

CS 61A Discussion 9

April 07, 2016

Topics for today

+ Midterm debrief, tail recursion, and interpreters



midterm debrief

tail recursion

A technique that increases spatial efficiency

Tail recursion means turning all of your recursive calls into **tail calls**. (*What is a tail call?* It's technically defined as a call in a tail context – but if you find that confusing, just think of it as a call that's the last thing to happen in the function body.)

In a tail-optimized language implementation, tail calls let us reuse frames. Since the tail call is the last thing that happens in a function body, we don't need to retain data from a frame that makes a tail call. Thus, when we execute the tail call we can just overwrite the old frame in memory – we won't have to create a new one.

This means constant space!

(/no stack overflows from excessive recursion depth)

Sumukh's tail recursion activity

Counting the number of students **recursively** vs. **tail-recursively**

Recursively: Set the far corner as the base case (that student should say 0). Every other student should ask the student behind them how many there are. When the student tells them, they let the person in front of them know (but add 1).

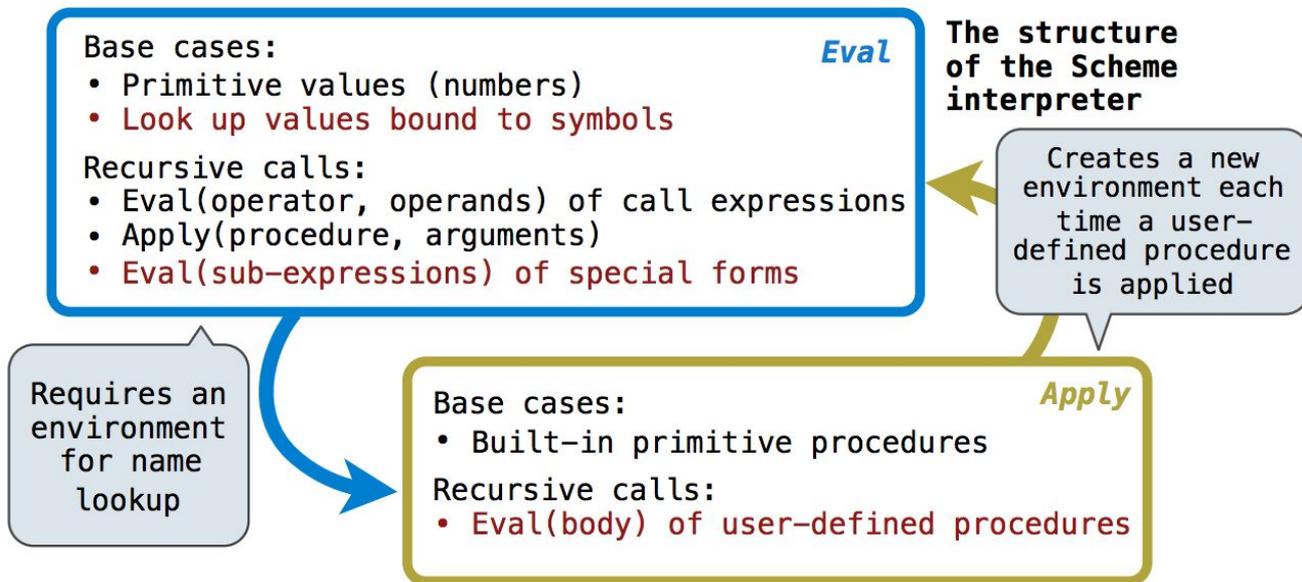
Tail-recursively: One student asks, says that there is 1 student so far. The next student says that there are 2 students and passes it on to the next student; by the time you get to the end you'll have the answer.

With recursion, everyone has to pay attention to the person behind them. Tail recursion makes it easier (/more lightweight).

interpreters

Reading code line-by-line and evaluating/executing it

The interpreter handles the evaluation/execution. Basically, it takes in code and evaluates it (“applying” functions to arguments when necessary).



Bonus: negatively-indexed Fibonacci numbers

If, as we've defined in the packet, $\text{fib}(0) = 0$ and $\text{fib}(1) = 1$... what would $\text{fib}(-1)$ or $\text{fib}(-2)$ be? They're just like the positively-indexed Fibonacci numbers, except that they alternate in sign.

Fibonacci numbers with indices -8 to 8:

$\text{fib}(-8)$	$\text{fib}(-7)$	$\text{fib}(-6)$	$\text{fib}(-5)$	$\text{fib}(-4)$	$\text{fib}(-3)$	$\text{fib}(-2)$	$\text{fib}(-1)$	$\text{fib}(0)$	$\text{fib}(1)$	$\text{fib}(2)$	$\text{fib}(3)$	$\text{fib}(4)$	$\text{fib}(5)$	$\text{fib}(6)$	$\text{fib}(7)$	$\text{fib}(8)$
21	-13	8	-5	3	-2	1	-1	0	1	1	2	3	5	8	13	21

(*Thanks to Kyle R. for pointing this out!)