Python Classes and Objects

A class is a user-defined blueprint or prototype from which objects are created. Classes provide a means of bundling data and functionality together. Creating a new class creates a new type of object, allowing new instances of that type to be made. Each class instance can have attributes attached to it for maintaining its state. Class instances can also have methods (defined by their class) for modifying their state.

To understand the need for creating a class and object in Python let's consider an example, let's say you wanted to track the number of dogs that may have different attributes like breed and age. If a list is

used, the first element could be the dog's breed while the second element could represent its age. Let's suppose there are 100 different dogs, then how would you know which element is supposed to be which? What if you wanted to add other properties to these dogs? This lacks organization and it's the exact need for classes.

Syntax: Class Definition

class ClassName: # Statement

Syntax: Object Definition

obj = ClassName() print(obj.atrr)

The class creates a user-defined data structure, which holds its own data members and member functions, which can be accessed and used by creating an instance of that class. A class is like a

blueprint for an object.

Some points on Python class:

- Classes are created by keyword class.
- Attributes are the variables that belong to a class.
- Attributes are always public and can be accessed using the dot (.) operator.
  Eg.: My class.Myattribute

Creating a Python Class

Here, the class keyword indicates that you are creating a class followed by the name of the class (Dog in this case).

Python3

```
class Dog:
```

```
    sound = "bark"
```

Object of Python Class

An Object is an instance of a Class. A class is like a blueprint while an instance is a copy of the class with *actual values*. It's not an idea anymore, it's an actual dog, like a dog of breed pug who's seven years old. You can have many dogs to create many different instances, but without the class as a guide, you would be lost, not knowing what information is required.

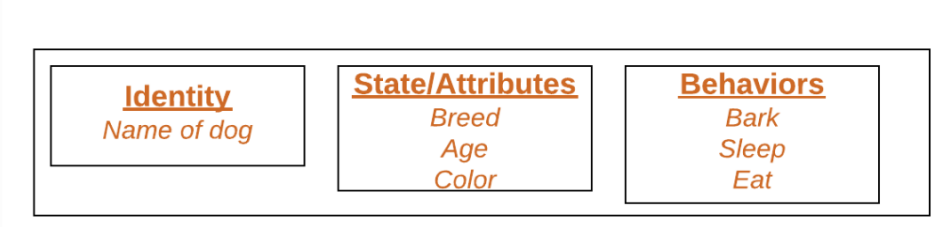
An object consists of:

- **State:** It is represented by the attributes of an object. It also reflects the properties of an object.

- **Behavior:** It is represented by the

methods of an object. It also reflects the response of an object to other objects.

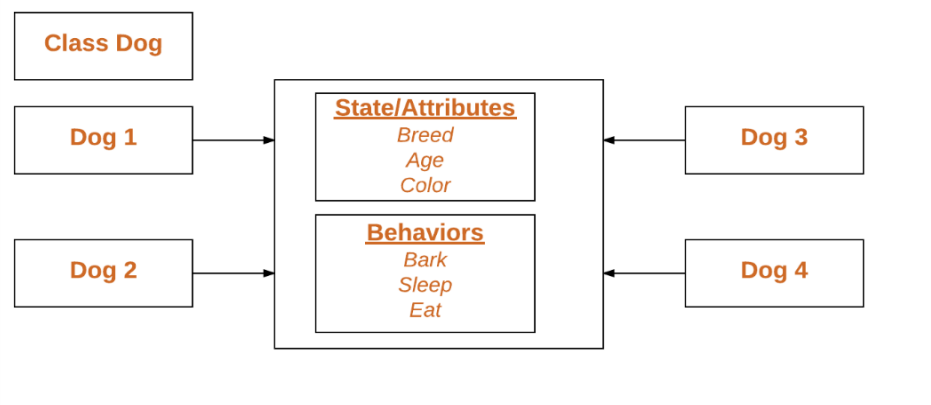
- **Identity:** It gives a unique name to an object and enables one object to interact with other objects.

- 

Declaring Claas Objects (Also called instantiating a class)

When an object of a class is created, the class is said to be instantiated. All the instances share the attributes and the behavior of the class. But the values of those attributes, i.e. the state are unique for each object. A single class may have any number of instances.

Example:

- 

Example of Python Class and object

Creating an object in Python involves instantiating a class to create a new instance of that class. This process is also referred to as object instantiation.

Python3

```
# Python3 program to

# demonstrate instantiating
```

```
# a class

class Dog:



    # A simple class

    # attribute

    attr1 = "mammal"

    attr2 = "dog"



    # A sample method

    def fun(self):

        print("I'm a", self.attr1)
```

```
        print("I'm a", self.attr2)



# Driver code

# Object instantiation

Rodger = Dog()



# Accessing class attributes

# and method through objects

print(Rodger.attr1)

Rodger.fun()
```

Output:

mammal I'm a mammal I'm a dog

In the above example, an object is created which is basically a dog named Rodger. This class only has two class attributes that tell us that Rodger is a dog and a mammal.

Explanation :

In this example, we are creating a Dog class and we have created two class variables **attr1 and attr2**. We have created a method named **fun()** which returns the string "I'm a, {attr1}" and I'm a, {attr2}. We have created an object of the Dog class and we are printing at the **attr1** of the object. Finally, we are calling the **fun()** function.

Self Parameter

When we call a method of this object as myobject.method(arg1, arg2), this is automatically converted by Python into MyClass.method(myobject, arg1, arg2) – this is all the special self is about.

Python3

```
class GFG:

    def __init__(self, name, company):

        self.name = name

        self.company = company



    def show(self):

        print("Hello my name is " + self.name+"
```

```
and I" +

            " work in "+self.company+".")



obj = GFG("John", "GeeksForGeeks")

obj.show()
```

The Self Parameter does not call it to be Self, You can use any other name instead of it. Here we change the self to the word someone and the output will be the same.

Python3

```
class GFG:

    def __init__(somename, name,
```

```
company):

        Somename.name = name

        Somename.company = company



    def show(somename):

        print("Hello my name is " +
Somename.name +

              " and I work in
"+somename.company+".")




obj = GFG("John", "GeeksForGeeks")

obj.show()
```

Output: Output for both of the codes will be the same.

Hello my name is John and I work in GeeksForGeeks.

Explanation:

In this example, we are creating a GFG class and we have created the **name, and company** instance variables in the constructor. We have created a method named **say_hi()** which returns the string "Hello my name is " + {name} +" and I work in "+{company}+"."."We have created a person class object and we passing the name **John and Company** GeeksForGeeks to the instance variable. Finally, we are calling the **show()** of the class.

Pass Statement

The program's execution is unaffected by the **pass** statement's inaction. It merely permits the program to skip past that section of the code without doing anything. It is frequently employed when the syntactic constraints of Python demand a valid statement but no useful code must be executed.

Python3

```
class MyClass:

    pass
```

__init__() method

The __init__ method is similar to constructors in C++ and Java. Constructors are used to initializing the object's state. Like methods, a

constructor also contains a collection of statements(i.e. instructions) that are executed at the time of Object creation. It runs as soon as an object of a class is instantiated. The method is useful to do any initialization you want to do with your object.

Python3

```
# Sample class with init method

class Person:



    # init method or constructor

    def __init__(self, name):

        self.name = name
```

```
    # Sample Method

    def say_hi(self):

        print('Hello, my name is', self.name)



p = Person('Nikhil')

p.say_hi()
```

Output:

```
Hello, my name is Nikhil
```

Explanation:

In this example, we are creating a Person class and we have created a **name** instance variable in the constructor. We have created a method named as say_hi() which returns the string "Hello, my name is {name}".We have created a person class object and we pass the name Nikhil to the instance variable. Finally, we are calling the say_hi() of the class.

__str__() method

Python has a particular method called **__str__()**. that is used to define how a **class** object should be represented as a string. It is often used to give an object a human-readable textual representation, which is helpful for logging, debugging, or showing users object information. When a class object is used to create a string using the built-in functions print() and str(),

the **__str__()** function is automatically used. You can alter how objects of a **class** are represented in strings by defining the **__str__()** method.

Python3

```
class GFG:

    def __init__(self, name, company):

        self.name = name

        self.company = company



    def __str__(self):

        return f"My name is {self.name} and I work in {self.company}."
```

```
my_obj = GFG("John", "GeeksForGeeks")

print(my_obj)
```

Output:

```
My name is John and I work in
GeeksForGeeks.
```

Explanation:

In this example, We are creating a class named GFG.In the class, we are creating two instance variables **name and company.** In the __str__() method we are returning the **name** instance variable
and **company** instance variable. Finally, we are creating the object of GFG class and

we are calling the __str__() method.

Class and Instance Variables

Instance variables are for data, unique to each instance and class variables are for attributes and methods shared by all instances of the class. Instance variables are variables whose value is assigned inside a constructor or method with self whereas class variables are variables whose value is assigned in the class.

Defining instance variables using a constructor.

Python3

```
# Python3 program to show that the
variables with a value

# assigned in the class declaration, are
```

class variables and

variables inside methods and
constructors are instance

variables.

Class for Dog

class Dog:

    # Class Variable

    animal = 'dog'

```
    # The init method or constructor

    def __init__(self, breed, color):



        # Instance Variable

        self.breed = breed

        self.color = color



# Objects of Dog class

Rodger = Dog("Pug", "brown")
```

```
Buzo = Dog("Bulldog", "black")



print('Rodger details:')

print('Rodger is a', Rodger.animal)

print('Breed: ', Rodger.breed)

print('Color: ', Rodger.color)



print('\nBuzo details:')

print('Buzo is a', Buzo.animal)

print('Breed: ', Buzo.breed)

print('Color: ', Buzo.color)
```

```
# Class variables can be accessed using
class

# name also

print("\nAccessing class variable using
class name")

print(Dog.animal)
```

Output:

```
Rodger details: Rodger is a dog Breed: Pug
Color: brown Buzo details: Buzo is a dog
Breed: Bulldog Color: black Accessing class
variable using class name dog
```

Explanation:

A class named Dog is defined with a class

variable animal set to the string "dog". Class variables are shared by all objects of a class and can be accessed using the class name. Dog class has two instance variables **breed and color.** Later we are creating two objects of the **Dog** class and we are printing the value of both objects with a class variable named animal.

Defining instance variables using the normal method:

Python3

```
# Python3 program to show that we can
create

# instance variables inside methods



# Class for Dog
```

```
class Dog:


    # Class Variable

    animal = 'dog'



    # The init method or constructor

    def __init__(self, breed):



        # Instance Variable
```

```
        self.breed = breed



    # Adds an instance variable

    def setColor(self, color):

        self.color = color



    # Retrieves instance variable

    def getColor(self):

        return self.color
```

```
# Driver Code

Rodger = Dog("pug")

Rodger.setColor("brown")

print(Rodger.getColor())
```

Output:

```
brown
```

Explanation:

In this example, We have defined a class named **Dog** and we have created a class variable animal. We have created an instance variable breed in the **constructor**. The class Dog consists of two methods **setColor** and **getColor**, they are used for creating and initializing an instance variable and retrieving the value

of the instance variable. We have made an object of the **Dog** class and we have set the instance variable value to brown and we are printing the value in the terminal.

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