

20. PYTHON – OBJECT ORIENTED PROGRAMMING

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20. PYTHON – OBJECT ORIENTED PROGRAMMING

- ✓ Object-Oriented Programming is a methodology to design software by using classes and objects.
- ✓ It simplifies the software development and maintenance by providing the below features,

1. Is Python follows Functional approach or Object-oriented approach?

- ✓ Python supports both functional and object-oriented programming.

2. Features of Object-Oriented Programming System

- ✓ class
- ✓ object
- ✓ constructor
- ✓ Inheritance & etc...

3. class:

3.1. Def1:

- ✓ A class is a model for creating an object and it does not exist physically.

3.2. Def2:

- ✓ A class is a specification (idea/plan/theory) of properties and actions of objects.

Syntax

```
class NameOfTheClass:  
    1. constructor  
    2. properties (attributes)  
    3. actions (behaviour)
```

- ✓ We can create class by using **class** keyword.
- ✓ class can contain,
 - constructor
 - properties
 - actions
- ✓ Properties also called as variables.
- ✓ Actions also called as methods.

4. How to define or create a class?

- ✓ A python class may contain the below things,

Syntax

```
class NameOfTheClass:  
    """ documentation string """
```

1. Constructor

2. Variables

1. instance variables

3. Methods

1. instance methods

5. Brief discussion about class

- ✓ We can create class by using **class** keyword.
- ✓ class keyword follows the **name of the class**.
- ✓ After name of the class we should give **colon :** symbol.
- ✓ After **:** colon symbol in next line we should provide the **indentation**, otherwise we will get error.
- ✓ class can contain,
 - **Constructor** are used for initialization purpose
 - **Variables** are used to represent the data.
 - **instance** variables
 - **Methods** are used to represent actions.
 - **instance** methods

Class naming convention

- ✓ While writing a class we need to follow the naming convention to meet real time standards,
 - class names should start with upper case and remaining letters are in lower case.
 - **Example:** Student
 - If name having multiple words, then every inner word should start with upper case letter.
 - **Example:** StudentInfo

Note

- ✓ Documentation string represents description of the class. Within the class doc string is always optional.

Program Define a class
Name demo1.py

```
class Employee:
    def display(self):
        print("Hello My name is Daniel")
```

output

Make a note

- ✓ In above program, when we run then we will not get any output because we didn't call display method
- ✓ Above program Employee represents a **class** which is defined by developer.
- ✓ Developer defined only one method as display(self)
- ✓ Method we can define by using **def** keyword.
- ✓ Methods means it's just like a functions to perform an operations

Kind info:

- ✓ Writing a class is not enough; we should know how to use the variables and methods.

So,

- ✓ We need to create an object to access instance data(variables/methods) of a class.

6. object

6.1. Why should we create an object?

- ✓ As per requirement we used to define variables and methods in a class.
- ✓ These variables and methods hold the data or values.
- ✓ When we create an object for a class, then only data will be store for the data members of a class.

6.2. What is an object?

Definition 1:

- ✓ Instance of a class is known as an object.
 - Instance is a mechanism to allocate enough memory space for data members of a class.

Definition 2:

- ✓ Grouped item is known as an object.
 - Grouped item is a variable which stores more than one value.

Definition 3:

- ✓ Real world entities are called as objects.

Make some notes

- ✓ An object exists physically in this world, but class does not exist.

6.3. Syntax to create an object

Syntax

```
nameoftheobject = nameoftheclass()
```

Example

```
emp = Employee()
```

Program Name

Creating a class and object
demo2.py

```
class Employee:
    def display(self):
        print("Hello my name is Daniel")

emp = Employee()
emp.display()
```

output

Hello my name is Daniel

Program Name	Creating a class and object demo2.py
	<pre>class Employee: def display(self): print("Hello my name is Daniel") def teaching(self): print("I like teaching") emp = Employee() emp.display() emp.teaching()</pre>
output	Hello my name is Daniel I like teaching

Make a note

- ✓ We can create object for class.
- ✓ In the above example **emp** is object name.
 - emp is just like a variable
- ✓ above example, display(self) is instance method.
 - To access instance method, we should create an object
 - So, we are accessing instance methods by using object name

7. Constructor

- ✓ Constructor is a special kind of method in python.
- ✓ So, we can create constructor by using **def** keyword
- ✓ The name of the constructor should be **__init__(self)**
 - Two underscore symbols before and after init with self as parameter
- ✓ self should be first parameter in constructor,

Syntax

```
class NameOfTheClass:  
    def __init__(self):  
        body of the constructor
```

7.1. What is the main purpose of constructor?

- ✓ The main purpose of constructor is to initialize instance variables.

7.2. When constructor will be executed?

- ✓ Constructor will be executed automatically at the time of object creation.

Program Name Creating a constructor
demo3.py

```
class Employee:
    def __init__(self):
        print("constructor is executed")
```

```
emp = Employee()
```

output
constructor is executed

7.3. How many times Constructor will executes?

- ✓ If we create object in two times then constructor will execute two times.

Program Name Creating a constructor
demo3.py

```
class Employee:
    def __init__(self):
        print("constructor is executed")
```

```
emp1 = Employee()
emp2 = Employee()
```

output
constructor is executed
constructor is executed

7.4. Types of constructors

- ✓ Based on parameters constructors can be divided into two types,
 1. Constructor without parameters
 2. Constructor with parameters

7.5. Constructor without parameters

- ✓ If constructor having no parameters, then at least it should contain **self** as one parameter.

Syntax

```
class NameOfTheClass:
    def __init__(self):
        body of the constructor
```

Program Creating a constructor
Name demo3.py

```
class Employee:
    def __init__(self):
        print("constructor is executed")

emp = Employee()
```

output
constructor is executed

7.6. Parameterised constructor

- ✓ Based on requirement constructor can contain any number of parameters.

7.6. Creating parameterised constructor

- ✓ By default, first parameter should be self to constructor.
- ✓ Constructor can contain more parameters along with **self**
- ✓ If constructor having more parameters, then the first parameter should be **self** and remaining parameters will be next.

Syntax

```
class NameOfTheClass:  
    def __init__(self, parameter1, parameter2):  
        body of the constructor
```

Note: One parameterised constructor

Program Name One parameterised constructor
demo6.py

```
class Employee:  
    def __init__(self, number):  
        self.number= number  
        print("Employee id is: ", self.number)
```

```
e1 = Employee(1)  
e2 = Employee(2)  
e3 = Employee(3)
```

output

```
Employee id is: 1  
Employee id is: 2  
Employee id is: 3
```

Note: One parameterised constructor

- ✓ If constructor having one parameter, then during object creation we need to pass one value.

Can i write a constructor and an instance method in a single program?

- ✓ Yes we can write constructor and instance method both in single program.
- ✓ Here constructor purpose is to initialize instance variables, and method purpose is to perform operations.

Two parameterised constructor

Program Name One parameterised constructor and instance method
demo7.py

```
class Employee:
    def __init__(self, number):
        self.number = number

    def display(self):
        print("Employee id is:", self.number)

e1 = Employee(1)
e2 = Employee(2)
e3 = Employee(3)

e1.display()
e2.display()
e3.display()
```

output

```
Employee id is: 1
Employee id is: 2
Employee id is: 3
```

Note: Access instance variable in instance method

- ✓ Inside instance method we can access instance variables by using self.

Two parameterised constructor

Program Name Two parameterised constructor and instance method
demo8.py

```
class Employee:
    def __init__(self, number, name):
        self.number = number
        self.name = name

    def display(self):
        print("Hello my id is :", self.number)
        print("My name is :", self.name)

e1=Employee(1, 'Daniel')
e1.display()

e2=Employee(2, 'Arjun')
e2.display()
```

Output

```
Hello my id is: 1
My name is: Daniel

Hello my id is: 2
My name is: Arjun
```

Note: Two parameterised constructor

- ✓ If constructor having two parameters, then during object creation we need to pass two values

Three parameterised constructor

Program Name Three parameterised constructor and instance method
demo9.py

```
class Employee:
    def __init__(self, number, name, age):
        self.number = number
        self.name = name
        self.age = age

    def display(self):
        print("Hello my id is :", self.number)
        print("My name is :", self.name)
        print("My age is sweet :", self.age)

e1=Employee(1, 'Daniel', 16)
e1.display()

e2=Employee(2, 'Arjun', 17)
e2.display()

e3=Employee(3, 'Prasad', 18)
e3.display()
```

Output

```
Hello my id is: 1
My name is: Daniel
My age is sweet: 16

Hello my id is: 2
My name is: Arjun
My age is sweet: 17

Hello my id is :3
My name is: Prasad
My age is sweet: 18
```


Note: Three parameterised constructor

- ✓ If constructor having three parameters, then during object creation we need to pass three values.

8. Difference between method and constructor

Method	Constructor
✓ Methods are used to perform operations or actions	✓ Constructors are used to initialize the instance variables.
✓ Method name can be any name.	✓ Constructor name should be <code>__init__(self)</code>
✓ Methods we should call explicitly to execute	✓ Constructor automatically executed at the time of object creation.

9. Instance variables:

9.1. What is instance variable?

- ✓ If the value of a variable is changing from object to object such type of variables is called as instance variables.

9.2. Separate copy instance variable for every object

- ✓ For every object a separate copy of instance variables will be created.

Program Instance variables
Name demo10.py

```
class Student:
    def __init__(self, name, number):
        self.name=name
        self.number=number
```

```
s1 = Student('Daniel', 101)
s2 = Student('Prasad', 102)
```

```
print("Studen1 info:")
print("Name: ", s1.name)
print("Id : ", s1.number)
```

```
print("Studen2 info:")
print("Name: ", s2.name)
print("Id : ", s2.number)
```

Output

```
Studen1 info:
Name: Daniel
Id: 101
```

```
Studen2 info:
Name: Prasad
Id: 102
```

9.3. Declaring & accessing instance variables

- ✓ We can declare instance variables inside constructor
- ✓ We can access instance variables by using object name

Program Name Initializing instance variables inside Constructor
demo11.py

```
class Employee:
    def __init__(self):
        self.eno = 10
        self.ename = "Daniel"
        self.esal = 10000

emp = Employee()

print("Employee number:", emp.eno)
print("Employee name:", emp.ename)
print("Employee salary:", emp.esal)
```

output

```
Employee number: 10
Employee name : Daniel
Employee salary : 10000
```

10. Instance methods

- ✓ Instance methods are methods which act upon the instance variables of the class.
- ✓ Instance methods are bound with instances or objects, that's why called as instance methods.
- ✓ The first parameter for instance methods is **self** variable.
- ✓ Along with **self** variable it can contains other variables as well.

Program Instance methods
Name demo13.py

```
class Demo:
    def __init__(self, a):
        self.a=a

    def m(self):
        print(self.a)
```

```
d=Demo(10)
d.m()
```

Output
10

11. self pre-defined variable

- ✓ self is a predefined variable in python, this variable belongs to current class object.
 - self variable we can use to create below things,
 - Constructor
 - Instance variable
 - Instance methods
- ✓ Constructor
 - By using self, we can initialize the instance variables inside constructor `__init__(self)`
- ✓ Instance variable
 - By using self, we can declare and access instance variables,
- ✓ Instance methods
 - By using self, we can create instance methods.