



Object Oriented Programming

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Learning Objectives

- Understand the main concepts related to the object-oriented approach
- Understand how object-oriented programming is implemented in Python
- Create a small application with object-oriented programming

Imperative Programming

- Procedural - instructions grouped into procedures
- Object-Oriented - instructions grouped together with the part of the state they operate on.

Object oriented Approach

The main structural components of all systems are:

- Objects
- Class Objects

Object

Object is something that takes up space in the real or conceptual world with which somebody may do things

(Booch et al . 1999)

Object

The objects have :

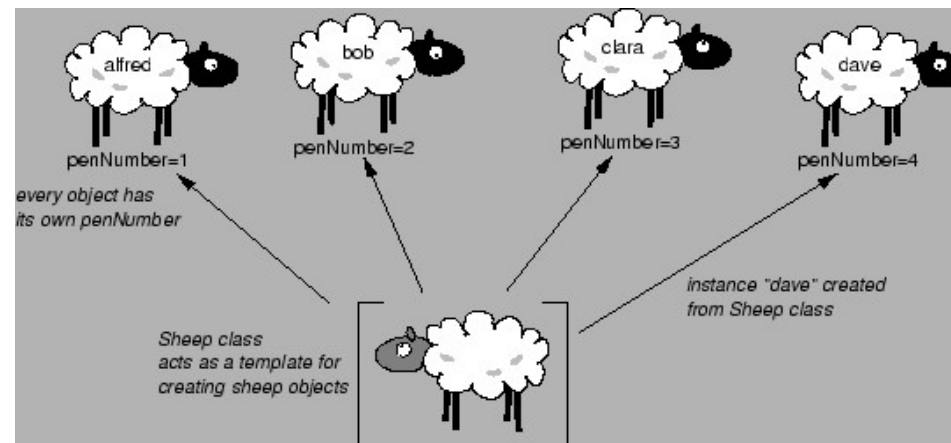
- Name (or ID)
- State
- Operations (or behavior)

Class

Class is the blueprint of an object.

Instance

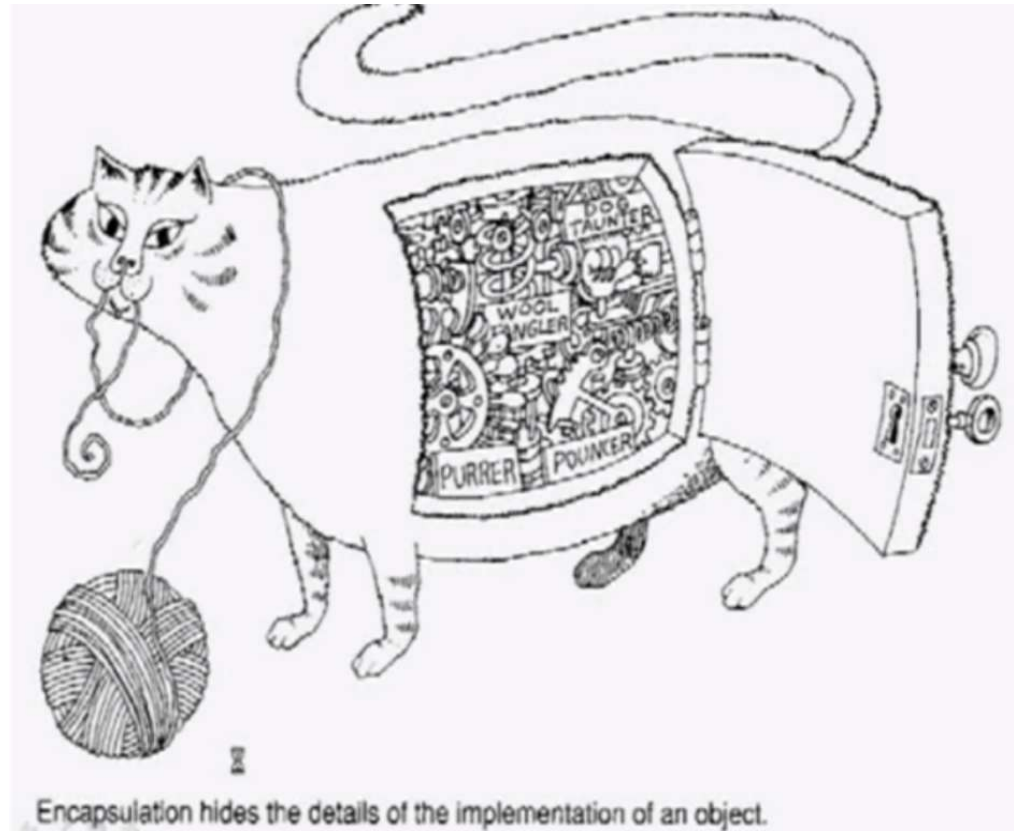
- An object is an instance of a class.



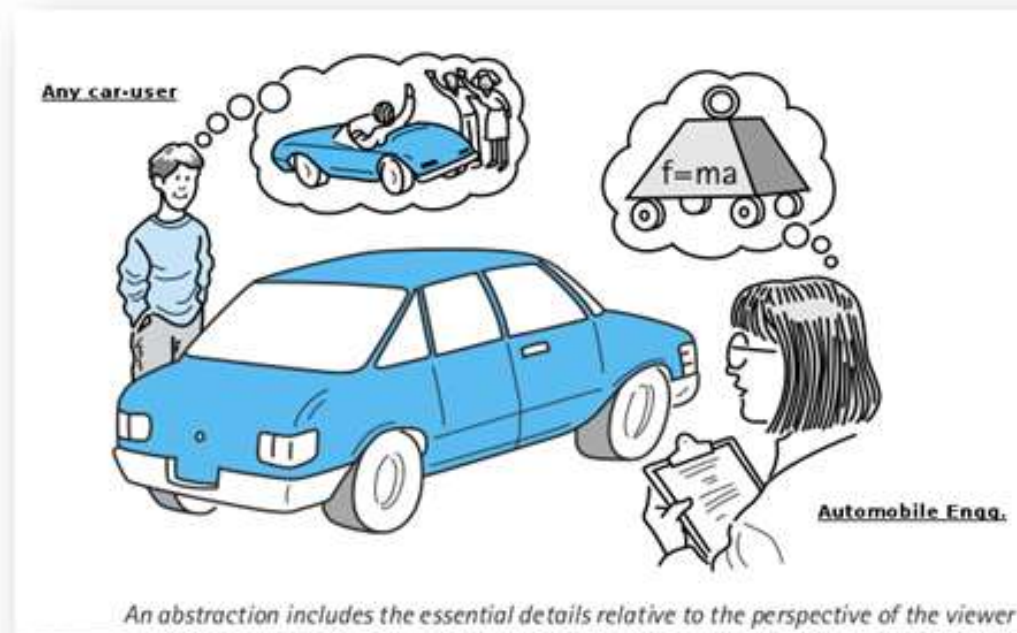
Main characteristics of the approach

- encapsulation
- abstraction
- inheritance
- polymorphism

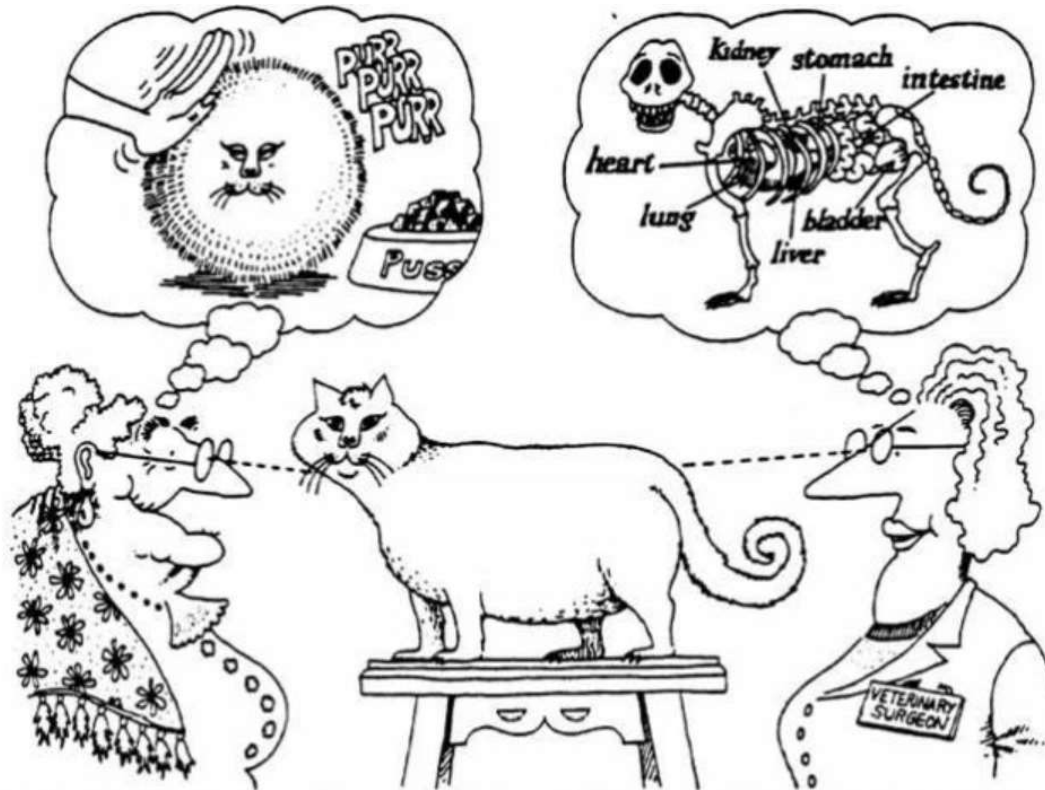
Encapsulation



Abstraction



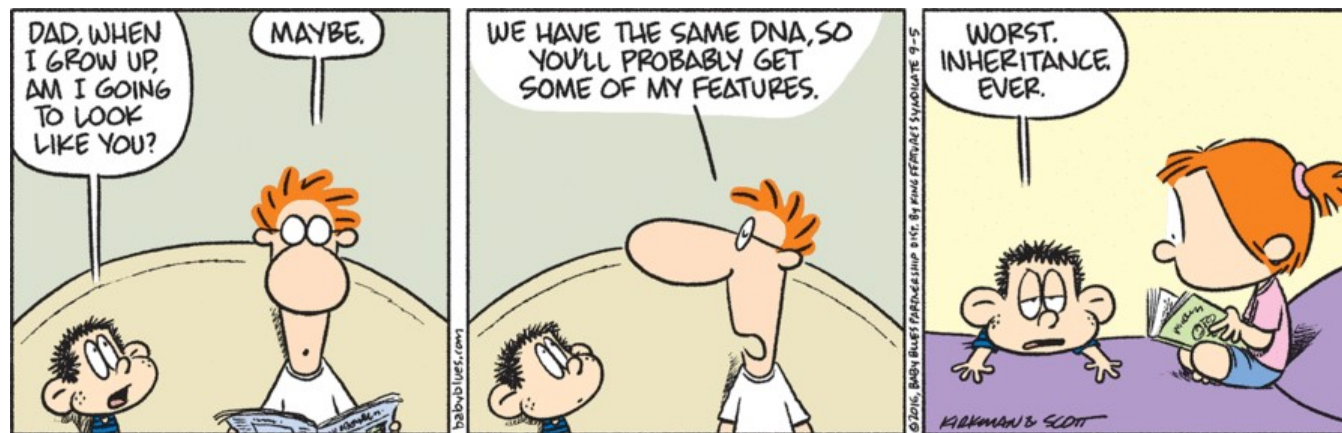
Abstraction



Abstraction focuses upon the essential characteristics of some object, relative to the perspective of the viewer.

Inheritance

- Inheritance is the mechanism of making new classes from existing one.

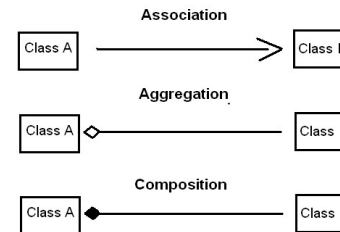
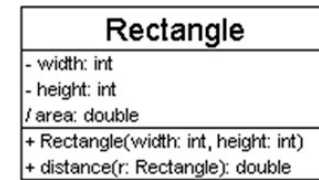


Polymorphism

- The word polymorphism means having many forms.
- Same function name (but different signatures) being used for different types.

Class Diagrams

- Elements of a class diagram :
 - Classes
 - Relations between classes
 - Associations
 - Compositions
 - Aggregations
 - Generalizations



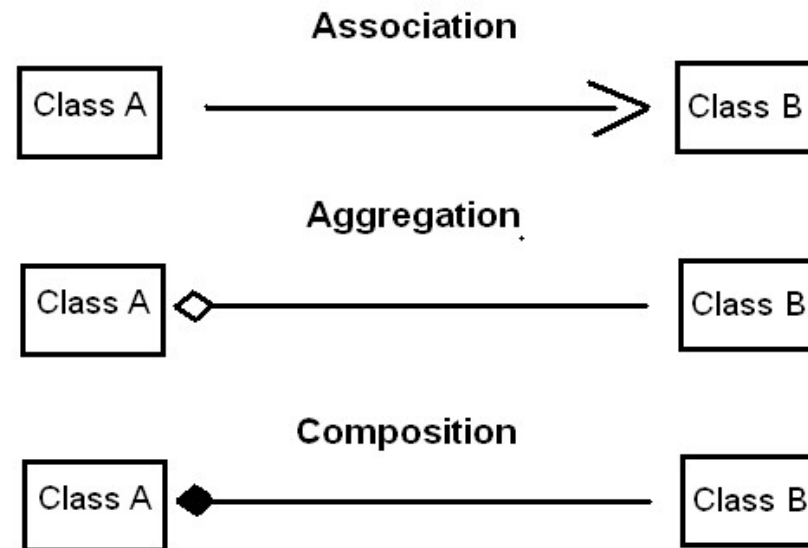
Classe

Campaign
code
description
annual Cost
expected cost
pay()
do Budget()

- ID Class (Class Name)
 - Refers to specific objects, but the must abstract
 - Nouns associated with the textual description of a problem
 - Choose carefully the names
 - using singular
- Attributes
 - Values that characterize the objects of a class
 - Types : Real, Integer , Text, Boolean , Enumerated , ...
- Operations
 - Behaviors of the class (service, method)

Relationship

- A relationship UML establishes the connection between elements



- Now let's go to



Class

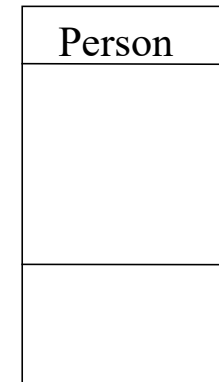
```
class Person:  
    pass # An empty block
```

Person

Class

```
class Person:  
    pass # An empty block
```

```
p = Person()  
print(p)
```



- **Result:**

```
<__main__.Person object at 0x0000021D9EED60F0>
```

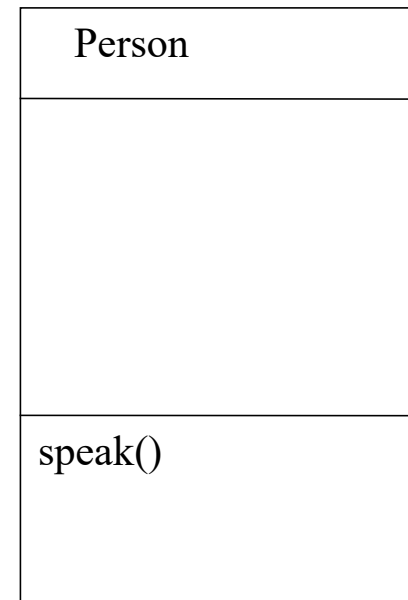
Method

- Define class with method

```
class Person:  
    def speak(self):  
        print('Hello, how are you?')
```

- Create object and call method

```
p = Person()  
p.speak()
```



init method

- The method **init()** is a special method,
- Is a method that Python calls when you create a new instance of this class.

init method

Person
<code>__init__()</code> <code>speak()</code>

```
class Person:
    def __init__(self, name):
        self.name = name
    def speak(self):
        print('Hello, my name is',
self.name)
p = Person('Carlos')
p.speak()
```

self

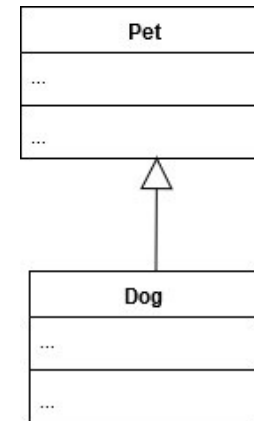
- The first argument of every class method, including init, is always a reference to the current instance of the class.
- By convention, this argument is always named self.

Class Pet

```
class Pet(object):  
    def __init__(self, name, species):  
        self.name = name  
        self.species = species  
    def getName(self):  
        return self.name  
    def getSpecies(self):  
        return self.species  
    def __str__(self):  
        return "%s is a %s" % (self.name, self.species)
```

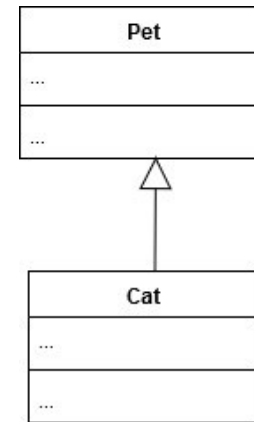
Inheritance

```
class Dog(Pet):  
  
    def __init__(self, name, chases_cats):  
        Pet.__init__(self, name, "Dog")  
        self.chases_cats = chases_cats  
  
    def chasesCats(self):  
        return self.chases_cats
```



Inheritance

```
class Cat(Pet):  
    def __init__(self, name, hates_dogs):  
        Pet.__init__(self, name, "Cat")  
        self.hates_dogs = hates_dogs  
  
    def hatesDogs(self):  
        return self.hates_dogs
```



```
myPet = Pet("Boby", "Dog")
myDog = Dog("Boby", True)
isinstance(myDog, Pet)
isinstance(myDog, Dog)
isinstance(myPet, Pet)
isinstance(myPet, Dog)
```

Access Modifiers

- Public,
- Private
- Protected

Private

- They can be handled only from within the class.

```
class Person:
```

```
    def __init__(self, name, age):
```

```
        self.__name=name
```

```
        self.__age=age
```

```
p=Person("David",23)
```

```
p.__name
```

Public

```
class Person:  
    def __init__(self, name, age):  
        self.name=name  
        self.age=age
```

```
p=Person("David",23)
```

```
p.name
```

Protected

```
class Person:  
    def __init__(self, name, age):  
        self._name=name  
        self._age=age
```

```
p=Person("David",23)
```

```
p.name
```


Conclusions

- Object Oriented Approach
- Concept of Class, Object, Methods, Variables
- Inheritance and Modifiers access

Bibliography

- **Bennet, S. McRobb, S & Farmer, R., *Object Oriented Systems Analysis and Design using UML*, MacGarw-Hill, 1999.**
- **Booch, G., Rumbaugh, J. & Jacobson, I, *The Unified Modeling Language User Guide*. Addison Wesley, 1999 (tradução portuguesa brasileira _____; *UML Guia do Usuário*; Campus, 2000).**
- **Costa, C. *Desenvolvimento para Web*, ITML Press, 2007**
- **Nunes, M & O'Neill, H. *Fundamental de UML*, FCA, 2001**
- **Silva, A & Videira, C., *UML, Metodologias e Ferramentas CASE*, Edições Centro Atlântico, 2001**
- **Terry, Q. *Visual Modeling With Rational Rose 2000 and UML*, Addison-Wesley. 2000.**
- ***Oxford Dictionary of Computing*, Oxford University Press.**