Python Functions

A function is a block of code which only runs when it is called.

You can pass data, known as parameters, into a function.

A function can return data as a result.

Creating a Function

In Python a function is defined using the `def` keyword:

Example

```
def my_function():
  print("Hello from a function")
```

Calling a Function

To call a function, use the function name followed by parenthesis:

Example

```
def my_function():
  print("Hello from a function")

my_function()
```

Arguments

Information can be passed into functions as arguments.

Arguments are specified after the function name, inside the parentheses. You can add as many arguments as you want, just separate them with a comma.

The following example has a function with one argument (fname). When the function is called, we pass along a first name, which is used inside the function to print the full name:

Example

```
def my_function(fname):
  print(fname + " Refsnes")

my_function("Emil")
my_function("Tobias")
my_function("Linus")
```

Parameters or Arguments?

The terms *parameter* and *argument* can be used for the same thing: information that are passed into a function.

From a function's perspective:

A parameter is the variable listed inside the parentheses in the function definition. An argument is the value that is sent to the function when it is called.

Number of Arguments

By default, a function must be called with the correct number of arguments. Meaning that if your function expects 2 arguments, you have to call the function with 2 arguments, not more, and not less.

Example

This function expects 2 arguments, and gets 2 arguments:

```
def my_function(fname, lname):
  print(fname + " " + lname)

my_function("Emil", "Refsnes")
```

If you try to call the function with 1 or 3 arguments, you will get an error:

Example

This function expects 2 arguments, but gets only 1:

```
def my_function(fname, lname):
  print(fname + " " + lname)

my_function("Emil")
```

Arbitrary Arguments, *args

If you do not know how many arguments that will be passed into your function, add a * before the parameter name in the function definition.

This way the function will receive a *tuple* of arguments, and can access the items accordingly:

Example

If the number of arguments is unknown, add a * before the parameter name:

```
def my_function(*kids):
  print("The youngest child is " + kids[2])

my_function("Emil", "Tobias", "Linus")
```

To know the number of arguments passed to the function we may use the *len()* function on the non-keyword argument **arg*.

Example

```
def manyArgs(*arg):
  print ("I was called with", len(arg), "arguments:", arg)


>>> manyArgs(1)
I was called with 1 arguments: (1,)
>>> manyArgs(1, 2, 3)
I was called with 3 arguments: (1, 2, 3)
```

As you can see, Python will *unpack* the arguments as a single tuple with all the arguments.

Keyword Arguments

You can also send arguments with the *key* = *value* syntax.

This way the order of the arguments does not matter.

Example

```
def my_function(child3, child2, child1):
  print("The youngest child is " + child3)

my_function(child1 = "Emil", child2 = "Tobias", child3 = "Linus")
```

The phrase *Keyword Arguments* are often shortened to *kwargs* in Python documentations.

Arbitrary Keyword Arguments, **kwargs

If you do not know how many keyword arguments that will be passed into your function, add two asterisk: `**` before the parameter name in the function definition.

This way the function will receive a *dictionary* of arguments, and can access the items accordingly:

Example

If the number of keyword arguments is unknown, add a double `**` before the parameter name:

```
def my_function(**kid):
  print("His last name is " + kid["lname"])

my_function(fname = "Tobias", lname = "Refsnes")
```

Arbitrary Kword Arguments are often shortened to ***kwargs* in Python documentations.

Default Parameter Value

The following example shows how to use a default parameter value.

If we call the function without argument, it uses the default value:

Example

```
def my_function(country = "Norway"):
  print("I am from " + country)

my_function("Sweden")
my_function("India")
my_function()
my_function("Brazil")
```

Passing a List as an Argument

You can send any data types of argument to a function (string, number, list, dictionary etc.), and it will be treated as the same data type inside the function.

E.g. if you send a List as an argument, it will still be a List when it reaches the function:

Example

```
def my_function(food):
  for x in food:
    print(x)

fruits = ["apple", "banana", "cherry"]

my_function(fruits)
```

Return Values

To let a function return a value, use the `return` statement:

Example

```
def my_function(x):
  return 5 * x
```

```
print(my_function(3))
print(my_function(5))
print(my_function(9))
```

The pass Statement

`function` definitions cannot be empty, but if you for some reason have a `function` definition with no content, put in the `pass` statement to avoid getting an error.

Example

```
def myfunction():
  pass
```

Recursion

Python also accepts function recursion, which means a defined function can call itself.

Recursion is a common mathematical and programming concept. It means that a function calls itself. This has the benefit of meaning that you can loop through data to reach a result.

The developer should be very careful with recursion as it can be quite easy to slip into writing a function which never terminates, or one that uses excess amounts of memory or processor power. However, when written correctly recursion can be a very efficient and mathematically-elegant approach to programming.

In this example, `tri_recursion()` is a function that we have defined to call itself ("recurse"). We use the `k` variable as the data, which decrements (`-1`) every time we recurse. The recursion ends when the condition is not greater than 0 (i.e. when it is 0).

To a new developer it can take some time to work out how exactly this works, best way to find out is by testing and modifying it.

Example

Recursion Example

```
def tri_recursion(k):
  if(k > 0):
    result = k + tri_recursion(k - 1)
    print(result)
  else:
    result = 0
  return result

print("\n\nRecursion Example Results")
tri_recursion(6)
```

Python Lambda

A lambda function is a small anonymous function.

A lambda function can take any number of arguments, but can only have one expression.

Syntax

```
lambda arguments : expression
```

The expression is executed and the result is returned:

Example

Add 10 to argument `a`, and return the result:

```
x = lambda a : a + 10
print(x(5))
```

Lambda functions can take any number of arguments:

Example

Multiply argument `a` with argument `b` and return the result:

```
x = lambda a, b : a * b
print(x(5, 6))
```

Example

Summarize argument a, b, and c and return the result:

```
x = lambda a, b, c : a + b + c
print(x(5, 6, 2))
```

Why Use Lambda Functions?

The power of lambda is better shown when you use them as an anonymous function inside another function.

Say you have a function definition that takes one argument, and that argument will be multiplied with an unknown number:

```
def myfunc(n):
  return lambda a : a * n
```

Use that function definition to make a function that always doubles the number you send in:

Example

```
def myfunc(n):
  return lambda a : a * n

mydoubler = myfunc(2)

print(mydoubler(11))
```

Or, use the same function definition to make a function that always *triples* the number you send in:

Example

```
def myfunc(n):
  return lambda a : a * n

mytripler = myfunc(3)
```

```
print(mytripler(11))
```

Or, use the same function definition to make both functions, in the same program:

Example

```
def myfunc(n):
  return lambda a : a * n

mydoubler = myfunc(2)
mytripler = myfunc(3)

print(mydoubler(11))
print(mytripler(11))
```

Use lambda functions when an anonymous function is required for a short period of time.

Python Built in Functions

Python has a set of built-in functions.

Function	Description
abs()	Returns the absolute value of a number
all()	Returns True if all items in an iterable object are true
any()	Returns True if any item in an iterable object is true

ascii()	Returns a readable version of an object. Replaces none-ascii characters with escape character
bin()	Returns the binary version of a number
bool()	Returns the boolean value of the specified object
bytearray()	Returns an array of bytes
bytes()	Returns a bytes object
callable()	Returns True if the specified object is callable, otherwise False
chr()	Returns a character from the specified Unicode code.
classmethod()	Converts a method into a class method
compile()	Returns the specified source as an object, ready to be executed
complex()	Returns a complex number

delattr()	Deletes the specified attribute (property or method) from the specified object
dict()	Returns a dictionary (Array)
dir()	Returns a list of the specified object's properties and methods
divmod()	Returns the quotient and the remainder when argument1 is divided by argument2
enumerate()	Takes a collection (e.g. a tuple) and returns it as an enumerate object
eval()	Evaluates and executes an expression
exec()	Executes the specified code (or object)
filter()	Use a filter function to exclude items in an iterable object
float()	Returns a floating point number
format()	Formats a specified value

frozenset()	Returns a frozenset object
getattr()	Returns the value of the specified attribute (property or method)
globals()	Returns the current global symbol table as a dictionary
hasattr()	Returns True if the specified object has the specified attribute (property/method)
hash()	Returns the hash value of a specified object
help()	Executes the built-in help system
hex()	Converts a number into a hexadecimal value
id()	Returns the id of an object
input()	Allowing user input
int()	Returns an integer number

isinstance()	Returns True if a specified object is an instance of a specified object
issubclass()	Returns True if a specified class is a subclass of a specified object
iter()	Returns an iterator object
len()	Returns the length of an object
list()	Returns a list
locals()	Returns an updated dictionary of the current local symbol table
map()	Returns the specified iterator with the specified function applied to each item
max()	Returns the largest item in an iterable
memoryview()	Returns a memory view object
min()	Returns the smallest item in an iterable

next()	Returns the next item in an iterable
object()	Returns a new object
oct()	Converts a number into an octal
open()	Opens a file and returns a file object
ord()	Convert an integer representing the Unicode of the specified character
pow()	Returns the value of x to the power of y
print()	Prints to the standard output device
property()	Gets, sets, deletes a property
range()	Returns a sequence of numbers, starting from 0 and increments by 1 (by default)
repr()	Returns a readable version of an object
reversed()	Returns a reversed iterator

round()	Rounds a numbers
set()	Returns a new set object
setattr()	Sets an attribute (property/method) of an object
slice()	Returns a slice object
sorted()	Returns a sorted list
staticmethod()	Converts a method into a static method
str()	Returns a string object
sum()	Sums the items of an iterator
super()	Returns an object that represents the parent class
tuple()	Returns a tuple
type()	Returns the type of an object

vars()	Returns the __dict__ property of an object
zip()	Returns an iterator, from two or more iterators