Environments

Announcements

Print and None Review

Fall 2022 CS 61A Midterm 1, Question 1

What does this expression print?

```
print(print(print("Knock", "Knock") or print("Who's There?")), "Who?")
```

r/berkeley • 6 mo. ago
by IndicationMotor6095

Join

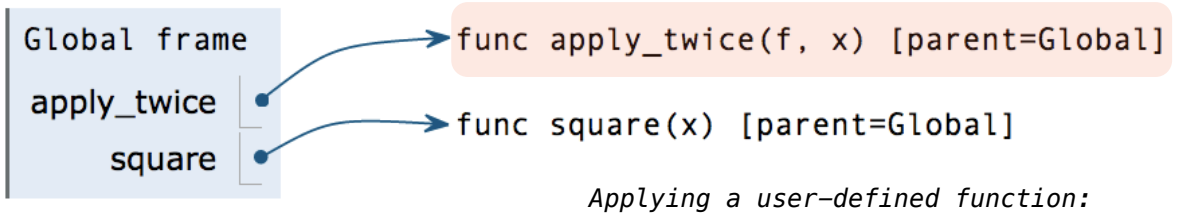
I cheated my way through cal and I'll let you know how

Listen, I've been using this method for years and I never got caught. I've also noticed that some of the head TAs and smart kids also cheat their way through cal with this method. If you follow these easy steps nobody will ever notice.

Environments for Higher-Order Functions

Names can be Bound to Functional Arguments

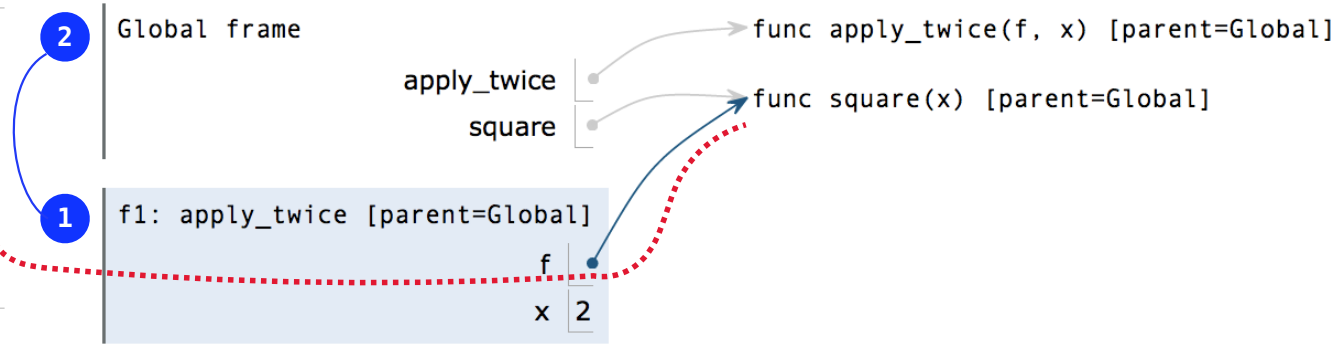
```
1  def apply_twice(f, x):
2      return f(f(x))
3
4  def square(x):
5      return x * x
6
7  result = apply_twice(square, 2)
```



Applying a user-defined function:

- Create a new frame
- Bind formal parameters (f & x) to arguments
- Execute the body: return f(f(x))

```
1  def apply_twice(f, x):
2      return f(f(x))
3
4  def square(x):
5      return x * x
6
7  result = apply_twice(square, 2)
```



pythontutor.com/composingprograms.html#code=def%20apply_twice%28f,%20x%29%3A%0A%20%20%20%20return%20f%28f%28x%29%29%0A%20%20%20%20%0Adef%20square%28x%29%3A%0A%20%20%20%20return%20x%20*%20x%0A%20%20%20%20%0Aresult%20%3D%20apply_twice%28square,%202%29&mode=display&origin=composingprograms.js&cumulative=true&py=3&rawInputLstJSON=[]&curInstr=0

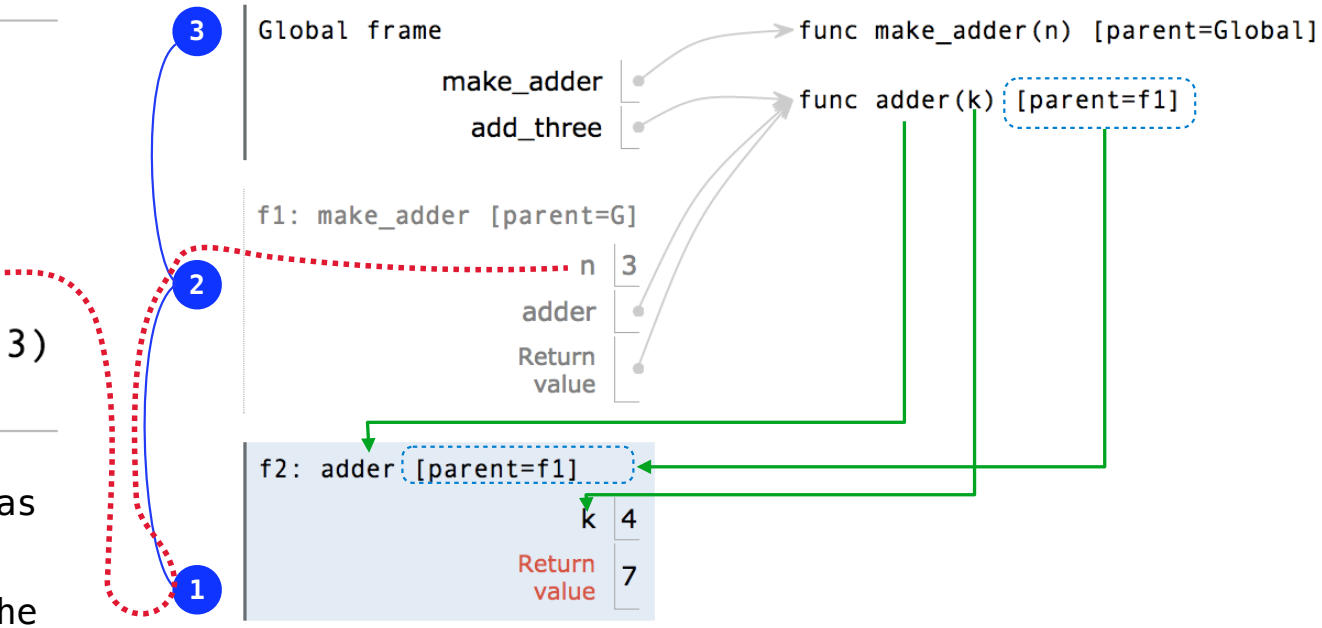
Environments for Nested Definitions

(Demo)

Environment Diagrams for Nested Def Statements

Nested def

```
1  def make_adder(n):
2      def adder(k):
3          return k + n
4      return adder
5
6  add_three = make_adder(3)
7  add_three(4)
```



- Every user-defined function has a parent frame (often global)
- The parent of a function is the frame in which it was defined
- Every local frame has a parent frame (often global)
- The parent of a frame is the parent of the function called

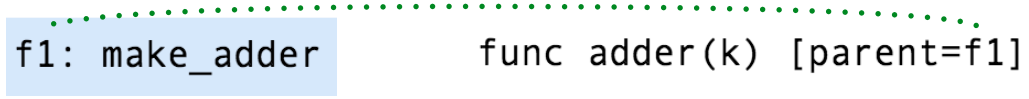
http://pythontutor.com/composingprograms.html#code=def%20make_adder%28n%29%3A%0A%20%20%20%20def%20adder%28k%29%3A%0A%20%20%20%20%20%20%20%20return%20k%20%2B%20n%0A%20%20%20%20return%20adder%0A%20%20%20%20%0Athree_more_than%20%3D%20make_adder%283%29%0Aresult%20%3D%20three_more_than%284%29&cumulative=false&curInstr=0&mode=display&origin=composingprograms.js&py=3&rawInputLstJSON=%5B%5D

How to Draw an Environment Diagram

When a function is defined:

Create a function value: `func <name>(<formal parameters>) [parent=<label>]`

Its parent is the current frame.



Bind `<name>` to the function value in the current frame

When a function is called:

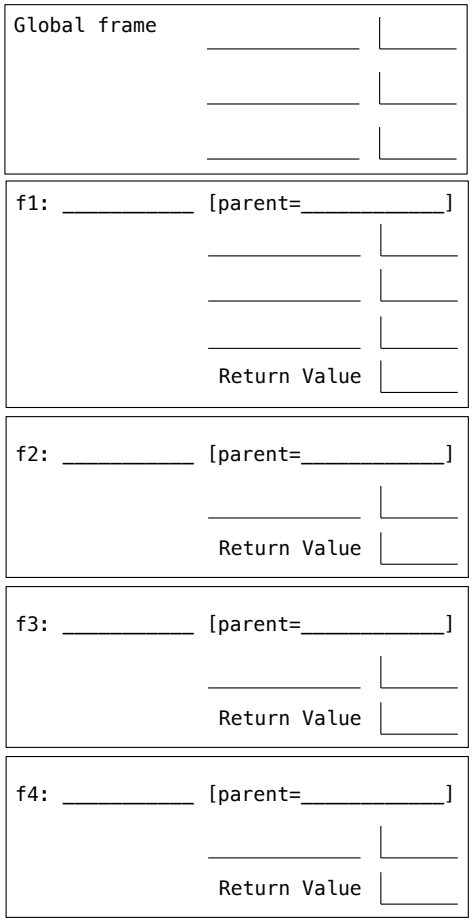
1. Add a local frame, titled with the `<name>` of the function being called.
2. Copy the parent of the function to the local frame: `[parent=<label>]`
3. Bind the `<formal parameters>` to the arguments in the local frame.
4. Execute the body of the function in the environment that starts with the local frame.

Lambda Expressions

(Demo)

Environment Diagram Practice

Fall 2022 CS 61A Midterm 1, Question 2




```
 1: def f(x):
 2:     """f(x)(t) returns max(x*x, 3*x)
 3:     if t(x) > 0, and 0 otherwise.
 4:     """
 5:     y = max(x * x, 3 * x)
 6:     def zero(t):
 7:         if t(x) > 0:
 8:             return y
 9:         return 0
10:     return zero
11:
12: # Find the largest positive y below 10
13: # for which f(y)(lambda z: z - y + 10)
14: # is not 0.
15: y = 1
16: while y < 10:
17:     if f(y)(lambda z: z - y + 10):
18:         max = y
19:     y = y + 1
```