Python Inheritance

Inheritance allows us to define a class that inherits all the methods and properties from another class.

Parent class is the class being inherited from, also called base class.

Child class is the class that inherits from another class, also called derived class.

Create a Parent Class

Any class can be a parent class, so the syntax is the same as creating any other class:

Create a Child Class

To create a class that inherits the functionality from another class, send the parent class as a parameter when creating the child class:

Example

Create a class named Student, which will inherit the properties and methods from the Person class:

```
class Student(Person):
  pass
```

Note: Use the pass keyword when you do not want to add any other properties or methods to the class.

Now the Student class has the same properties and methods as the Person class.

Abstract Classes in Python

- Difficulty Level : Easy
- Last Updated : 19 Mar, 2021

An abstract class can be considered as a blueprint for other classes. It allows you to create a set of methods that must be created within any child classes built from the abstract class. A class which contains one or more abstract methods is called an abstract class. An abstract method is a method that has a declaration but does not have an implementation. While we are designing large functional units we use an abstract class. When we want to provide a common interface for different implementations of a component, we use an abstract class.

Why use Abstract Base Classes :

By defining an abstract base class, you can define a common Application Program Interface(API) for a set of subclasses. This capability is especially useful in situations where a third-party is going to provide implementations, such as with plugins, but can also help you when working in a large team or with a large code-base where keeping all classes in your mind is difficult or not possible.

How Abstract Base classes work :

By default, Python does not provide abstract classes. Python comes with a module that provides the base for defining Abstract Base classes(ABC) and that module name is ABC. ***ABC*** works by decorating methods of the base class as abstract and then registering concrete classes as implementations of the abstract base. A method becomes abstract when decorated with the keyword @abstractmethod. For Example –

Code 1:

- Python3

```
# Python program showing
# abstract base class work

from abc import ABC, abstractmethod

class Polygon(ABC):

    @abstractmethod
    def noofsides(self):
        pass

class Triangle(Polygon):

    # overriding abstract method
    def noofsides(self):
        print("I have 3 sides")

class Pentagon(Polygon):

    # overriding abstract method
    def noofsides(self):
        print("I have 5 sides")

class Hexagon(Polygon):

    # overriding abstract method
    def noofsides(self):
        print("I have 6 sides")

class Quadrilateral(Polygon):

    # overriding abstract method
    def noofsides(self):
        print("I have 4 sides")

# Driver code
R = Triangle()
R.noofsides()

K = Quadrilateral()
K.noofsides()

R = Pentagon()
R.noofsides()

K = Hexagon()
K.noofsides()
```

Output:

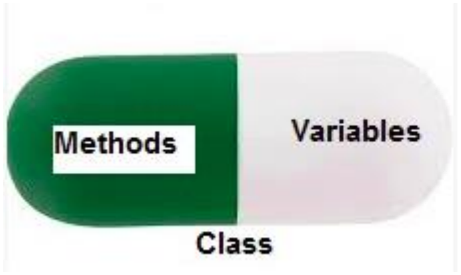
```
I have 3 sides
I have 4 sides
I have 5 sides
I have 6 sides
```

Encapsulation in Python

- Difficulty Level : Easy
- Last Updated : 03 Mar, 2022

Encapsulation is one of the fundamental concepts in object-oriented programming (OOP). It describes the idea of wrapping data and the methods that work on data within one unit. This puts restrictions on accessing variables and methods directly and can prevent the accidental modification of data. To prevent accidental change, an object's variable can only be changed by an object's method. Those types of variables are known as **private**
variable

A class is an example of encapsulation as it encapsulates all the data that is member functions, variables, etc.



Consider a real-life example of encapsulation, in a company, there are different sections like the accounts section, finance section, sales section etc. The finance section handles all the financial transactions and keeps records of all the data related to finance. Similarly, the sales section handles all the sales-related activities and keeps records of all the sales. Now there may arise a situation when for some reason an official from the finance section needs all the data about sales in a particular month. In this case, he is not allowed to directly access the data of the sales section. He will first have to contact some other officer in the sales section and then request him to give the particular data. This is what encapsulation is. Here the data of the sales section and the employees that can manipulate them are wrapped under a single name "sales section". Using encapsulation also hides the data. In this example, the data of the sections like sales, finance, or accounts are hidden from any other section.

Protected members

Protected members (in C++ and JAVA) are those members of the class that cannot be accessed outside the class but can be accessed from within the class and its subclasses. To accomplish this in Python, just follow **the convention** by prefixing the name of the member by a **single underscore "_"**.

Although the protected variable can be accessed out of the class as well as in the derived class(modified too in derived class), it is customary(convention not a rule) to not access the protected out the class body.

Note: The **__init__** method is a constructor and runs as soon as an object of a class is instantiated.

- Python3

```
# Python program to
# demonstrate protected members

# Creating a base class
class Base:
    def __init__(self):

        # Protected member
        self._a = 2

# Creating a derived class
class Derived(Base):
    def __init__(self):

        # Calling constructor of
        # Base class
        Base.__init__(self)
        print("Calling protected member of base class: ",
              self._a)

        # Modify the protected variable:
        self._a = 3
        print("Calling modified protected member outside class: ",
              self._a)


obj1 = Derived()

obj2 = Base()
```

```
# Calling protected member
# Can be accessed but should not be done due to convention
print("Accessing protected member of obj1: ", obj1._a)

# Accessing the protected variable outside
print("Accessing protected member of obj2: ", obj2._a)
```

Output:

```
Calling protected member of base class:  2
Calling modified protected member outside class:  3
Accessing protected member of obj1:  3
Accessing protected member of obj2:  2
```

Polymorphism in Python

- Difficulty Level : Easy
- Last Updated : 04 Aug, 2021

What is Polymorphism: The word polymorphism means having many forms. In programming, polymorphism means the same function name (but different signatures) being used for different types.

Example of inbuilt polymorphic functions :

- Python3

```
# Python program to demonstrate in-built poly-
# morphic functions

# len() being used for a string
print(len("geeks"))

# len() being used for a list
print(len([10, 20, 30]))
```

Output:

```
5
```

3

Examples of user-defined polymorphic functions :

- Python3

```
# A simple Python function to demonstrate
# Polymorphism

def add(x, y, z = 0):
    return x + y+z

# Driver code
print(add(2, 3))
print(add(2, 3, 4))
```

Output:

```
5
9
```

Polymorphism with class methods:
The below code shows how Python can use two different class types, in the same way. We create a for loop that iterates through a tuple of objects. Then call the methods without being concerned about which class type each object is. We assume that these methods actually exist in each class.

- Python3

```
class India():
    def capital(self):
        print("New Delhi is the capital of India.")

    def language(self):
        print("Hindi is the most widely spoken language of India.")
    def type(self):
        print("India is a developing country.")

class USA():
    def capital(self):
        print("Washington, D.C. is the capital of USA.")

    def language(self):
        print("English is the primary language of USA.")

    def type(self):
        print("USA is a developed country.")

obj_ind = India()
obj_usa = USA()
for country in (obj_ind, obj_usa):
    country.capital()
    country.language()
    country.type()
```

Output:

```
New Delhi is the capital of India.
Hindi is the most widely spoken language of India.
India is a developing country.
Washington, D.C. is the capital of USA.
English is the primary language of USA.
USA is a developed country.
```