Tutorial_Session6

March 17, 2018

1 CLASSES

- A class is a template that provides a logical grouping of data and methods that operate on them.
- Instances of a class are called objects.
- Data and methods associated with a class are collectively known as class attributes.

1.1 Classes and Objects

- Variables used so far took values of types (also called classes) string (str), integer (int), floating point (float), Boolean (bool), list, tuple, or dictionary (dict).

```
In [3]: print(type(12), type(12.5), type('hello'))
```

```
<class 'int'> <class 'float'> <class 'str'>
```

** Accessing attribute of an instance of class** * To specify an attribute of a class (or class instance), we write the name of the class (or class instance) followed by a dot, followed by the name of that attribute. The method **lower** defined in class **str** has been invoked for the object **name**.

```
In [4]: name = 'Raman'
        lname = name.lower()
        print(lname)
```

```
raman
```

Alternative way of invoking the method associated with an instance of class: * Specify the name of the class (str), followed by the dot operator (.), followed by the name of the method (lower), followed by an object (name). The object name being an argument is enclosed in parentheses.

```
In [5]: lname = str.lower(name)
        print(lname)
```

```
raman
```

1.2 PERSON class

1.2.1 Syntax of Class Definiton

A class definition begins with the keyword class followed by the name of the class, and a colon. By convention, the first letter of the class name is capitalized. The syntax for class definition is as follows:

```
class ClassName:
    classBody
```

1.2.2 Operations supported by classes:

1. **Instantiation**: It refers to the creation of an object, i.e. an instance of the class.
2. **Attribute references**: Methods and data members of an object of a class are accessed using the notation: name of the object, followed by dot operator, followed by the member name.

```
In [5]: class Person:
            ''' The class Person describes a person'''
            count = 0
            def __init__(self, name, DOB, address):
                '''
                Objective: To initialize object of class Person
                Input Parameters:
                    self (implicit parameter) - object of type Person
                    name - string
                    DOB - string (Date of Birth)
                    address - string
                Return Value: None
                '''
                self.name = name
                self.DOB = DOB
                self.address = address
                Person.count += 1

            def getName(self):
                '''
                Objective: To retrieve name of the person
                Input Parameter: self (implicit parameter) - object of type Person
                Return Value: name - string
                '''
                return self.name

            def getDOB(self):
                '''
                Objective: To retrieve the date of birth of a person
                Input Parameter: self (implicit parameter) - object of type Person
                Return Value: DOB - string
                '''
                return self.DOB

            def getAddress(self):
                '''
                Objective: To retrieve address of person
                Input Parameter: self (implicit parameter) - object of type Person
                Return Value: address - string
                '''
                return self.address

            def getCount(self):
                '''
                Objective: To get count of objects of type Person
                Input Parameter: self (implicit parameter) - object of type Person
                Return Value: count: numeric
                '''
                return Person.count

            def __str__(self):
                '''
                Objective: To return string representation of object of type Person
                Input Parameter: self (implicit parameter)- object of type
                Person
                Return Value: string
                '''
                return 'Name:'+self.name+'\nDOB:'+str(self.DOB)\
                +'\nAddress:'+self.address
```

1.2.3 Creating an instance of class Person

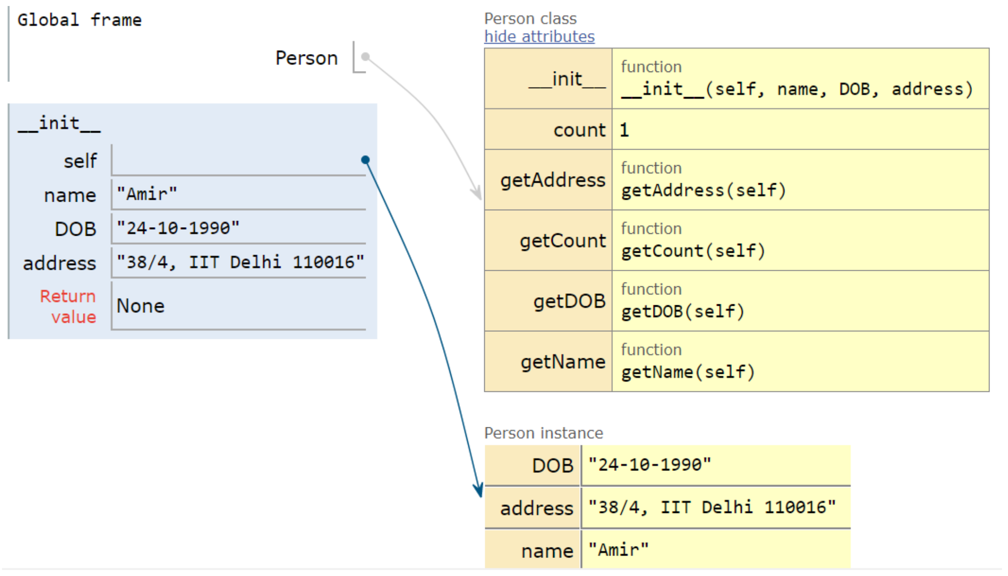
```
In [6]: p1 = Person('Amir','24-10-1990','38/4, IIT Delhi 110016')
        print(Person.count)
```

```
1
```

The execution of the above statement does three things: 1. Creates an instance of class Person 2. Initializes it by invoking the method **__init__** defined in lines 3. Returns a reference to it, so the name p1 now refers to the instance of the class Person that has just been created

By default, Python passes object itself (such as p1) as the first argument to the method **__init__**.

1.2.4 Instance p1 of class Person


Global frame
Person
__init__
self
name "Amir"
DOB "24-10-1990"
address "38/4, IIT Delhi 110016"
Return value None
Person class
hide attributes
__init__ function __init__(self, name, DOB, address)
count 1
getAddress function getAddress(self)
getCount function getCount(self)
getDOB function getDOB(self)
getName function getName(self)
Person instance
DOB "24-10-1990"
address "38/4, IIT Delhi 110016"
name "Amir"

1.2.5 Printing an instance of class

Python invokes **__str__** method of the corresponding class to obtain a string representation of the object

```
In [61]: print(7)
         # OR
         print(int.__str__(7))
         print(str(7))
```

```
7
7
7
```

```
In [151]: print(p1)
          print('*****************')
          print(p1.__str__())
          print('*****************')
          print(Person.__str__(p1))
          print('*****************')
          print(str(p1))
```

```
Name:Amir
DOB:24-10-1990
Address:38/4, IIT Delhi 110016
*****************
Name:Amir
DOB:24-10-1990
Address:38/4, IIT Delhi 110016
```

```
*****************
Name:Amir
DOB:24-10-1990
Address:38/4, IIT Delhi 110016
*****************
Name:Amir
DOB:24-10-1990
Address:38/4, IIT Delhi 110016
```

```
In [63]: p1.getDOB()
```

```
Out[63]: '24-10-1990'
```

1.2.6 List of attributes of the object

```
In [64]: dir(p1)
```

```
Out[64]: ['DOB',
          '__class__',
          '__delattr__',
          '__dict__',
          '__dir__',
          '__doc__',
          '__eq__',
          '__format__',
          '__ge__',
          '__getattribute__',
          '__gt__',
          '__hash__',
          '__init__',
          '__init_subclass__',
          '__le__',
          '__lt__',
          '__module__',
          '__ne__',
          '__new__',
          '__reduce__',
          '__reduce_ex__',
          '__repr__',
          '__setattr__',
          '__sizeof__',
          '__str__',
          '__subclasshook__',
          '__weakref__',
          'address',
          'count',
          'getAddress',
          'getCount',
          'getDOB',
          'getName',
          'name']
```

1.2.7 Deleting an object of class Person

```
In [7]: def __del__(self):
            '''
            Objective: To be invoked on deletion of an instance of the
            class Person
            Input Parameter:
            self (implicit parameter)  object of type Person
            Return Value: None
            '''
            print('Deleted !!')
            Person.count -= 1
```

```
In [8]: p1.__del__ = __del__
```

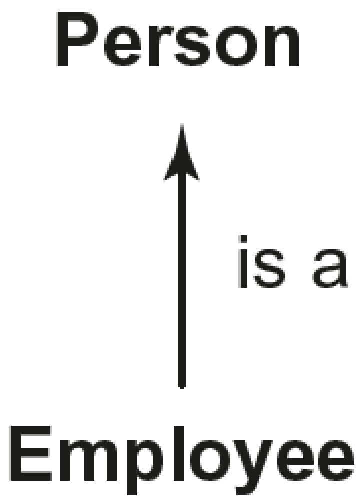
```
In [9]: del p1
```

```
In [10]: print(p1)
```

```
        ---------------------------------------------------------------------------

        NameError                                 Traceback (most recent call last)

        <ipython-input-10-71a0f0e933fe> in <module>()
    ----> 1 print(p1)


        NameError: name 'p1' is not defined
```

1.3 Inheritance

- Inheritance is an important feature of object oriented programming that imparts ability to a class to inherit properties and behavior of another class



- In the language of Object-oriented Programming (OOP), we say that Employee class inherits or derives the data and method attributes from the Person class.
- Here, Person class is called base, super, or parent class, and Employee class is called derived, sub, or child class.

1.3.1 Single Inheritance

- When inheritance involves a derived class that derives its properties from a single base class, it is called **single inheritance**

```
In [36]: class Employee(Person):
             nextId = 1001
             empCount = 0

             def __init__(self, name, DOB, address, basicSalary, dateOfJoining):
                 '''
                 Objective: To initialize an object of class Employee
                 Input Parameters:
                     self (implicit parameter)  object of type Employee
                     name - string, address  string
                     DOB - Date of Birth  object of type MyDate
                     basicSalary - numeric value
                     dateOfJoining  object of type MyDate
                 Return Value: None
                 '''
                 Person.__init__(self, name, DOB, address)
                 self.idNum = Employee.nextId
                 self.basicSalary = basicSalary
                 self.dateOfJoining = dateOfJoining
                 Employee.nextId += 1
                 Employee.empCount += 1
```

```
        def getId(self):
            '''
            Objective: To retrieve id of the Employee
            Input Parameter: self (implicit parameter) object of type Employee
            Return Value: id - numeric value
            '''
            return self.idNum

        def getSalary(self):
            '''
            Objective: To retrieve salary of the Employee
            Input Parameter: self (implicit parameter) - object of type Employee
            Return Value: basicSalary - numeric value
            '''
            return self.basicSalary

        def reviseSalary(self, newSalary):
            '''
            Objective: To update salary of the Employee
            Input Parameters: self (implicit parameter) - object of type Employee
            newSalary - numeric value
            Return Value: None
            '''
            self.basicSalary = newSalary

        def getJoiningDate(self):
            '''
            Objective: To retrieve joining date of the Employee
            Input Parameter: self (implicit parameter) - object of type Employee
            Return Value: dateOfJoining - object of type MyDate
            '''
            return self.dateOfJoining

        def __str__(self):
            '''
            Objective: To return string representation of object of type
            Employee.
            Input Parameter: self (implicit parameter) - object of type Employee
            Return Value: string
            '''
            return Person.__str__(self)+'\nId:'+str(self.getId())+\
                '\nSalary:'+str(self.getSalary())+\
                '\nDate of Joining:'+str(self.getJoiningDate())
```

```
In [37]: emp1 = Employee('Rehman', '5 June 1990', ' D-9, Vivek Vihar, Delhi', 50000, '2 August
```

```
In [38]: print(Employee.empCount)
```

```
1
```

- Call to the method **init** is made using a superclass name and the object instance is explicitly passed as an argument to the superclass method.
- Alternatively, we may use the **super** function to access a method of the superclass.

```
super(Employee, self).__init__(name, DOB, address)
super().__init__(name, DOB, address)
```

1.4 5. Built-in Functions for Classes

1.4.1 Function issubclass

- The function issubclass returns True if sub is the subclass of class super, and False otherwise.

```
issubclass(sub, super)
```

```
In [146]: issubclass(Employee, Person)
```

```
Out[146]: True
```

1.4.2 Function isinstance

- The function isinstance returns True if either obj is an instance of class class1 or it is an instance of a subclass of class class1.

```
isinstance(obj, class1)
```

```
In [147]: isinstance(emp1, Person)
```

```
Out[147]: True
```

1.4.3 Function hasattr

- The function hasattr returns True if instance obj contains an attribute attr, and False otherwise.

```
hasattr(obj, attr)
```

```
In [149]: hasattr(emp1, 'dateOfJoining')
```

```
Out[149]: True
```