# 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 :

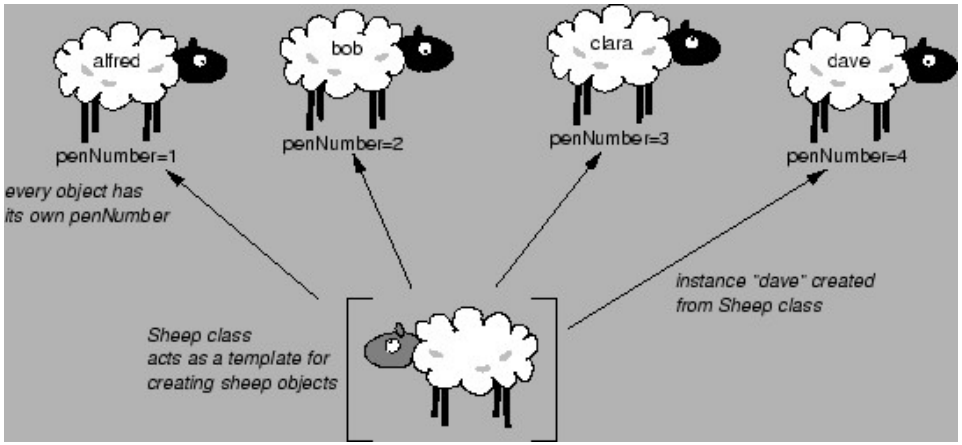
- Name (or ID )
- State
- Operations (or behavior )

# Class

Class is the blueprint of an object.

# Instance

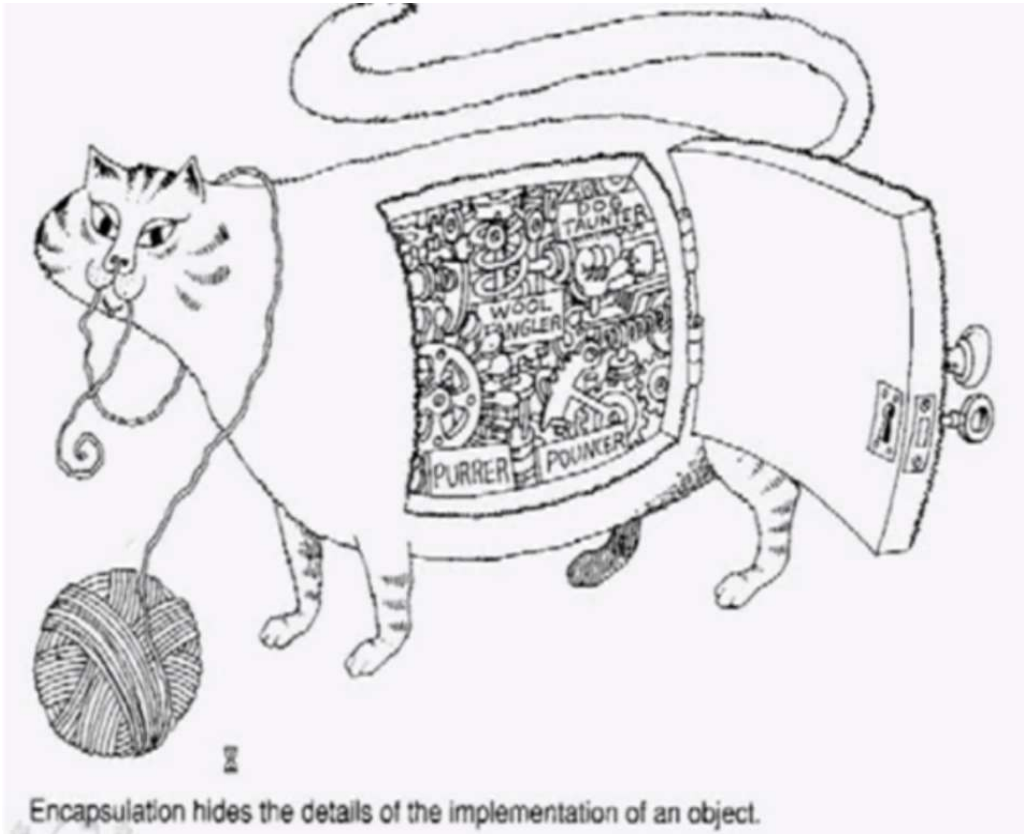
- An object is an instance of a class.



# Main caracteristics of the approach

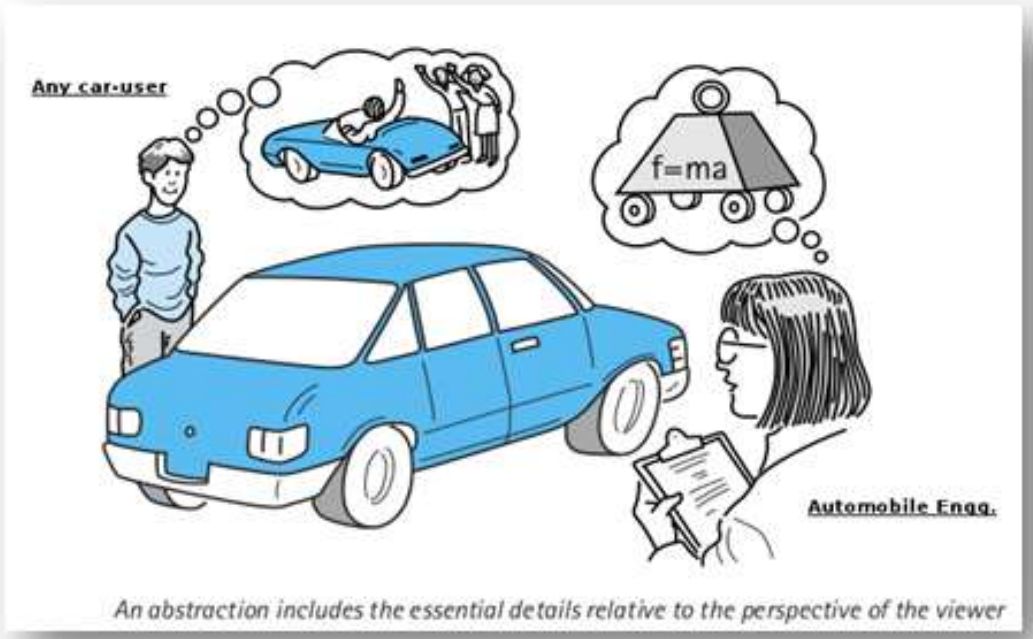
- encapsulation
- abstraction
- inheritance
- polymorphism

# Encapsulation

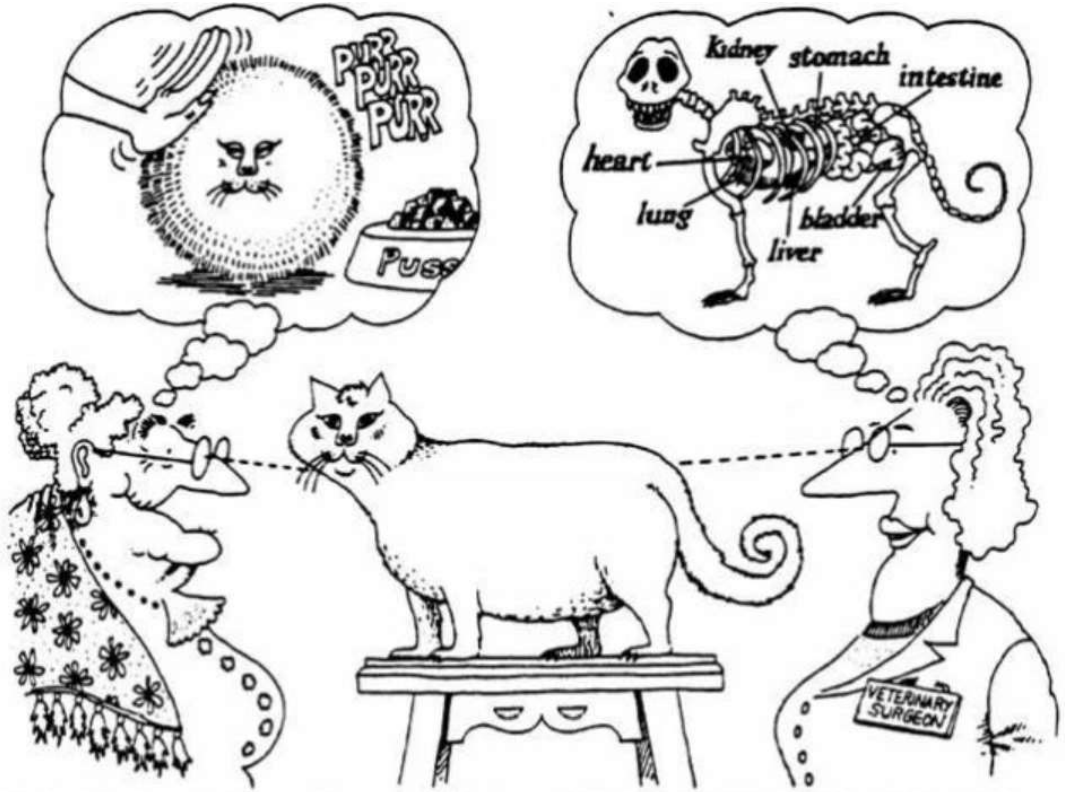



Encapsulation hides the details of the implementation of an object.

# Abstraction



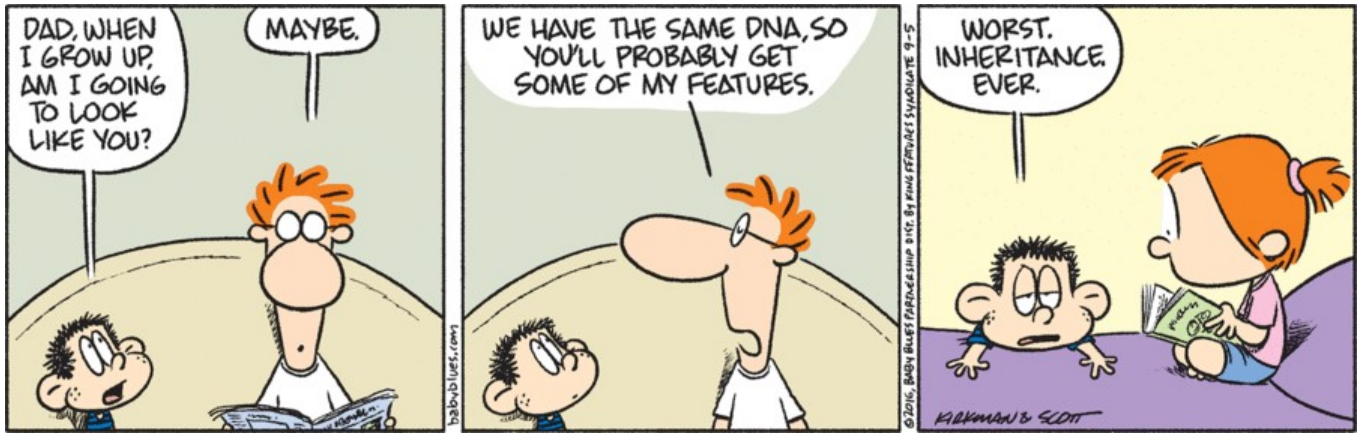
# Abstraction




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

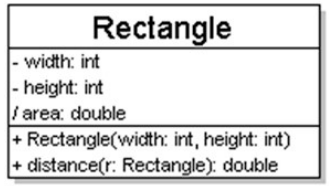
# Inheritance

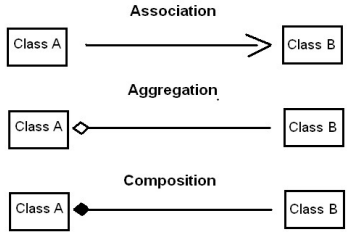
- Inheritance is the mechanism of making new classes from existing one.



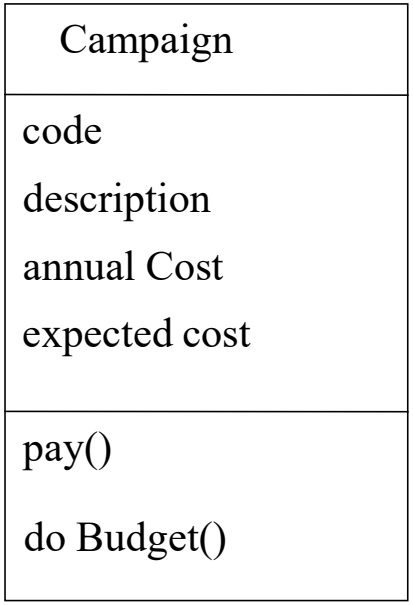
# Class Diagrams

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



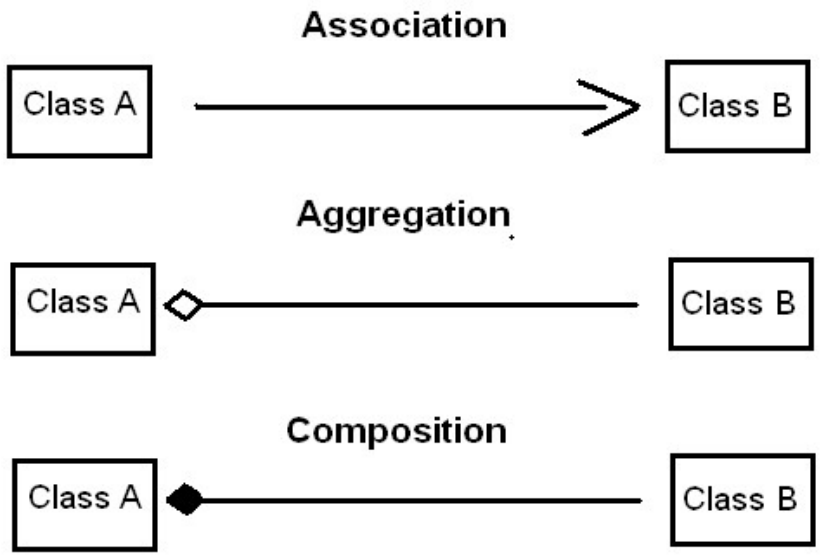
# Classe




- 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

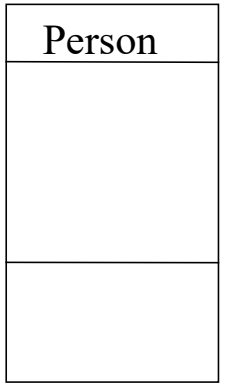
- A relationship UML establishes the connection between elements




- Now let’s go to

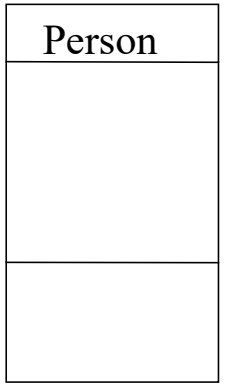
# Class

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



# Class

```
class Person:
    pass  # An empty block

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




- **Result:**

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

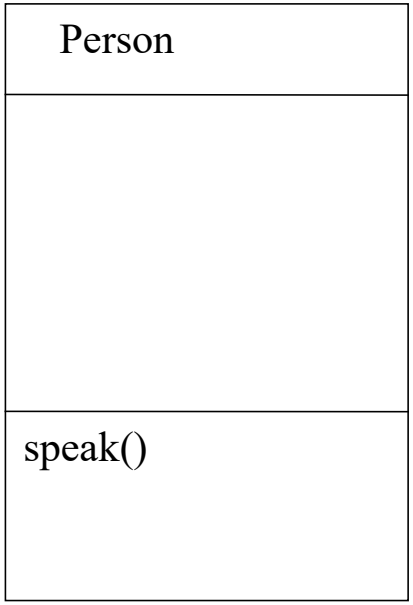
# Method

- Define class with method

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

- Create object and call method

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

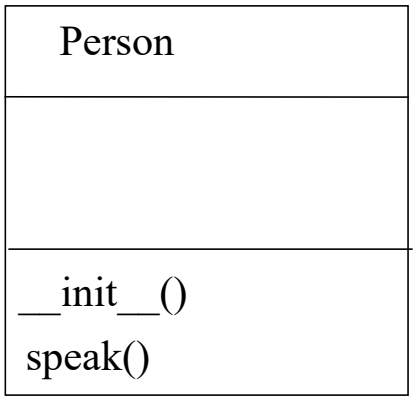


# init method

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

# init method

```
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

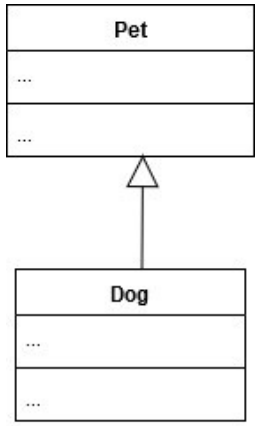
- The first argument of every class method, including init, is always a reference to the current instance of the class.
- By convention, this argument is always named self.

# 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)
```

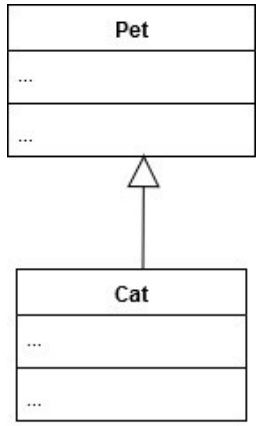
# Inheritance

```
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.**