Inheritance and Overriding (and some virtual env and debugging stuff)

What we’re going to learn

- What inheritance is
- How to implement and use inheritance
- When to use inheritance
  - Inheritance vs. composition
- What overriding is and how to implement it
- What venv is in Python and why it’s used
- How to use VS Code’s debugger

Check In

Write your favorite movie or video game soundtrack that you like to study to

Students, write your response!

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Recap of OOP: Fill in the blanks

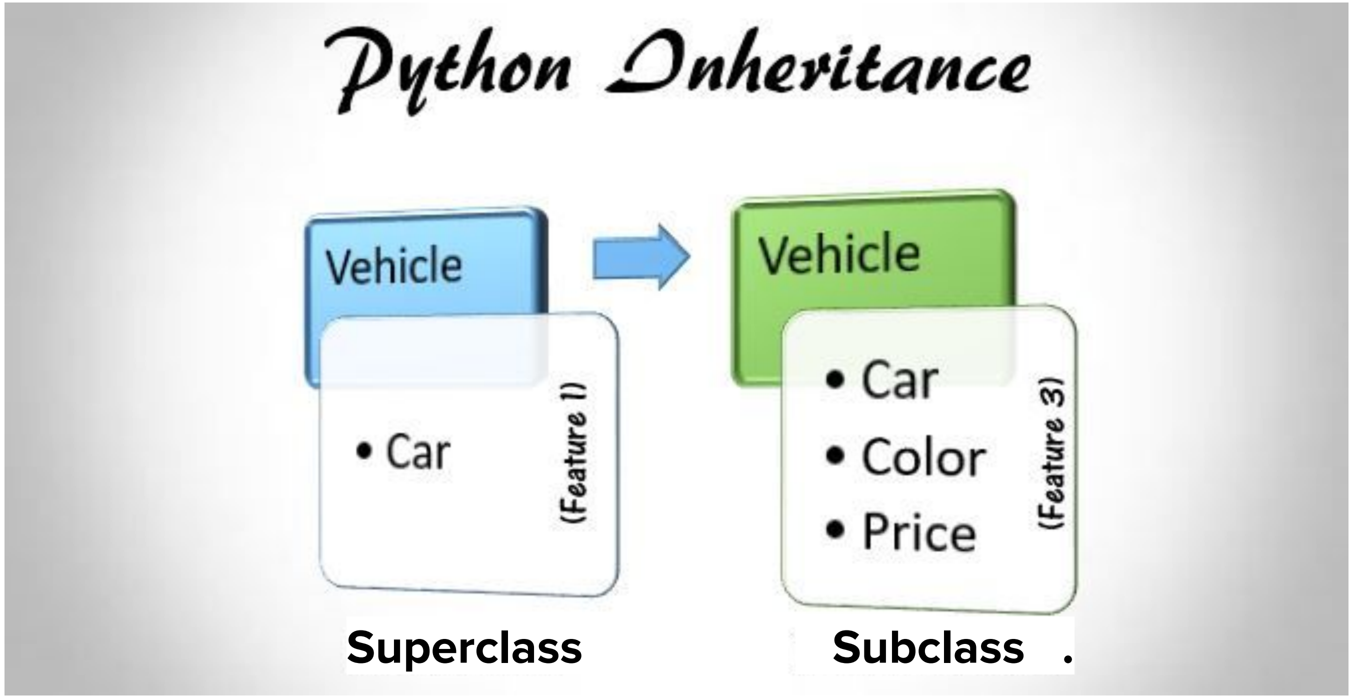
- An **object** is __
- **Classes** are __
- Classes can be utilized by ____ them into computer memory.

Recap of OOP Part 1: Encapsulation

- An **object** is a way to organize a collection of variables (called **properties**) and functions (called **methods**) that can act on the object's properties. This concept is known as **encapsulation**, which helps manage complexity.
- **Classes** are blueprints (definitions) of all objects of the same type.
- Classes can be utilized by **instantiating** them into computer memory.
- **Instantiation** of a class creates it in memory and allows users to explicitly manipulate the object.

Object Inheritance

- **Inheritance** is a mechanism of objects that allows one to derive classes from other classes and share methods and properties among different class hierarchies.
- An important distinction with object inheritance involves identifying **subclasses** and **superclasses**.
  - A **superclass** is a higher-hierarchy base class that has basic attributes to derive from.
  - A **subclass** is a lower-hierarchy class that derives attributes from another base class.



Class inheritance for the **`Vehicle`** class.

Pac-Man with OOP

Consider the famous arcade game **Pac-Man**.

Pac-Man can be used to illustrate class hierarchies and conventions.

Let's consider two classes: **`PacMan`** and **`Pellet`**.

Pac-Man must eat **`Pellet`** instances.

`Pellet` instances have a property called **`.is_eaten`**.

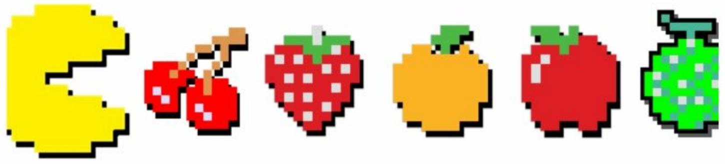
Pac-Man and Inheritance

Consider our **Pac-Man** example.

Let’s extend the classes to now include some examples of inheritance.

The **`Pellet`** class can be a subclass of a more generalized **`Eatable`** class.

This allows us to create some other eatable objects, including a **`Fruit`** object and a **`Ghost`** class.

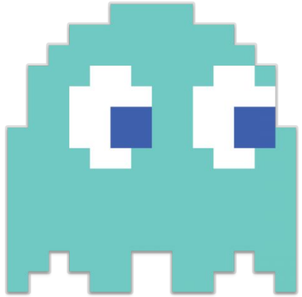


Pac-Man and Inheritance

Since the **`Eatable`** class has a property called **`.is_eaten`**, its subclasses *inherit* that property.

The **`Fruit`** class can have its own properties and methods (like **`.move()`**), and also *inherits* the **`.is_eaten`** property from its **`Eatable`** superclass.

The **`Ghost`** class can have its own properties (like **`.speed`**, **`.is_alive`**, **`.is_scared`**) and methods (like **`.move()`**), and also *inherits* the **`.is_eaten`** property from **`Eatable`**.

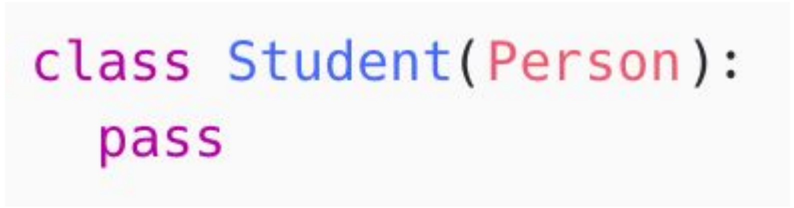


Activity: Model a Team with OOP

1. Form a group of **3-4 students** and write your response in pear deck.
2. Select a **team sport (or organization)** that involves people in **several different roles**. (Ex: soccer, field hockey, student council, rock band, ...)
3. Define **at least 3 classes**, one for each **role** on the team/organization.
4. Choose **2-3 attributes** and **2-3 behaviors** the roles typically exhibit.
5. Define a **superclass** of which each role you defined is a **subclass**.
6. Abstract **common attributes and behaviors** in the superclass that all subclasses will **inherit**.
7. Distinguish **attributes and behaviors that differ between roles** and are included only in the **subclasses** (not in the superclass).

Create a *Student* Subclass

Let's create a Student class that inherits from person!



```
class Student(Person):
  pass
```

Instantiating A Subclass

Even though our subclass doesn't contain any new properties and methods, it **inherits** all properties and methods from its superclass!

Note that we still must set the object's **`.name`** property to instantiate it.

```
# TODO: Change the class name and argument to your name
Jane = Student("Jane")

Jane.say_hello()
```

Create Method in Subclass

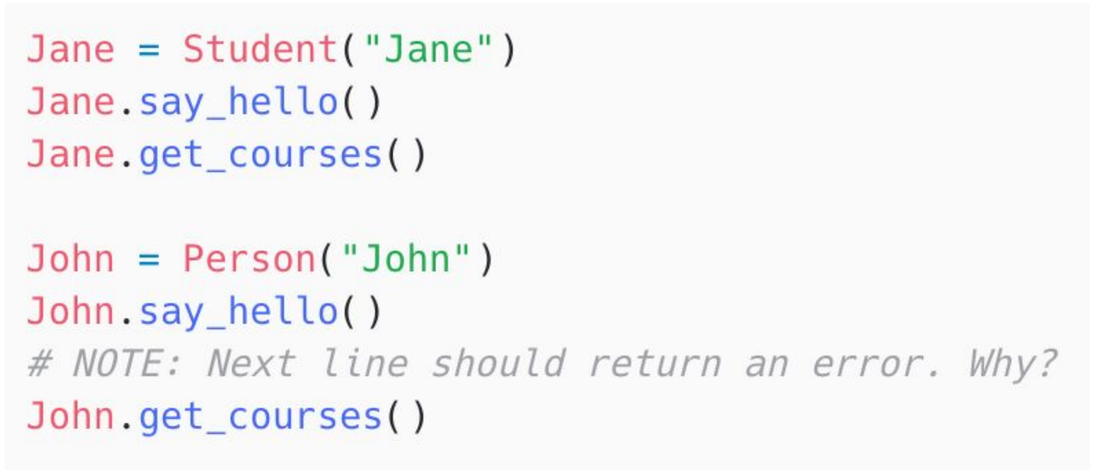
Properties and methods defined in our **subclass** do not live in our **superclass** and thus **are not inherited** by other subclasses. Let's write a method to print out your courses at Make School! Update your code to the following:

```python
class Student(Person):
  def get_courses(self):
    print("These are the current courses I'm taking: CS 1.1.")
```

Instantiating a Subclass and Superclass

Now that our subclass has inherited and explicitly defined methods, let’s test out both!

Run the following code to see the difference between superclass and subclass.



```python
Jane = Student("Jane")
Jane.say_hello()
Jane.get_courses()

John = Person("John")
John.say_hello()
# NOTE: Next line should return an error. Why?
John.get_courses()
```

Initializing Superclass in Subclass Initializer

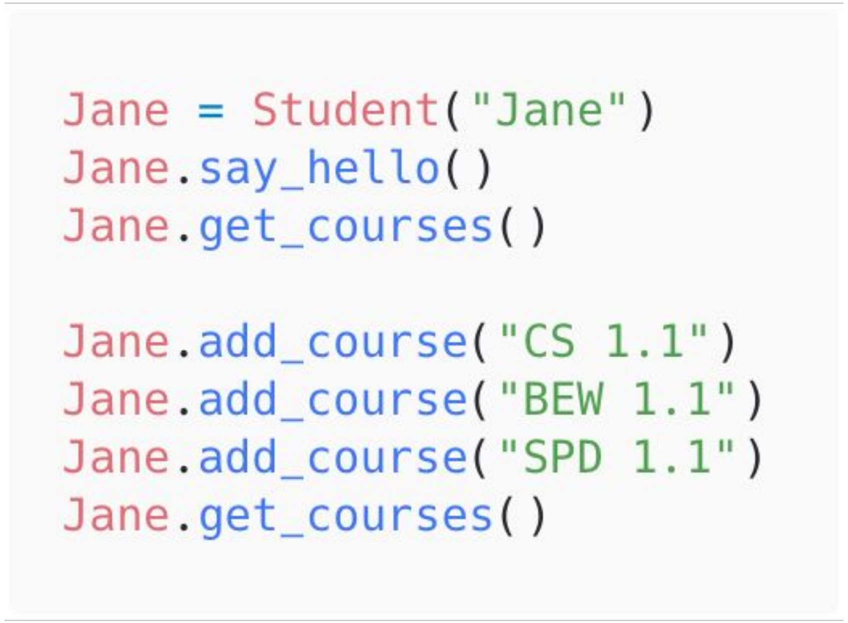
```python
class Student(Person):
  def __init__(self, name):
    # Initialize Person object with name
    super().__init__(name)
    # Student has not enrolled in courses
    self.courses = []

  def add_course(self, course):
    self.courses.append(course)

  def get_courses(self):
    count = len(self.courses)
    print(f"I'm taking {count} courses:")
    for course in self.courses:
      print(f"  - {course}")
```

Using New Improved Methods

Run the following code to see how we can use the new and improved methods:



```
Jane = Student("Jane")
Jane.say_hello()
Jane.get_courses()

Jane.add_course("CS 1.1")
Jane.add_course("BEW 1.1")
Jane.add_course("SPD 1.1")
Jane.get_courses()
```

Now it’s your turn!

Create a **subclass** of **`Person`** called **`Musician`**.

Create a method in the **`Musician`** class called **`.get_instruments()`** that prints the instruments that the **`Musician`** plays. Override the introduce_self() method to say name age and instruments

Instantiate a new **`Musician`** object that represents a musician that you like. 😁

Students browse: repl.it/@MakeSchool/createmusiciansubclass?lite=true

Awesome work!

You’ve successfully extended a class with properties and methods inherited from a superclass.

Summary

- **Objects** are structured collections of data in the form of variables (**properties**) and functions that act on those variables (**methods**).
- **Classes** are blueprint-like structures used to **create object instances**.
- To use a class, access its properties and call its methods, one must **instantiate an object** that represents an instance of that class.
- A **superclass** contains common properties and methods shared between several **subclasses** that **extend** and differentiate from their superclass.
- **Subclasses** will **inherit** all properties and methods from its **superclass**, which allows code using OOP to avoid duplication and remain DRY.

Virtualenv

MAKE SCHOOL

- Virtualenv is a tool used to create an isolated Python environment
- This environment has its own installation directories that doesn't share libraries with other virtualenv environments
- Why might using Python virtual environments be good engineering practice?

Students, write your response!

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Virtual Env demo

- pip3 install virtualenv
- virtualenv --version
- cd project_folder
- virtualenv venv
- source venv/bin/activate
- pip3 install ----
- deactivate
- pip3 freeze > requirements.txt
- pip3 install -r requirements.txt

VS Code Debugger demo

- Breakpoint
- Step Over
- Step Into
- Step Out
- Watch
- Call Stack

MAKE SCHOOL

Shout outs

Students, write your response!

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OOP Worksheet!

Assignments

- Flower Garden
- Quiz 1 study guide given soon
- Next Time: Quiz 1 released Thursday
  - 30 min - 1 hr in gradescope
  - Open note open book
  - 3 days to complete, not timed
- Next Time: Superhero Team Dueler Tutorial