Week 9 Lecture: More Fun with Functions
In labs 8-9, we’re implementing an interpreter for a dialect of LISP.

**Lab 8**: basics of evaluation (including function calls)
**Lab 9**: conditionals, lists, and other nice things
def fib(n):
    if n <= 1:
        return n
    return fib(n-1) + fib(n-2)

fib(20)
Why Bother Writing Interpreters?

- It is *just so cool!!!*
- It can help you understand the semantics of languages you already know (and contrast differing semantics).
- There is something powerful about the idea that an interpreter (CPython, for example) is *just another program.*
Why LISP?

- LISP is weird/cool :)
  - "A language that doesn’t affect the way you think about programming, is not worth knowing" - Alan Perlis

- MIT and LISP have a long history
  - invented here in 1958 (McCarthy)
  - one widely-used dialect (Scheme) implemented here as well, used in 6.001 from ~1980-2007

- LISP generally has very minimal syntax, so we can spend less time thinking about tokenizing/parsing, and more time thinking about rules for evaluation.
A key feature of our little LISP (and of Python) is the ability to define *functions* to abstract away the details of a particular computation.

Two Pieces: Function **Definition** and Function **Application**

Example:

```python
def foo(x):
    return x+7

foo(3)
```

\((:=(\text{foo } x) (+ x 7))\)

\((\text{foo } 3)\)
def deriv(f, dx):
    return lambda x: (f(x+dx) - f(x-dx)) / (2 * dx)
Another Example: in LISP

(\( := \) (deriv f dx)
  (function (x) (/ (- (f (+ x dx)) (f (- x dx)))
    (* 2 dx))))

(\( := \) (nth-deriv f n dx)
  (if (=? n 0)
    f
    (deriv (nth-deriv f (- n 1) dx) dx)
  )
)
Functions are Awesome!

Functions are really powerful; we can implement many other language features using them.

For example, our LISP does not have looping keywords like `for` or `while`. Does this mean that we can’t write code that involves loops?