

Object Oriented Programming (OOP)



Hello!

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Hello!

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Why OOP ?!

Let's see Why ^_~



Calculate Sum 10000 times ?!

```
1 x = 10
2 y = 20
3 print(x + y)
4
5 x = 50
6 y = 70
7 print(x + y)
8
9 x = 90
10 y = 200
11 print(x + y)
```



Calculate Sum 10000 times ?!

What if I want to modify code to multiply ?



Calculate Sum 10000 times ?!

What if I w



```
1 x = 10
2 y = 20
3 print(x + y)
4
5 x = 50
6 y = 70
7 print(x + y)
8
9 x = 90
10 y = 200
11 print(x + y)
```

Albert Einstein: Insanity is doing the same thing over and over and expecting different results



Calculate Sum 10000 times ?!

What if I want to modify code to multiply ?

```
1 def calculate(x, y):  
2     return x + y # to multiply just make '+' -> '*'  
3  
4 calculate(1, 2) # 3  
5 calculate(10, 20) # 30  
6 calculate(50, 40) # 90  
7 ...
```



Make Full Calculator ?

```
1 def summ(x, y):  
2     return x + y  
3  
4 def multiply(x, y):  
5     return x * y  
6  
7 def subtract(x, y):  
8     return x - y  
9  
10 def divide(x, y):  
11     return x / y  
12  
13 summ(1, 2) # 3  
14 multiply(10, 20) # 200  
15 subtract(50, 40) # 10  
16 divide(50, 2) # 25  
17 ...
```



Make Lots of Features ?

```
● ● ●  
1 def summ(x, y):  
2     pass  
3  
4 def subtract(x, y):  
5     pass  
6  
7 def read_file(path):  
8     pass  
9  
10 def write_data_in_file(data, path):  
11    pass  
12  
13 def get_data_from_internet(url):  
14    pass  
15  
16 def delete_data_from_database(data):  
17    pass  
18  
19 ...
```



Make Lots of Features ?

```
1 def summ(x, y):  
2     pass  
3  
4 def subtract(x, y):  
5     pass  
6  
7 def read_file(path):  
8     pass  
9  
10 def write_data_in_file(da  
11     pass  
12  
13 def get_data_from_interne  
14     pass  
15  
16 def delete_data_from_data  
17     pass  
18  
19 ...
```



What is OOP ?!

Everything is an
Object



Dog

Attributes

- Size
- Color
- Breed
- Age
- ...

Methods

- Run()
- Park()
- Eat()
- Sleep()
- ...



Car

Attributes

- Model
- Color
- Plate Number
- Speed
- ...

Methods

- Steer()
- Back()
- Break()
- Throttle()
- ...



Person

Attributes

- Name
- Age
- Address
- Gender
- ...

Methods

- Eat()
- Sleep()
- Walk()
- Pray()
- ...



Camera

Attributes

- Lens_width
- Has_Flash
- Depth
- ...

Methods

- Take_Photo()
- Take_Video()
- Toggle_Flash()
- Zoom()
- ...



Classes & Objects



Person

Attributes

- Name
- Age
- Address
- Gender
- ...

Methods

- Eat()
- Sleep()
- Walk()
- Pray()
- ...



Class: Person

Object 1

- Name: Eslam
- Age: 26
- Gender: Male
- Eat Meat
- Sleep at 9 pm

Object 2

- Name: Ahmed
- Age: 15
- Gender: Male
- Eat Chicken
- Sleep at 12 am

Object 3

- Name: Sara
- Age: 30
- Gender: Female
- Eat Fish
- Sleep at 6 am

```
1 class Circle:
2     pi = 3.14
3
4     # Circle gets instantiated with a radius (default is 1)
5     def __init__(self, radius=1):
6         self.radius = radius
7
8
9     # Method for resetting Radius
10    def getArea(self):
11        return (self.radius ** 2) * self.pi
12
13
14    # Method for getting Circumference
15    def getCircumference(self):
16        return self.radius * self.pi * 2
17
18
19 c1 = Circle()
20 print(c1.radius)          # 1
21 print(c1.getArea())        # 3.14
22 print(c1.getCircumference()) # 6.28
23
24
25 c2 = Circle(10)
26 print(c2.radius)          # 10
27 print(c2.getArea())        # 314.0
28 print(c2.getCircumference()) # 62.8
```

OOP in Python ?



```
1 class Person:
2
3     def __init__(self, name, age, gender):
4         self.name = name
5         self.age = age
6         self.gender = gender
7
8
9     def greet(self):
10        if self.gender == 'male':
11            print('Hello, Mr. ' + self.name)
12        elif self.gender == 'female':
13            print('Hello, Mrs. ' + self.name)
14
15
16    def is_old(self):
17        return (self.age >= 60)
18
19
20 ahmed = Person('ahmed', 20, 'male')
21 mohammed = Person('mohammed', 67, 'male')
22 sara = Person('sara', 30, 'female')
23
24 ahmed.is_old() # false
25 mohammed.is_old() # true
26
27 ahmed.greet() # Hello, Mr. ahmed
28 sara.greet() # Hello, Mrs. sara
29
```

OOP in Python ?



Person

OOP Concepts

- Data Hiding (Encapsulation)
- Inheritance
- Polymorphism
- Special Functions and Operators Overloading
- Static Attributes & Methods



Data Hiding (Encapsulation)

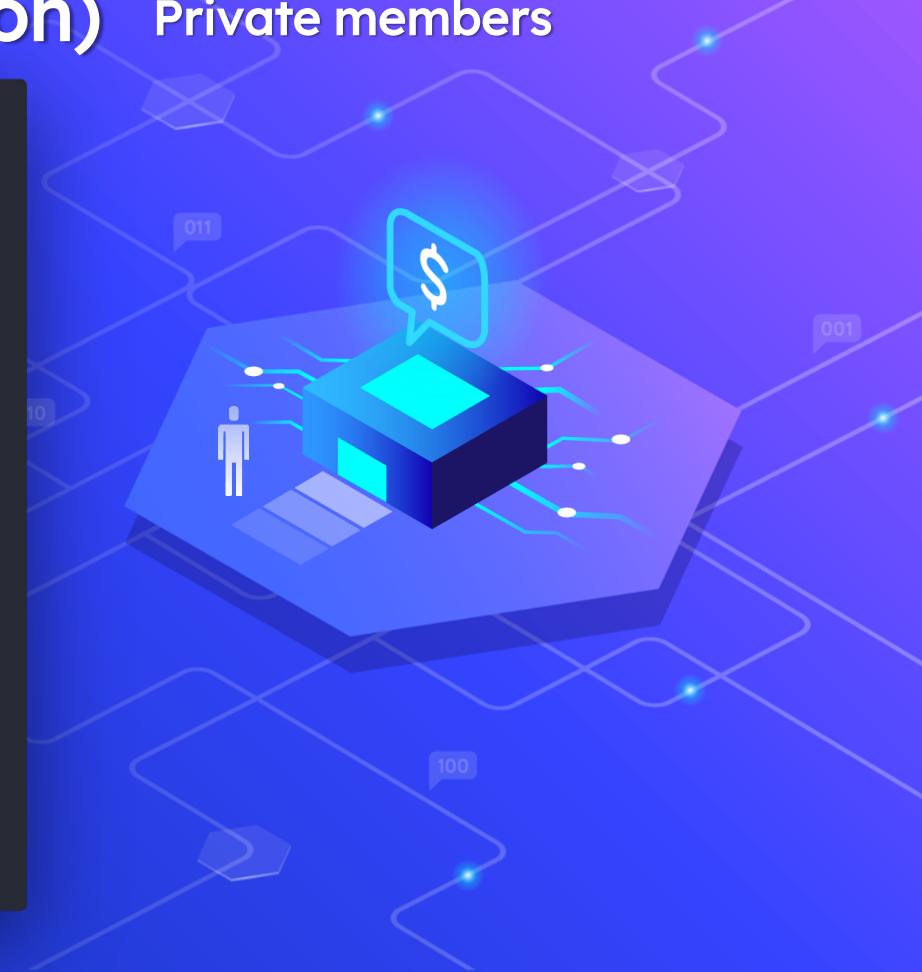


Data Hiding (Encapsulation)

An object's attributes may or may not be visible outside the class definition. You need to name attributes with a double underscore prefix, and those attributes then are not be directly visible to outsiders.

Data Hiding (Encapsulation) Private members

```
●●●  
1 class Circle:  
2     pi = 3.14  
3  
4  
5     # Circle gets instantiated with a radius (default is 1)  
6     def __init__(self, radius=1):  
7         self.__radius = radius  
8  
9     # Method for resetting Radius  
10    def getArea(self):  
11        return self.__radius * self.__radius * self.pi  
12  
13    # Method for getting Circumference  
14    def getCircumference(self):  
15        return self.__radius * self.pi * 2  
16  
17  
18  
19 c1 = Circle(10)  
20  
21 print('Radius is: ',c1.__radius)  
22  
23 """  
24 AttributeError: 'Circle' object has no attribute '__radius'  
25 """
```



Data Hiding (Encapsulation) Setter and Getter

```
1 class Circle:  
2     pi = 3.14  
3  
4  
5     # Circle gets instantiated with a radius (default is 1)  
6     def __init__(self, radius=1):  
7         if type(radius) == int:  
8             self.__radius = radius  
9         else:  
10             self.__radius = 1  
11  
12  
13     # Setter  
14     def set_radius(self, new_radius):  
15         if type(new_radius) == int:  
16             self.__radius = new_radius  
17         else:  
18             print('this is not an integer')  
19  
20     # Getter  
21     def get_radius(self):  
22         print(f'the radius is: {self.__radius}')
```



OOP Concepts

- Data Hiding (Encapsulation)
- Inheritance
- Polymorphism
- Special Functions and Operators Overloading
- Static Attributes & Methods



Inheritance



Inheritance

It is a way to form new classes using classes that have already been defined. The newly formed classes are called derived classes, the classes that we derive from are called base classes.

Inheritance

```
1 class Animal:
2
3     def __init__(self):
4         self.species = 'mammal'
5         print("Animal created")
6
7     def whoAmI(self):
8         print("Animal")
9
10    def eat(self):
11        print("Eating")
12
13 # -----
14
15 class Dog(Animal):
16
17     def __init__(self):
18         Animal.__init__(self)      # call parent __init__
19         self.sound = 'High'
20         self.love_bones = True
21         print("Dog created")
22
23     def bark(self):
24         print(f'Woof Woof with {self.sound} Sound')
25
26     def eat(self):
27         if self.love_bones:
28             print('Love eating bones')
29         else:
30             print('Love meat')
31
32 # -----
33
34
35 sam = Dog()
36 # Animal created
37 # Dog created
38
39 sam.species      # mammal
40 sam.love_bones  # True
41
42 sam.whoAmI()    # Animal
43 sam.eat()        # Love eating bones
44 sam.bark()       # Whao Whao with High Sound
```



OOP Concepts

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Polymorphism



Polymorphism

polymorphism refers to the way in which different object classes can share the same method name but each acts differently.

Polymorphism

```
1 class Dog:  
2     def __init__(self, name):  
3         self.name = name  
4  
5     def speak(self):  
6         return self.name+' says Woof!'  
7  
8 class Cat:  
9     def __init__(self, name):  
10        self.name = name  
11  
12    def speak(self):  
13        return self.name+' says Meow!'  
14  
15  
16 jack = Dog('Jack')  
17 meshmesh = Cat('Meshmesh')  
18  
19  
20 for pet in [jack,meshmesh]:  
21     print(pet.speak())
```



OOP Concepts

- Data Hiding (Encapsulation)
- Inheritance
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- Special Functions and Operators Overloading
- Static Attributes & Methods

Special Functions and Operators Overloading

Math Operators

- __add__
- __sub__
- __mul__
- __truediv__
- __floordiv__
- __mod__
- __pow__

Comparison Operators

- __eq__
- __nq__
- __lt__
- __le__
- __gt__
- __ge__

Other Operators

- __init__
- __str__
- ...

OOP Concepts

- Data Hiding (Encapsulation)
- Inheritance
- Polymorphism
- Special Functions and Operators Overloading
- **Static Attributes & Methods**

Static Attributes & Methods

```
1 class Calculator:
2     pi = 3.14
3
4     @staticmethod
5     def summ(x, y):
6         return x + y
7
8     @staticmethod
9     def sub(x, y):
10        return x - y
11
12    @staticmethod
13    def mul(x, y):
14        return x * y
15
16    @staticmethod
17    def div(x, y):
18        if y == 0:
19            return 'Cant divide on zero'
20        else:
21            return x / y
22
23
24 # -----
25 Calculator.pi      # 3.14
26 Calculator.summ(10, 20) # 30
27 Calculator.sub(30, 20) # 10
28 Calculator.mul(10, 20) # 200
29 Calculator.div(100, 20) # 5
30 Calculator.div(100, 0) # Cant divide on zero
```



Other Concepts

- ▷ Exceptions
- ▷ Decorators
- ▷ Iterators and Generators



Exceptions

```
1 try:  
2     lst = [1,2,3,4,5]  
3     print(lst[10])  
4  
5 except ZeroDivisionError:  
6     print('cant divide on zero')  
7  
8 except IndexError:  
9     print('you accessed non found index')  
10  
11 except ValueError:  
12     print('this is value error')  
13  
14 except Exception as e:  
15     print(type(e).__name__)  
16  
17 else:  
18     print('No Error')  
19  
20 finally:  
21     print('Printed if there is exception or no')
```



Check Python Error Types
<https://docs.python.org/3/library/exceptions.html>

Other Concepts

- ◊ Exceptions
- ◊ Decorators
- ◊ Iterators and Generators



Decorators

```
1 def new_decorator(func):
2
3     def wrap_func():
4         print("Code would be here, before executing the func")
5         func()
6         print("Code here will execute after the func()")
7
8     return wrap_func
9
10 def func_needs_decorator():
11     print("This function is in need of a Decorator")
12
13
14 func_needs_decorator()
15 """
16 This function is in need of a Decorator
17 """
18
19 func_needs_decorator = new_decorator(func_needs_decorator)
20
21 func_needs_decorator()
22 """
23 Code would be here, before executing the func
24 This function is in need of a Decorator
25 Code here will execute after the func()
26 """
```

```
1 def new_decorator(func):
2
3     def wrap_func():
4         print("Code would be here, before executing the func")
5
6         func()
7
8         print("Code here will execute after the func()")
9
10    return wrap_func
11
12
13 @new_decorator
14 def func_needs_decorator():
15     print("This function is in need of a Decorator")
16
17
18 func_needs_decorator()
19 """
20 Code would be here, before executing the func
21 This function is in need of a Decorator
22 Code here will execute after the func()
23 """
```

Other Concepts

- ▷ Exceptions
- ▷ Decorators
- ▷ Iterators and Generators



Iterators

```
● ● ●  
1 # define a list  
2 my_list = [4, 7, 0, 3]  
3  
4 # get an iterator using iter()  
5 my_iter = iter(my_list)  
6  
7 ## iterate through it using next()  
8  
9 # prints 4  
10 print(next(my_iter))  
11  
12 # prints 7  
13 print(next(my_iter))  
14  
15 ## next(obj) is same as obj.__next__()  
16  
17 # prints 0  
18 print(my_iter.__next__())  
19  
20 # prints 3  
21 print(my_iter.__next__())  
22  
23 ## This will raise StopIteration error, no items left  
24 next(my_iter)
```



Custom Iterators

```
 1 class PowTwo:
 2
 3     def __init__(self, max = 0):
 4         self.max = max
 5
 6     def __iter__(self):
 7         self.n = 0
 8         return self
 9
10    def __next__(self):
11        if self.n <= self.max:
12            result = 2 ** self.n
13            self.n += 1
14            return result
15        else:
16            raise StopIteration
17
18
19 a = iter(PowTwo(4))
20 a.__next__() # 1
21 a.__next__() # 4
22 a.__next__() # 8
23 a.__next__() # 16
24 a.__next__() # 32
25 a.__next__() # Raise StopIteration Exception
```



Generator

Much Better

no need to implement `__iter__()` and `__next__()`

```
1 def my_gen():
2     n = 1
3     print('This is printed first')
4     yield n
5
6     n += 1
7     print('This is printed second')
8     yield n
9
10    n += 1
11    print('This is printed at last')
12    yield n
13
14 a = my_gen()
15 a.__next__() # This is printed first 1
16 a.__next__() # This is printed second 2
17 a.__next__() # This is printed at last 3
18 a.__next__() # Raise StopIteration Exception
19
20 #####
21
22 for item in my_gen():
23     print(item)
24
25 """
26 This is printed first
27 1
28 This is printed second
29 2
30 This is printed at last
31 3
32 """
```

Questions ?!



Thanks!

>_ Live long and prosper

