Functional Programming 1: Recursion and Immutable Data

CS 350

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Overview

- Topic: Functional Programming in Racket and plait

Programming in CS 350

All coding for this class uses:

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- The Dr. Racket editor

Racket

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- Language for making languages

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  - see `https://docs.racket-lang.org/guide/other-editors.html`

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- Minimal
  - Has what you need to write programming languages
  - Not much else
  - You can do a lot with very little

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- Algebraic Data Types

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  - Racket writes `(f x)`, not `f(x)`
- `x` is not the same as `(x)`
  - `x` gets the value of the variable `x`
  - `(x)` is calling a function named `x` with zero arguments

Numbers

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```
(+ 2 7)
```

Numbers

```
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```

```
9
```

Numbers

```
(+ 2 7)
(- 10 0.5)
```

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Numbers

```
(+ 2 7)
(- 10 0.5)
(* 1/3 2/3)
```

```
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```
9
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```

Numbers

```
(+ 2 7)
(- 10 0.5)
(* 1/3 2/3)
(/ 1 1000000000000.0)
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(+ 2 7)
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(max 10 20)
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```

Booleans

```
(= (+ 2 3) 5)
(> (/ 0 1) 1)
(zero? (- (+ 1 2) (+ 3 0)))
(and (< 1 2) (> 1 0))
(or (zero? 1) (even? 3))
```

```
#t
#f
#t
#t
#f
```

Conditionals

- Conditionals are **expressions**, not statements

```
(if (< 2 3) "hello" "goodbye")
(+ 3
  (if (= 2 (+ 1 1))
      3
      40))
```

```
"hello"
6
```

Conditionals

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- Boolean changes what the expression **is**, not what it does

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Functions

- Calling a function replaces variable with concrete argument

```
(define (addOne [x : Number]) : Number
  (+ x 1))
(addOne 10)

(define (isRemainder [x : Number]
                     [y : Number]
                     [remainder : Number])
        : Boolean
  (= remainder (modulo x y)))
(isRemainder 10 3 1)
(isRemainder 10 4 1)
```

```
11
#t
#f
```

Functions (ctd.)

- General form:

```
(define (functionName
          [argName : argType]
          ...
          [argNameN : argTypeN]) : returnType
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- Later in the course we'll see another way of defining functions

Functional Thinking: Lists And Recursion

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  - But lots aren’t

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Further reference:
`http://htdp.org`, Matthew Flatt's Notes (URCourses)