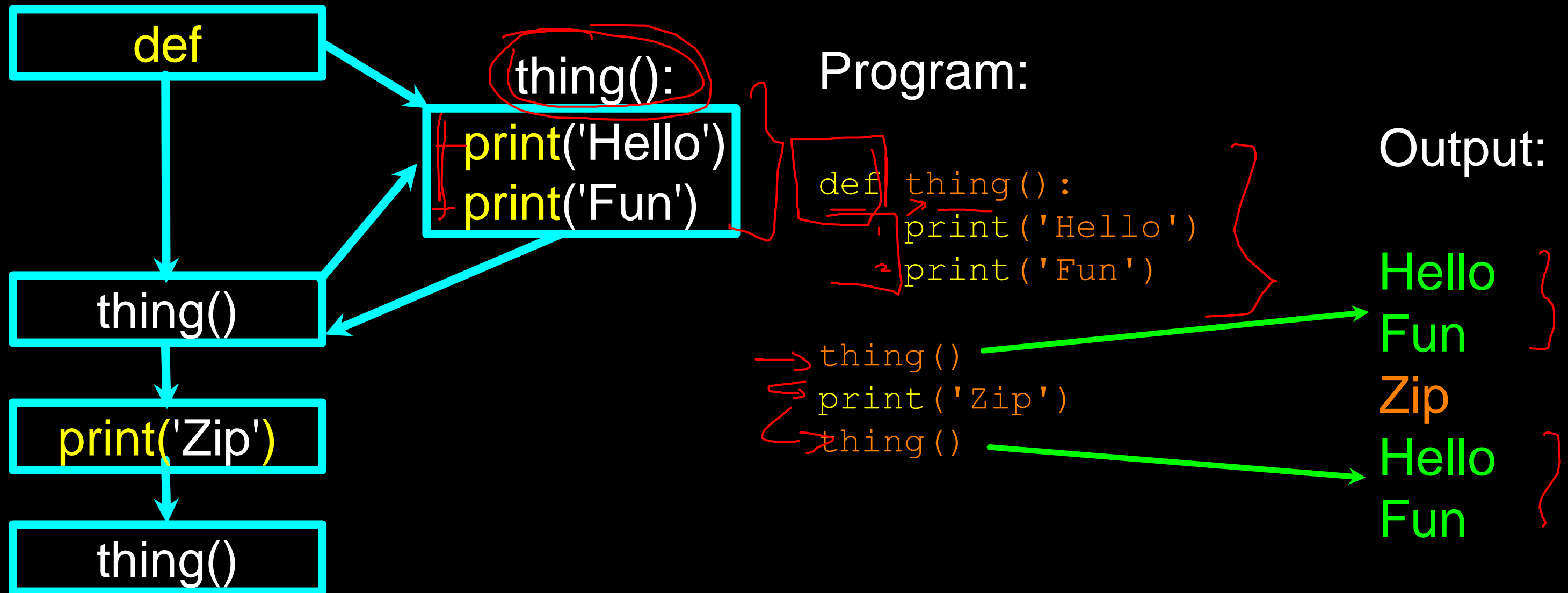


Functions

Chapter 4



Stored (and reused) Steps



We call these reusable pieces of code “functions”

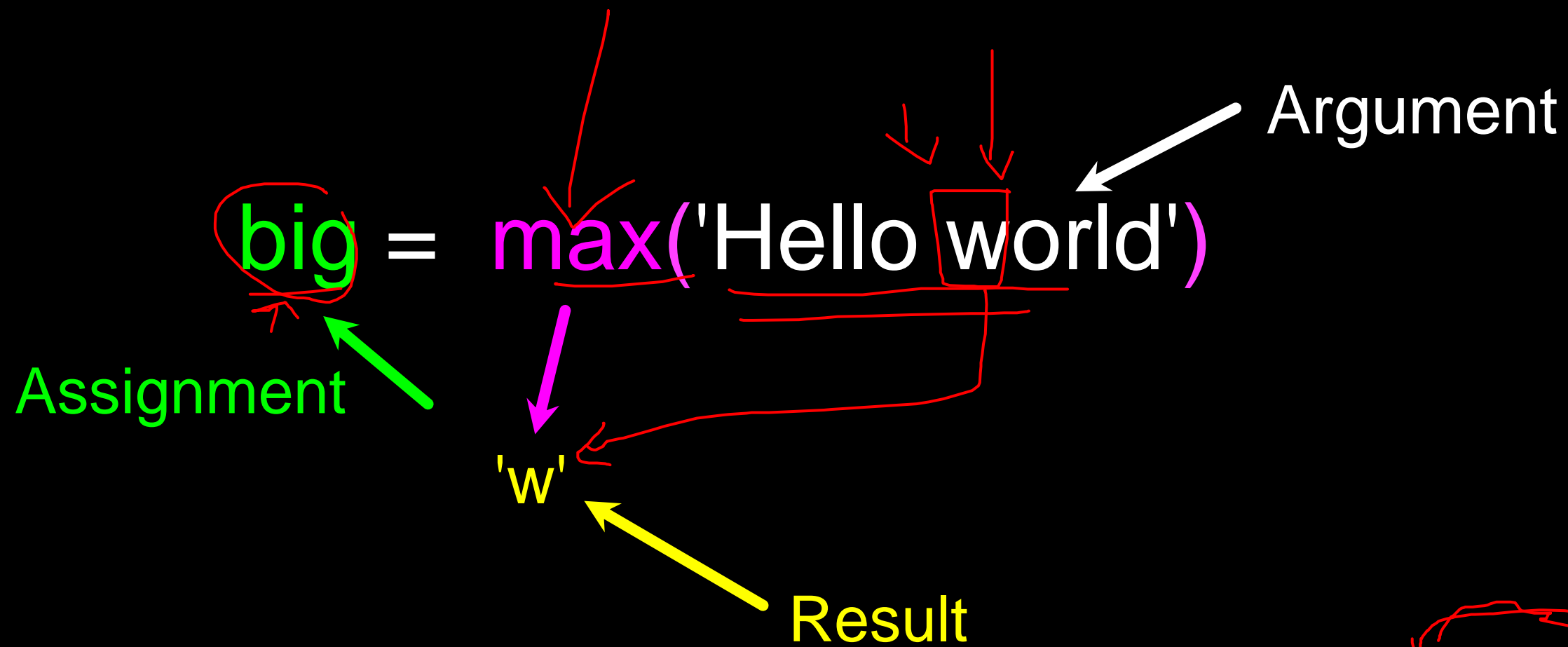
Python Functions

- There are two kinds of functions in Python.
 - Built-in functions that are provided as part of Python - print(), input(), type(), float(), int() ...
 - Functions that we define ourselves and then use
- We treat the built-in function names as “new” **reserved words** (i.e., we avoid them as variable names)

Function Definition

print("H")

- In Python a **function** is some reusable code that takes arguments(s) as input, does some computation, and then returns a result or results
- We define a **function** using the **def** reserved word *→ thing []*
- We call/invoke the **function** by using the function name, parentheses, and **arguments** in an expression

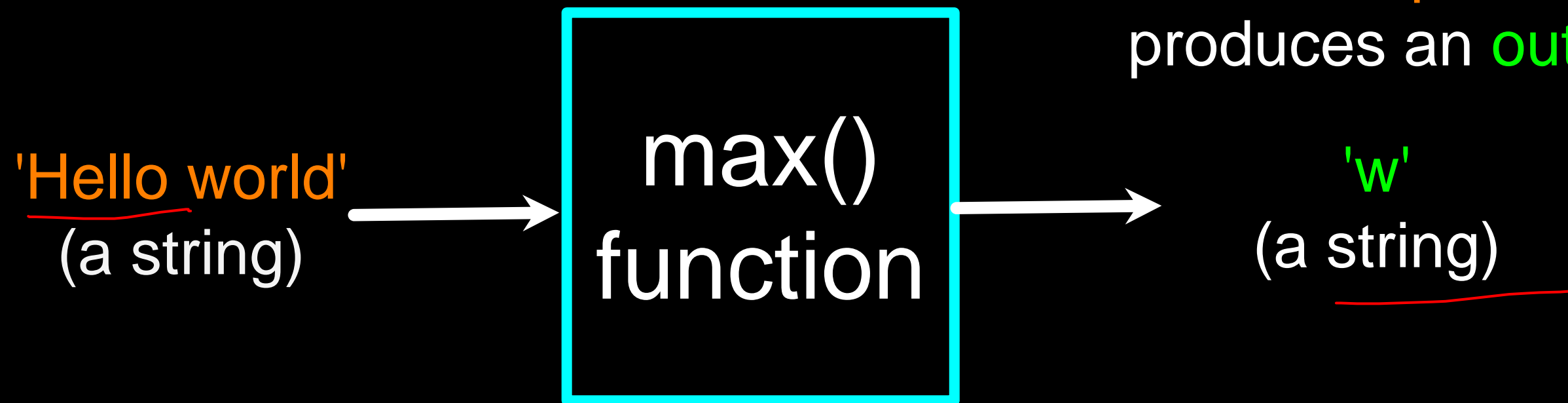


```
>>> big = max('Hello world')
>>> print(big)
w
>>> tiny = min('Hello world')
>>> print(tiny)
d
```

Max Function

```
>>> big = max('Hello world')  
>>> print(big)  
w
```

A **function** is some **stored code** that we use. A function takes some **input** and produces an **output**.



Guido wrote this code

Max Function

A function is some stored code that we use. A function takes some input and produces an output.

```
>>> big = max('Hello world')
>>> print(big)
w
```

'Hello world'
(a string)



```
def max(inp):
    blah
    blah
    for x in inp:
        blah
        blah
```



'w'
(a string)

Guido wrote this code

Type Conversions

- When you put an integer and floating point in an expression, the integer is **implicitly** converted to a float
- You can control this with the built-in functions `int()` and `float()`

```
>>> print(float(99) / 100)
0.99
>>> i = 42
>>> type(i)
<class 'int'>
>>> f = float(i)
>>> print(f)
42.0
>>> type(f)
<class 'float'>
>>> print(1 + 2 * float(3) / 4 - 5)
-2.5
>>>
```

String Conversions

- You can also use `int()` and `float()` to convert between strings and integers
- You will get an **error** if the string does not contain numeric characters

```
>>> sval = '123'
>>> type(sval)
<class 'str'>
>>> print(sval + 1)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
TypeError: cannot concatenate 'str'
and 'int'
>>> ival = int(sval)
>>> type(ival)
<class 'int'>
>>> print(ival + 1)
124
>>> nsv = 'hello bob'
>>> niv = int(nsv)
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
ValueError: invalid literal for int()
```

Functions of Our Own...

Building our Own Functions

- We create a new function using the **def** keyword followed by optional parameters in parentheses
- We indent the body of the function
- This **defines** the function but **does not** execute the body of the function

```
def print_lyrics():  
    print("I'm a lumberjack, and I'm okay.")  
    print('I sleep all night and I work all day.')
```

X ~~7~~

5 ↓ 2

print_lyrics():

```
print("I'm a lumberjack, and I'm okay.")  
print('I sleep all night and I work all day.')
```

→ x = 5

→ print('Hello')

→ def print_lyrics():

 print("I'm a lumberjack, and I'm okay.")

 print('I sleep all night and I work all day.')

→ print('Yo')

→ x = x + 2

→ print(x)

* Hello
* Yo
* 7

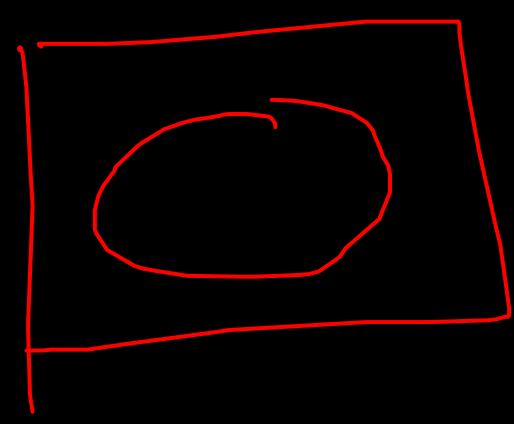
Definitions and Uses

- Once we have **defined** a function, we can **call** (or **invoke**) it as many times as we like
- This is the **store** and **reuse** pattern

x 7

5-12

print_lyr



```
x = 5
print('Hello')

def print_lyrics():
    print("I'm a lumberjack, and I'm okay.")
    print('I sleep all night and I work all day.')

print('Yo')
print_lyrics()
x = x + 2
print(x)
```

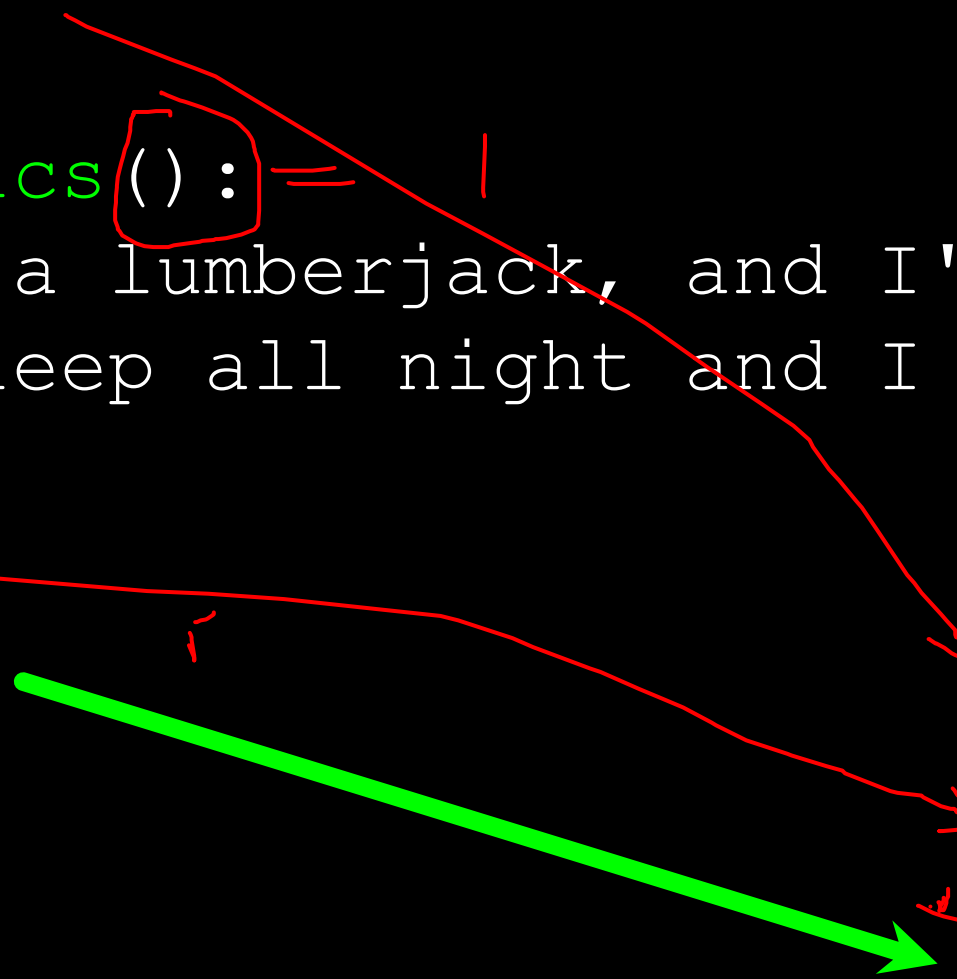
Hello

Yo

I'm a lumberjack, and I'm okay.

* I sleep all night and I work all day.

7



Arguments

- An **argument** is a value we pass into the **function** as its **input** when we call the function
- We use **arguments** so we can direct the **function** to do different kinds of work when we call it at **different** times
- We put the **arguments** in parentheses after the **name** of the function

big = **max**('Hello world')



Argument

Parameters

A parameter is a variable which we use in the function definition. It is a “handle” that allows the code in the function to access the arguments for a particular function invocation.

```
>>> def greet(lang):  
...     if lang == 'es':  
...         print('Hola')  
...     elif lang == 'fr':  
...         print('Bonjour')  
...     else:  
...         print('Hello')  
...  
>>> greet('en')  
→ Hello  
>>> greet('es')  
→ Hola  
>>> greet('fr')  
→ Bonjour  
>>>
```

Handwritten annotations in red: A box around the function definition, arrows pointing from the parameter 'lang' to the conditional checks, and a circled 'es' above the first invocation.

Return Values

Often a function will take its arguments, do some computation, and **return** a value to be used as the value of the function call in the **calling expression**. The **return** keyword is used for this.

```
def greet():
```

```
    return "Hello"
```

```
print(greet(), "Glenn")
```

```
print(greet(), "Sally")
```

```
Hello Glenn
```

```
Hello Sally
```

Return Value

- A “fruitful” **function** is one that produces a **result** (or **return value**)
- The **return** statement ends the **function** execution and “sends back” the **result** of the **function**

```
>>> def greet(lang):
...     if lang == 'es':
...         → return 'Hola'
...     elif lang == 'fr':
...         return 'Bonjour'
...     else:
...         return 'Hello'
...
>>> print(greet('en'), 'Glenn')
→ Hello Glenn
>>> print(greet('es'), 'Sally')
Hola Sally
>>> print(greet('fr'), 'Michael')
Bonjour Michael
>>>
```

Arguments, Parameters, and Results

```
>>> big = max('Hello world')
>>> print(big)
w
```

Argument → 'Hello world'

Parameter

```
def max(inp):
    blah
    blah
    for x in inp:
        blah
        blah
    return 'w'
```

Result

→ 'w'

Multiple Parameters / Arguments

8

- We can define more than one **parameter** in the **function definition**
- We simply add more **arguments** when we call the **function**
- We match the number and order of arguments and parameters

```
def addtwo(a, b):  
    added = a + b  
    return added  
  
x = addtwo(3, 5)  
print(x)
```

8

Void (non-fruitful) Functions

- When a function does not return a value, we call it a “**void**” function
- Functions that return values are “fruitful” functions
- **Void** functions are “not fruitful”

To function or not to function...

- Organize your code into “paragraphs” - capture a complete thought and “name it”
- Don't repeat yourself - make it work once and then reuse it
- If something gets too long or complex, break it up into logical chunks and put those chunks in functions
- Make a library of common stuff that you do over and over - perhaps share this with your friends...

Summary

- Functions
- Built-In Functions
- Type conversion (int, float)
- String conversions
- Parameters
- Arguments
- Results (fruitful functions)
- Void (non-fruitful) functions
- Why use functions?

Exercise

- Rewrite your pay computation with time-and-a-half for overtime and create a function called **computepay** which takes two parameters (hours and rate).

Enter Hours: 45

Enter Rate: 10

Pay: 475.0

$$475 = 40 * 10 + 5 * 15$$