

The Beauty and Joy of Computing

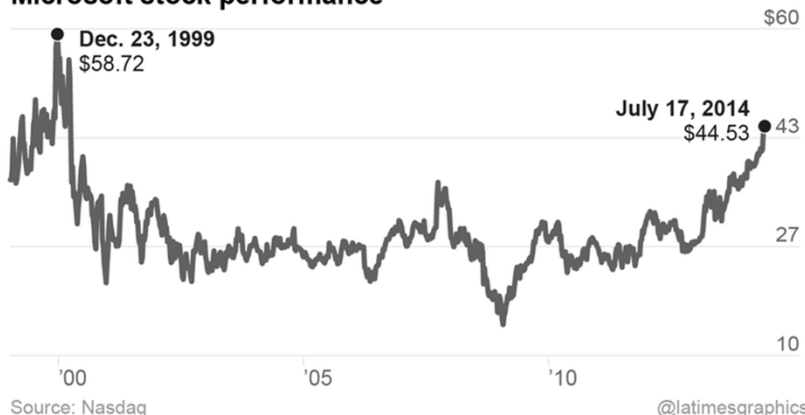
Lecture #19 Higher Order Functions



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MICROSOFT CUTS JOBS

Microsoft stock performance

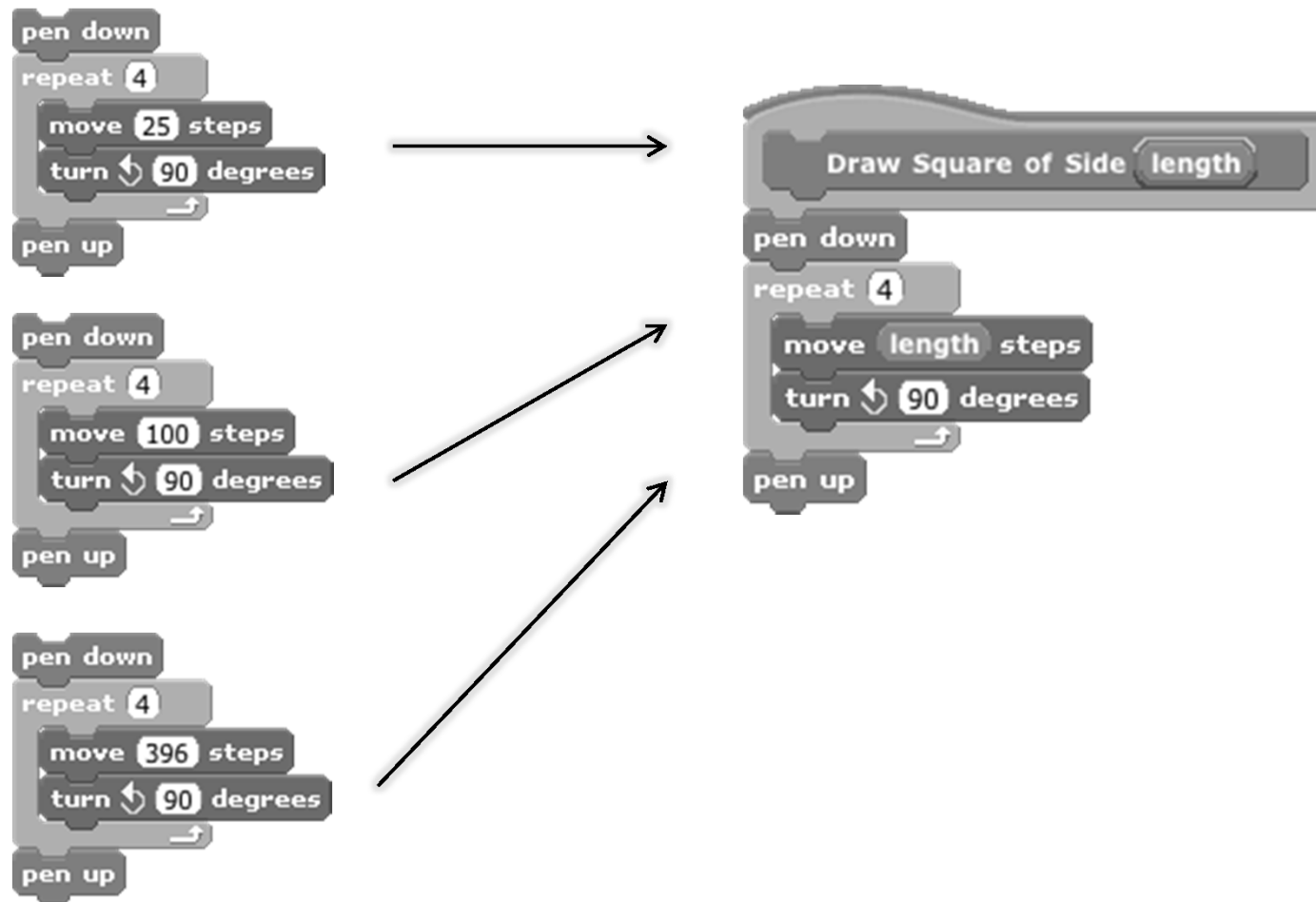


Microsoft cuts over 18000 jobs, namely at Nokia branch, to incorporate it and revamp their image to compete with Amazon, Google, and Apple.

<http://www.latimes.com/business/la-fi-microsoft-layoffs-20140718-story.html>

bjc

Why use functions? (review)



The power of generalization!



bjc

But how general can we be?

```
Min of llist
script variables best so far
set best so far to item 1 of llist
# foreach item of llist
if item < best so far
set best so far to item
report best so far
```

```
Max of llist
script variables best so far
set best so far to item 1 of llist
# foreach item of llist
if item > best so far
set best so far to item
report best so far
```

```
Closest to 6 llist
script variables best so far
set best so far to item 1 of llist
# foreach item of llist
if item closer to 6 than best so far
set best so far to item
report best so far
```

```
find best element using better from list
script variables best so far
set best so far to item 1 of llist
# foreach item of llist
if call better with inputs item best so far
set best so far to item
report best so far
```

```
find best element using closer to 6 than
from list 2 5 1 9 4
```

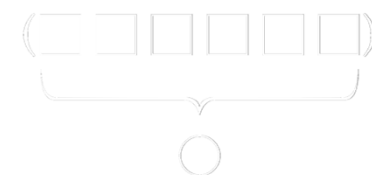
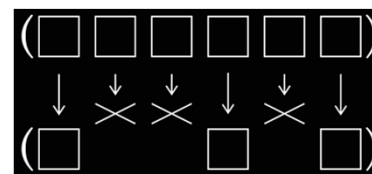
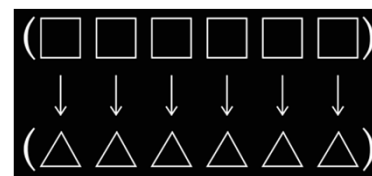
The power of generalization!





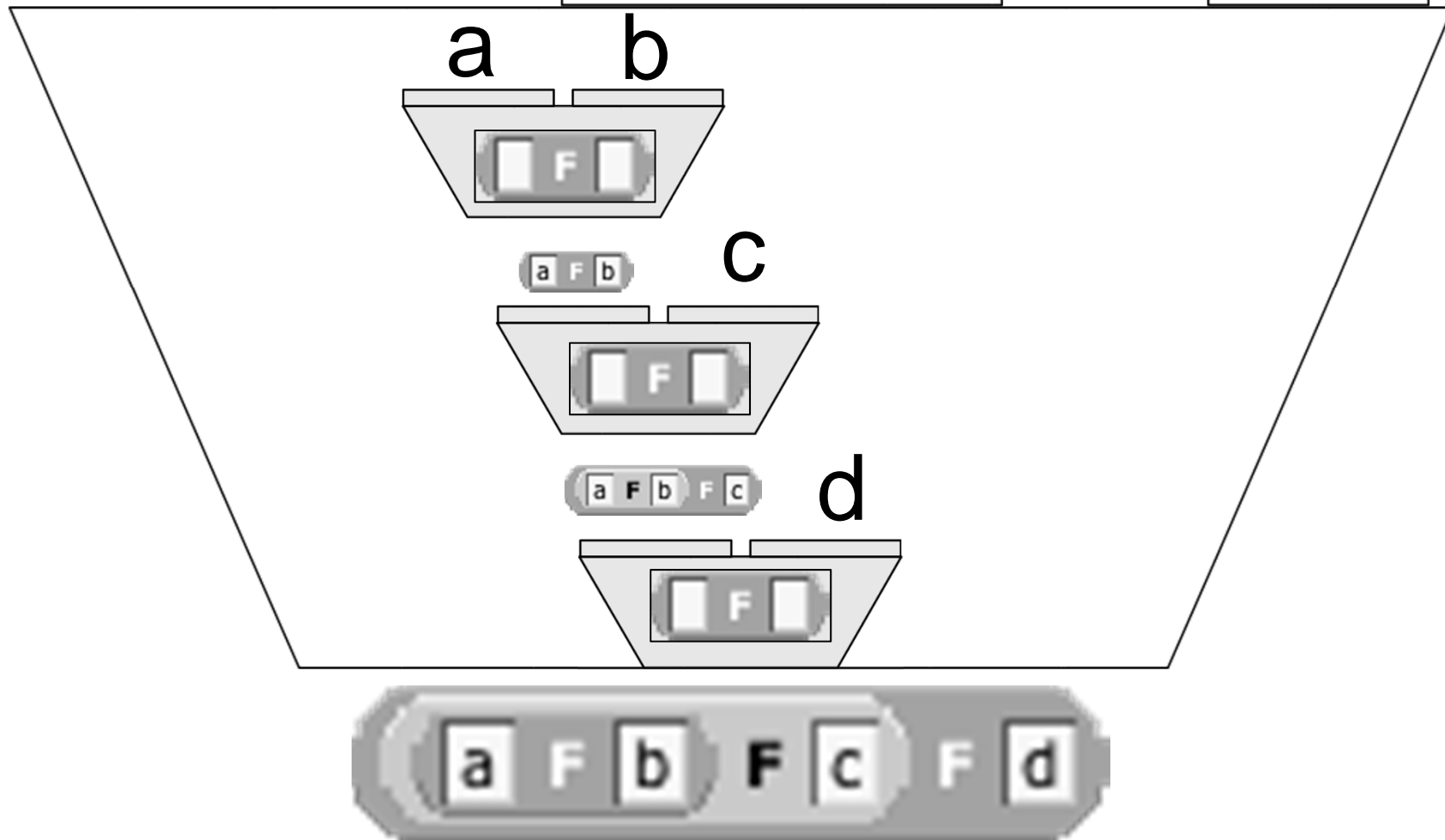
Today

- Functions as Data
- Higher-Order Functions
- 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 such that 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”
- Acronym example
 - keep → map → combine





combine with Reporter over List





Peer Instruction



I understand higher-order functions.

- a) Strongly disagree
- b) Disagree
- c) Neutral
- d) Agree
- e) Strongly agree





Summary

- Functions as data is one of the two (programming) big ideas in this course
- It's a beautiful example of the abstraction of the list iteration details
- Google (and other companies) use this!
 - They use “map-reduce”

(Image Credit: *Simply Scheme* by Brian Harvey & Matt Wright)



Turning function machines into plowshares

