Operator Overloading

In this lesson, we will be learning about operator overloading in Python.

We'll cover the following

Overloading Operators in Python

Operators in Python can be overloaded to operate in a certain user-defined way. Whenever an operator is used in Python, its corresponding method is invoked to perform its *predefined* function. For example, when the `+` operator is called, it invokes the special function, `__add__`, in Python, but this operator acts differently for different data types. For example, the `+` operator **adds** the numbers when it is used between two `int` data types and **merges** two strings when it used between `string` data types.

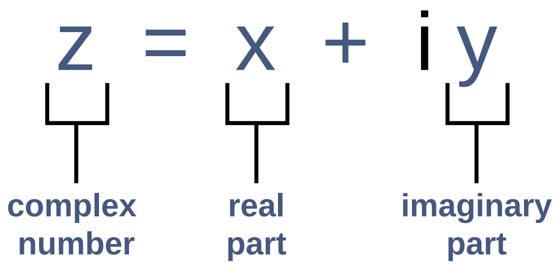
Run the code below for the implementation of the `+` operator for integers and strings:

```
print(5 + 3)  # adding integers using '+'
print("money" + "maker")  # merging strings us
```

Overloading Operators for a User-Defined Class

When a class is defined, its objects can interact with each other through the operators, **BUT** it is necessary to define the behavior of these operators through operator overloading.

We are going to implement a class that represents a complex number, which has a real part and an imaginary part.



When we *add* a complex number, the real part is added to the real part and the imaginary part is added to the imaginary part.

Similarly, when we *subtract* a complex number, the real part is subtracted from the real part and the imaginary part is subtracted from the imaginary part.

An example of this is shown below:

$a = 3 + 7i$

$b = 2 + 5i$

$a + b = (3 + 2) + (7 + 5)i = 5 + 12i$

$a - b = (3 - 2) + (7 - 5)i = 1 + 2i$

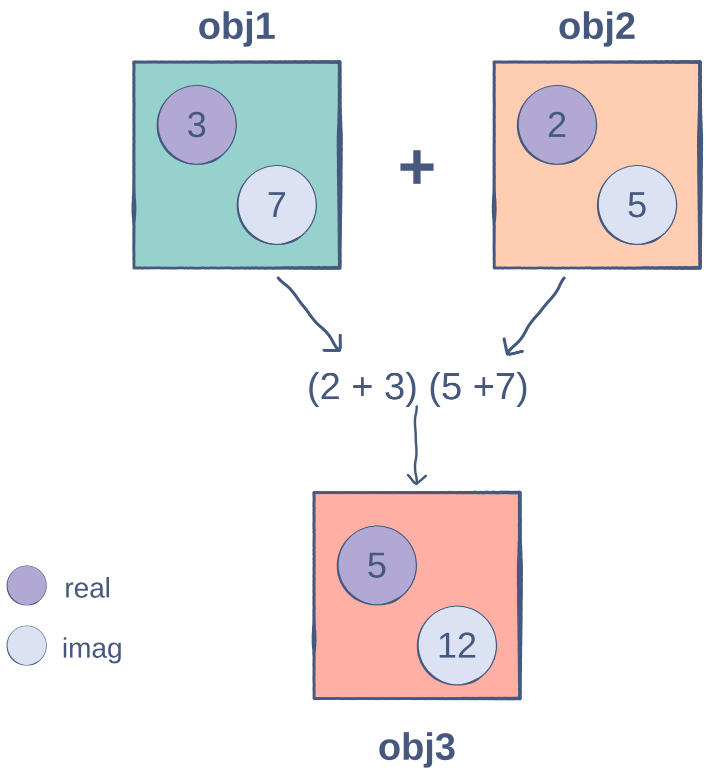
Now let's implement the complex number class and overload the `+` and `-` operators below:

```
class Com:
    def __init__(self, real=0, imag=0):
        self.real = real
        self.imag = imag

    def __add__(self, other):  # overloading the `+` operator
        temp = Com(self.real + other.real, self.imag + other.imag)
        return temp

    def __sub__(self, other):  # overloading the `-` operator
        temp = Com(self.real - other.real, self.imag - other.imag)
        return temp


obj1 = Com(3, 7)
obj2 = Com(2, 5)

obj3 = obj1 + obj2
obj4 = obj1 - obj2

print("real of obj3:", obj3.real)
print("imag of obj3:", obj3.imag)
print("real of obj4:", obj4.real)
print("imag of obj4:", obj4.imag)
```

Explanation

- In the above code, we have overloaded the built-in method `__add__` (**line 6**) and `__sub__` (**line 10**) that are invoked when the `+` and the `-` operators are used.
- Whenever two objects of class `Com` are added using the `+` operator, the overloaded `__add__` method is called.
- This method adds the `real` property separately and the `imag` property separately and then returns a new `Com` class object that is initialized by these sums.
- Note that `__add__` and `__sub__` methods have *two* input parameters. The first one is `self`, which we know is the reference to the class itself. The second parameter is `other`. `other` is a reference to the *other* objects that are interacting with the class object.

- In **line 18**, `obj2` will be considered the other object, the operator will be called on the `obj1` object and the returned object will be stored in `obj3`.
- In **line 19**, `obj2` will be considered the other object, the operator will be called on the `obj1` object and the returned object will be stored in `obj4`.
- Other has `Com` class attributes and thus, it has the `real` and the `imag` properties.



You can name the second argument to be anything, but as per convention, we will be using the word `other` to reference the *other* object.

Similarly, whenever two objects of class `Com` are subtracted using the `-` operator, the overloaded `__sub__` method is called. This method subtracts the `real` property separately and the `imag` property separately and then returns a new `Com` class object that is initialized by these differences.

Special Functions for Some Common Operators

Below are some common special functions that can be overloaded while implementing operators for objects of a class.

Operator	Method
+	__add__ (self, other)
-	__sub__ (self, other)
/	__truediv__ (self, other)
*	__mul__ (self, other)
<	__lt__ (self, other)
>	__gt__ (self, other)
==	__eq__ (self, other)

It is for the user to decide how they want the objects to interact when an operator *operates* on them, but they usually make sure that these operations make sense. For example, the `+` is not going to be used for finding products of different properties of a class.

This is it for operator overloading in Python. Now let's learn how to implement polymorphism using duck typing in Python.

Back
Method Overriding

Next
Polymorphism Using Duck Typing

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