Web Programming

Week 4

"Developers seem to love those languages most, in which they understood the value of higher-order functions."

@ProfDKoenig

Retrospective

JS Goodie

Last Week Refresher

Open Questions

Agenda

Applied Map/Filter/Reduce

Snake and Tuple(n)

Quiz

(a, b) vs. a => b =>

```
// multiple arguments
const times  = (a, b) => a * b;

times(2) // ???

// argument chain, "curried"

const times  = a => b => a * b;

times(2) // ???
```

error message?

useful?

Partial Application

Is particularly elegant in combination with higher-order functions like in

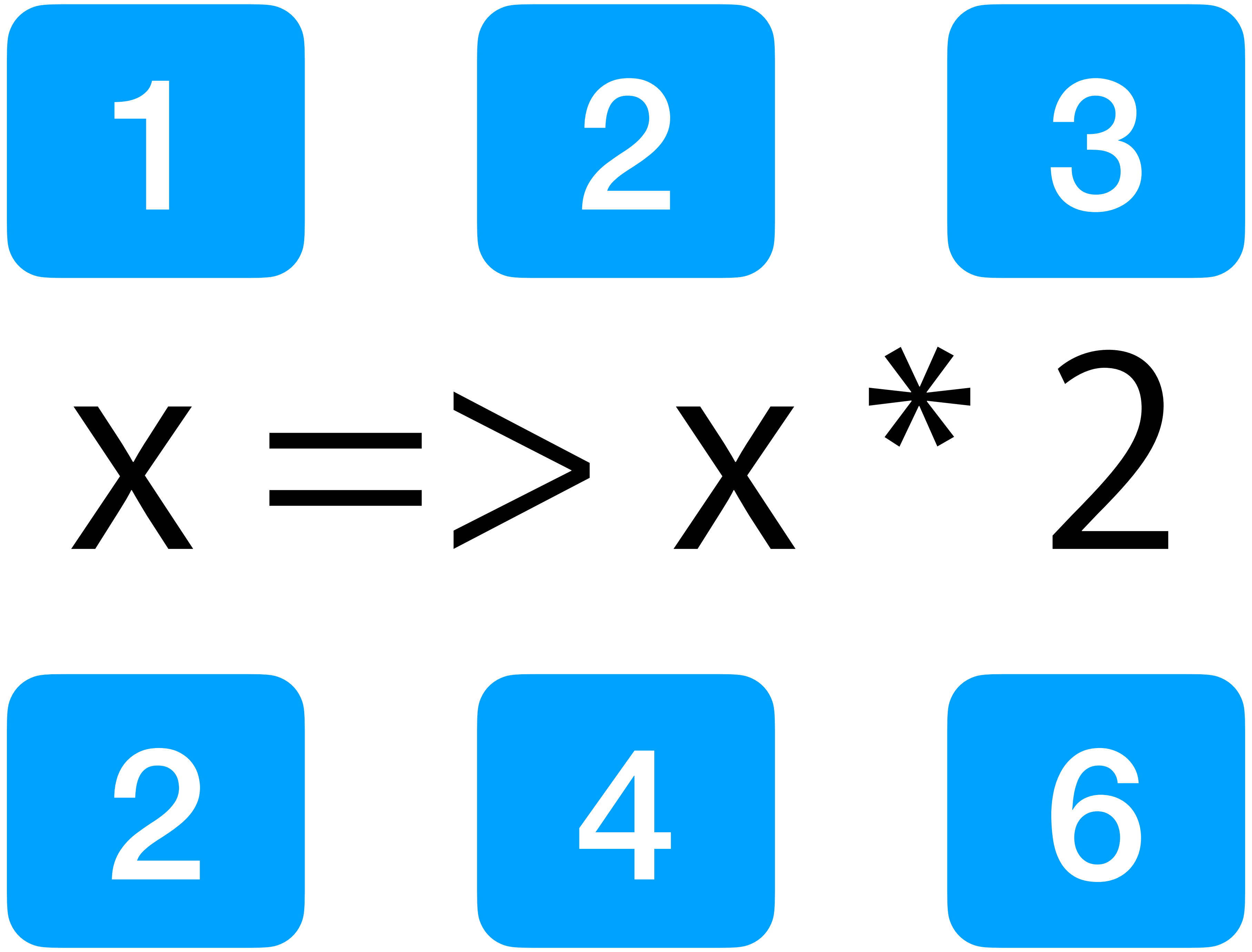
map, filter, and reduce

map

1 2 3

x => x * 2

map



1 2 3

x => x * 2

2 4 6

"partial" application: map

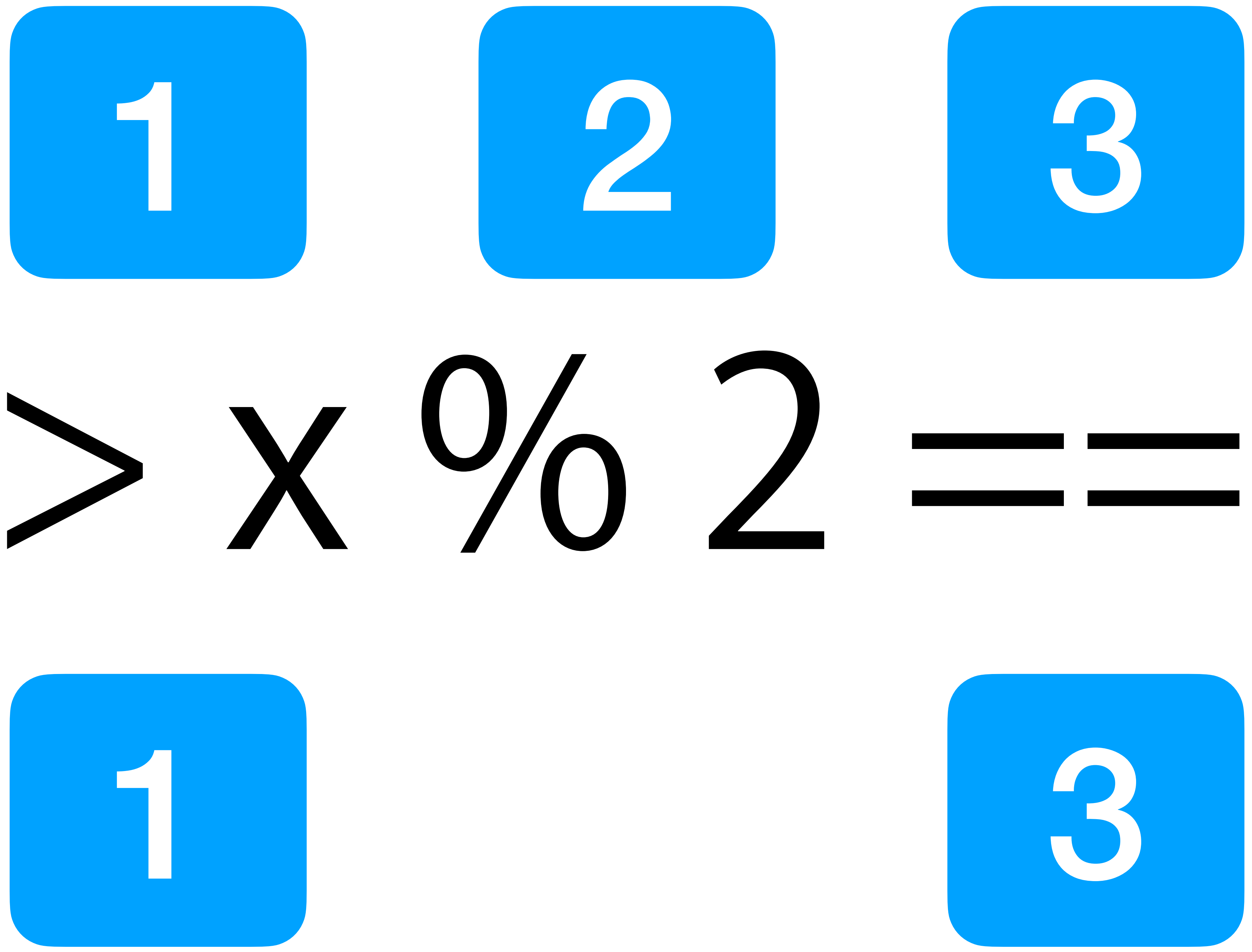
```
const times    = a => b => a * b;

const twoTimes = times(2);

[1, 2, 3].map(x => times(2)(x));
[1, 2, 3].map(times(2));
[1, 2, 3].map(twoTimes);
```

filter

1 2 3

```
x => x % 2 === 1
```

filter

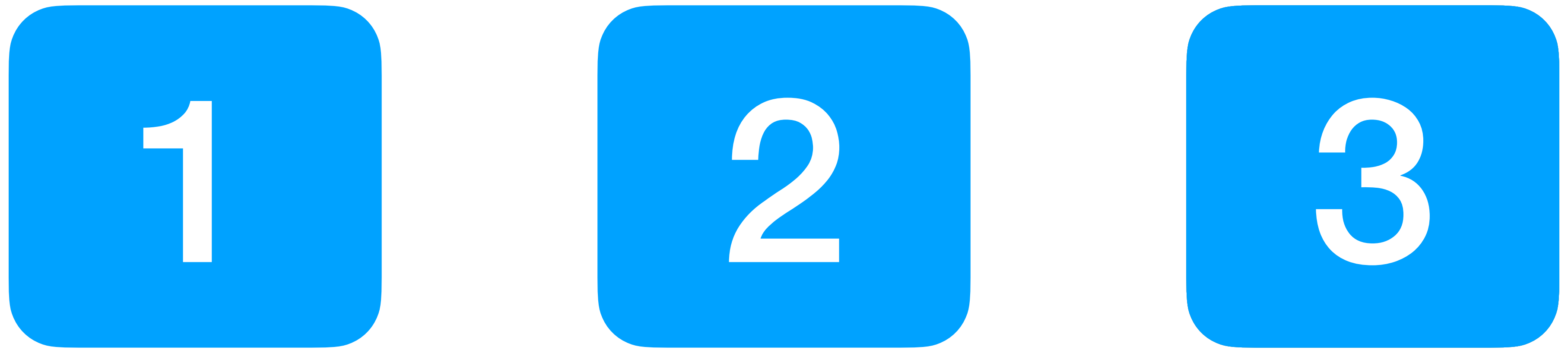


x => x % 2 === 1

"partial" filter

```
const odd    = x => x % 2 === 1;


[1, 2, 3].filter(x => x % 2 === 1);
[1, 2, 3].filter(x => odd(x));
[1, 2, 3].filter(odd);
```

```
reduce((acc, cur) => acc + cur)
```

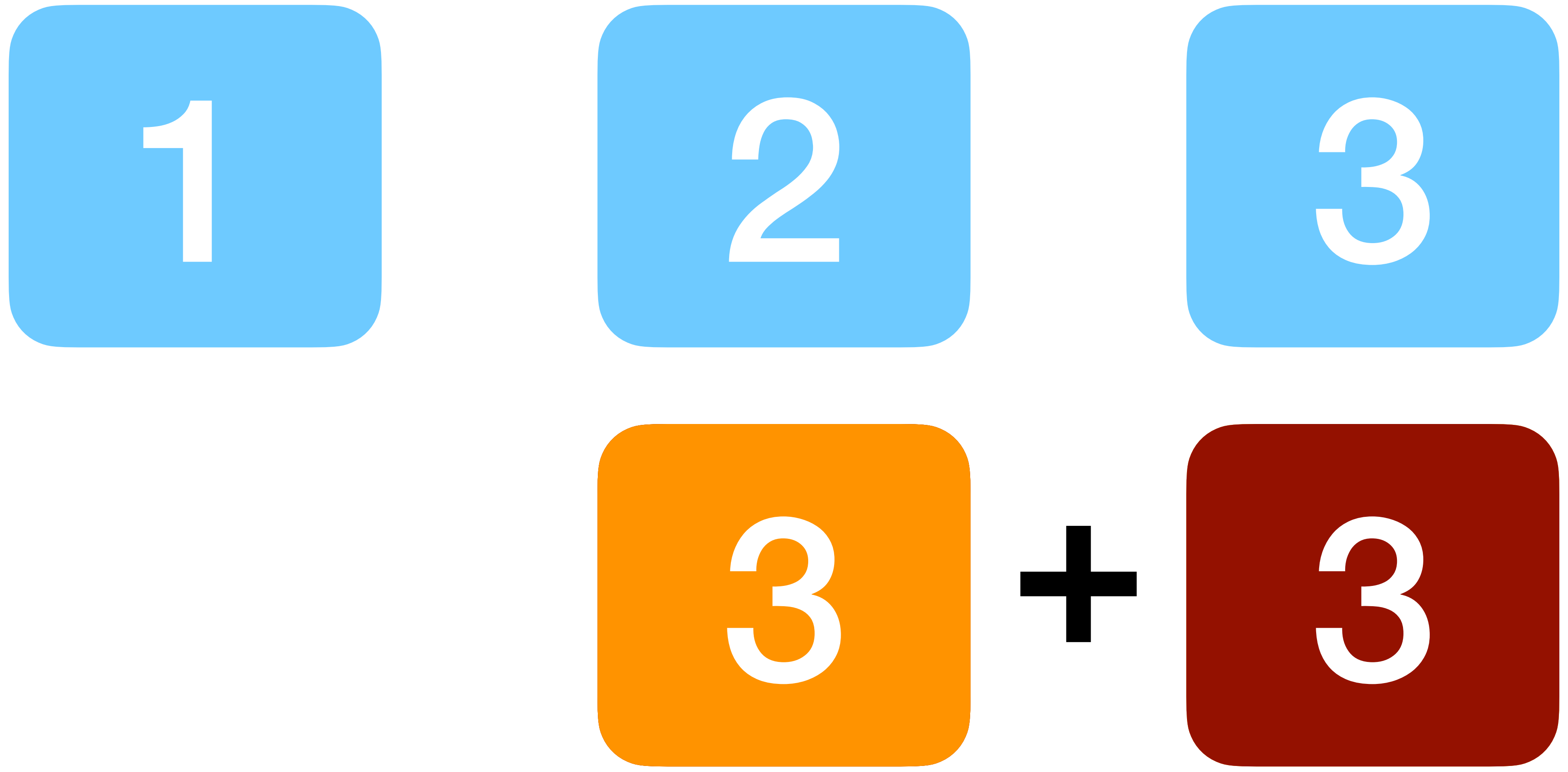


1 2 3

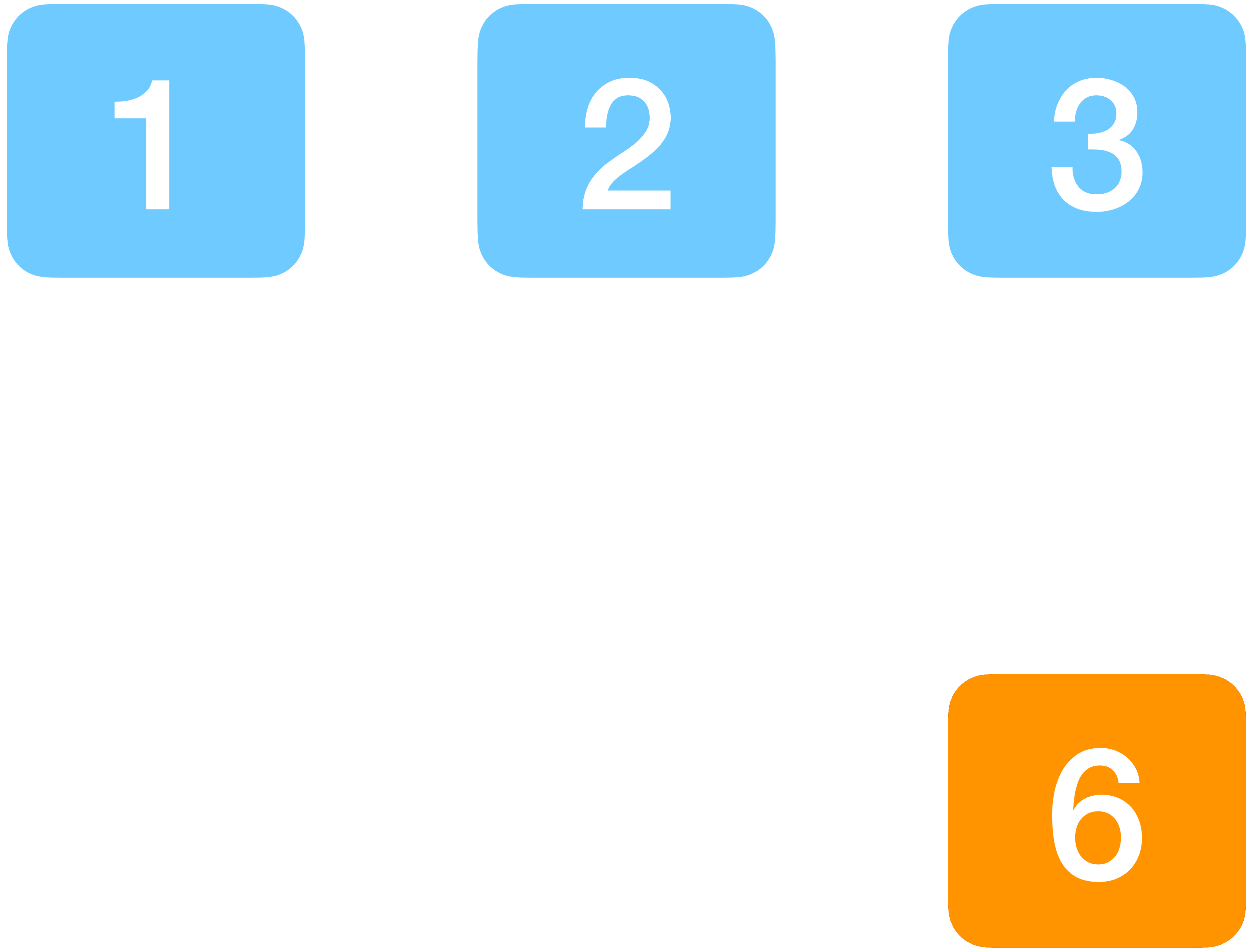
```
reduce((acc, cur) => acc + cur)
```

1 + 2 3

reduce((acc, cur) => acc + cur)



```
reduce((acc, cur) => acc + cur)
```



1 2 3

6

"un-partial" reduce

```
const plus =     (accu, cur) => accu + cur;

[1, 2, 3].reduce((accu, cur) => accu + cur);
[1, 2, 3].reduce(plus);


// variant with initial accu value as 2nd argument
// then cur starts at first element

[1, 2, 3].reduce(plus, 0);
```

Functions everywhere

Literal scope (IIFE)

Capturing scope (closures)

Higher-order functions

Constructors (returning functions)

Pair, Product Type

```
const pair = x => y => f => f(x)(y);
const fst  = p => p(T);
const snd  = p => p(F);
```

the basic product type

Either, Co-Product, Sum

```
const Left   = x => f => g => f(x);       // ctor 1
const Right  = x => f => g => g(x);       // ctor 2
const either = e => f => g => e(f)(g);    // accessor
```

the basic sum type

Special Case: Maybe

```
const Nothing  = Left ();
const Just     = Right  ;
const maybe    = either ;

maybe (expressionThatMightGoWrong)
      (handleBad)
      (handleGood);
```

go around null / undefined

Lambdafy Snake

Use pairs and either where possible

Follow the todos

Neue Konzepte in Snake

```
pair + pair == pair          // monoid
map (f) (pair) == pair   // functor
```

To Do at Home

Complete lambdafied snake.

Make the following work:

```
[1,2,3].reduce(preOrder, []) === [3,2,1]
```