The Beauty and Joy of Computing

bjc

Lecture #17
Higher Order Functions

Arkansas leading K-12 CS initiatives!

Arkansas became the first state to pass a law requiring all K-12 public and charter schools to offer CS! Unlike Texas (which passed a similar act but didn't fund it), this one is funded at $5M (small, but still) and pays for teacher training and incentives for schools that enroll kids.
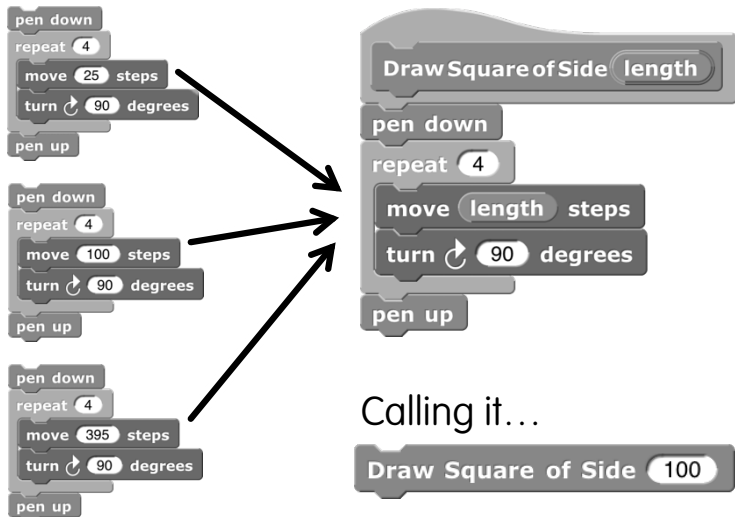
www.wired.com/2015/03/arkansas-computer-science
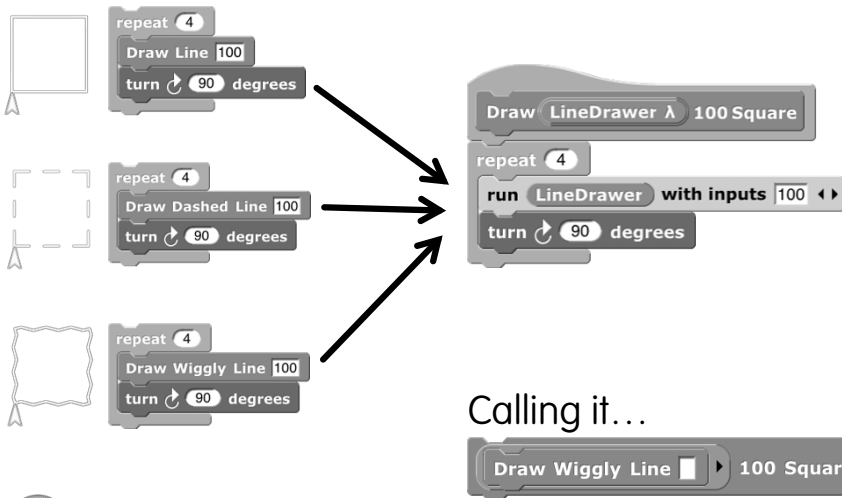
Higher Order Functions... Why? Basics...

Why Use Functions? (review)

Calling it…

Draw Square of Side 100

Why Use Higher-Order Functions?

Calling it…

Why HOFs are like Pregnant Fish, Sharks

Data (e.g,. Sentences, Words, Booleans, Lists)

Functions

Normal Fish

Sharks

Data (e.g,. Sentences, Words, Booleans, Lists)
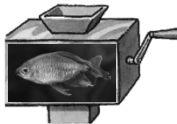
Data (e.g,. Sentences, Words, Booleans, Lists)

Data (e.g,. Sentences, Words, Booleans, Lists)

Functions

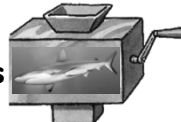**Pregnant Fish**
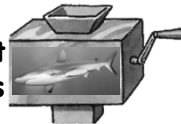
Pregnant Sharks

Functions

Functions

Functions

Useful HOFs (you can build your own!)

- **map** <u>Reporter</u> **over** <u>List</u>
  - Report a new list, every element E of List becoming Reporter(E)

- **keep items s.t.** <u>Predicate</u> **from** <u>List</u>
  - Report a new list, keeping only elements E of List if Predicate(E)

- **combine with** <u>Reporter</u> **over** <u>List</u>
  - Combine all the elements of List with Reporter(E)
  - This is also known as "reduce"

How combine works:
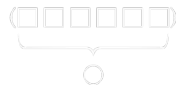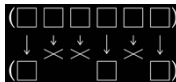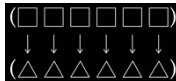
combine with **Reporter** **over** **List**

List

1	a
2	b
3	c
4	d

+ ☰ length: 4

(a b c d)

combine using f
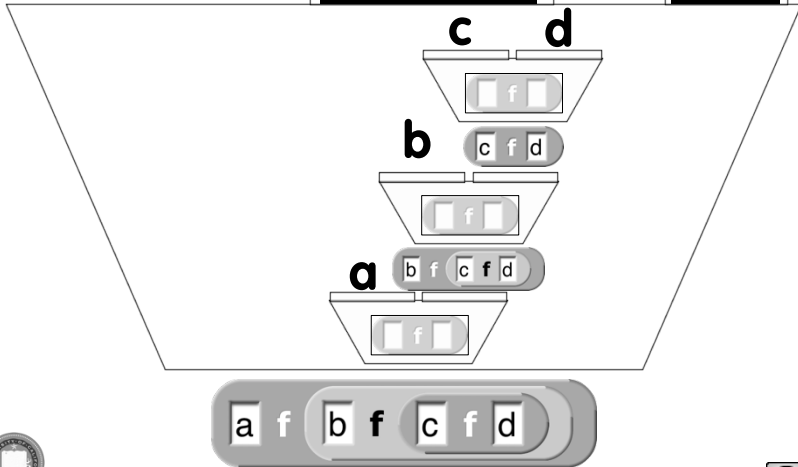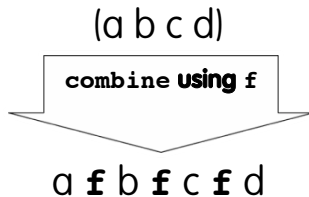
a **f** b **f** c **f** d

Your **f** should be **associative**, and work if it's

(a **f** b) **f** (c **f** d)   ((a **f** b) **f** (c **f** d))

or…

(a **f** b) **f** c **f** d   (((a **f** b) **f** c) **f** d)

etc…

What is reported here?

a) abcd

b) acdb

c) bdac

d) dcba

e) (nothing)


```
L joinswap R

report (join R L) ◀▶
```

```
combine with ( ⬜ joinswap ⬜ ) ▶ items of (list a b c d ◀▶)
```

Acronym

🍦 Acronym Algorithm

input

1	the
2	Beauty
3	and
4	Joy
5	of
6	Computing

length: 6

(the Beauty and Joy of Computing)

keep only uppercase words

(Beauty Joy Computing)

map first letter only

(B J C)

combine into one word (join)

BJC

Acronym (uses `map`, `keep`, `combine`)


```
Acronym phrase :
report
  combine with ( join ☐ ☐ ◀▶ ) ▶ items of
  map ( letter ① of ☐ ) ▶ over
    keep items such that ( unicode of ( letter ① of ☐ ) < unicode of a ) ▶
    from phrase
  ◀▶
```

```
Acronym ( sentence ➡ list the·Beauty·and·Joy·of·Computing )        BJC
```
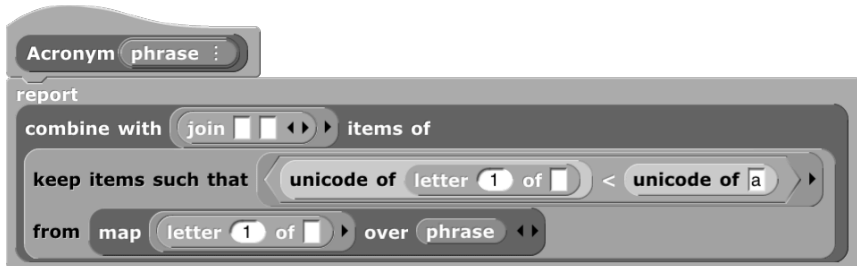
☑

(Cal) Clicker Question

What is reported if I swap **keep** and **map** in Acronym and call it on **(the Beauty and Joy of Computing)**

a) bjc
b) BJC
c) CJB
d) (nothing)
e) Error


```
Acronym (phrase :)
report
  combine with (join ▢ ▢ ◄►) ► items of
    keep items such that ⟨ (unicode of (letter ① of ▢)) < (unicode of (a)) ⟩
    from (map (letter ① of ▢) ► over (phrase) ◄►)
```

HOF Tools & Demo

run

launch

call

input names: #1

input names: #1

input names: #1