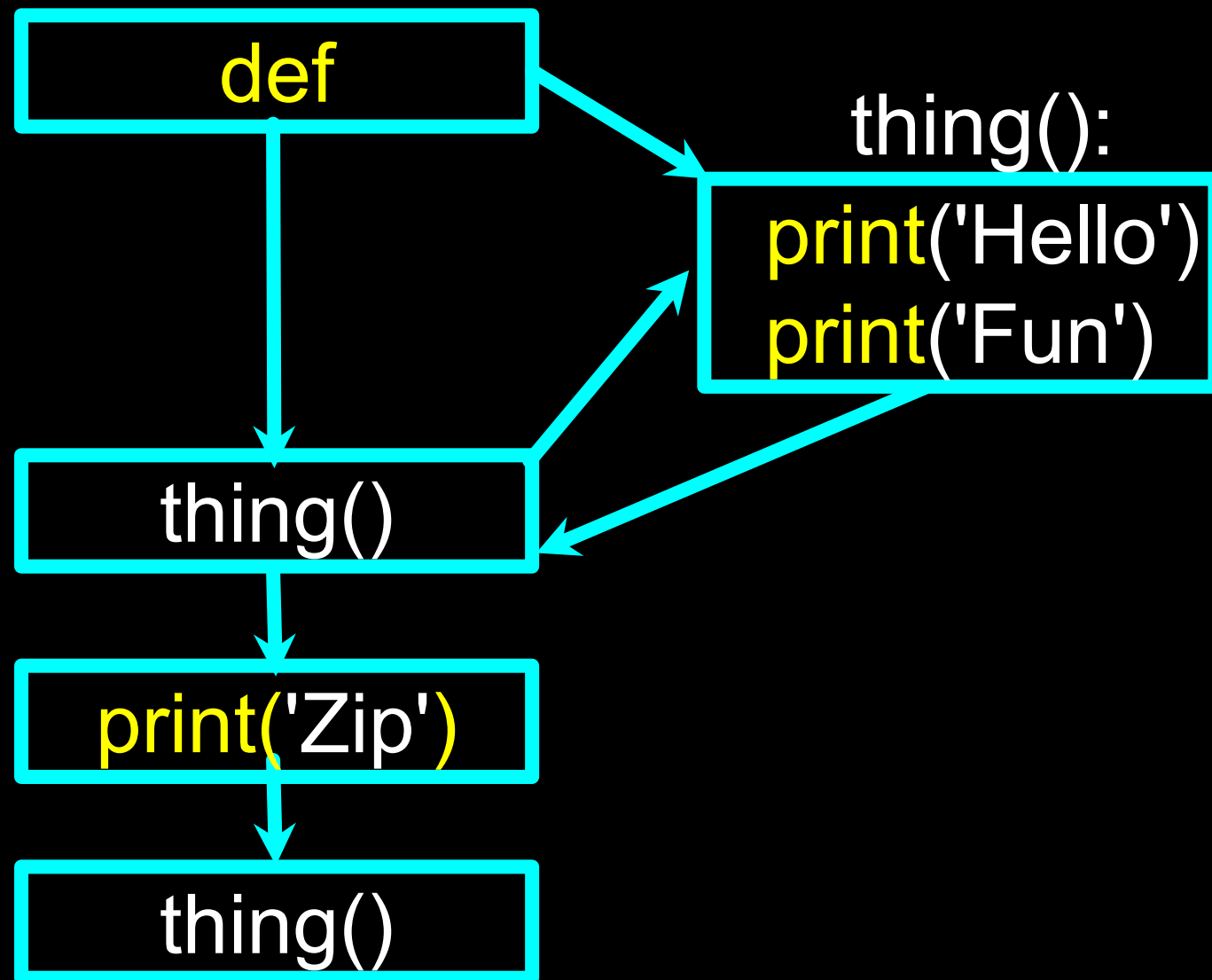


Functions

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Stored (and reused) Steps



Program:

```
def thing():  
    print('Hello')  
    print('Fun')
```

```
thing()  
print('Zip')  
thing()
```

Output:

```
Hello  
Fun  
Zip  
Hello  
Fun
```

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

- 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
- We call/invoke the **function** by using the function name, parentheses, and **arguments** in an expression

Argument

big = max('Hello world')

Assignment

'w'

Result

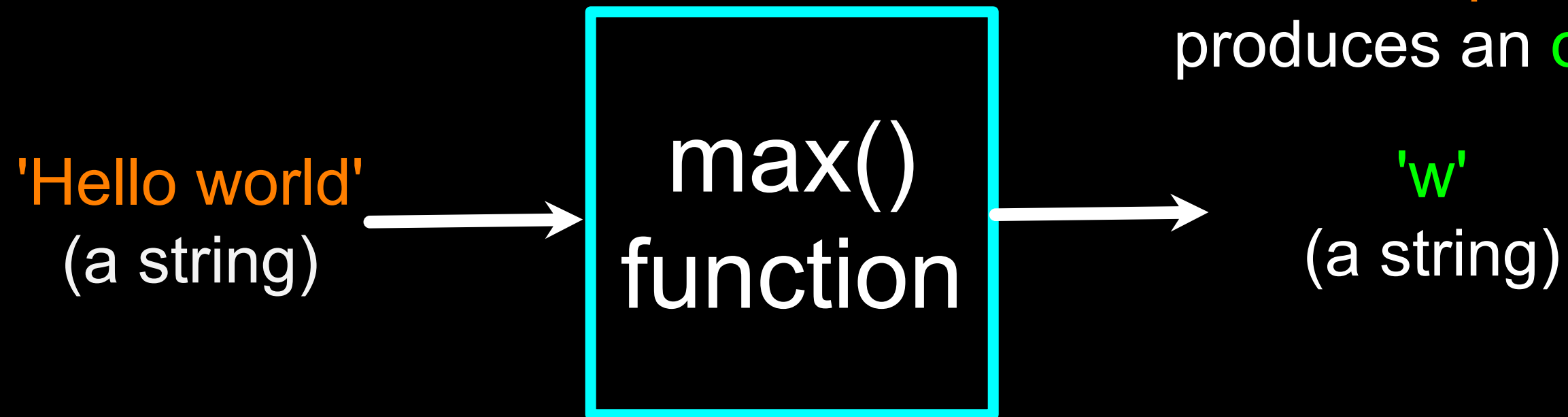
```
>>> big = max('Hello world')
>>> print(big)
w
>>> tiny = min('Hello world')
>>> print(tiny)

>>>
```

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
```



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
>>> nsval = 'hello bob'
>>> niv = int(nsval)
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_myself():  
    print("My name is Alex, and I'm a lecturer.")  
    print('I am teaching Python programming.')
```

```
print_myself():    print("My name is Alex, and I'm a lecturer.")  
                  print('I am teaching Python programming.')
```

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

```
def print_myself():  
    print("My name is Alex, and I'm a lecturer.")  
    print('I am teaching Python programming.')
```

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

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

```
def print_myself():  
    print("My name is Alex, and I'm a lecturer.")  
    print('I am teaching Python programming.')
```

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

Hello

Yo

My name is Alex, and I'm a lecturer.
I am teaching Python programming.

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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
>>>
```


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'

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

Parameter

'w' → Result

Multiple Parameters / Arguments

- 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)
```

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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...