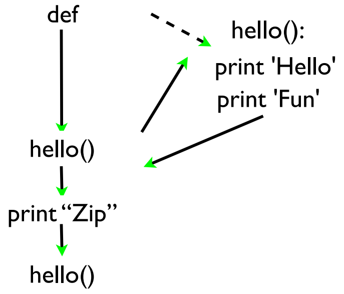
Functions

Chapter 4

Python for Informatics: Exploring Information
www.pythonlearn.com

Stored (and reused) Steps



Program:

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

hello()
print 'Zip'
hello()
```

Output:

```
Hello
Fun
Zip
Hello
Fun
```

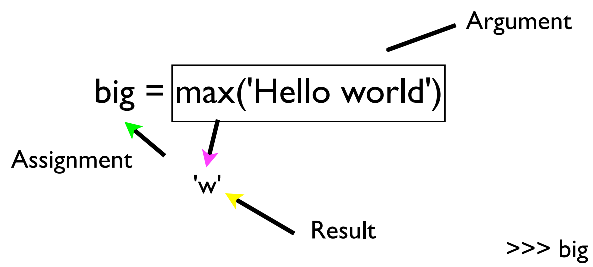
We call these reusable pieces of code "functions".

Python Functions

- There are two kinds of functions in Python.
  - Built-in functions that are provided as part of Python - raw_input(), type(), float(), int() ...
  - Functions that we define ourselves and then use
- We treat the of 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, parenthesis and arguments in an expression



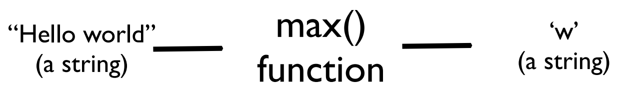
```
>>> big = max('Hello world')
>>> print big
w
>>> tiny = min('Hello world')
>>> print tiny

>>>
```

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.

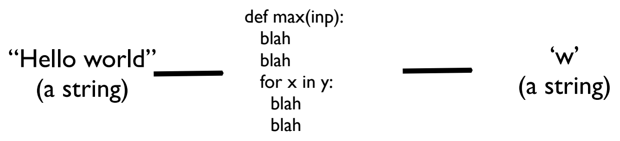


Guido wrote this code

Max Function

```
>>> 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.



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

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)
<type 'int'>
>>> f = float(i)
>>> print f
42.0
>>> type(f)
<type '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)
<type '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)
<type '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()
```

Building our Own Functions

- We create a new function using the def keyword followed by optional parameters in parenthesis.
- 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.'
```

```
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 = 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 parenthesis after the name of the function

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

Argument

Parameters

- A parameter is a variable which we use in the function definition that 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
```

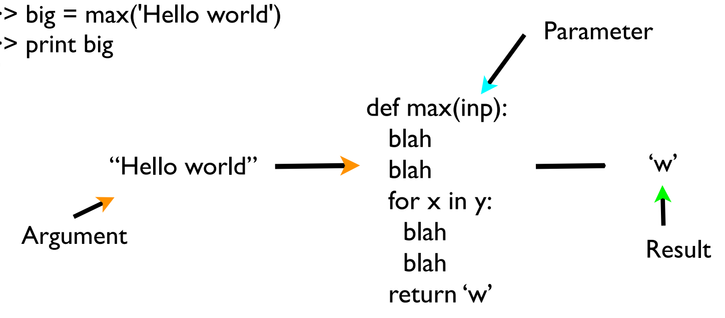
Return Value

- 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'
```



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

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
```

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 up 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)
  - Math functions (sin, sqrt)
- Try / except (again)
- Arguments
- Parameters
- 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