

UC Berkeley EECS
Teaching Professor
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The Beauty and Joy of Computing

Lecture #17 Higher Order Functions



Arkansas leading K-12 CS initiatives!

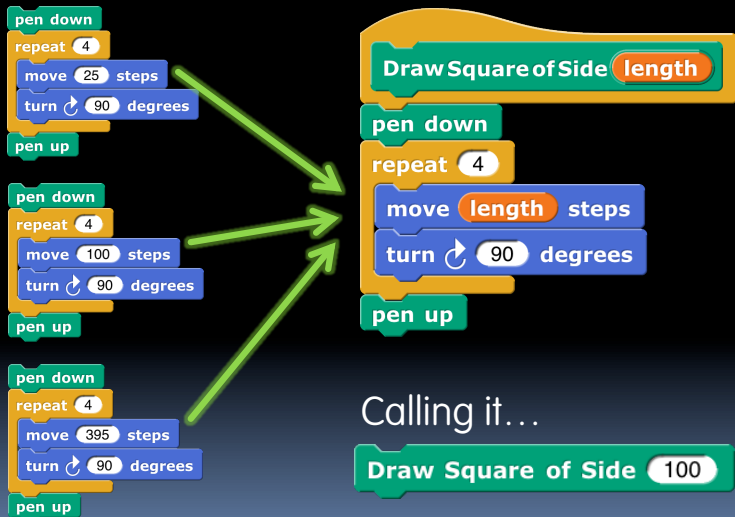
Arkansas became the first state to pass a law requiring all K-12 public and charter schools to offer CS! Unlike Texas (which passed a similar act but didn't fund it), this one is funded at \$5M (small, but still) and pays for teacher training and incentives for schools that enroll kids.



www.wired.com/2015/03/arkansas-computer-science

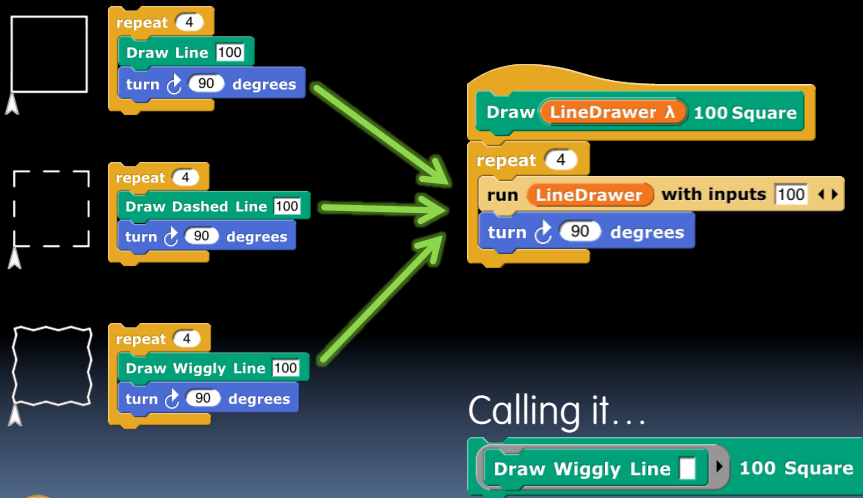
Higher Order
Functions...
Why? Basics...

Why Use Functions? (review)





Why Use Higher-Order Functions?



Why HOFs are like Pregnant Fish, Sharks

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

Normal
Fish



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

Pregnant
Fish



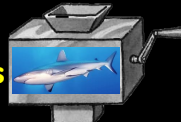
Functions



Functions



Sharks



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

Functions



Pregnant
Sharks



Functions



Source: Brian Harvey, Wikipedia (Fbattail, Aka, Evdaimon)

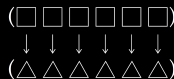
UC Berkeley "The Beauty and Joy of Computing": Higher-Order Functions (5)

HOFs you have seen before

Useful HOFs (you can build your own!)

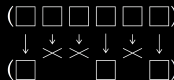
- **map** Reporter **over** List

- Report a new list, every element E of $List$ becoming $Reporter(E)$



- **keep items s.t.** Predicate **from** List

- Report a new list, keeping only elements E of $List$ if $Predicate(E)$



- **combine with** Reporter **over** List

- Combine all the elements of $List$ with $Reporter(E)$
- This is also known as "reduce"



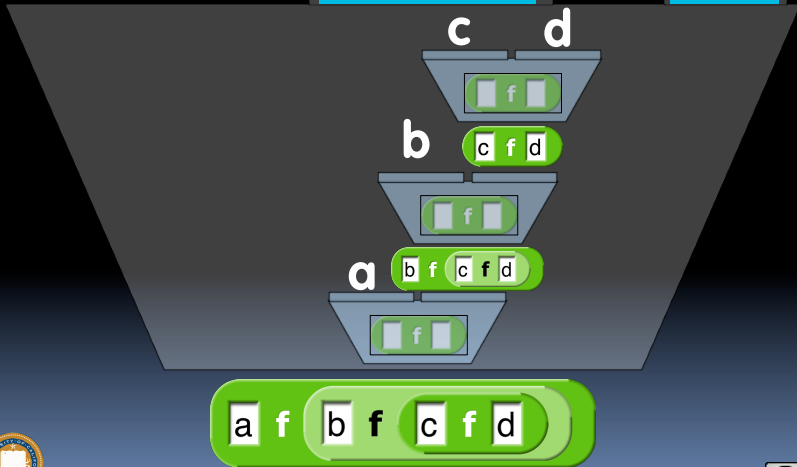
bjc

How combine works:



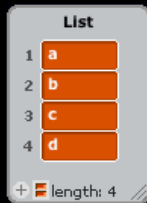
List	
1	a
2	b
3	c
4	d
+ length: 4	

combine with Reporter over List





combine above the abstraction line



(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))

or...

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

etc...



(Cal) Clicker Question

What is reported here?

- a) abcd
- b) acdb
- c) bdac
- d) dcba
- e) (nothing)



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 sentence → list the Beauty and Joy of Computing

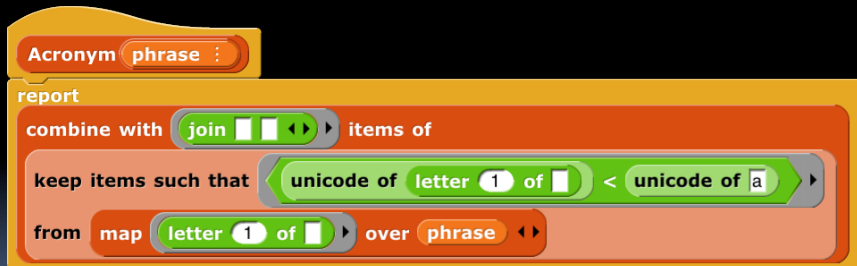
BJC



(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



HOF Tools & Demo

HOF tools, sharks, pregnant fish, mymap

