Lambda Functions

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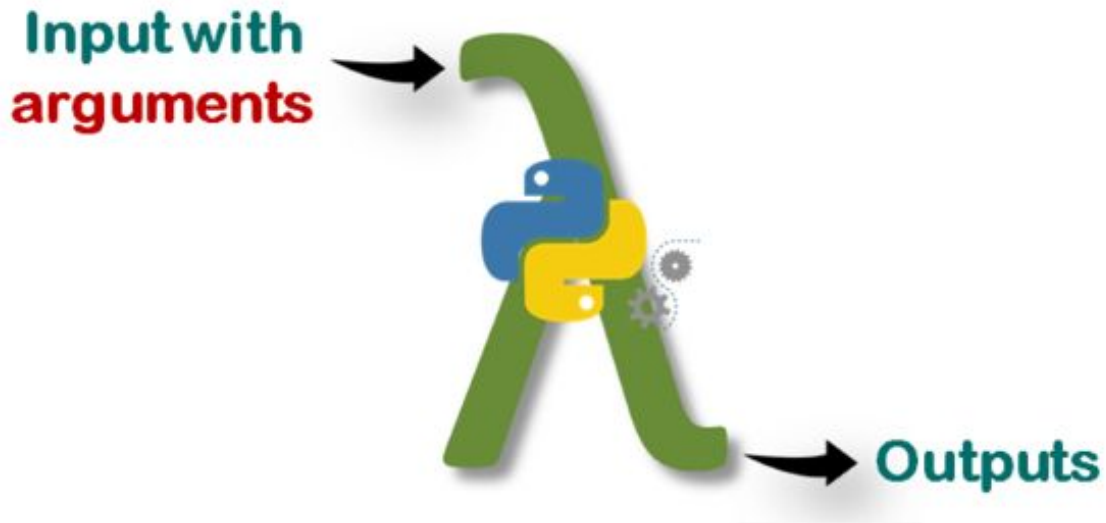
1 Defining a Lambda Function

Defining a `lambda` Function(review)

```
The formula syntax is : lambda parameters : expression
```



Why we need `lambda` functions?

- Compare the two types of functions :

```
1  def square(x)
2      return x**2
```

- And now we'll define `lambda` function to do the same.

```
1  lambda x: x**2
```

Why we need `lambda` functions?

- Compare the two types of functions :

```
1  def square(x)
2      return x**2
```

- ⚠ **Avoid:**
  - Note that you do not need to use `return` statement in lambda functions.

Defining a `lambda` Function(review)

- Multiple parameters/arguments :

```
1  lambda x, y: (x+y)/2  # takes two numbers, returns the
       result
```

Defining a `lambda` Function(review)

- The formula syntax of conditional lambda statement is :

```
lambda parameters : first_result if conditional statement else second_result
```

```
lambda x: 'odd' if x%2 != 0 else 'even'
```

evaluated first

else

⚠ **Avoid:**

- Note that you can't use the usual conditional statement with lambda definition.

Defining a `lambda` Function(review)

- Conditional statements in a lambda function :

```
1  lambda x: 'odd' if x % 2 != 0 else 'even'
```

2 Uses of the `lambda` Functions

Uses of the `lambda` Functions(review)

- Usage alternatives of Lambda functions:
  - ... its own syntax using parentheses,
  - ... assigning it to a variable,
  - ... inside several built-in functions,
  - ... inside user-defined functions (def),

Uses of the `lambda` Functions(review)

- **By enclosing the function in parentheses**

First use

```
The formula syntax is :
(lambda parameters: expression)(arguments)
```

```
1  print((lambda x: x**2)(2))
```

What is the output? Try to figure out in your mind...

Students, write your response!

Uses of the `lambda` Functions(review)

- By enclosing the function in parentheses :

```
The formula syntax is :
(lambda parameters : expression)(arguments)
```

```
1  print((lambda x: x**2)(2))
```

```
1  4
```

Uses of the `lambda` Functions(review)

- Multiple arguments :
  - Option - I

```
print((lambda x, y: (x+y)/2)(3, 5))  # takes two int,
    returns mean of them
```

  - Option - II

```
average = (lambda x, y: (x+y)/2)(3, 5)
print(average)
```

Uses of the `lambda` Functions(review)

- Or you can use multiple arguments using the same syntax :

```
1  print((lambda x, y: (x+y)/2)(3, 5))  # takes two int,
       returns mean of them
```

```
1  4.0
```

- You can also assign the lambda statement in parentheses to a variable :

```
1  average = (lambda x, y: (x+y)/2)(3, 5)
2  print(average)
```

Uses of the `lambda` Functions (review)

- Or you can use multiple arguments using the same syntax :

```
1  print((lambda x, y: (x+y)/2)(3, 5))  # takes two int,
       returns mean of them
```

```
1  4.0
```

- You can also assign the lambda statement in parentheses to a variable :

```
1  average = (lambda x, y: (x+y)/2)(3, 5)
2  print(average)
```

```
1  4.0
```

Uses of the `lambda` Functions

- **Task** :
  - Define a `lambda` function to reverse the elements of any iterables.
  - Use **parentheses** for arguments and print the result.

Uses of the `lambda` Functions

- **The code can be as :**

```
1  iterable = "clarusway"
2
3  reverser = (lambda x : x[::-1])(iterable)
4
5  print(reverser)
6
```

Output

```
yawsuralc
```

Uses of the `lambda` Functions

- **Task** :
  - Write a Python program that types ‘**even**’ or ‘**odd**’ in accordance with the numbers in a `list`.
  - Use `lambda` function and loop.
  - Your code must contain no more than 2 lines.
  - The sample `list` and desired output are as follows :

```
1 [1, 2, 3, 4]
2
```

Output

```
1 : odd
2 : even
3 : odd
4 : even
```

Uses of the `lambda` Functions

- **The code can be as :**

```
1 for x in [6, 12, -5, 11]:
2     print(x, ":", (lambda x: "odd" if x%2 != 0 else "even")(x))
3
```

Output

```
6 : even
12 : even
-5 : odd
11 : odd
```

Uses of the `lambda` Functions (review)

By assigning a function object to a variable : **Second use**

- Assigning a variable :

```
1  average = lambda x, y: (x+y)/2
2  print(average(3, 5))  # we call
```

What is the output? Try to figure out in your mind...

Students, write your response!

Uses of the `lambda` Functions (review)

- Using variable :

```
1  average = lambda x, y: (x+y)/2
2  print(average(3, 5))  # we call
```

```
1  4.0
```

Uses of the `lambda` Functions (review)

- **Task** :
  - Define a `lambda` function to reverse the elements of any **iterables**.
  - Use **variable** for arguments and print the result.

Uses of the `lambda` Functions (review)

- **The code can be as :**

```
1  iterable = "clarusway"
2
3  reverser = lambda x : x[::-1]
4
5  print(reverser(iterable))
6
```

Output

```
yawsuralc
```

Third use

3

Lambda within Built-in (`map()`) Functions-1

Lambda within Built-in (`map()`) Functions-1

- **Lambda within `map()` function :**
  - `map()` returns a list of the outputs after applying the given function to *each element* of a given *iterable object* such as `list`, `tuple`, etc.

```
The basic formula syntax is : map(function, iterable)
```

Lambda within Built-in (`map()`) Functions-1

- Let's square all the numbers in the list using `map()` and `lambda`. Consider this *pre-class* example :

```
1  iterable = [1, 2, 3, 4, 5]
2  map(lambda x:x**2, iterable)
3  result = map(lambda x:x**2, iterable)
4  print(type(result))  # it's a map type.
5
6  print(list(result))  # we've converted it to list type to print
7
8  print(list(map(lambda x:x**2, iterable)))  # you can print directly
```

What is the output? Try to figure out in your mind...

Students, write your response!

Lambda within Built-in (`map()`) Functions-1

- The output of this *pre-class* example :

```
1  iterable = [1, 2, 3, 4, 5]
2  map(lambda x:x**2, iterable)
3  result = map(lambda x:x**2, iterable)
4  print(type(result))  # it's a map type.
5
6  print(list(result))  # we've converted it to list type to print
7
8  print(list(map(lambda x:x**2, iterable)))  # you can print directly
```

```
1  <class 'map'>
2  [1, 4, 9, 16, 25]
3  [1, 4, 9, 16, 25]
```

Lambda within Built-in (`map()`) Functions-1

- **Task :**
  - Do the same thing using user-defined function (`def`).
  - Use the `def` in `map()` function.

Lambda within Built-in (`map()`) Functions-1

- Disadvantages of the `def` :

```
1  def square(n):   # at least two additional lines of code
2      return n**2
3
4  iterable = [1, 2, 3, 4, 5]
5  result = map(square, iterable)
6  print(list(result))
```

Lambda within Built-in (`map()`) Functions-1

- Multiple arguments in `lambda` function using `map()` :

```
1  letter1 = ['o', 's', 't', 't']
2  letter2 = ['n', 'i', 'e', 'w']
3  letter3 = ['e', 'x', 'n', 'o']
4  numbers = map(lambda x, y, z: x+y+z, letter1, letter2, letter3)
5
6  print(list(numbers))
```

What is the output? Try to figure out in your mind...

- In the above example, we have combined three strings using 👉+ operator in `lambda` definition.

Students, write your response!

Lambda within Built-in (`map()`) Functions-1

- The output :

```
letter1 = ['o', 's', 't', 't']
letter2 = ['n', 'i', 'e', 'w']
letter3 = ['e', 'x', 'n', 'o']
numbers = map(lambda x, y, z: x+y+z, letter1, letter2, letter3)

print(list(numbers))
```

```
['one', 'six', 'ten', 'two']
```

- In the above example, we have combined three strings using 👉+ operator in lambda definition.

> 💡**Tips :**
> - Note that `map()` takes each element from iterable objects one by one and in order.

Lambda within Built-in (`map()`) Functions-1

- **Task :**
  - Using `lambda` in `map()` function, Write a program that calculates the arithmetic means of two element pairs in the following two `list`s in accordance with **their order** and collects them into a `list`.

```
1  nums1 = [9,6,7,4]
2  nums2 = [3,6,5,8]
```

Output

```
[6.0, 6.0, 6.0, 6.0]
```

Lambda within Built-in (`map()`) Functions-1

- **The code can be as follows :**

```
1  nums1 = [9,6,7,4]
2  nums2 = [3,6,5,8]
3
4  numbers = map(lambda x, y: (x+y)/2, nums1, nums2)
5
6  print(list(numbers))
7
```

Lambda within Built-in (`map()`) Functions-1

- **Task :**
  - Using `lambda` in `map()` function, write a program that sets three **meaningful sentences** derived from the elements in the following three `lists` in accordance with **their order**.
  - Print these sentences on separate lines.

```
1  words1 = ["you","much","hard"]
2  words2 = ["i","you","he"]
3  words3 = ["love", "ate", "works"]
```

Lambda within Built-in (`map()`) Functions-1

- **The code can be as follows :**

```
1  words1 = ["you","much","hard"]
2  words2 = ["i","you","he"]
3  words3 = ["love", "ate", "works"]
4
5  sentences = map(lambda x, y, z: x + " " + y + " " + z, words2, words3, words1)
6
7  for i in sentences:  # attention here! The "sentences" is an iterable
8      print(i)
9
```

Output

```
i love you
you ate much
he works hard
```

Third use

4

Lambda within Built-in (`filter()`) Functions-2

Lambda within Built-in (`filter()`) Functions-2

- **Lambda within filter() function :**
  - `filter()` filters the given sequence (iterable objects) with the help of a function (`lambda`) that tests each element in the sequence to be `True` or not.

```
The basic formula syntax is : filter(function, sequence)
```

Lambda within Built-in (`filter()`) Functions-2

- Filtering the even numbers :

```
1  first_ten = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]
2
3  even = filter(lambda x:x%2==0, first_ten)
4  print(type(even))  # it's 'filter' type,
5                     # in order to print the result,
6                     # we'd better convert it into the list type
7
8  print('Even numbers are :', list(even))
```

Lambda within Built-in (`filter()`) Functions-2

- The output :

```
first_ten = [0, 1, 2, 3, 4, 5, 6, 7, 8, 9]

even = filter(lambda x:x%2==0, first_ten)
print(type(even))  # it's 'filter' type,
                   # in order to print the result,
                   # we'd better convert it into the list type

print('Even numbers are :', list(even))
```

```
<class 'filter'>
Even numbers are : [0, 2, 4, 6, 8]
```

Lambda within Built-in (`filter()`) Functions-2

- **Task :**
  - Using `lambda` in `filter()` function, write a program that filters out words (elements of the given `list`) with less than 5 chars.
  - Print these words which has less than 5 chars on separate lines.

```
1  words = ["apple", "swim", "clock", "me", "kiwi", "banana"]
2
```

Lambda within Built-in (`filter()`) Functions-2

- **The code can be as follows :**

```
1  words = ["apple", "swim", "clock", "me", "kiwi", "banana"]
2
3  for i in filter(lambda x: len(x)<5, words):
4      print(i)
5
```

Output

```
swim
me
kiwi
```

Lambda within Built-in (`filter()`) Functions-2

- **Task :**
  - This time, let's filter the vowels from the given letters in a `list`.
  - Print these letters in a `list`.

```
1
2 first_ten = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']
3
```

Lambda within Built-in (`filter()`) Functions-2

- The code should look like :

```
1  vowel_list = ['a', 'e', 'i', 'o', 'u']
2  first_ten = ['a', 'b', 'c', 'd', 'e', 'f', 'g', 'h', 'i', 'j']
3
4  vowels = filter(lambda x: True if x in vowel_list else False, first_ten)
5
6  print('Vowels are :', list(vowels))
```

```
1  Vowels are : ['a', 'e', 'i']
```

- We draw your attention to this issue that *lambda definition* we use in this example gives only `True` or `False` as a result.

Last use

4

Lambda within User-Defined Functions

Lambda within User-Defined Functions

- **Lambda within def :**

```
1  def modular_function(n):
2      return lambda x: x ** n
3
4  power_of_2 = modular_function(2)  # first sub-function derived from def
5  power_of_3 = modular_function(3)  # second sub-function derived from def
6  power_of_4 = modular_function(4)  # third sub-function derived from def
7
8  print(power_of_2(2))  # 2 to the power of 2
9  print(power_of_3(2))  # 2 to the power of 3
10 print(power_of_4(2))  # 2 to the power of 4
```

What is the output?

Try to figure out in your mind...

Students, write your response!

Lambda within User-Defined Functions

- **Lambda within def :**

```
1  def modular_function(n):
2      return lambda x: x ** n
3
4  power_of_2 = modular_function(2)  # first sub-function derived from def
5  power_of_3 = modular_function(3)  # second sub-function derived from def
6  power_of_4 = modular_function(4)  # third sub-function derived from def
7
8  print(power_of_2(2))  # 2 to the power of 2
9  print(power_of_3(2))  # 2 to the power of 3
10 print(power_of_4(2))  # 2 to the power of 4
```

```
1  4
2  8
3  16
```

Lambda within User-Defined Functions

- **Task :** (pre-class content)
  - We can define a function with the same logic as the previous example that repeats the string passed into it.
  - Define a function (`def`) named `repeater` using `lambda` to print the string `n` times.

Lambda within User-Defined Functions

- The sample code and the output :

```
1  def repeater(n):
2      return lambda x: x * n
3
4  repeat_2_times = repeater(2)  # repeats 2 times
5  repeat_3_times = repeater(3)  # repeats 3 times
6  repeat_4_times = repeater(4)  # repeats 4 times
7
8  print(repeat_2_times('alex '))
9  print(repeat_3_times('lara '))
10 print(repeat_4_times('linda '))
```

```
1 alex alex
2 lara lara lara
3 linda linda linda linda
```

Lambda within User-Defined Functions

- **Task :**
  - Define a *simple* function (`def`) named `functioner` using `lambda` to create your own `print` function with ***emoji faces***. Such as :

```
# these functions were derived from the "functioner" function
myPrint_smile("hello")
myPrint_sad("hello")
myPrint_neutral("hello")
```

Output

```
hello :)
hello :(
hello :|
```

Lambda within User-Defined Functions

- The sample code and the output :

```
1  def functioner(emoji=None):
2      return lambda message : print(message, emoji)
3
4  myPrint_smile = functioner(":)")
5  myPrint_sad = functioner(":(")
6  myPrint_neutral = functioner(":|")
7
```

THANKS!

End of the Lesson

(Lambda Functions)

next Lesson

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