PROGRAMMING WITH PYTHON

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What is recursion?

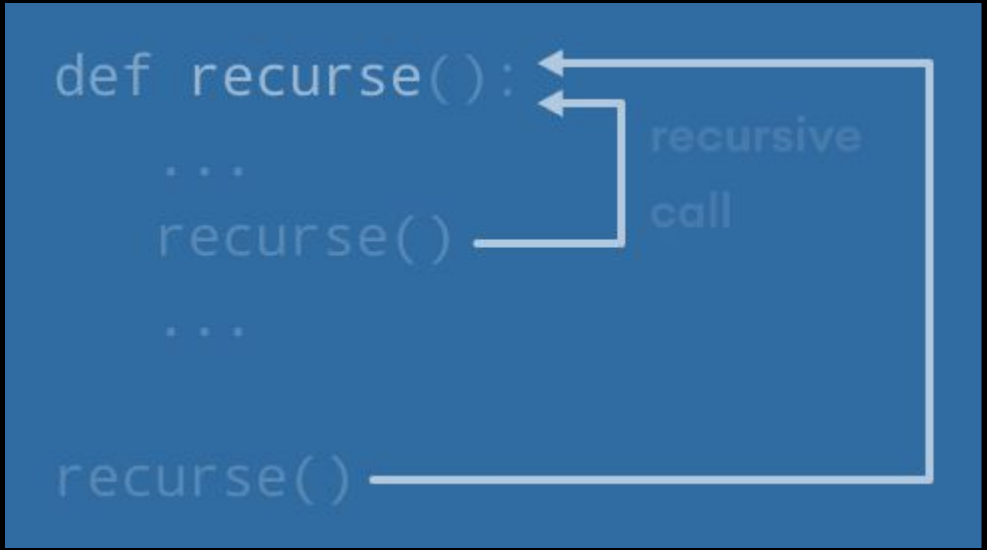
Recursion is the process of defining something in terms of itself.

A physical world example would be to place two parallel mirrors facing each other. Any object in between them would be reflected recursively.

PYTHON RECURSIVE FUNCTION

In Python, we know that a function can call other functions. It is even possible for the function to call itself. These types of construct are termed as recursive functions.

The following image shows the working of a recursive function called recurse.



```
def recurse():
    ...
    recurse()
    ...

recurse()
```

Example

Factorial of a number is the product of all the integers from 1 to that number. For example, the factorial of 6 (denoted as 6!) is 1*2*3*4*5*6 = 720.

```
def factorial(x):
    """This is a recursive function
    to find the factorial of an integer"""
    if x == 1:
        return 1
    else:
        return (x * factorial(x-1))                    #Recursion
num = 6
print("The factorial of", num, "is", factorial(num))
```

Output:

```
The factorial of 6 is 720
```

lambda functions in Python

In Python, an anonymous function is a function that is defined without a name.

While normal functions are defined using the def keyword in Python, anonymous functions are defined using the lambda keyword.

Hence, anonymous functions are also called lambda functions.

Syntax of Lambda Function in python

lambda arguments: expression

Lambda functions can have any number of arguments but only one expression. The expression is evaluated and returned.

Lambda functions can be used wherever function objects are required.

Example of Lambda Function in python

```
# Program to show the use of lambda functions
dobl = lambda x: x * 2

print(dobl(5))
```

Output

```
10
```

In the above program, lambda x: x * 2 is the lambda function. Here x is the argument and x * 2 is the expression that gets evaluated and returned.

This function has no name. It returns a function object which is assigned to the identifier double.

Example

A lambda function that multiplies argument a with argument b and print the result:

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

Output

```
30
```

Example

A lambda function that sums argument a, b, and c and print the result:

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

Output:

```
13
```

Use of Lambda Function in python

- We use lambda functions when we require a nameless function for a short period of time.
- In Python, we generally use it as an argument to a higher-order function (a function that takes in other functions as arguments). Lambda functions are used along with built-in functions like filter(), map() etc.

Example

A lambda function that adds 10 to the number passed in as an argument, and print the result:

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

Output:

```
15
```

Example use with filter()

The filter() function in Python takes in a function and a list as arguments.

The function is called with all the items in the list and a new list is returned which contains items for which the function evaluates to True.

Here is an example use of filter() function to filter out only even numbers from a list.

```
# Program to filter out only the even items from a list
my_list = [1, 5, 4, 6, 8, 11, 3, 12]

new_list = list(filter(lambda x: (x%2 == 0) , my_list))

print(new_list)
```

Output

```
[4, 6, 8, 12]
```

Example use with map()

The map() function in Python takes in a function and a list.

The function is called with all the items in the list and a new list is returned which contains items returned by that function for each item.

Here is an example use of map() function to double all the items in a list.

```
# Program to double each item in a list using map()

my_list = [1, 5, 4, 6, 8, 11, 3, 12]

new_list = list(map(lambda x: x * 2 , my_list))

print(new_list)
```

Output

```
[2, 10, 8, 12, 16, 22, 6, 24]
```

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))
```

Output:

```
22
```