Python Classes/Objects

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Python is an object oriented programming language. Almost everything in Python is an object, with its properties and methods. A class is used for creating objects.

1. To create a class, use the keyword class, like this:

Syntax

```
class myClass:
  x=5
print(myClass)
```

2. To create an object of some myClass class, the following statement is used:

```
nameObj=myClass()
```

3. To access to members of an object, notation . is used.

Example

```
p1 = MyClass()
p1.x=99
print(p1.x)
```

4. Use the special __init__() function to assign values to object properties. The syntax of the __init__() function is like this:

Syntax:

```
class NameClass:
  def __init__(self, par1, …, parn):
    self.par1 = par1
       ….
    self.parn = parn
```

Example:

#definition the Point class with the __init__ function.

```
class Point:

  def __init__(self,x,y):
```

```
        self.x=x
        self.y=y
    #Creation of objects
    p1=Point(1,2)
    p2=Point(-1,-2)
    print('The first point: ',p1.x,' ',p1.y)
    print('The second point: ',p2.x,'',p2.y)
```

Note: The `self` parameter is a reference to the class itself, and is used to access variables that belongs to the class.

5. Object Methods

Objects can also contain methods. Methods in objects are functions that belongs to the object. Consider again the Point class:

Example:

```
#Definition of the Point class

class Point:

    def __init__(self,x,y):

        self.x=x

        self.y=y

    def show(self):

        print('Point: ',self.x,' ',self.y)

# Creation of objects

p1=Point(1,2)

p2=Point(-1,-2)

p1.show()  (*)

p2.show() (**)
```

6. Consider the following statements:

```
p1.show()

p2.show()
```

W.r.t some call of a function, the object invoking the function is called the current object. For example, for the first statement, the current is p1, whereas for the second, it is p2.

7. Application

a. Write a Vector class dedicated for three-dimensional vectors. First write the special function __init__ and the show function which allows to display the coordinates of a vector (x,y,z) like this: (x,y,z). Then test your class by creating two vector objects.
b. Write the norm function which returns the norm of the current object given by the following formula: $sqrt(x^2+y^2+z^2)$, where x,y and z are its coordinates.

c. Write the sum function which multiplies the coordinates of the current object by a scalar passed as parameter.

d. Write the add function which returns a vector, representing the addition of the current object and an other one passed as parameter.

```
def add(self,other):

        x=self.x+other.x

        y=self.y+other.y

        z=self.z+other.z

        return Vector(x,y,z)
```

e. Write an access function called item which accepts an index and returns the coordinate corresponding to the index. Use the following conventions:

   - Index 0 or -3 for x,
   - Index 1 or -2 for y,
   - Index 2 or -1 for z.

   Raise an exception if for an incorrect index by using the statement: raise IndexError('Message to be shown').

f. generalize the class vector to handle N-dimensional vectors, with N> 3.