Intro to Computer Science

Andey Robins & Mike Borowczak

Reinforcement Week 1

Outline

- Temperatures
- Don't Repeat Yourself (DRY)
- More About Types
- More About Functions

Previously

```
pb_per_sandwich = 4
j_per_sandwich = pb_per_sandwich - 1
print(pb_per_sandwich, "oz of PB",
        j_per_sandwich, "oz of jelly")

pb_per_sandwich = 8
print(pb_per_sandwich, "oz of PB",
        j_per_sandwich, "oz of jelly")
```

Idea: We can combine variables with values to calculate new values.

Temperature Calculator

Celsius to Fahrenheit

$$Y = (X \times \frac{9}{5}) + 32$$

And this equation has 2 variables:

```
given_temp_in_c    # X
calc_temp_in_f     # Y
```

```
given_temp_in_c = 0
# we want calc_temp_in_f to be 32
calc_temp_in_f = 32
```

Convert an Equation to Python

$$(X \times \frac{9}{5}) + 32$$

Which in code is:

```
given_temp_in_c * 9 / 5 + 32
```

Clarify Order of Operations

```
(given_temp_in_c * (9 / 5)) + 32
```

Assign to a Variable

```
calc_temp_in_f = (given_temp_in_c
                     * (9 / 5)) + 32
```

Put it together in a program

```
given_temp_in_c = 100
calc_temp_in_f  = given_temp_in_c * 9/5 + 32
```

Questions

What's the Problem?

This is kinda difficult to calculate all these values. Running all three lines of code each time, by hand, is a pain, and wouldn't it be nice if there was a better way?

The Better Way

Don't Repeat Yourself
AKA D.R.Y.

DRY

"'Don't repeat yourself' is a principle of software development aimed at reducing repetition of software patterns, replacing it with abstractions or using data normalization to avoid redundancy." - Wikipedia

DRY

"'Don't repeat yourself' is a principle of software development aimed at ***reducing repetition*** *of software patterns, replacing it with abstractions or using data normalization* ***to avoid redundancy.****"* - Wikipedia

Or even this one:

```
codio@stormeternal-cornereverest:~/workspace$ python3
Python 3.6.9 (default, Apr 18 2020, 01:56:04)
[GCC 8.4.0] on linux
Type "help", "copyright", "credits" or "license" for more i
>>> quit()
codio@stormeternal-cornereverest:~/workspace$
```

- `type(...)` is the function to get the type of a value
- `print(...)` is the function to display a value in the terminal
- `quit()` is a function in the interpreter to leave the interpreter

Anatomy of a Function Call

How do we invoke (or call) a function?

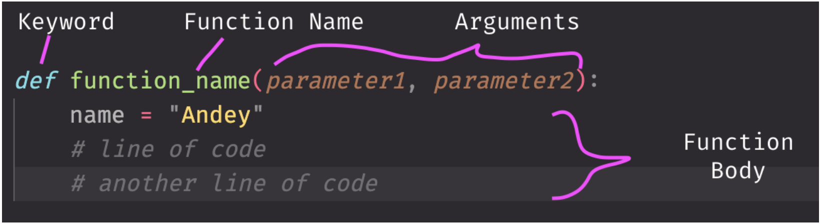
- Write the function's name
- An open parenthesis '('
- Any arguments the function may take
- A closing parenthesis ')'

i.e. `type(1.414)`

What is an Argument?

An **argument** is a value that is given to a function.

```
# the argument is the string "Hello World"
print("Hello world")
# the argument is the float 1.732
type(1.732)
# this function takes no arguments
quit()
```



```python
def function_name(parameter1, parameter2):
    name = "Andey"
    # line of code
    # another line of code
```

Figure 1: The anatomy of a function

1. The function begins with the keyword `def`
2. The name of the function comes next
3. Parentheses are placed
4. Provide the names of any arguments
5. End the line with a colon
6. Indent the “body” of the function

`convert_c_to_f`

```
def convert_c_to_f(temp_in_c):
    temp_in_f = temp_in_c * (9 / 5) + 32
```

What happens when we run our code?

```
# something like this
given_temp_in_c = 100
calc_temp_in_f  = convert_c_to_f(given_temp_in_c)
print(given_temp_in_c, "C is ", calc_temp_in_f,"F")
100 C is  None F
```

Why None?

After we call our function, the value of `temp_in_f` doesn’t go anywhere! It only exists within our function.

```python
def convert_c_to_f(temp_in_c):
    temp_in_f = temp_in_c * (9 / 5) + 32
    return temp_in_f
```

We can even apply the idea of DRY to refactor out the `temp_in_f` variable.

```python
def convert_c_to_f(temp_in_c):
    return temp_in_c * (9 / 5) + 32
```

Now let's rewrite some of our earlier work using our new function!

```
givenTempinC = 0
convertedTempinF  = convert_c_to_f(givenTempinC)
print(givenTempinC, "C is ", convertedTempinF,"F")

givenTempinC = 100
convertedTempinF  = convert_c_to_f(givenTempinC)
print(givenTempinC, "C is ", convertedTempinF,"F")

givenTempinC = 20
convertedTempinF  = convert_c_to_f(givenTempinC)
print(givenTempinC, "C is ", convertedTempinF,"F")
```

And even apply DRY principles. . .

```
givenTempinC = 0
print(givenTempinC, "C is ",
        convert_c_to_f(givenTempinC),"F")

givenTempinC = 100
print(givenTempinC, "C is ",
        convert_c_to_f(givenTempinC),"F")

givenTempinC = 20
print(givenTempinC, "C is ",
        convert_c_to_f(givenTempinC),"F")
```

Questions?

More About Types

More about Types

```
>>> type(1.23)
<class 'float'>
>>> type('hi!')
<class 'str'>
>>> type(1 + 2)
<class 'int'>
```

How can we combine different types?

All of these examples use the ‘+’ (plus) operator

- What does a ‘string’ + ‘string’ give us?
- How about ‘int’ + ‘float’?
- ‘string’ + ‘int’?
- ‘int’ + ‘string’?

- ‘string’
- ‘float’
- TypeError: can only concatenate str (not “int”) to str
- TypeError: unsupported operand type(s) for +: ‘int’ and ‘str’

Can you subtract types?

- 1.3 - 2
- 1.1 - 1
- 2 - 1
- ‘asdf’ - ‘f’
- ‘asdf’ - 17

- ‘float’
- ‘float’
- ‘int’
- ???
- ???

- ‘float’
- ‘float’
- ‘int’
- TypeError: unsupported operand type(s) for -: ‘str’ and ‘str’
- TypeError: unsupported operand type(s) for -: ‘str’ and ‘str’

Can you multiply types?

Let’s assume that any combination of numbers continues to work (i.e. float & int, int & int, etc.)

- `'a' * 'a'`
  - `<str> * <str>`
- `'a' * 3`
  - `<str> * <int>`

- TypeError: can’t multiply sequence by non-int of type ‘str’
- ‘aaa’
    - `<str>`

How do you know what type an action has?

```
>>> type('a' * 3)
<class 'str'>
```

Think Types are Cool?

I do! And there’s lots of other people who think so too! (like at least 7 of us)

There’s a whole field of study about types and how they relate to programming languages called *Type Theory*, and it’s something I use in my research. Don’t worry, there’s plenty of interesting things to continue learning about types as we go along in the course!

Questions?

More about Functions

Coming soon to a classroom near you!