
λ
λ
Haskell
GAVE MY CAT A
TOM HARDING
BEARD!
AND A
MOOG

Zygohistomorphic Prepromorphisms

~~Zygohistomorphic Prepromorphisms~~

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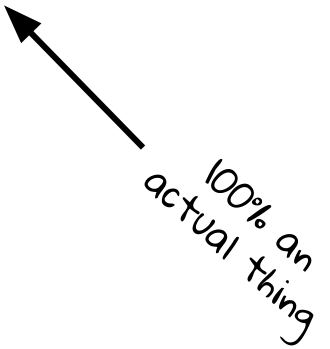

OOP Is Masochism

~~OOP Is Masochism~~

Sukant Hajra
@shajra

Follow

Good OO design just leads you to FP.

RETWEETS	LIKES
57	60

9:49 am - 23 Jan 2016

57 60


JAVASCRIPT IS
"FUNCTIONAL"
memegenerator.net

Some Ugly Imperative Code

```
var input = [1, 2, 3, 4, 5]
var total = 0

for (var i = 0; i < input.length; i++) {
  if (input[i] <= 3) {
    total += input[i] * 2
  }
}
```

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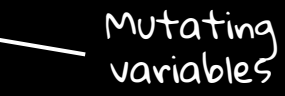

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Mutating variables

Stateful code blocks

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Mutating variables

Branches

Stateful code blocks

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Mutating variables

Branches

Requires state to connect lines

Stateful code blocks

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  }
}
```

Mutating variables

Requires state to connect lines

Branches

Stateful code blocks

Program **must** run in the order specified

Some Functional Code

```
[1, 2, 3, 4, 5]
  .filter(x => x <= 3)
  .map(x => x * 2)
  .reduce((acc, x) => acc + x, 0)
```

Some Functional Code

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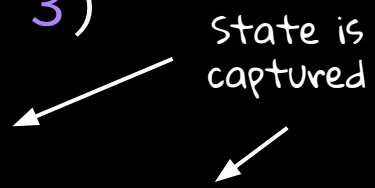

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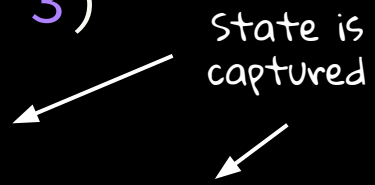

Obvious program flow ↓

Some Functional Code

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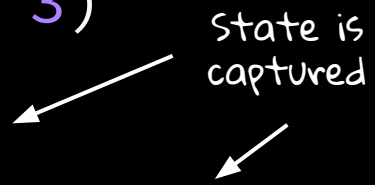

Obvious program flow ↓

HOW DOES IT WORK?

Some Functional Code

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State is captured

Obvious program flow ↓

HOW DOES IT WORK?

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HOW DOES IT WORK?

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Obvious program flow ↓

HOW DOES IT WORK?

```
[1, 2,
  .filt
  .map(
  .redu
```

How

Generators?

```
[1, 2, 3, 4, 5]
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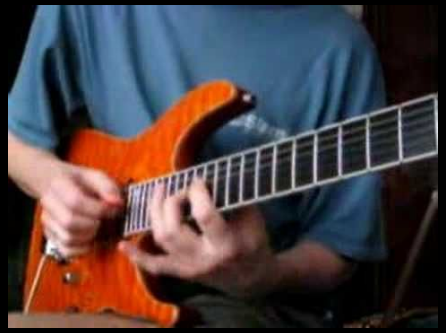

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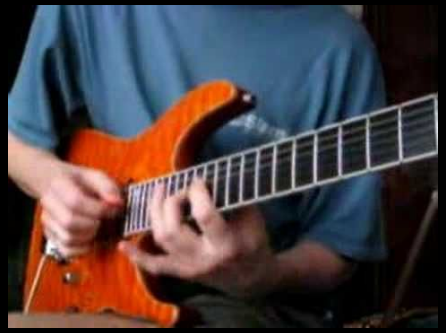


```
[1, 2, 3, 4, 5]
  .filter(x => x <= 3)
  .map(x => x * 2)
  .reduce((acc, x) => acc + x, 0)
```

We ♥ commutative/associative reducers

Example: Infinity

```
const inf = function *() {
    for (var i = 0; ; i++) yield i
}

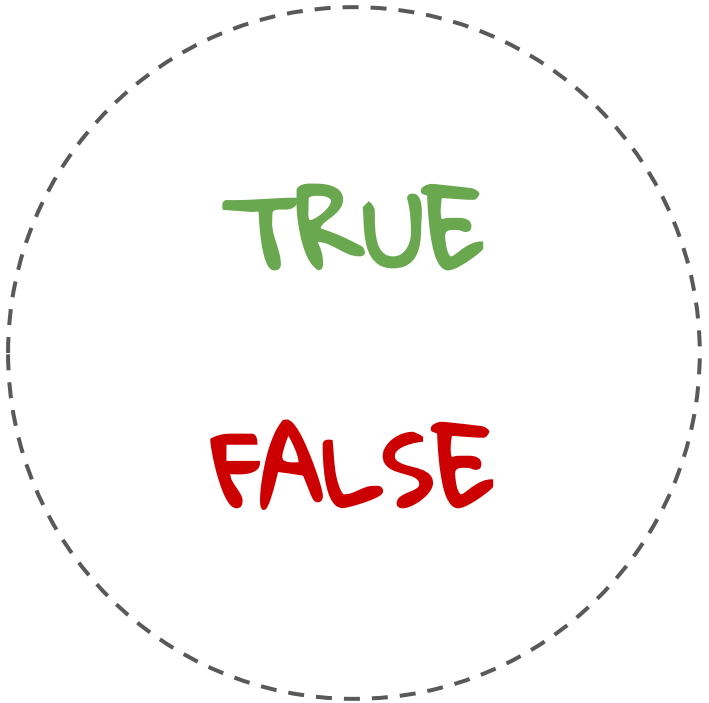
const negativeInf = map(x => -x, inf())
const allEvens = filter(x => !(x % 2), inf())
```

Lazy List Operations

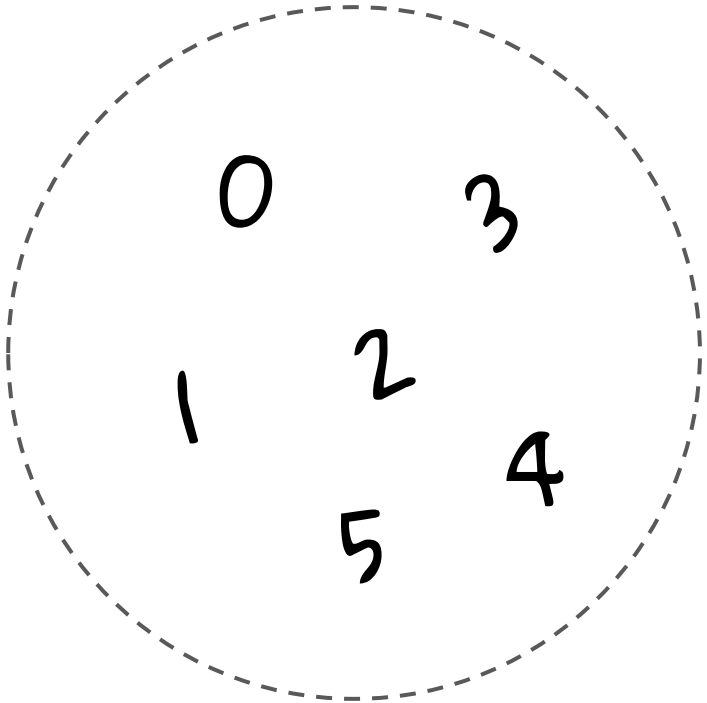
```
const map = function * (f, xs) {
  for (const x of xs) yield f (x)
}
const filter = function * (p, xs) {
  for (const x of xs) if (p (x)) yield x
}
```


KEEP PORTLAND WEIRD
Loop
Fusion

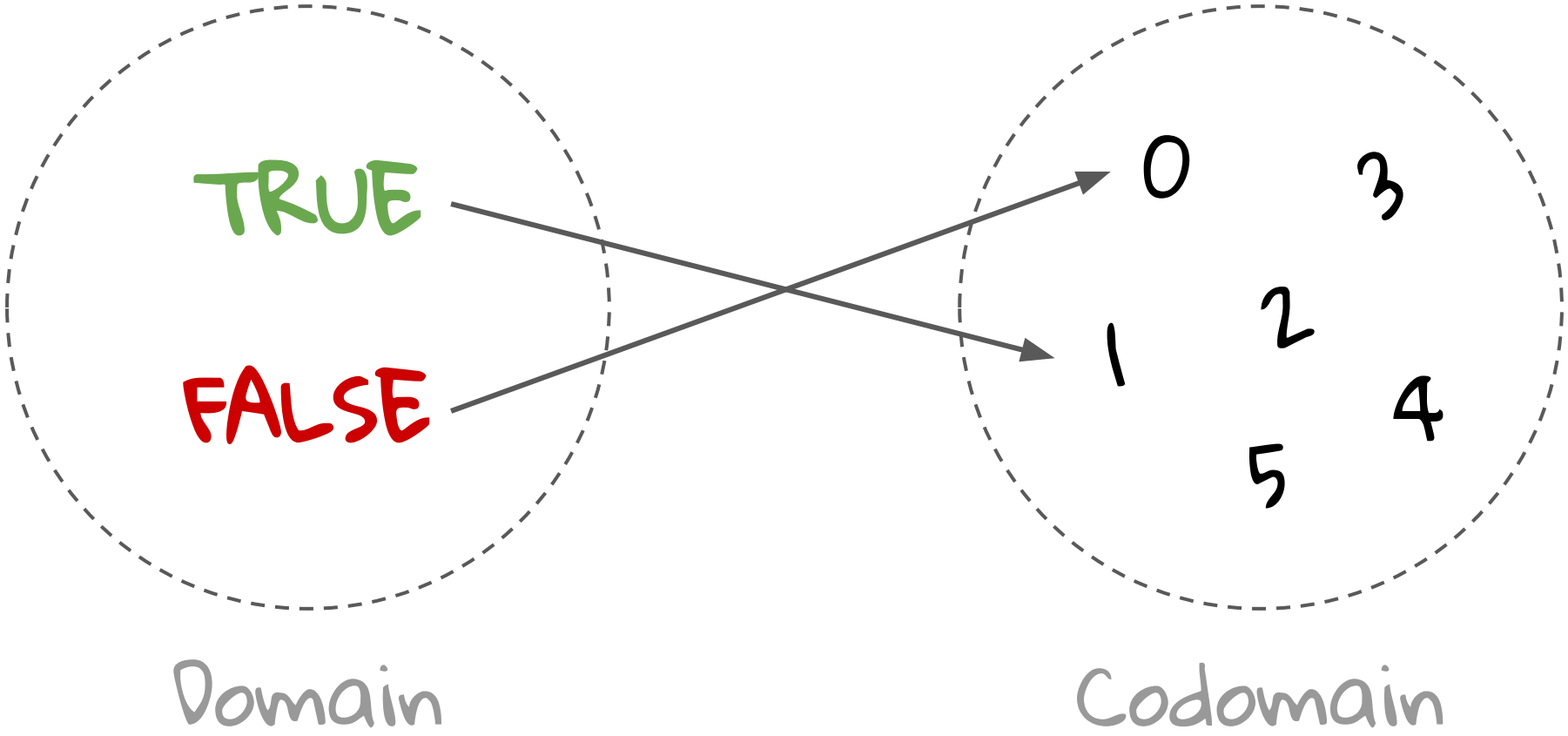

FUNCTIONS

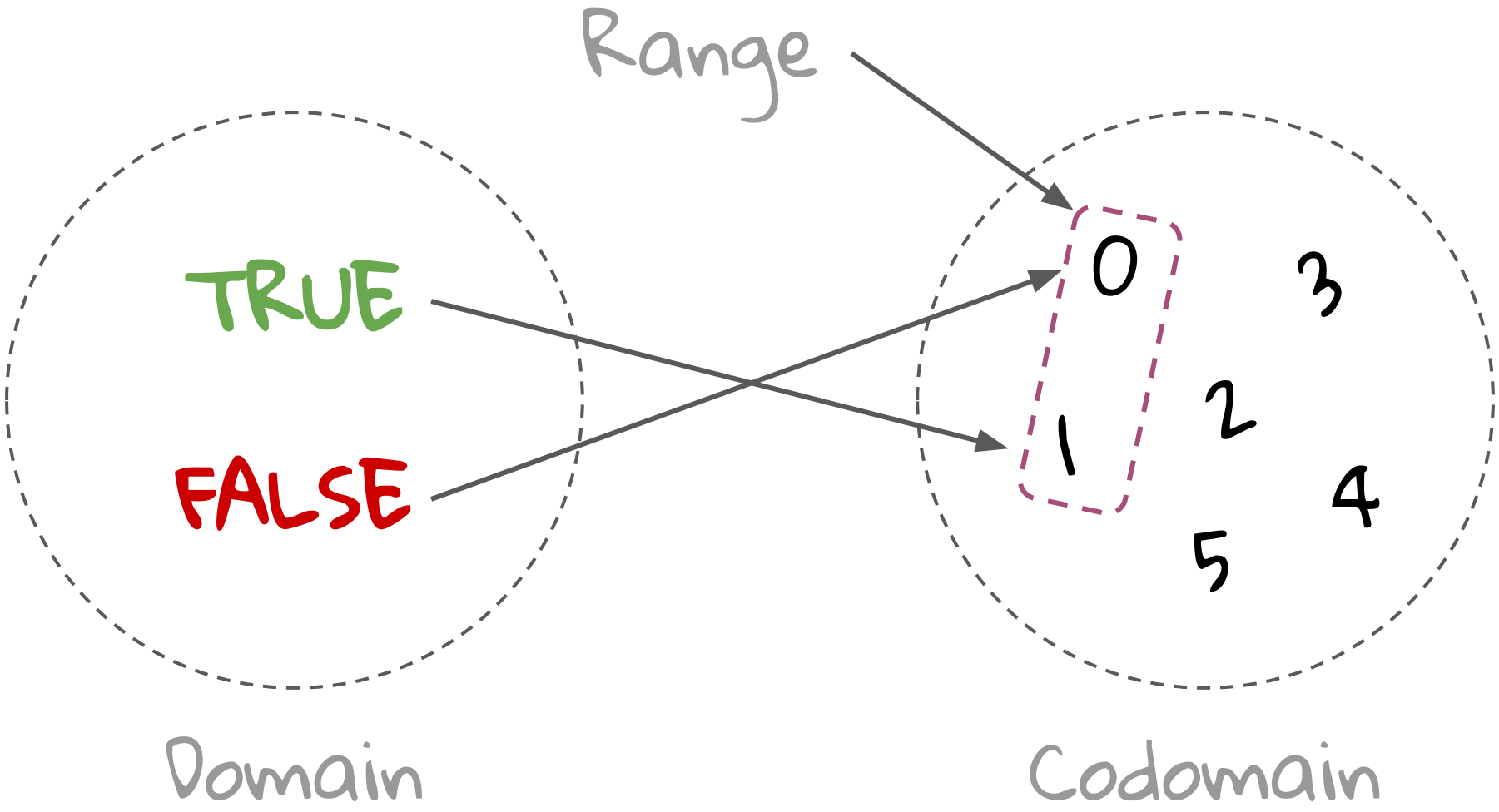


Bool



Int


TRUE
FALSE
0
3
1
2
4
5
Domain
Codomain


Range
TRUE
FALSE
0
1
2
3
4
5
Domain
Codomain

Here is a function:

```
const toBinary = b => b ? 1 : 0


toBinary(true)  == 1
toBinary(false) == 0
```

Here is a map:

```
const toBinary = { true:  1, false: 0 }
```

```
toBinary[true]  == 1
toBinary[false] == 0
```

Maps don't have side-effects

Here is a **map**:

```
const toBinary = { true:  1, false: 0 }
```

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toBinary[true]  == 1
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Functions don't have side-effects

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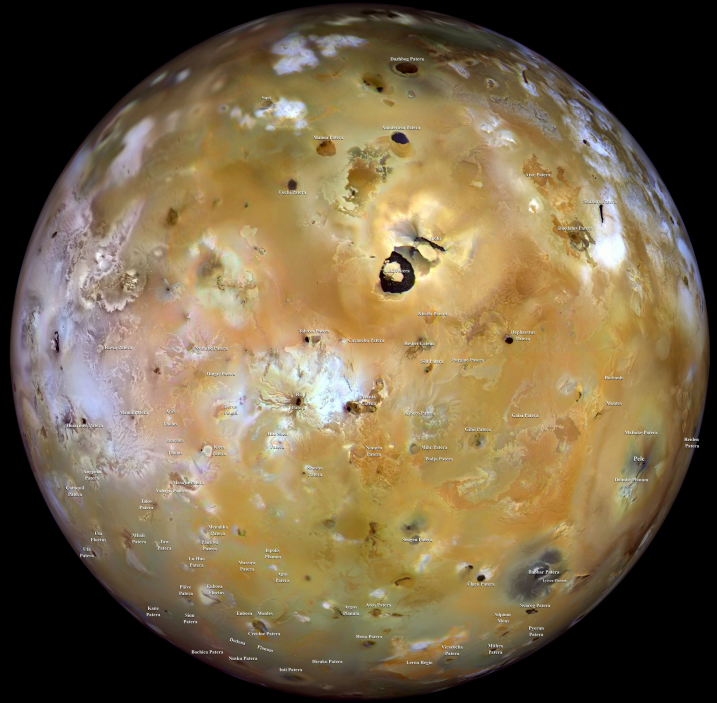
Functions don't have side-effects

Io



Input/Output

Io

Input/Output

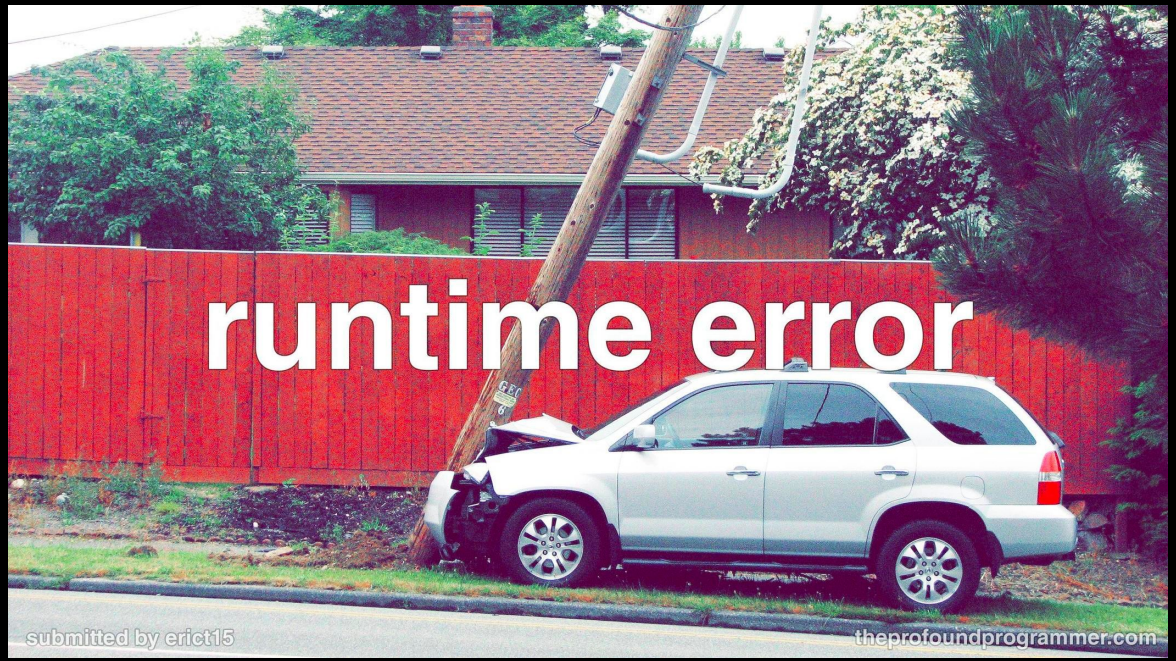
Random

Random

State Mutation

State Mutation

Exceptions


runtime error
submitted by erict15
theprofoundprogrammer.com

Exceptions

WE NEED

MONADS

WE NEED

MONADS

Another talk for
another time.

Functions are all unary

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BUT inputs and outputs can be functions

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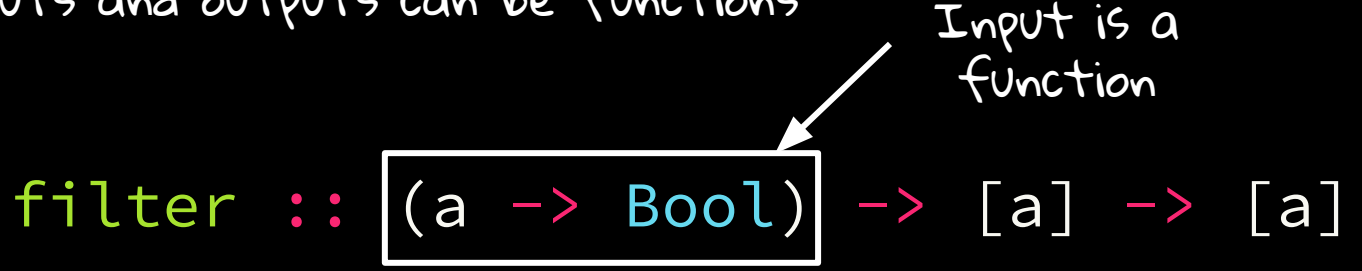
BUT inputs and outputs can be functions

```
filter :: (a -> Bool) -> [a] -> [a]
```

Functions are all unary

BUT inputs and outputs can be functions



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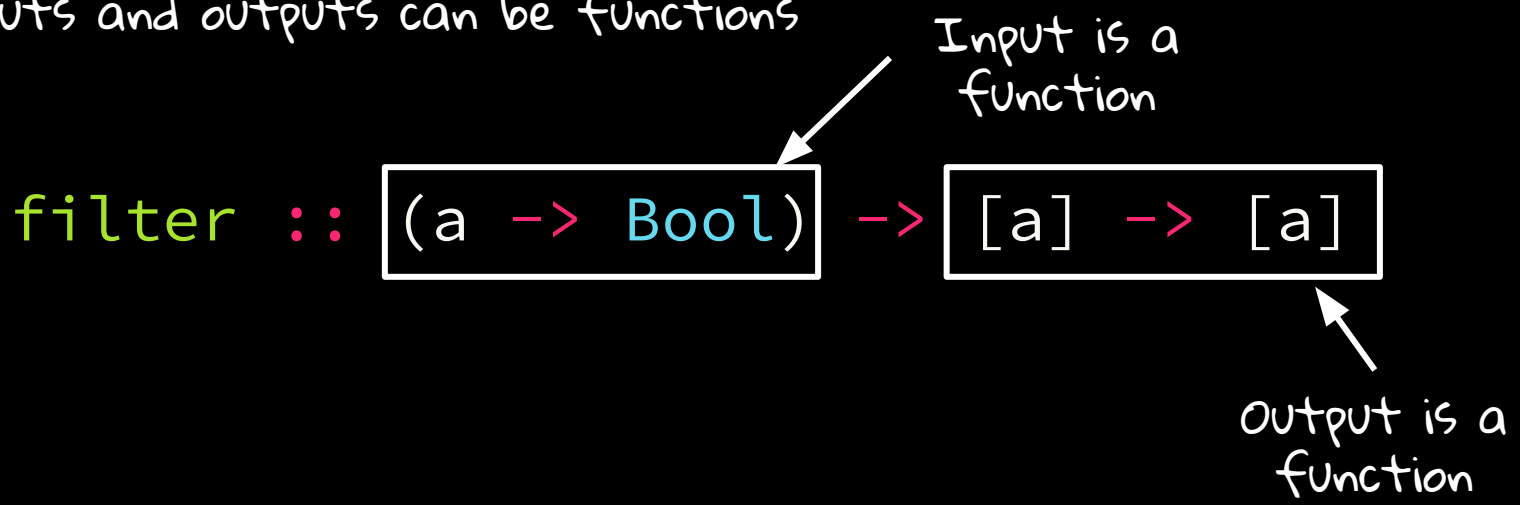

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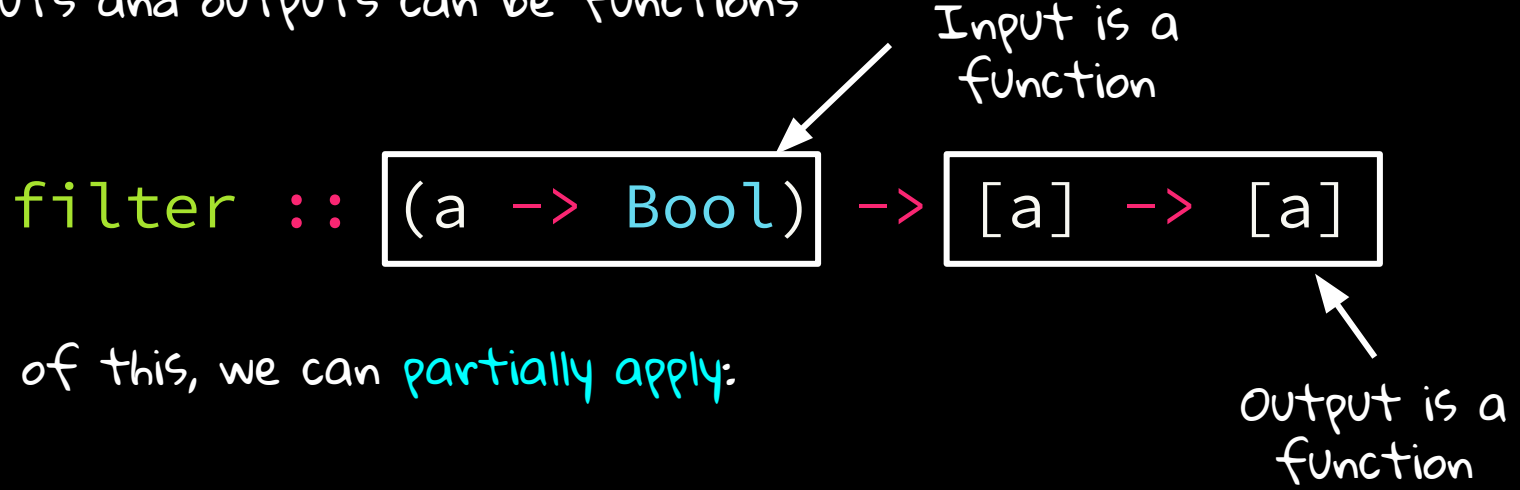

Because of this, we can partially apply:

```
f = filter (x => x > 3)

f ([1, 3, 4, 5]) == [4, 5]
```

Functions are all unary

BUT inputs and outputs can be functions

Input is a function

```
filter :: (a -> Bool) -> [a] -> [a]
```

Output is a function

Because of this, we can partially apply:


```
f = filter (x => x > 3)

f ([1, 3, 4, 5]) == [4, 5]
```


COMPOSER

Composition

```
const compose = (f, g) => x => f(g(x))

const uppercase = x => x.toUpperCase()
const head = xs => xs[0]

const firstCap = compose(head, uppercase)
firstCap('hello') // 'H'
```

Composition

```
const compose = (f, g) => x => f(g(x))

const uppercase = x => x.toUpperCase()
const head = xs => xs[0]

const firstCap = compose(head, uppercase)
firstCap('hello') // 'H'
```

Composition ♥ Partial Application

```
const add = x => y => x + y
const times = x => y => x * y

const incAndTwice = compose(times(2), add(1))
```

Composition ♥ Partial Application

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const add = x => y => x + y
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Fun fact (that we already knew):

```
compose(map(f), map(g)) == map(compose(f, g))
```

Composition ♥ Partial Application

```
const add = x => y => x + y
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Fun fact (that we already knew):

```
compose(map(f), map(g)) == map(compose(f, g))
```

Super Important Business Example (TM)

```
const availablePrices = cars => {
  const available_cars = cars.filter(prop('in_stock'))

  return available_cars.map(x => {
    accounting.formatMoney(x.dollar_value)
  })
}
```

Spot the pipelines!

Thanks, @DrBoolean

Super Important Business Example™

```
const getPrice = compose(
  accounting.formatMoney,
  prop('dollar_value')
) // We have a reusable function!

const availablePrices = compose(
  map(getPrice),
  filter(prop('in_stock'))
)
```


KEEP PORTLAND WEIRD


N
VANDEVALL


N
[X]
VANDEVALL

```
const inc = x => x + 1

inc([1, 2, 3]) // Error!
```

[1, 2, 3]

```
const inc = x => x + 1

map(inc)([1, 2, 3]) // [2, 3, 4]
```

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const inc = x => x + 1

map(inc)([1, 2, 3]) // [2, 3, 4]
```

Map works without complaint for any number of values

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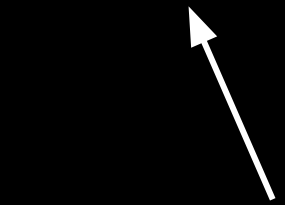

Map works without complaint for any number of values

- We can do safe composition
- We can capture state
- We can do clever optimisations

Let's try

```
const MyBox = val => ({
  map: f => MyBox(f(val))
})
```

Let's try

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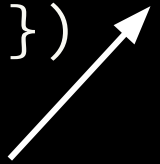


Functors are anything with a map

Let's try

```
const MyBox = val => ({
  map: f => MyBox(f(val))
})
```

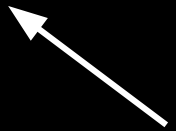
Functors are anything with a map

Safe and pretty pipelines

```
MyBox(2)
  .map(x => x + 1)
  .map(x => '' + x)
  .map(x => 'I like ' + x)
```

Lemme at it

```
const MyBox = val => ({
  map: f => MyBox(f(val)),
  fold: f => f(val)
})
```



We need a fold (val) to get the value out

Lemme at it

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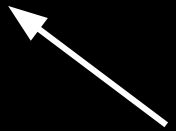

We need a fold (`val`) to get the value out

```
fold(id, MyBox(a)) == a
```

reduce is fold for lists

So, how does this help us?


Maybe

```
const Just = val => ({
  map: f => Just(f(val)),
  fold: (_, f) => f(val)
})

const Nothing = {
  map: f => Nothing,
  fold: (n, _) => n
}
```

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  map: f => Nothing,
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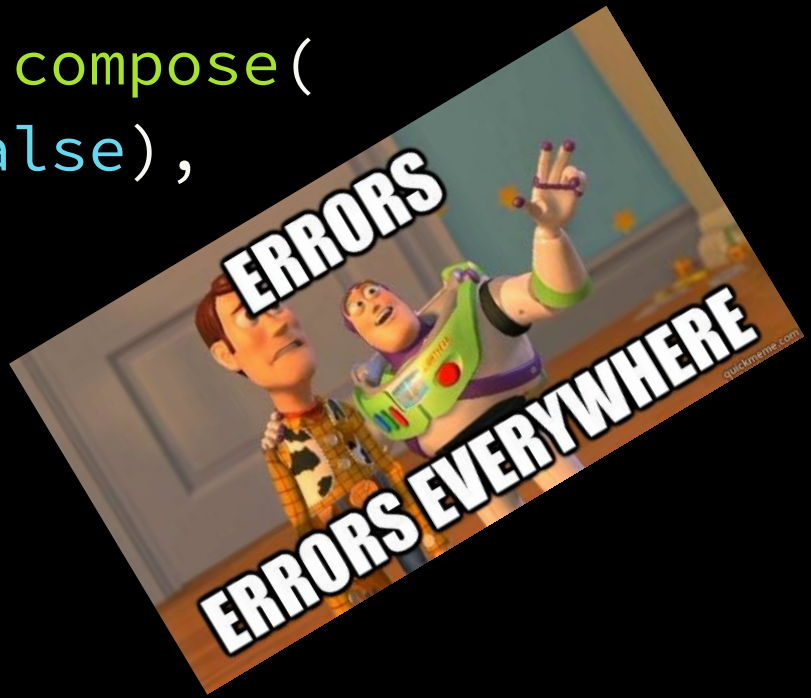
```

Just like our box!

Default

```
const deleteUser = compose(
  update('live', false),
  findUser
)
```

```
const deleteUser = compose(
  update('live', false),
  findUser
)
```



```
const deleteUser = compose(
  map(update('live', false)),
  findUser
)
```

```
const deleteUser = compose(
  map(update('live', false)),
  findUser
)

findUser(validId)   // Just User
findUser(invalidId) // Nothing
```

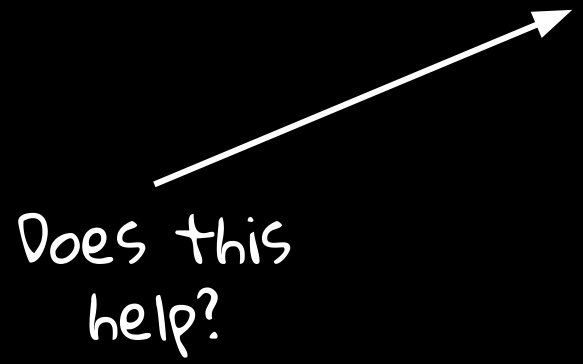
```
  const deleteUser = compose(
    map(update('live', false)),
    findUser
  )

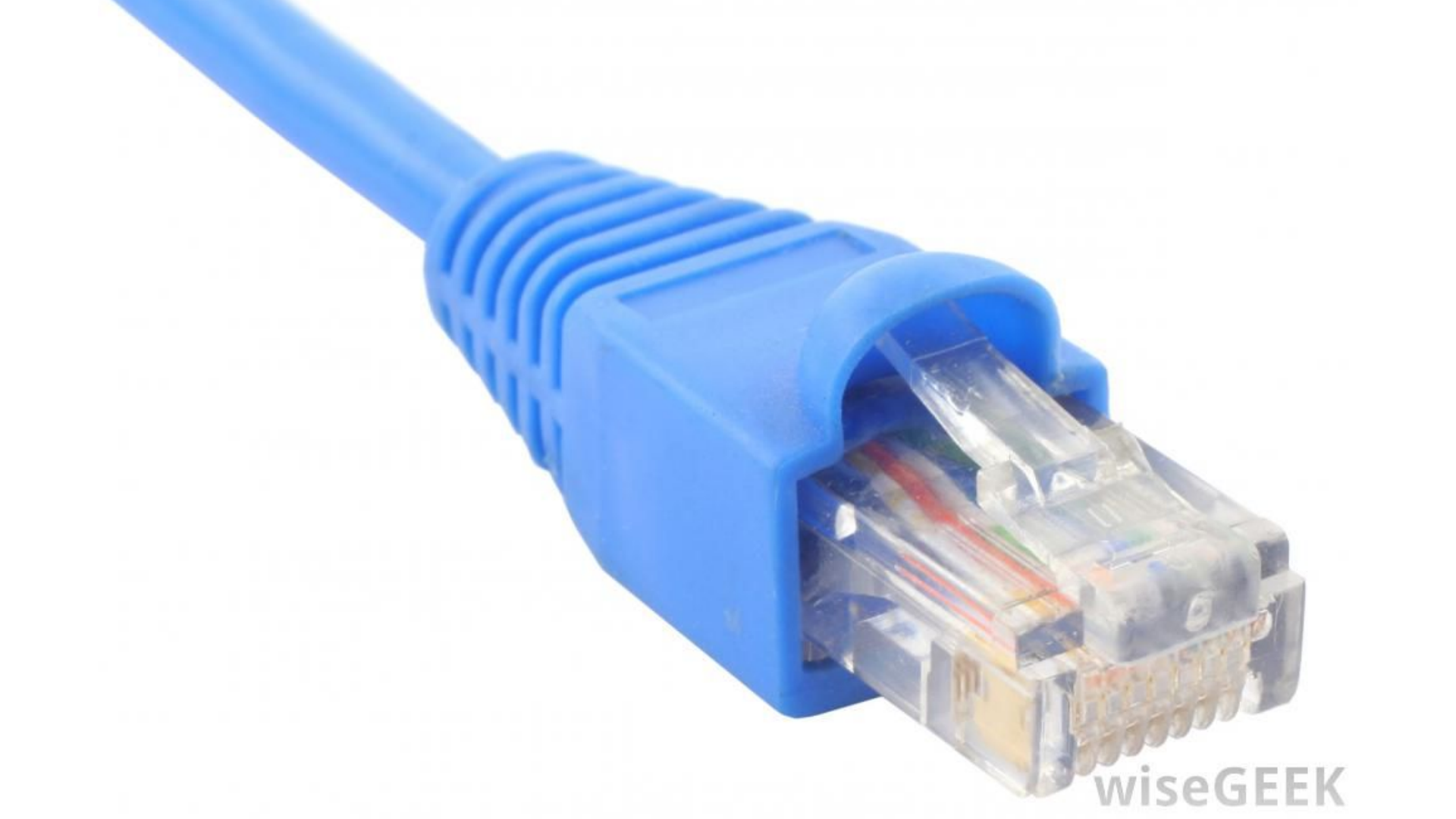
findUser(validId)   // Just User
findUser(invalidId) // Nothing

deleteUser(validId)   // Just User
deleteUser(invalidId) // Nothing
```

```
const getSecret = username => password =>
  username == 'test' && password === 'shh'
    ? Just('$$$') : Nothing
```

```
const getSecret = username => password =>
  username == 'test' && password === 'shh'
    ? Just('$$$') : Nothing
```




wiseGEEK


Either
wiseGEEK

```
const Right = val => ({
  map: f => Right(f(val)),
  fold: (_, g) => g(val)
})

const Left = val => ({
  map: f => Left(val),
  fold: (f, _) => f(val)
})
```

```
const Right = val => ({
  map: f => Right(f(val)),
  fold: (_, g) => g(val)
})

const Left = val => ({
  map: f => Left(val),
  fold: (f, _) => f(val)
})
```

```
const getSecret = username => password =>
  username !== 'test'
    ? Left('Incorrect username')
    : password !== 'shh'
      ? Left('Incorrect password')
      : Right('$$$')
```

Functors

- Let us capture stateful operations as pure transformations
- Let us implement error-checking (and other wizardry) at type-level
- Make for beautiful code
- Admit a window for low-level optimisations
- Come with stable and provable laws
- Allow us an easy way to modify function behaviour

TL ; RF

- Declarative code is flexible and clear.
- Functional programming is naturally declarative.
- Pure functions make for easy unit testing.
- Partial application and composition are so DRY
- Maps aren't just for arrays
- Functors can give us type-safe failure

What we didn't talk about

- Monoids
- Applicatives
- Monads
- Combinators (other than compose)
- Other folds (e.g. corecursion, catamorphisms)
- Typing (properly)
- Bifunctors (AKA completely escaping if/else)

Questions?

@whoaitstom

GitHub: i-am-tom

People you should follow:

Brian Lonsdorf

Bodil Stokke

Quildreen Motta

Fantasy Land