Lecture 4: Environment Diagrams

Brian Hou
June 21, 2016

Announcements

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- Ask questions during lecture on Piazza!

Roadmap

Introduction

Functions

Data

Mutability

Objects

Interpretation

Paradigms

Applications

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Introduction

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Objects

Interpretation

Paradigms

Applications

- This week (Introduction), the goals are:
  - To learn the fundamentals of programming
  - To become comfortable with Python

Abstraction

Abstraction

"The essence of abstraction is preserving information that is relevant in a given context, and forgetting information that is irrelevant in that context."

– John V. Guttag, *Introduction to Computation and Programming Using Python*

Discussion Question 1

n^2

$(n+1)^2$

$2 \cdot (n+1)$

$n^2 + 1$

$n \cdot (n+1)$

What does pyramid compute?

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def pyramid(n):
    a, b, total = 0, n, 0
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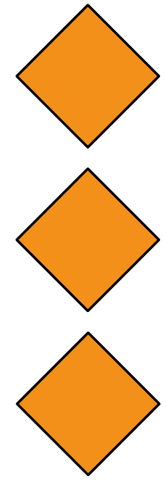

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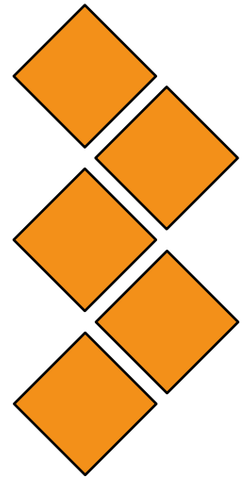

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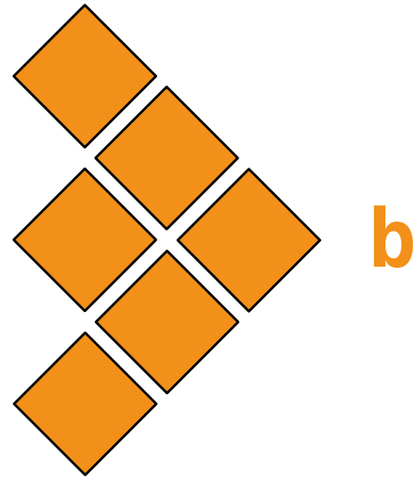

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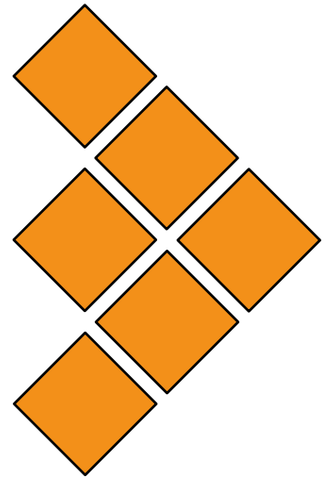

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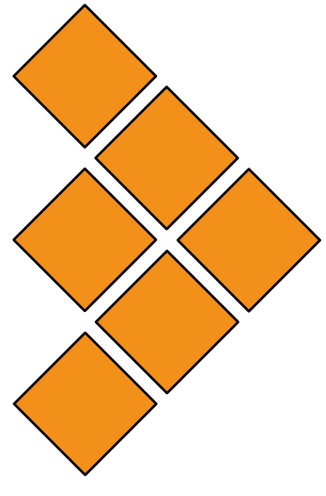

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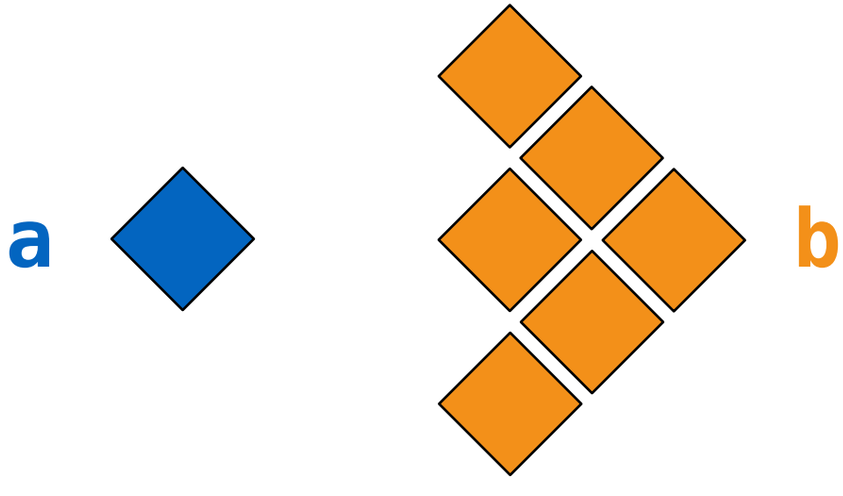

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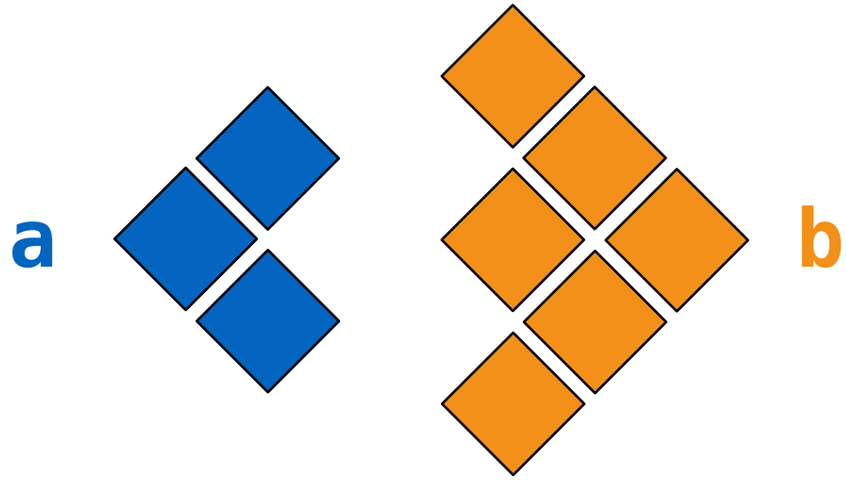

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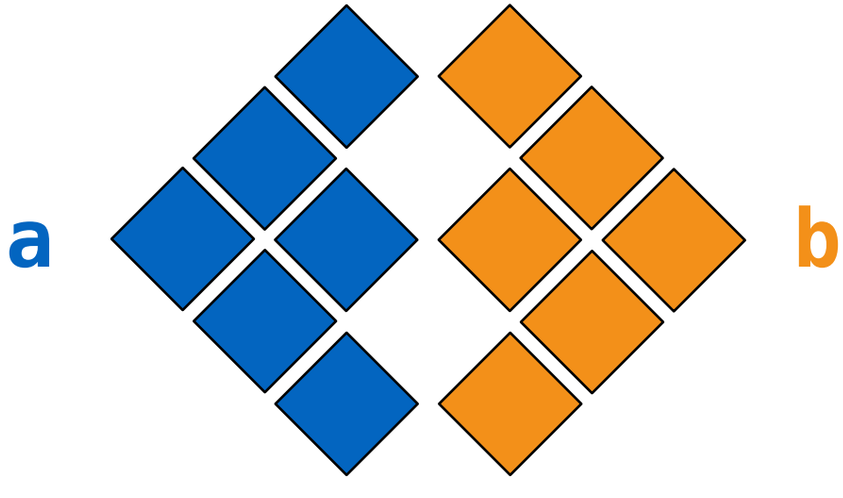

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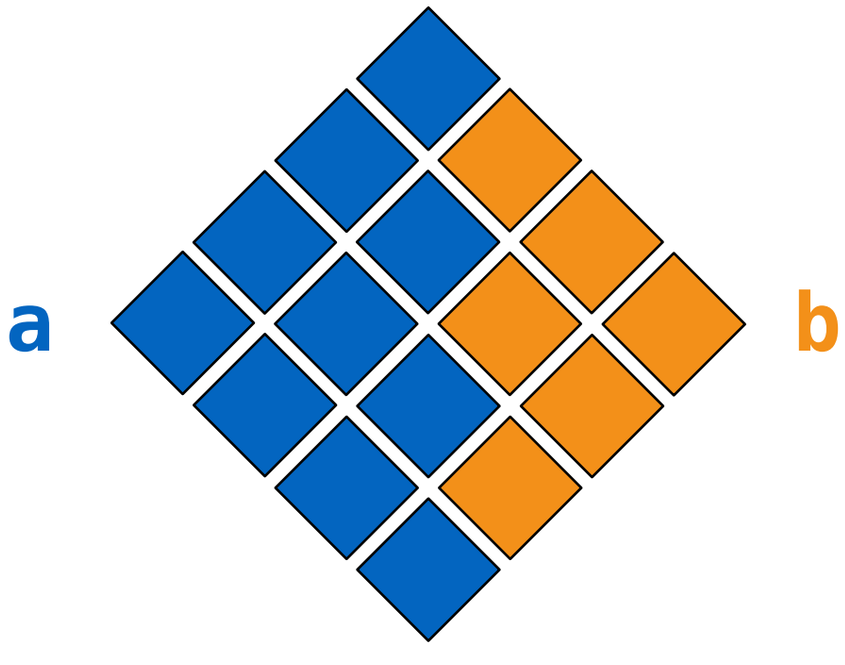

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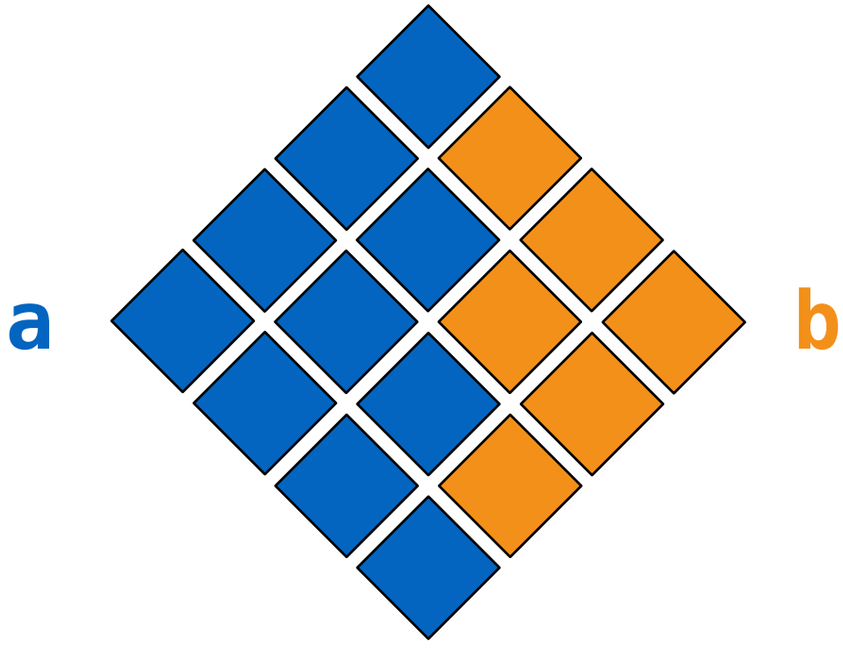

Tools for abstraction

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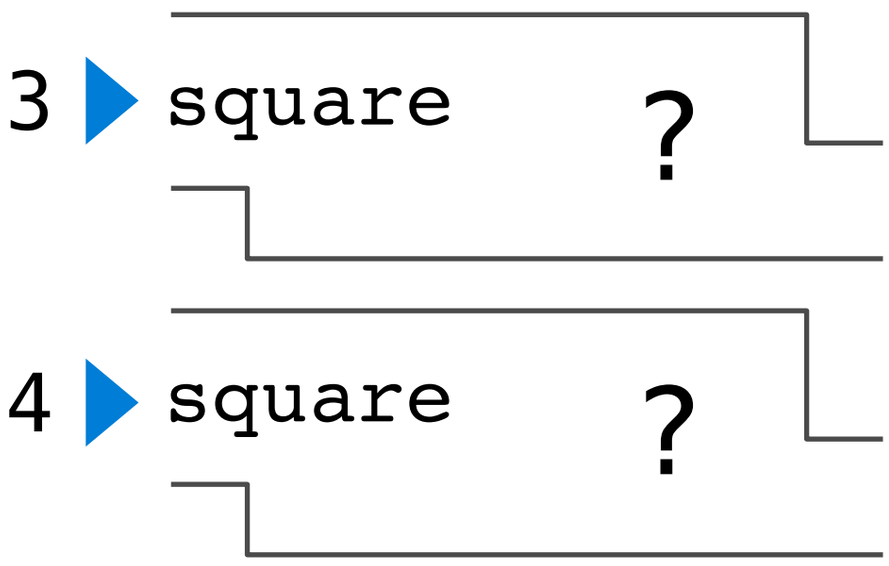

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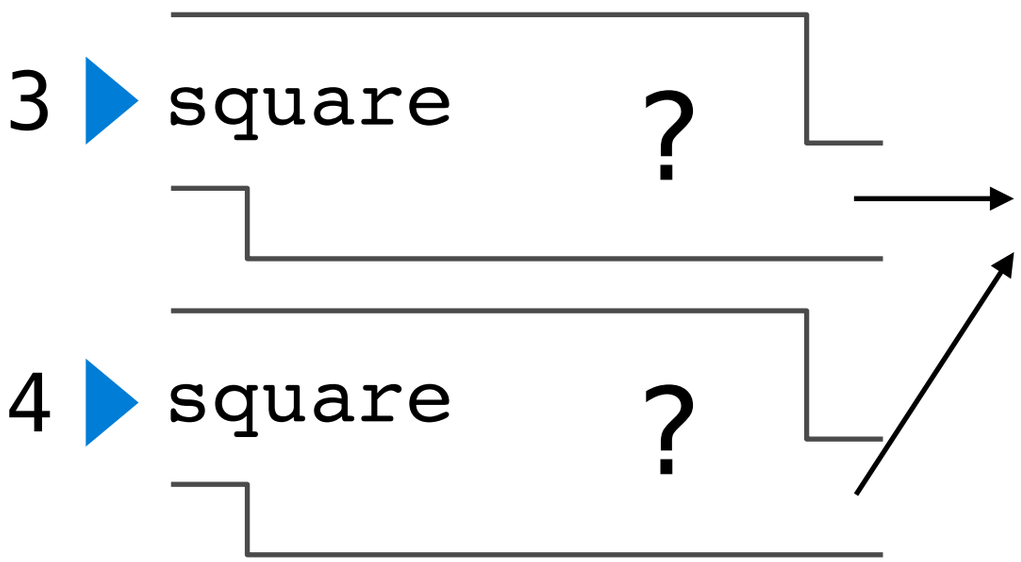

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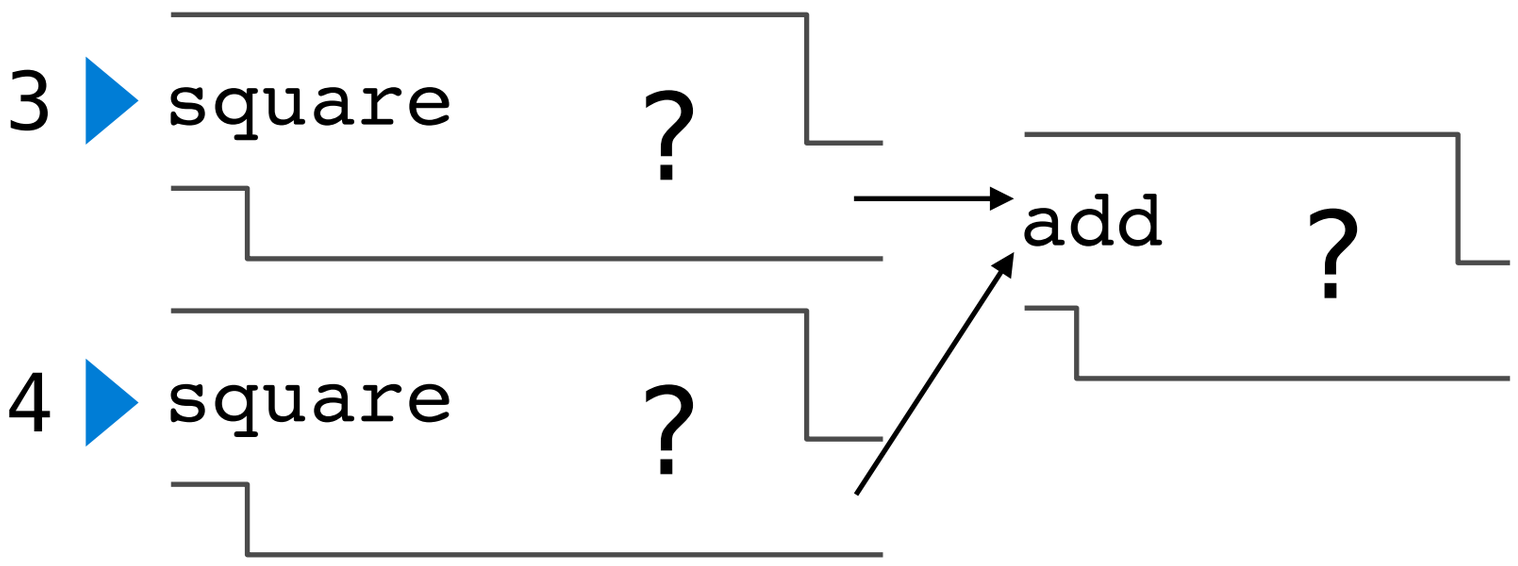

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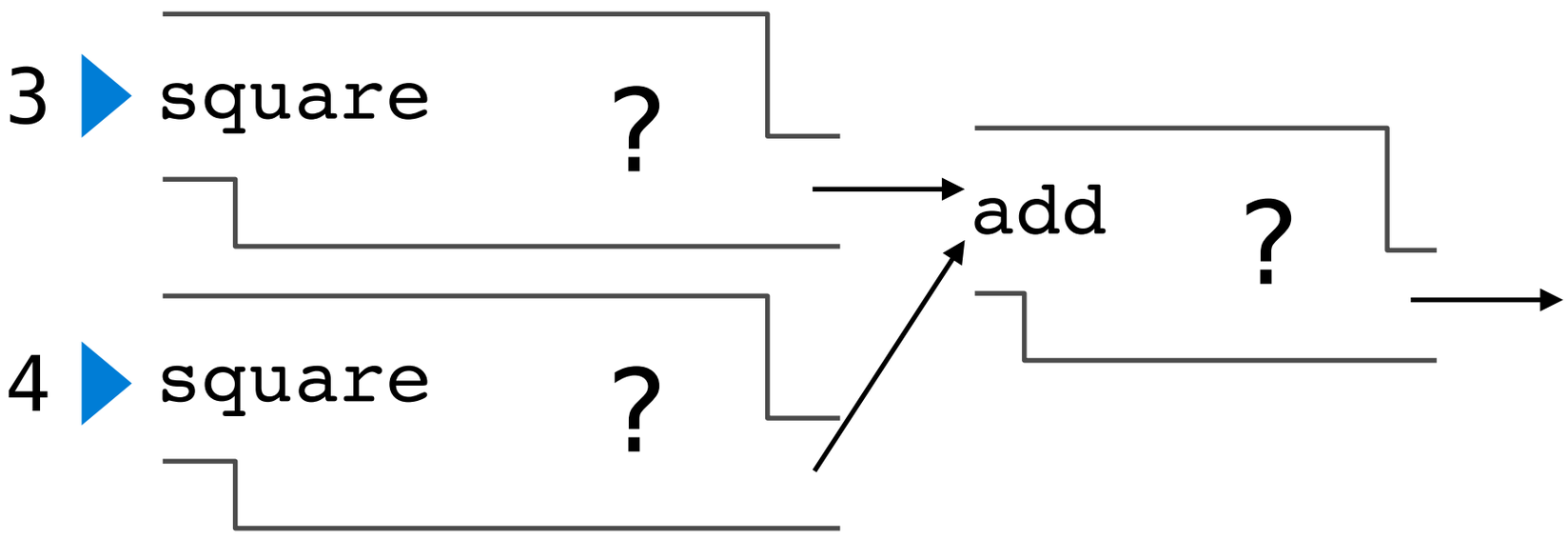

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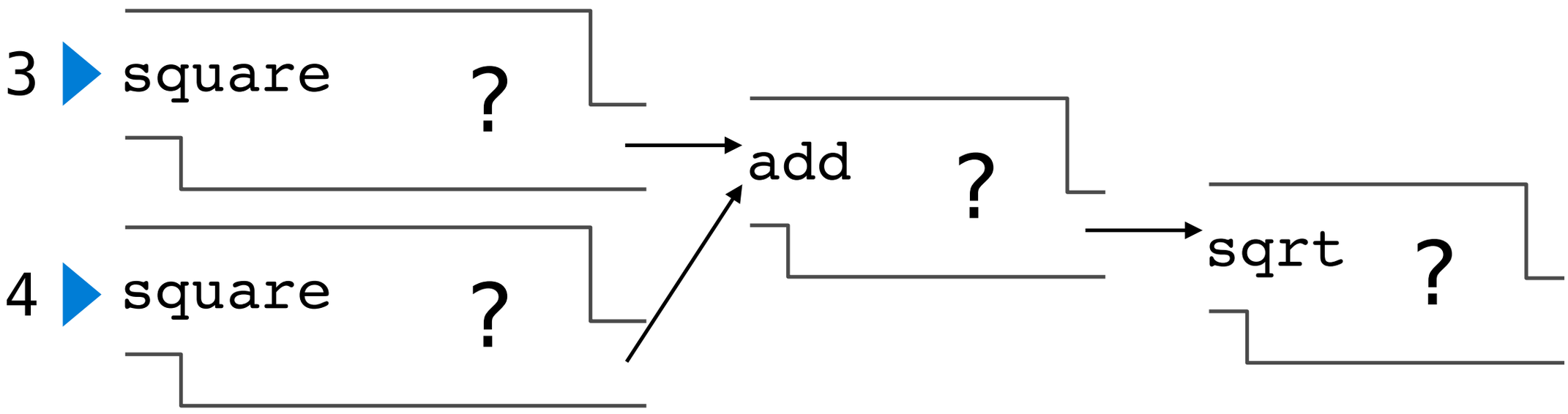

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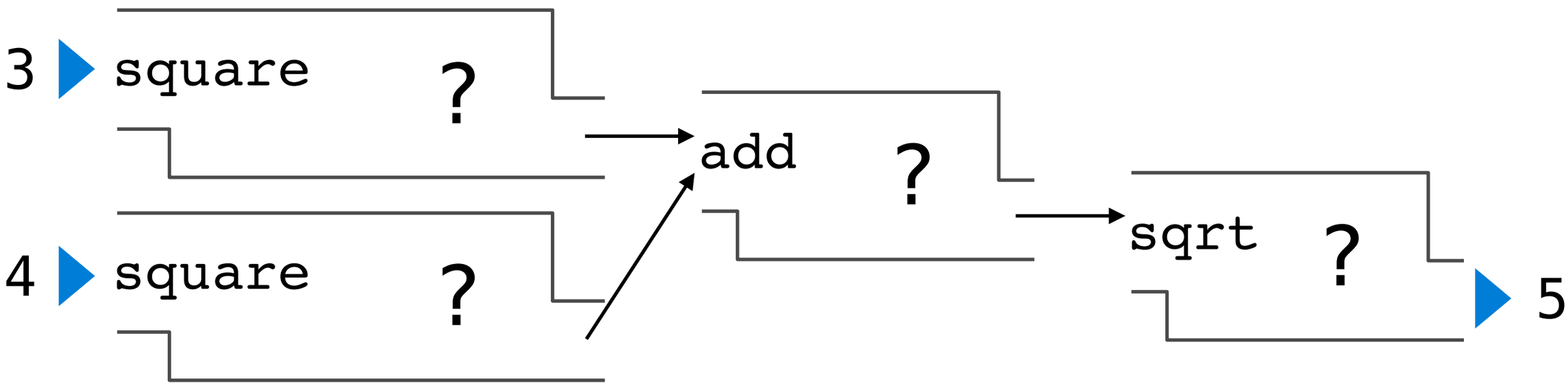

Miscellaneous Python features (demo)

- Operators
- Multiple return values
- Docstrings
- Doctests
- Default arguments

Environment Diagrams

Lists and **for** Loops

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```
s = [3, 1, 4, 1, 5, 9]
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    while n > 0:
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x = 2
def repeated(f, n, x):
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A function with parameter x

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Lambda expressions in Python cannot contain statements at all!

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Lambda expressions aren't common in Python, but important in general

lambda

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lambda (demo)

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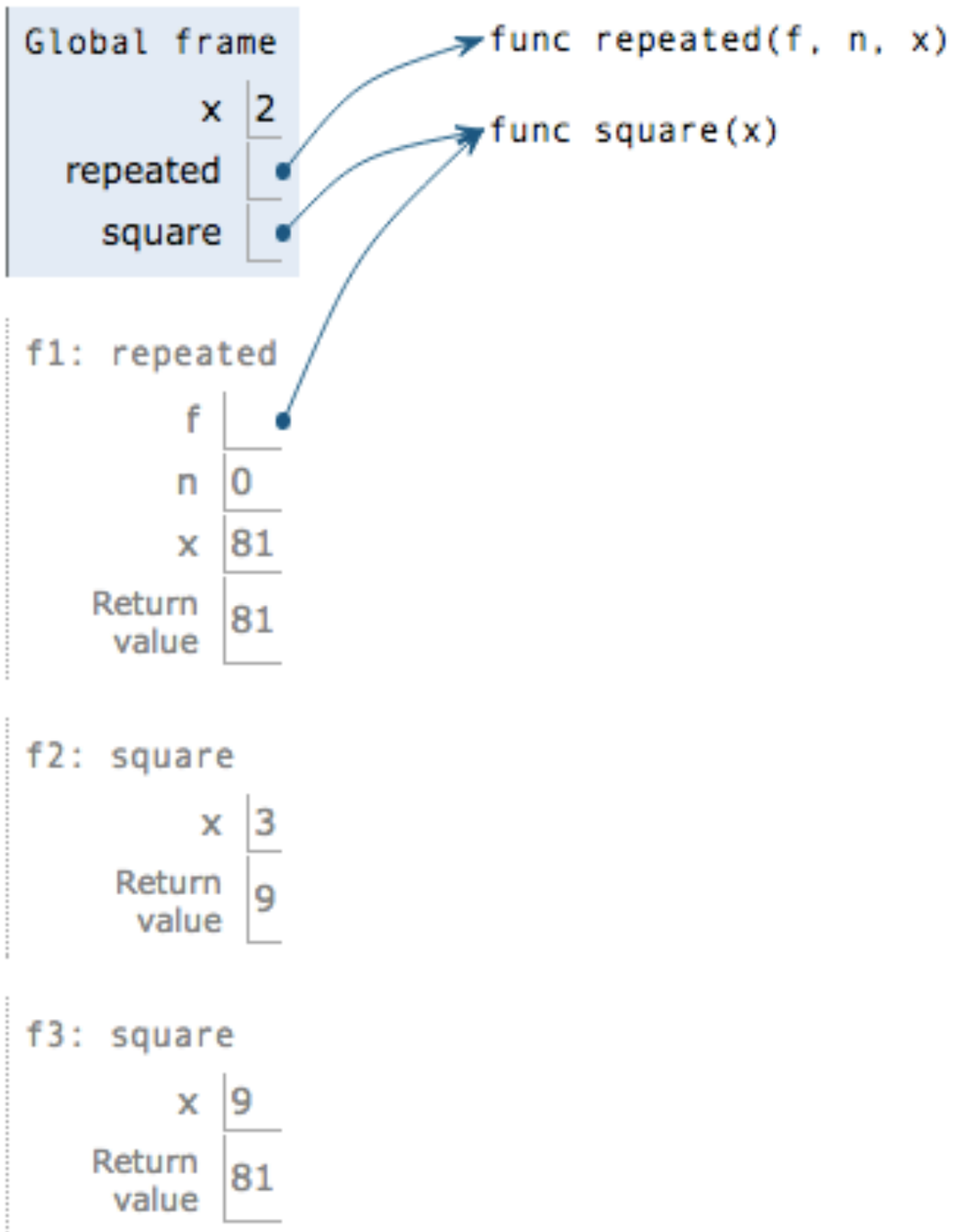
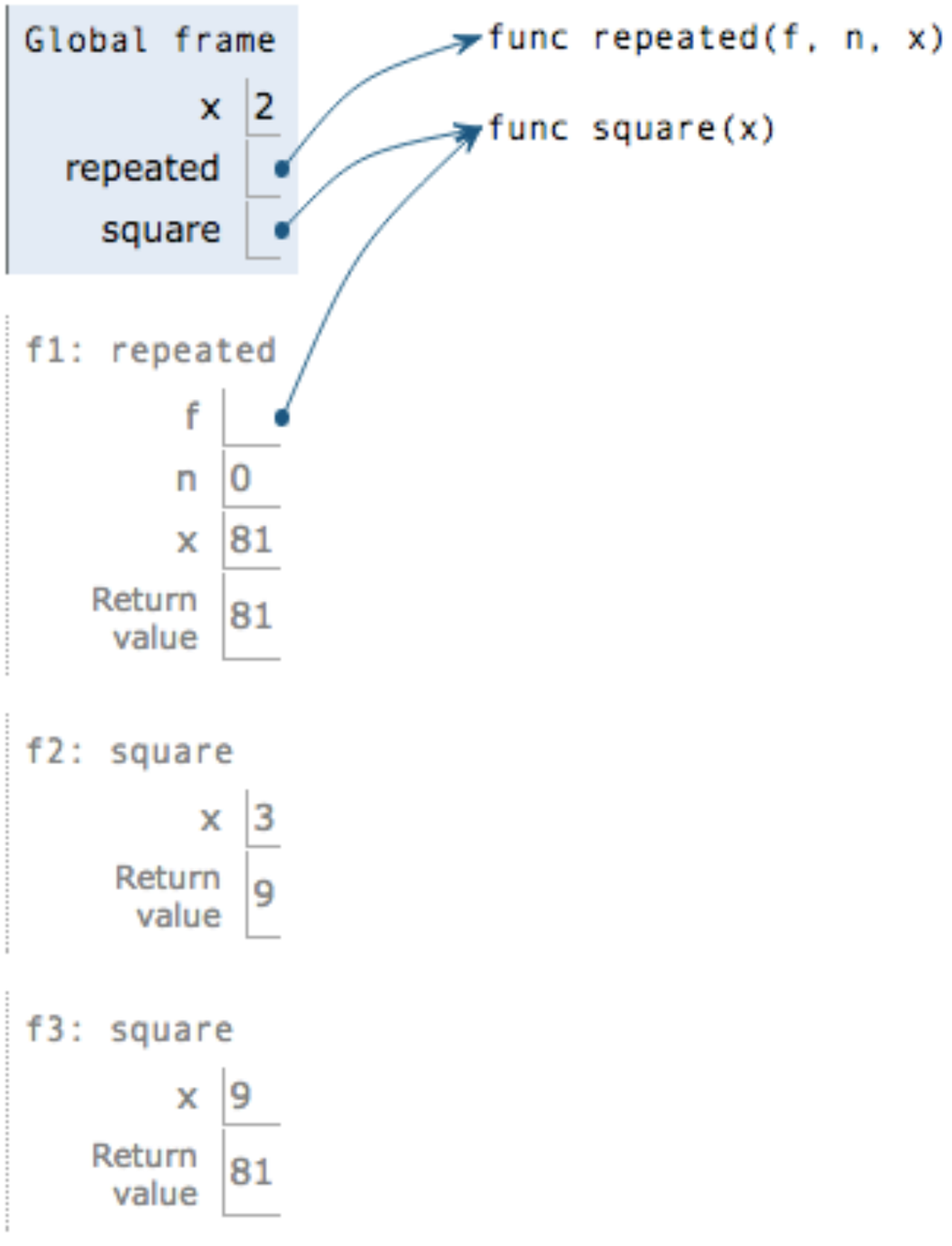
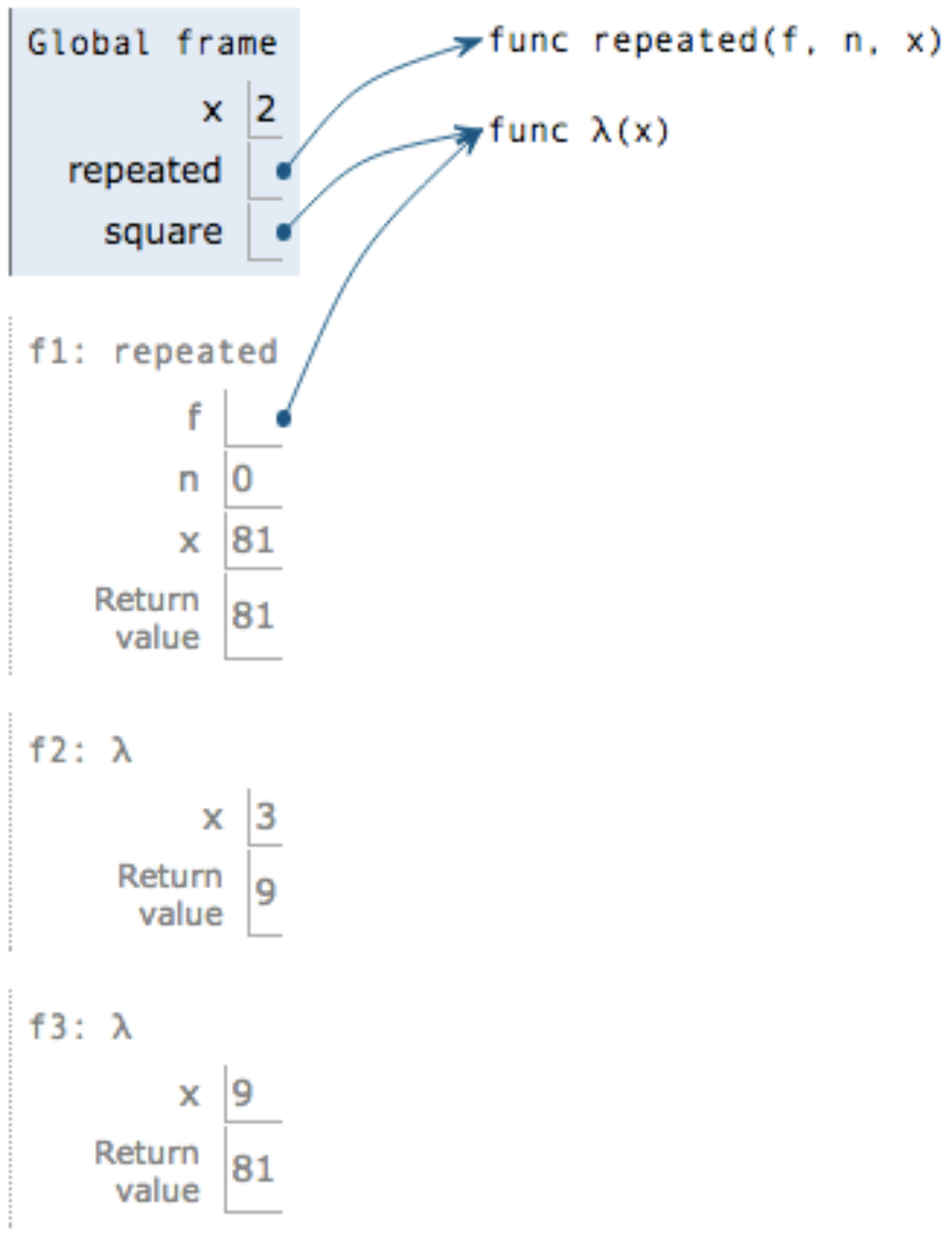
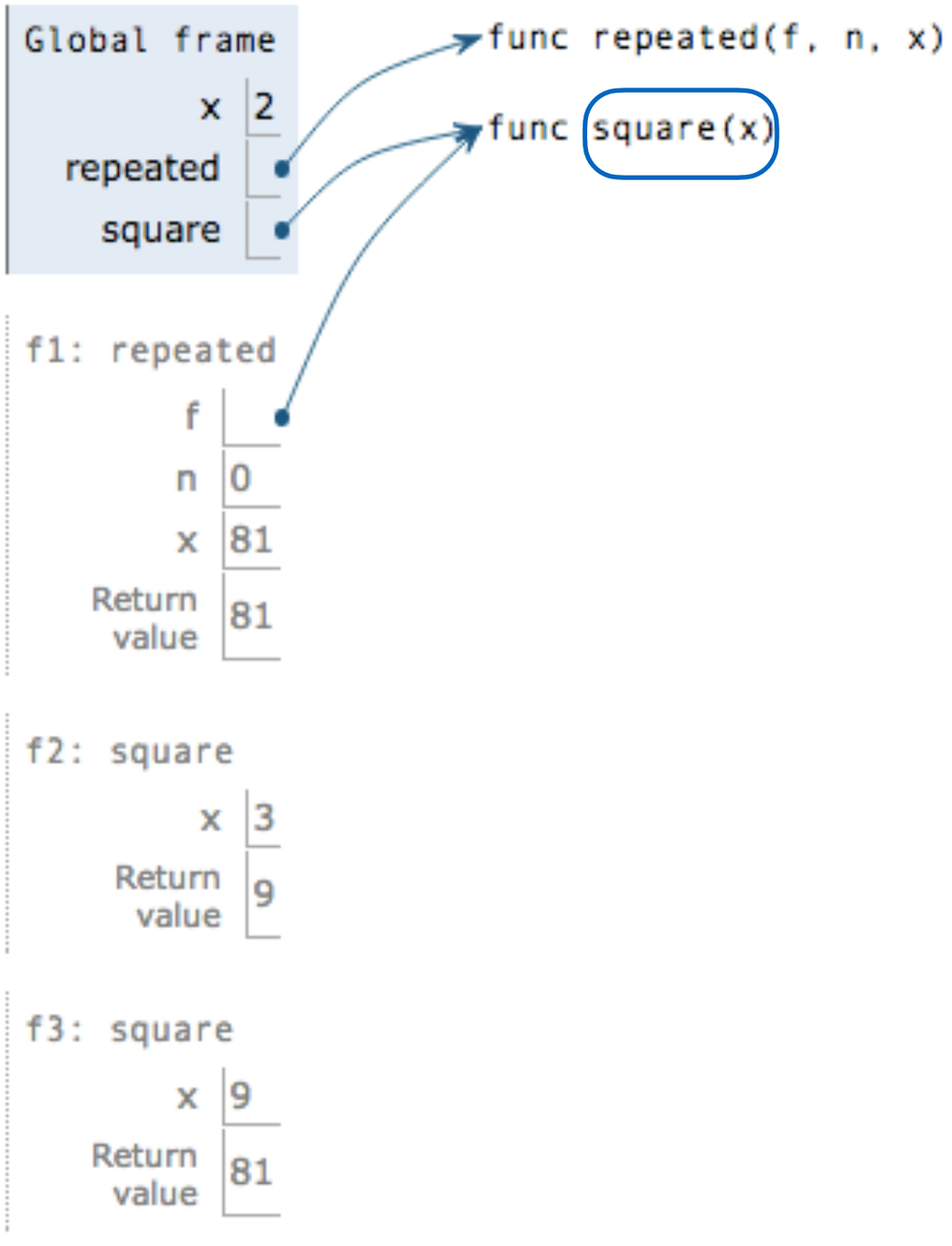

Global frame
x 2
repeated
square
func repeated(f, n, x)
func square(x)
f1: repeated
f
n 0
x 81
Return value 81
f2: square
x 3
Return value 9
f3: square
x 9
Return value 81

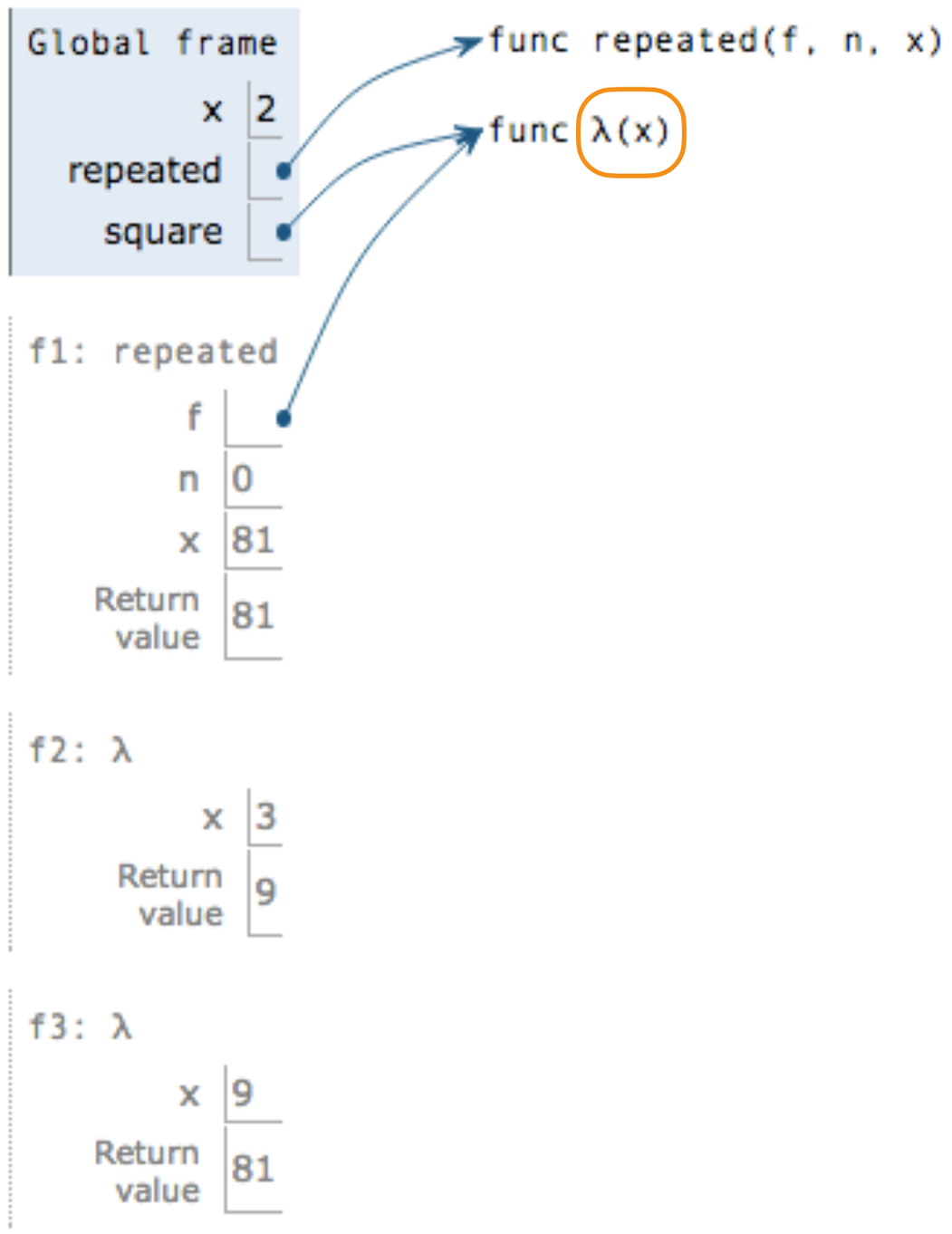
lambda


Global frame
x 2
repeated
square
func repeated(f, n, x)
func square(x)
f1: repeated
f
n 0
x 81
Return value 81
f2: square
x 3
Return value 9
f3: square
x 9
Return value 81

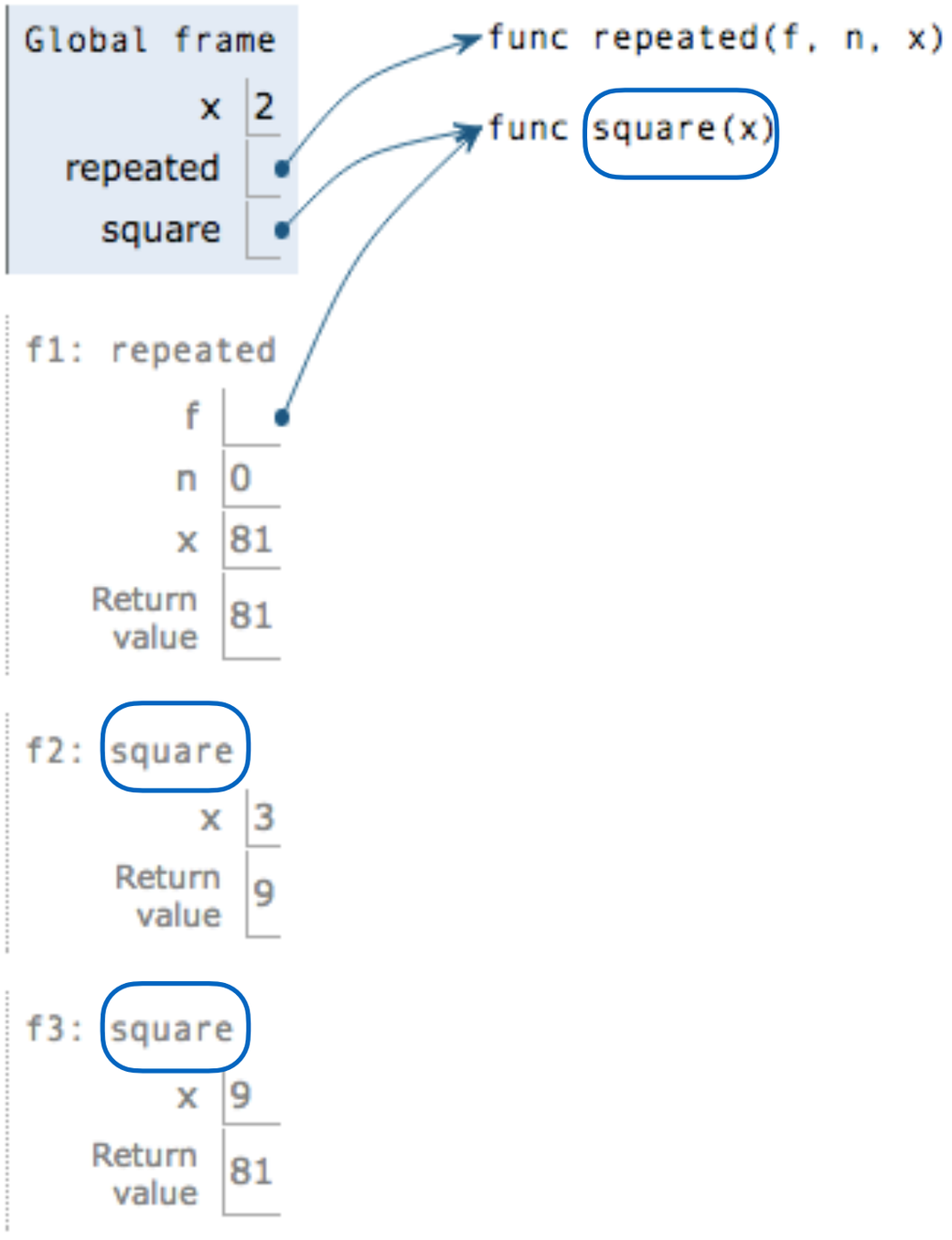

Global frame
x 2
repeated
square
func repeated(f, n, x)
func λ(x)
f1: repeated
f
n 0
x 81
Return value 81
f2: λ
x 3
Return value 9
f3: λ
x 9
Return value 81

lambda


Global frame
x 2
repeated
square
func repeated(f, n, x)
func square(x)
f1: repeated
f
n 0
x 81
Return value 81
f2: square
x 3
Return value 9
f3: square
x 9
Return value 81


Global frame
x 2
repeated
square
func repeated(f, n, x)
func λ(x)
f1: repeated
f
n 0
x 81
Return value 81
f2: λ
x 3
Return value 9
f3: λ
x 9
Return value 81

lambda


Global frame
x 2
repeated
square
func repeated(f, n, x)
func square(x)
f1: repeated
f
n 0
x 81
Return value 81
f2: square
x 3
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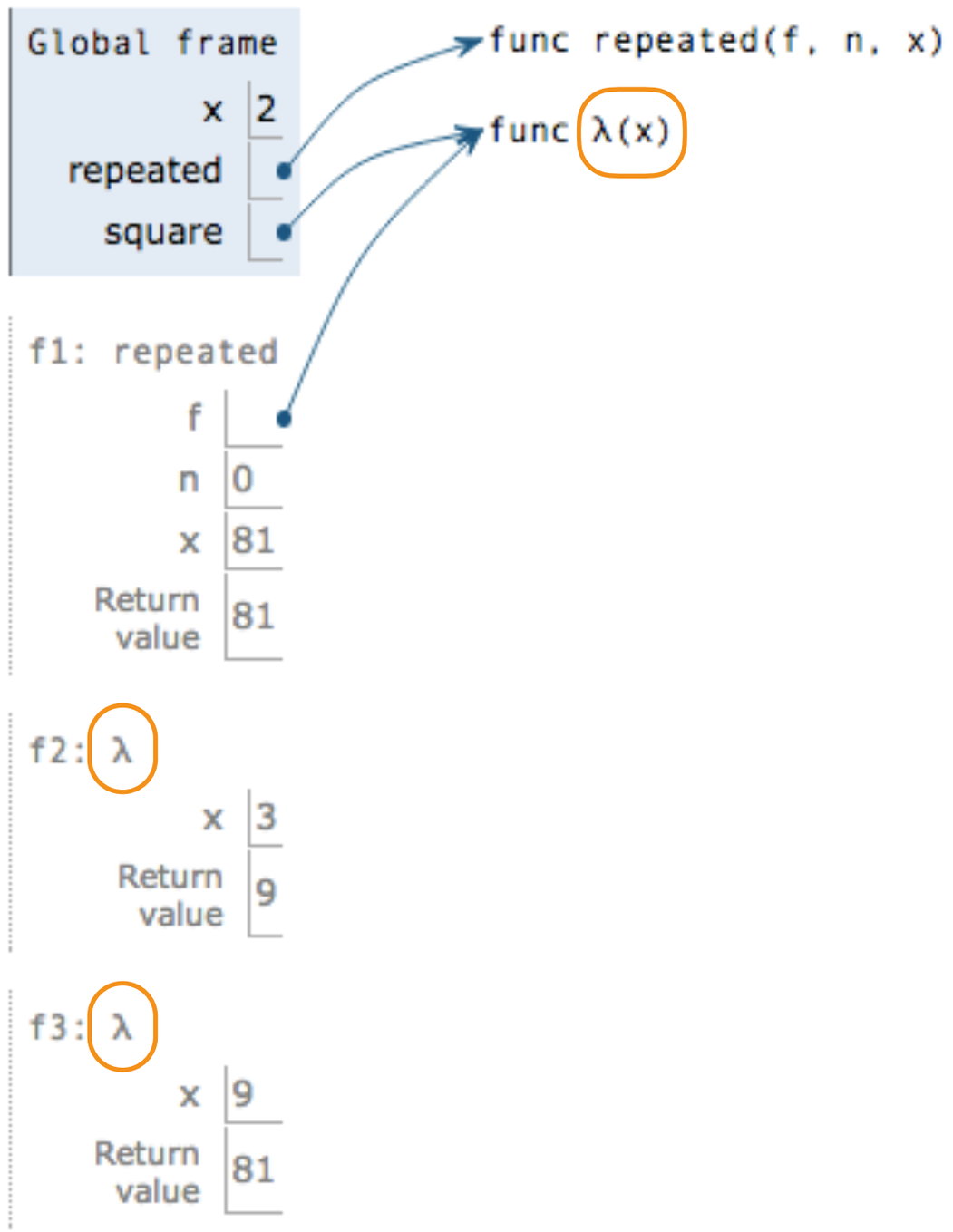
x 9
Return value 81


Global frame
x 2
repeated
square
func repeated(f, n, x)
func λ(x)
f1: repeated
f
n 0
x 81
Return value 81
f2: λ
x 3
Return value 9
f3: λ
x 9
Return value 81