5.27 %	-1.0 %
7		R	4.26 %	+0.5 %
8	↑↑↑	TypeScript	2.43 %	+0.7 %
9	↓	Objective-C	2.21 %	+0.1 %
10	↓	Swift	2.17 %	+0.4 %
11	↑↑	Matlab	1.71 %	+0.2 %
12	↓↓	Kotlin	1.57 %	-0.2 %
13	↓	Go	1.48 %	+0.0 %
14	↑↑	Rust	1.29 %	+0.4 %
15		Ruby	1.1 %	-0.0 %
16	↓↓	VBA	1.07 %	-0.2 %
17	↑↑	Ada	0.95 %	+0.4 %
18	↑↑↑	Scala	0.73 %	+0.2 %
19	↓↓	Visual Basic	0.65 %	-0.0 %
20	↓↓	Dart	0.64 %	+0.0 %

프로그래밍 언어란?


let x = read in
letrec fact(n) =
if iszero n then 1
else ((fact (n-1)) * n)
in (fact x)
?

프로그래밍 언어란?


let x = read in
letrec fact(n) =
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else ((fact (n-1)) * n)
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!

그냥 코딩 할 줄 알면 되는 거 아닌가?

Weird Python

```
False is False is True
```

→ ???

그냥 코딩 할 줄 알면 되는 거 아닌가?

Weird Python

```
14 and 40 and 1 and [] and 7 and 0
→ ???
```

그냥 코딩 할 줄 알면 되는 거 아닌가?

퀵소트 (Quick sort) 코드 예제 - C++

```cpp
int partition (int arr[], int low, int high)
{
    int pivot = arr[high]; // pivot
    int i = (low - 1); // Index of smaller element and indicates the right position of pivot found so far

    for (int j = low; j ⩽ high - 1; j++)
    {
        // If current element is smaller than the pivot
        if (arr[j] < pivot)
        {
            i++; // increment index of smaller element
            swap(&arr[i], &arr[j]);
        }
    }
    swap(&arr[i + 1], &arr[high]);
    return (i + 1);
}

void quickSort(int arr[], int low, int high)
{
    if (low < high)
    {
        /* pi is partitioning index, arr[p] is now
        at right place */
        int pi = partition(arr, low, high);

        // Separately sort elements before
        // partition and after partition
        quickSort(arr, low, pi - 1);
        quickSort(arr, pi + 1, high);
    }
}
```

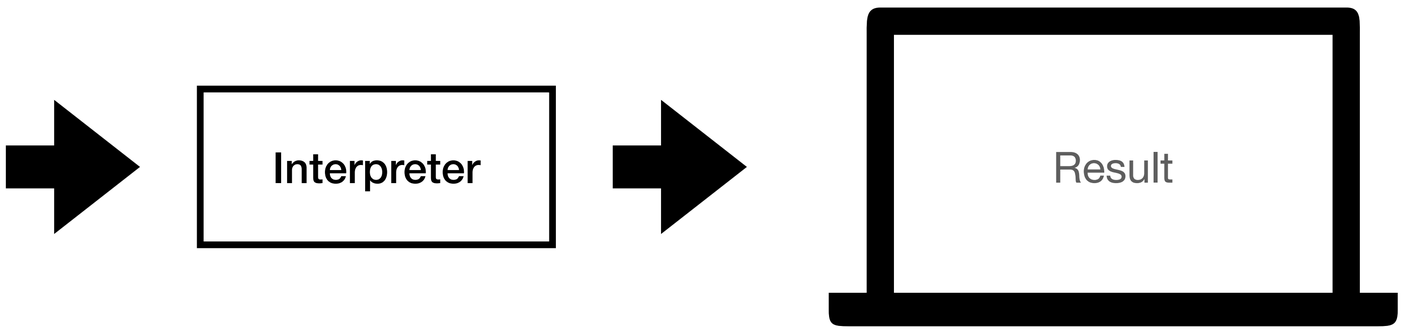
그냥 코딩 할 줄 알면 되는 거 아닌가?

퀵소트 (Quick sort) 코드 예제 - Haskell

```haskell
qsort :: [Int] → [Int]
qsort = \list →
    case list of
        [] → []
        x:xs →
            qsort (smallerEq x xs) ++ x:qsort (greater x xs)
```

실행기(Interpreter)

```
let x = read in
letrec fact(n) =
  if iszero n then 1
  else ((fact (n-1)) * n)
in (fact x)
```



타입 검사기(Type Checker)

```
let x = read in
letrec fact(n) =
  if iszero n then 1
  else ((fact (n-1)) * n)
in (fact x)
```