Procedural Abstraction: Functions

also known as procedures, methods, subroutines
Chunking

Very limited working capacity

Nearly unlimited complexity
Modular Structure

Brain-size chunks

Not too many details. Not too many interactions. Something to focus on.

Units of work

Good size for a work assignment. Good size to build and test before moving on.

Units of change

Something that can be replaced
O, be some other name! – Jul**i**et

def diff ( a, b) :
    return a – b

... *then in main ...*

a = 5
b = 7;
c = diff( b, a );
    ## ??? What happens
def diff (a b) :
    return a – b

... then in main ...

a = 5
b = 7

c = diff(b, a);
def diff (int a, int b) :
    return a – b

... then in main ...

a = 5
b = 7

c = diff( b, a )

The called method gets its own copies of the inputs, by position (not by name).
“Pass by value”

```
def foo( a, b, c, d ):
  foo( x, y, 37.489, "et tu, Brute?" )
```

The “actual arguments” x, y, 37.489, “et tu, Brute” are copied into the “formal arguments” of the function. The copies become distinct, local variables.
What does it print?

def foo(x, y):
    x = 17
    y = 19

...  
x = 3  
m = 22  
foo(x, m)
print "Now", x, "and", m
What makes a good function?

Simplifies the code that calls it
Isolates a design decision (easier to change)
Used more than once
Can be tested separately

...  

A good function may have only some of these properties. Few have all.
Bad function smells

Complicated description

If the simplest description is “blah blah and blah and blah and blah except blah or blah”, maybe it shouldn’t be a method

Have to keep looking back at it

I should be able to use the function without remembering details of how it works
Breaking it down ...

Task:

Input: Read three pairs of (x,y) coordinates
Output: Print “equilateral”, “isoceles”, “scalene”, or “invalid” depending on the triangle defined by the three points

Let’s design and (partially) build it, piece by piece.
Let’s design some functions ...

Is YYYY a leap year?
Is MM/DD a valid date?
How many days between MM/DD/YYYY and (the next occurrence of) MM/DD?

(How do they smell? You may use these in assignment 2)