PYTHON PROGRAMMING LANGUAGE: OOPS CONCEPT

Python Programming Language

PREPARED FOR

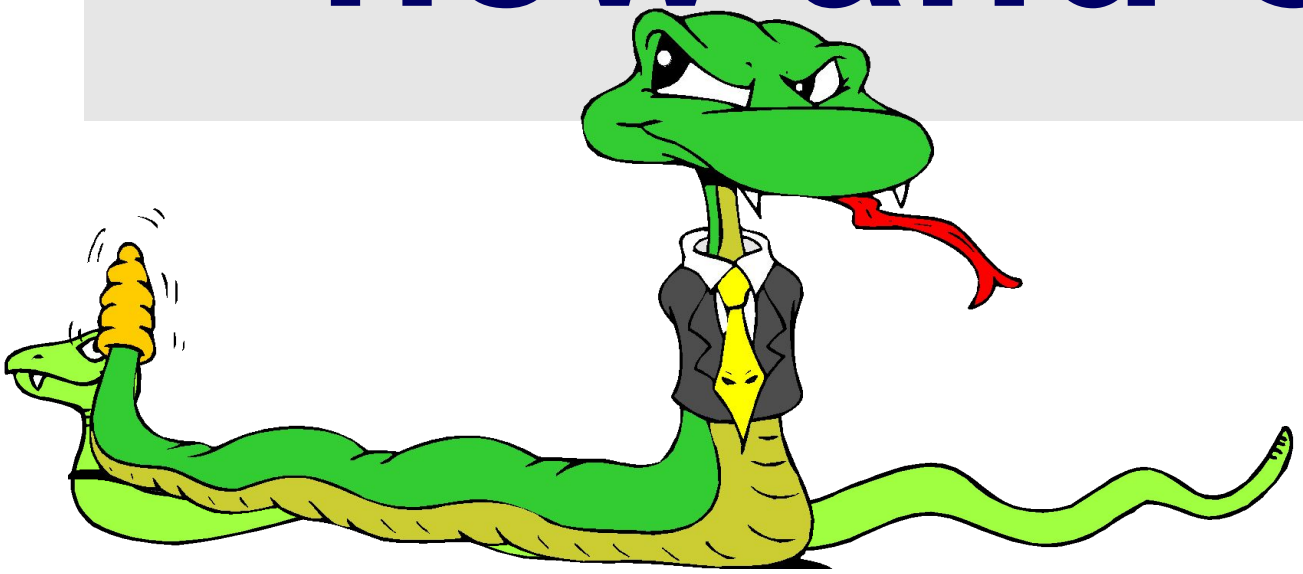
Engineering Students

All Engineering College

(PP)
PREPARED BY: MS. SHWETA TIWARI
Published On: April, 2022

FALL SEMESTER, YEAR (IVth, 2nd)
FALL SESSION (2021-22)

Python classes: new and old



New and classic classes

- With Python 2.2, classes and instances come in two flavors: old and new
- New classes cleaned up the language by
  - Unifying classes and types
  - Allowing all built-in types to be sub-classed
- For compatibility, default 2.x class is old style; Python 3 only has new classes
- New classes support interesting features
- New classes subclass object

New class *student*

```
class Student(object):
 """A new class representing a student"""
 def __init__(self,n,a):
     self.full_name = n
     self.age = a
 def get_age(self):
     return self.age
```

Class property

- One neat feature in new classes is the property function
- It's a better way to manage private attributes, and getter and setter methods
- While still keeping access simple
- We'll also see decorators, an interesting feature

Boxes, little boxes

```
class Box(object):
    def __repr__(self):
        return ”<A box with length:%s, width:%s, area:%s>"
     % (self.length, self.width, self.area)

class Box1(Box):
    """A rectangle"""
    def __init__(self, l=1, w=1):
        self.length = l
        self.width = w
        self.area = l * w
```

http://cs.umbc.edu/courses/331/current/code/python/box.py

Boxes, little boxes

- Ok, but not perfect

```
>>> from box import *
>>> b1 = Box1(2, 3)
>>> b1
A box with length:2, width:3, area:6
>>> b1.area = 9
>>> b1
<A box with length:2, width:3, area:9>
```

http://cs.umbc.edu/courses/331/current/code/python/box.py

Boxes, little boxes

- Let's use a getter method for area

```
class Box2(Box):
    """A rectangle with area getter"""
    def __init__(self, l=1, w=1):
        self.length = l
        self.width = w
    def get_area(self):
        return self.length * self.width
    def set_area(self, val=1):
        print "Warning: area is read only!"
```

http://cs.umbc.edu/courses/331/current/code/python/box.py

Boxes, little boxes

- Not without problems, though…

```
>>> from box import *
>>> b2 = Box2(2, 3)
>>> b2
Traceback (most recent call last):
  File "<stdin>", line 1, in <module>
  File "box.py", line 5, in __repr__
    return "<A box with length:%s, width:%s, area:%s>" %
     (self.length, self.width, self.area)
AttributeError: 'Box2' object has no attribute 'area'
```

http://cs.umbc.edu/courses/331/current/code/python/box.py

Boxes, little boxes

- There are two problems that the getter/setter idiom creates
- It results in different access patterns for different attributes ☹
- If we start with plain attributes and later decide to use getter and setters, we may have a lot of code to change ☹

http://cs.umbc.edu/courses/331/current/code/python/box.py

Boxes, little boxes

- Python solution: property()

```
class Box3(Box):
    """A rectangle with area property"""
    def __init__(self,l=1,w=1):
        self.length = l
        self.width = w
    def get_area(self): return self.length * self.width
    def set_area(self, val=1):
      print "Warning: area is read only!"
    area = property(get_area, set_area)
```

http://cs.umbc.edu/courses/331/current/code/python/box.py

Boxes, little boxes

- The property() function takes optional args for an attribute's getter, setter, deleter and doc string

  property([fget[, fset[, fdel[, doc]]]])

- and returns an object
- Not providing a setter results in a read-only attribute

http://cs.umbc.edu/courses/331/current/code/python/box.py

Decorated Boxes

- Use Python decorators

```
class Box4(Box):
    """A rectangle with area property"""
    def __init__(self,l=1,w=1):
        self.length = l
        self.width = w
    @property
    def area(self): return self.length * self.width
    @area.setter
    def area(self, val=1): print "Warning: area is read only!”
```

http://cs.umbc.edu/courses/331/current/code/python/box.py

Python Decorators

- Python's decorator is syntactic sugar

```
@foo
def bar (x): pass
```

- Is the equivalent of

```
def bar (x): pass
bar = foo(bar)
```

- That is: rebind the name bar to the result of calling foo with the function object bar
- foo typically returns a modified version of the function bar

Decorator example: trace

```
def trace(f):
  def new_f(*args)
     print 'Entering %s%s' % (f.__name__, args)
     result = f(*args, **kwargs)
     print 'Exiting %s%s with %s' % (f.__name__, args, result)
     return result
  return new_f

@trace
def sum(n, m):
    return n + m
```

```
>>> sum(10,20)
Entering sum(10, 20)
Exiting sum(10, 20) with 30
30
```

http://cs.umbc.edu/courses/331/current/code/python/trace.py

Decorator example: trace

```
@trace
def fact(n): return 1 if n<2 else n * fact(n-1)
>>> fact(4)
Entering fact(4,)
Entering fact(3,)
Entering fact(2,)
Entering fact(1,)
Exiting fact(1,) with 1
Exiting fact(2,) with 2
Exiting fact(3,) with 6
Exiting fact(4,) with 24
24
```

Decorated Boxes

```
class Box5(Box):
def __init__(self,l=1,w=1):
        self.length = l
        self.width = w
        self._color = None
    @property
    def area(self):  return self.length * self.width
    @area.setter
    def area(self, val=1):  self.length = self.width = math.sqrt(val)
    @property
    def color(self): return self._color
    @color.setter
    def color(self, val): self._color = val
    @color.deleter
    def color(self): del self._color
```