Exercise 21: Functions Can Return Something

You have been using the `=` character to name variables and set them to numbers or strings. We're now going to blow your mind again by showing you how to use `=` and a new Python word `return` to set variables to be a *value from a function*. There will be one thing to pay close attention to, but first type this in:

```
1  def add(a, b):
2      print "ADDING %d + %d" % (a, b)
3      return a + b
4
5  def subtract(a, b):
6      print "SUBTRACTING %d - %d" % (a, b)
7      return a - b
8
9  def multiply(a, b):
10     print "MULTIPLYING %d * %d" % (a, b)
11     return a * b
12
13 def divide(a, b):
14     print "DIVIDING %d / %d" % (a, b)
15     return a / b
16
17
18 print "Let's do some math with just functions!"
19
20 age = add(30, 5)
21 height = subtract(78, 4)
22 weight = multiply(90, 2)
23 iq = divide(100, 2)
24
25 print "Age: %d, Height: %d, Weight: %d, IQ: %d" % (age, height, weight, iq)
26
27
28 # A puzzle for the extra credit, type it in anyway.
29 print "Here is a puzzle."
30
31 what = add(age, subtract(height, multiply(weight, divide(iq, 2))))
32
33 print "That becomes: ", what, "Can you do it by hand?"
```

We are now doing our own math functions for `add`, `subtract`, `multiply`, and `divide`. The important thing to notice is the last line where we say `return a + b` (in `add`). What this does is the following:

1. Our function is called with two arguments: `a` and `b`.
2. We print out what our function is doing, in this case "ADDING."
3. Then we tell Python to do something kind of backward: we return the addition of `a + b`. You might say this as, "I add `a` and `b` then return them."
4. Python adds the two numbers. Then when the function ends, any line that runs it will be able to assign this `a + b` result to a variable.

As with many other things in this book, you should take this real slow, break it down, and try to trace what's going on. To help there are extra credit to solve a puzzle and learn something cool.

What You Should See

```
$ python ex21.py
Let's do some math with just functions!
ADDING 30 + 5
SUBTRACTING 78 - 4
MULTIPLYING 90 * 2
DIVIDING 100 / 2
Age: 35, Height: 74, Weight: 180, IQ: 50
Here is a puzzle.
DIVIDING 50 / 2
MULTIPLYING 180 * 25
SUBTRACTING 74 - 4500
ADDING 35 + -4426
That becomes:  -4391 Can you do it by hand?
```

Study Drills

1. If you aren't really sure what `return` does, try writing a few of your own functions and have them return some values. You can return anything that you can put to the right of an `=`.
2. At the end of the script is a puzzle. I'm taking the return value of one function and *using* it as the argument of another function. I'm doing this in a chain so that I'm kind of creating a formula using the functions. It looks really weird, but if you run the script you can see the results. What you should do is try to figure out the normal formula that would recreate this same set of operations.
3. Once you have the formula worked out for the puzzle, get in there and see what happens when you modify the parts of the functions. Try to change it on purpose to make another value.
4. Do the inverse. Write a simple formula and use the functions in the same way to calculate it.

This exercise might really whack your brain out, but take it slow and easy and treat it like a little game. Figuring out puzzles like this is what makes programming fun, so I'll be giving you more little problems like this as we go.

Common Student Questions

Why does Python print the formula or the functions "backward"?

> It's not really backward, it's "inside out." When you start breaking down the function into separate formulas and function calls you'll see how it works. Try to understand what I mean by "inside out" rather than "backward."

How can I use `raw_input()` to enter my own values?

> Remember `int(raw_input())`? The problem with that is then you can't enter floating point, so also try using `float(raw_input())`

instead.

What do you mean by "write out a formula"?

Try `24 + 34 / 100 - 1023` as a start. Convert that to use the functions. Now come up with your own similar math equation and use variables so it's more like a formula.

Video