

Data Visualization **Ai-EDU**

Python 3x Programing

Lesson Python 3.x

Tutor MR. Huynh Nam

Time 90 mins

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Content

- Introduction to OOP in Python
- Python Class
- Python Inheritance
- Multiple Inheritance
- Operator Overloading
- Example

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Introduction to OOP in Python

- Python is a multi-paradigm programming language. Meaning, it supports different programming approach.
- One of the popular approach to solve a programming problem is by creating objects. This is known as Object-Oriented Programming (OOP).
- An object has two characteristics:
 - Attributes
 - Behavior
- Example: Parrot is an object,
 - Name, age, color are **attributes**
 - Flying, singing, dancing, eating and love are **behavior**

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The Concept of OOP

- Abstraction
- Inheritance: A process of using details from a new class without modifying existing class.
- Encapsulation: Hiding the private details of a class from other objects.
- Polymorphism: A concept of using common operation in different ways for different data input.

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Example in mind

- [Redacted]
- [Redacted]
- [Redacted]

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Class

- A class is a blueprint for the object.
- Use class keyword to define a class.
- From class, we construct instances.
- An instance is a specific object created from a particular class.

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Example Class Parrot

```
class Parrot:
    # instance attribute
    def __init__(self, name, age):
        self.name = name
        self.age = age
```

class Parrot:
pass

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Object

- An object (instance) is an instantiation of a class.
- When class is defined, only the description for the object is defined. Therefore, no memory or storage is allocated.
- The example for object of parrot class can be:

class Parrot: pass ➔ 1 obj = Parrot()

```
class Parrot:
    # instance attribute
    def __init__(self, name, age):
        self.name = name
        self.age = age
```

instantiate the Parrot class
blu = Parrot("Blu", 10)
woo = Parrot("Woo", 15)

access the instance attributes
print("{} is {} years old".format(blu.name, blu.age))
print("{} is {} years old".format(woo.name, woo.age))

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Class Attribute

```

class Parrot:
    # class attribute
    species = "bird"

    # instance attribute
    def __init__(self, name, age):
        self.name = name
        self.age = age
  
```

instantiate the Parrot class

```

blu = Parrot("Blu", 10)
woo = Parrot("Woo", 15)
  
```

access the class attributes

```

print("Blu is a {}".format(blu.__class__.species))
print("Woo is also a {}".format(woo.__class__.species))
  
```

access the instance attributes

```

print("{} is {} years old".format( blu.name, blu.age))
print("{} is {} years old".format( woo.name, woo.age))
  
```

```

Blu is a bird
Woo is also a bird
Blu is 10 years old
Woo is 15 years old
  
```

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Methods

- Methods are functions defined inside the body of a class. They are used to define the behaviors of an object.

```

class Parrot:
    # instance attributes
    def __init__(self, name, age):
        self.name = name
        self.age = age

    # instance method
    def sing(self, song):
        return "{} sings {}".format(self.name, song)

    def dance(self):
        return "{} is now dancing".format(self.name)
  
```

instantiate the object

```

blu = Parrot("Blu", 10)
  
```

call our instance methods

```

print(blu.sing("Happy"))
print(blu.dance())
  
```

```

Blu sings 'Happy'
Blu is now dancing
  
```

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Example - 1

- Point in plane (**Point2D**) is defined as: coordinator X (**x**), coordinator Y (**y**), show 2D-point information (**display**), calculate distance between two 2D-point (**distance**) based on Euclid's formulas
- Design OOP Point2D class which has field, method, constructor.
- Creating two instances as **pointA**, **pointB**. Then showing their information
- Display on screen the distance of two points above

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Concept of Inheritance

The relation "is a" is implemented as a sub-class

The relation "has a" is implemented as reference

```

class Person:
    - String name, address
    - String birthDate
    + String getName();
    + void setName(String n);
    .....

class Professor:
    - String department
    + String getDepartment();
    + void setDepartment(String d);

class Student:
    - String studentId, majorField
    - String degreeSought
    + String getStudentId();
    + void setStudentID(String id)
    .....
  
```

Classes Professor, Student are sub-classes of the class Person. Sub-classes inherit the structure of super class.

Professor teaches Student.

The class Professor has the field Student[] students

The class Student has the field Professor pr

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Inheritance

- Inheritance is a way of creating new class for using details of existing class without modifying it. The newly formed class is a derived class (or child class). Similarly, the existing class is a base class (or parent class).
- Example:
 - Electric Products < code, name, make, price, guaranty, voltage, power >
 - Ceramic Products < code, name, make, price, type >
 - Food Products < code, name, make, price, date, expiredDate >

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Example in mind - Vietnamese

Phân tích phân cấp thừa kế cho các đối tượng trong một học viện:

- Nhân viên quản lý** < mã nv, tên nv, năm sinh, trình độ, trường đào tạo, chuyên môn, lương cb, phụ cấp chức vụ >
- Nhân viên nghiên cứu** < mã nv, tên nv, năm sinh, trình độ, trường đào tạo, chuyên môn, lương cb, phụ cấp độc hại >
- Nhân viên phục vụ** < mã nv, tên nv, năm sinh, trình độ, lương cb >

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Technique in Inheritance - Vietnamese

- Liệt kê đặc điểm của các đối tượng cần quan tâm.
- Tìm tập giao của các tính chất giữa các lớp, tách tập giao này để xây dựng lớp cha.
- Đặt 1 tên gọi có ý nghĩa cho lớp cha.
- Phần còn lại sau khi tách tập giao là các lớp con.

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Example

- Encapsulation
- Inheritance
- Polymorphism

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Exercise

- Đối tượng hình chữ nhật (**Rectangle**) bao gồm các thuộc tính về chiều dài (**length**), chiều rộng (**width**) và phương thức tính diện tích (**area**)
- Đối tượng hình hộp (**Box**) cũng bao gồm các thuộc tính về chiều dài (**length**) và chiều rộng (**width**). Tuy nhiên, có bổ sung thêm thuộc tính chiều cao (**height**). Ngoài ra có 2 phương thức tính diện tích xung quanh (**area**) và tính thể tích (**volumn**)
- Hãy vẽ sơ đồ thiết kế hướng đối tượng cho mô tả trên bao gồm: **attributes, constructors, methods, getters, setters**
- Hãy viết chương trình nhập danh sách các hình và xuất ra trong danh sách đó có bao nhiêu hình chữ nhật và bao nhiêu hình hộp

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Conclusion

- The programming gets easy and efficient.
- The class is sharable, so codes can be reused.
- The productivity of programmars increases
- Data is safe and secure with data abstraction.

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