

Sections CMS

3, 4 in 211 upson MW
11:15a 7:30p

PS#1 9/6 11:59 PM EST

PS+ bugs - versioning

Office hours

PSets back on M in section

Quiz #1 Thu 9/8 1st 10 min.

Functional vs Imperative programs

C/Java
statements do
things

LHS := **RHS** **RHS**

Expressions have values

Math = equational reasoning

```
int sumsq (int n) {
    y = 0;
    for (x=1; x<=n; x++)
        y += x*x;
    return y;
}
```

```
let rec sumsq (n:int):int =
    if n=0 then 0 else n*n +
        sumsq (n-1)
```

$$\cos^2 + \sin^2 = 1$$

Expressions have values

Def

identifier x, f variables, names $fact, n,$
 constant c $0, 3.4, "hello", true$
 binary op b $+, -, *$
 unary op u $-, not$
 term e $x | c | u e | e_1 e_2$ $not(not(not true))$

$(1, 2, 0)$ $| if e_1, then e_2 else e_3$
 $| e_0(e_1, e_2, \dots, e_n)$ combination

$int \times float$ $| let \{rec\} d in e$
 $| let \{rec\} d_1 and d_2 \dots d_n in e$

$decl d$ $| x = e$
 $| f(x_1, \dots, x_n): t = e$

$type t$ $| int | bool | char | string$
 $| t_1 * t_2 * \dots * t_n$
 $| t_1 * t_2 * \dots * t_n \rightarrow t$

Types Inference \leftarrow int

let $f(x,y) = (x = \text{String.length}(y))$ \leftarrow str

$f(x:\text{int}, y:\text{string}) : \text{bool}$ $f(3, "hi")$

Errors:

2.0\$ 2.\$0 Lexical

let x 0 syntax

Runtime 1/0

Type errors 1+"a" 1+2.0

CATCH ERRORS EARLY

F

Functions are 1st class

- bound to variable
- passed as argument
- returned as value
- stuck in data structures
- can be anonymous

$1 + (2 * 3)$

- Create via fun

lots of `|` in CS3110

→ `let square z = z * z`

→ `let square = fun z → z * z`

`let square = 3 * 5`