Object-Oriented Programming (OOP) in Python

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Table of Contents

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Object-oriented programming (OOP) in Python lets you structure your code by grouping related properties and behaviors into individual objects. You create classes as blueprints and instantiate them to form objects. With OOP, you can model real-world entities and their interactions, and create complex systems with reusable components.

OOP in Python revolves around four main concepts: **encapsulation**, **inheritance**, **abstraction**, and **polymorphism**. Encapsulation bundles data with methods, inheritance lets you create subclasses, abstraction hides complex details, and polymorphism allows for different implementations.

By the end of this tutorial, you'll understand that:

- **Object-oriented programming in Python** involves structuring code into classes to model real-world entities.
- **The four key concepts of OOP in Python** are encapsulation, inheritance, abstraction, and polymorphism.
- **OOP in Python** is considered straightforward to learn due to its clear syntax and readability.
- **The main focus of OOP in Python** involves creating classes as blueprints for objects. These objects contain data and the methods needed to manipulate that data.

You'll explore how to define classes, instantiate classes to create objects, and leverage inheritance to build robust systems in Python.

Note: This tutorial is adapted from the chapter "Object-Oriented Programming (OOP)" in *Python Basics: A Practical Introduction to Python 3*.

The book uses Python's built-in IDLE editor to create and edit Python files and interact with the Python shell, so you'll see occasional references to IDLE throughout this tutorial. If you don't use IDLE, you can run the example code from the editor and environment of your choice.

Get Your Code: Click here to download the free sample code that shows you how to do object-oriented programming with classes in Python 3.

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Interactive Quiz

Object-Oriented Programming (OOP) in Python

Object-oriented programming (OOP) is a method of structuring a program by bundling related properties and behaviors into individual objects.

What Is Object-Oriented Programming in Python?

Object-oriented programming is a programming paradigm that provides a means of structuring programs so that properties and behaviors are bundled into individual **objects**.

For example, an object could represent a person with **properties** like a name, age, and address and **behaviors** such as walking, talking, breathing, and running. Or it could represent an email with properties like a recipient list, subject, and body and behaviors like adding attachments and sending.

Put another way, object-oriented programming is an approach for modeling concrete, real-world things, like cars, as well as relations between things, like companies and employees or students and teachers. OOP models real-world entities as software objects that have some data associated with them and can perform certain operations.

OOP also exists in other programming languages and is often described to center around the four pillars, or **four tenants of OOP**:

1. **Encapsulation** allows you to bundle data (attributes) and behaviors (methods) within a class to create a cohesive unit. By defining methods to control access to attributes and its modification, encapsulation helps maintain data integrity and promotes modular, secure code.

2. **Inheritance** enables the creation of hierarchical relationships between classes, allowing a subclass to inherit attributes and methods from a parent class. This promotes code reuse and reduces duplication.

3. **Abstraction** focuses on hiding implementation details and exposing only the essential functionality of an object. By enforcing a consistent interface, abstraction simplifies interactions with objects, allowing developers to focus on what an object does rather than how it achieves its functionality.

4. **Polymorphism** allows you to treat objects of different types as instances of the same base type, as long as they implement a common interface or behavior. Python's duck typing make it especially suited for polymorphism, as it allows you to access attributes and methods on objects without needing to worry about their actual class.

In this tutorial you'll take a practical approach to understanding OOP in Python. But keeping these four concepts of object-oriented programming in mind may help you to remember the information that you gather.

The key takeaway is that objects are at the center of object-oriented programming in Python. In other programming paradigms, objects only represent the data. In OOP, they additionally inform the overall structure of the program.

How Do You Define a Class in Python?

In Python, you define a class by using the `class` keyword followed by a name and a colon. Then you use `.__init__()` to declare which attributes each instance of the class should have:

Python

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

But what does all of that mean? And why do you even need classes in the first place? Take a step back and consider using built-in, primitive data structures as an alternative.

Primitive data structures—like numbers, strings, and lists—are designed to represent straightforward pieces of information, such as the cost of an apple, the name of a poem, or your favorite colors, respectively. What if you want to represent something more complex?

For example, you might want to track employees in an organization. You need to store some basic information about each employee, such as their name, age, position, and the year they started working.

One way to do this is to represent each employee as a list:

Python

```
kirk = ["James Kirk", 34, "Captain", 2265]
spock = ["Spock", 35, "Science Officer", 2254]
mccoy = ["Leonard McCoy", "Chief Medical Officer", 2266]
```

There are a number of issues with this approach.

First, it can make larger code files more difficult to manage. If you reference `kirk[0]` several lines away from where you declared the `kirk` list, will you remember that the element with index `0` is the employee's name?

Second, it can introduce errors if employees don't have the same number of elements in their respective lists. In the `mccoy` list above, the age is missing, so `mccoy[1]` will return `"Chief Medical Officer"` instead of Dr. McCoy's age.

A great way to make this type of code more manageable and more maintainable is to use **classes**.

Classes vs Instances

Classes allow you to create user-defined data structures. Classes define functions called **methods**, which identify the behaviors and actions that an object created from the class can perform with its data.

In this tutorial, you'll create a `Dog` class that stores some information about the characteristics and behaviors that an individual dog can have.

A class is a blueprint for how to define something. It doesn't actually contain any data. The `Dog` class specifies that a name and an age are necessary for defining a dog, but it doesn't contain the name or age of any specific dog.

While the class is the blueprint, an **instance** is an object that's built from a class and contains real data. An instance of the `Dog` class is not a blueprint anymore. It's an actual dog with a name, like Miles, who's four years old.

Put another way, a class is like a form or questionnaire. An instance is like a form that you've filled out with information. Just like many people can fill out the same form with their own unique information, you can create many instances from a single class.

Class Definition

You start all class definitions with the `class` keyword, then add the name of the class and a colon. Python will consider any code that you indent below the class definition as part of the class's body.

Here's an example of a `Dog` class:

Python dog.py

```python
class Dog:
    pass
```

The body of the `Dog` class consists of a single statement: the `pass` keyword. Python programmers often use `pass` as a placeholder indicating where code will eventually go. It allows you to run this code without Python throwing an error.

> **Note:** Python class names are written in CapitalizedWords notation by convention. For example, a class for a specific breed of dog, like the Jack Russell Terrier, would be written as `JackRussellTerrier`.

The `Dog` class isn't very interesting right now, so you'll spruce it up a bit by defining some properties that all `Dog` objects should have. There are several properties that you can choose from, including name, age, coat color, and breed. To keep the example small in scope, you'll just use name and age.

You define the properties that all `Dog` objects must have in a method called `.__init__()`. Every time you create a new `Dog` object, `.__init__()` sets the initial **state** of the object by assigning the values of the object's properties. That is, `.__init__()` initializes each new instance of the class.

You can give `.__init__()` any number of parameters, but the first parameter will always be a variable called `self`. When you create a new class instance, then Python automatically passes the instance to the `self` parameter in `.__init__()` so that Python can define the new **attributes** on the object.

Update the `Dog` class with an `.__init__()` method that creates `.name` and `.age` attributes:

Python dog.py

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

Make sure that you indent the `.__init__()` method's signature by four spaces, and the body of the method by eight spaces. This indentation is vitally important. It tells Python that the `.__init__()` method belongs to the `Dog` class.

In the body of `.__init__()`, there are two statements using the `self` variable:

1. **`self.name = name`** creates an attribute called `name` and assigns the value of the `name` parameter to it.
2. **`self.age = age`** creates an attribute called `age` and assigns the value of the `age` parameter to it.

Attributes created in `.__init__()` are called **instance attributes**. An instance attribute's value is specific to a particular instance of the class. All `Dog` objects have a name and an age, but the values for the `name` and `age` attributes will vary depending on the `Dog` instance.

On the other hand, class attributes are attributes that have the same value for all class instances. You can define a class attribute by assigning a value to a variable name outside of `.__init__()`.

For example, the following `Dog` class has a class attribute called `species` with the value `"Canis familiaris"`:

Python dog.py

```python
class Dog:
    species = "Canis familiaris"

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

You define class attributes directly beneath the first line of the class name and indent them by four spaces. You always need to assign them an initial value. When you create an instance of the class, then Python automatically creates and assigns class attributes to their initial values.

Use class attributes to define properties that should have the same value for every class instance. Use instance attributes for properties that vary from one instance to another.

Now that you have a `Dog` class, it's time to create some dogs!

How Do You Instantiate a Class in Python?

Creating a new object from a class is called **instantiating** a class. You can create a new object by typing the name of the class, followed by opening and closing parentheses:

Python

```python
>>> class Dog:
...     pass
...
>>> Dog()
<__main__.Dog object at 0x106702d30>
```

You first create a new `Dog` class with no attributes or methods, and then you instantiate the `Dog` class to create a `Dog` object.

In the output above, you can see that you now have a new `Dog` object at `0x106702d30`. This funny-looking string of letters and numbers is a **memory address** that indicates where Python stores the `Dog` object in your computer's memory. Note that the address on your screen will be different.

Now instantiate the `Dog` class a second time to create another `Dog` object:

Python

```
>>> Dog()
<__main__.Dog object at 0x0004ccc90>
```

The new Dog instance is located at a different memory address. That's because it's an entirely new instance and is completely unique from the first Dog object that you created.

To see this another way, type the following:

Python

```
>>> a = Dog()
>>> b = Dog()
>>> a == b
False
```

In this code, you create two new Dog objects and assign them to the variables a and b. When you compare a and b using the == operator, the result is False. Even though a and b are both instances of the Dog class, they represent two distinct objects in memory.

Class and Instance Attributes

Now create a new Dog class with a class attribute called .species and two instance attributes called .name and .age:

Python

```
>>> class Dog:
...     species = "Canis familiaris"
...     def __init__(self, name, age):
...         self.name = name
...         self.age = age
...
```

To instantiate this Dog class, you need to provide values for name and age. If you don't, then Python raises a TypeError:

Python

```
>>> Dog()
Traceback (most recent call last):
  ...
TypeError: __init__() missing 2 required positional arguments: 'name' and 'age'
```

To pass arguments to the name and age parameters, put values into the parentheses after the class name:

Python

```
>>> miles = Dog("Miles", 4)
>>> buddy = Dog("Buddy", 9)
```

This creates two new Dog instances—one for a four-year-old dog named Miles and one for a nine-year-old dog named Buddy.

The Dog class's .__init__() method has three parameters, so why are you only passing two arguments to it in the example?

When you instantiate the Dog class, Python creates a new instance of Dog and passes it to the first parameter of .__init__(). This essentially removes the self parameter, so you only need to worry about the name and age parameters.

> **Note:** Behind the scenes, Python both creates and initializes a new object when you use this syntax. If you want to dive deeper, then you can read the dedicated tutorial about the Python class constructor.

After you create the Dog instances, you can access their instance attributes using **dot notation**:

Python

```
>>> miles.name
'Miles'
>>> miles.age
4

>>> buddy.name
'Buddy'
>>> buddy.age
9
```

You can access class attributes the same way:

Python

```
>>> buddy.species
'Canis familiaris'
```

One of the biggest advantages of using classes to organize data is that instances are guaranteed to have the attributes you expect. All `Dog` instances have `.species`, `.name`, and `.age` attributes, so you can use those attributes with confidence, knowing that they'll always return a value.

Although the attributes are guaranteed to exist, their values *can* change dynamically:

Python

```
>>> buddy.age = 10
>>> buddy.age
10

>>> miles.species = "Felis silvestris"
>>> miles.species
'Felis silvestris'
```

In this example, you change the `.age` attribute of the `buddy` object to `10`. Then you change the `.species` attribute of the `miles` object to `"Felis silvestris"`, which is a species of cat. That makes Miles a pretty strange dog, but it's valid Python!

The key takeaway here is that custom objects are mutable by default. An object is mutable if you can alter it dynamically. For example, lists and dictionaries are mutable, but strings and tuples are immutable.

Instance Methods

Instance methods are functions that you define inside a class and can only call on an instance of that class. Just like `.__init__()`, an instance method always takes `self` as its first parameter.

Open a new editor window in IDLE and type in the following `Dog` class:

Python dog.py

```python
class Dog:
    species = "Canis familiaris"

    def __init__(self, name, age):
        self.name = name
        self.age = age

    # Instance method
    def description(self):
        return f"{self.name} is {self.age} years old"

    # Another instance method
    def speak(self, sound):
        return f"{self.name} says {sound}"
```

This `Dog` class has two instance methods:

1. **`.description()`** returns a string displaying the name and age of the dog.
2. **`.speak()`** has one parameter called `sound` and returns a string containing the dog's name and the sound that the dog makes.

Save the modified `Dog` class to a file called `dog.py` and press F5 to run the program. Then open the interactive window and type the following to see your instance methods in action:

Python

```python
>>> miles = Dog("Miles", 4)

>>> miles.description()
'Miles is 4 years old'

>>> miles.speak("Woof Woof")
'Miles says Woof Woof'

>>> miles.speak("Bow Wow")
'Miles says Bow Wow'
```

In the above `Dog` class, `.description()` returns a string containing information about the `Dog` instance `miles`. When writing your own classes, it's a good idea to have a method that returns a string containing useful information about an instance of the class. However, `.description()` isn't the most [Pythonic](https://realpython.com/learning-paths/writing-pythonic-code/) way of doing this.

When you create a `list` object, you can use `print()` to display a string that looks like the list:

Python

```python
>>> names = ["Miles", "Buddy", "Jack"]
>>> print(names)
['Miles', 'Buddy', 'Jack']
```

Go ahead and print the `miles` object to see what output you get:

Python

```python
>>> print(miles)
<__main__.Dog object at 0x00aeff70>
```

When you print `miles`, you get a cryptic-looking message telling you that `miles` is a `Dog` object at the memory address `0x00aeff70`. This message isn't very helpful. You can change what gets printed by defining a special instance method called `.__str__()`.

In the editor window, change the name of the `Dog` class's `.description()` method to `.__str__()`:

Python dog.py

```python
class Dog:
    # ...

    def __str__(self):
        return f"{self.name} is {self.age} years old"
```

Save the file and press F5. Now, when you print `miles`, you get a much friendlier output:

Python

```python
>>> miles = Dog("Miles", 4)
>>> print(miles)
'Miles is 4 years old'
```

Methods like `.__init__()` and `.__str__()` are called **dunder methods** because they begin and end with double underscores. There are many dunder methods that you can use to customize classes in Python. Understanding dunder methods is an important part of mastering object-oriented programming in Python, but for your first exploration of the topic, you'll stick with these two dunder methods.

Note: Check out When Should You Use `.__repr__()` vs `.__str__()` in Python? to learn more about `.__str__()` and its cousin `.__repr__()`.

If you want to reinforce your understanding with a practical exercise, then you can click on the block below and work on solving the challenge:

Exercise: Create a `Car` Class Show/Hide

When you're done with your own implementation of the challenge, then you can expand the block below to see a possible solution:

Solution: Create a `Car` Class Show/Hide

When you're ready, you can move on to the next section. There, you'll see how to take your knowledge one step further and create classes from other classes.

How Do You Inherit From Another Class in Python?

Inheritance is the process by which one class takes on the attributes and methods of another. Newly formed classes are called **child classes**, and the classes that you derive child classes from are called **parent classes**.

You inherit from a parent class by creating a new class and putting the name of the parent class into parentheses:

Python `inheritance.py`

```python
class Parent:
    hair_color = "brown"

class Child(Parent):
    pass
```

In this minimal example, the child class `Child` inherits from the parent class `Parent`. Because child classes take on the attributes and methods of parent classes, `Child.hair_color` is also `"brown"` without your explicitly defining that.

Note: This tutorial is adapted from the chapter "Object-Oriented Programming (OOP)" in *Python Basics: A Practical Introduction to Python 3*. If you enjoy what you're reading, then be sure to check out the rest of the book and the learning path.

You can also check out the Python Basics: Building Systems With Classes video course to reinforce the skills that you'll develop in this section of the tutorial.

Child classes can override or extend the attributes and methods of parent classes. In other words, child classes inherit all of the parent's attributes and methods but can also specify attributes and methods that are unique to themselves.

Although the analogy isn't perfect, you can think of object inheritance sort of like genetic inheritance.

You may have inherited your hair color from your parents. It's an attribute that you were born with. But maybe you decide to color your hair purple. Assuming that your parents don't have purple hair, you've just **overridden** the hair color attribute that you inherited from your parents:

Python inheritance.py

```python
class Parent:
    hair_color = "brown"

class Child(Parent):
    hair_color = "purple"
```

If you change the code example like this, then `Child.hair_color` will be `"purple"`.

You also inherit, in a sense, your language from your parents. If your parents speak English, then you'll also speak English. Now imagine you decide to learn a second language, like German. In this case, you've **extended** your attributes because you've added an attribute that your parents don't have:

Python inheritance.py

```python
class Parent:
    speaks = ["English"]

class Child(Parent):
    def __init__(self):
        super().__init__()
        self.speaks.append("German")
```

You'll learn more about how the code above works in the sections below. But before you dive deeper into inheritance in Python, you'll take a walk to a dog park to better understand why you might want to use inheritance in your own code.

Example: Dog Park

Pretend for a moment that you're at a dog park. There are many dogs of different breeds at the park, all engaging in various dog behaviors.

Suppose now that you want to model the dog park with Python classes. The `Dog` class that you wrote in the previous section can distinguish dogs by name and age but not by breed.

You could modify the `Dog` class in the editor window by adding a `.breed` attribute:

Python dog.py

```python
class Dog:
    species = "Canis familiaris"

    def __init__(self, name, age, breed):
        self.name = name
        self.age = age
        self.breed = breed

    def __str__(self):
        return f"{self.name} is {self.age} years old"

    def speak(self, sound):
        return f"{self.name} says {sound}"
```

Press F5 to save the file. Now you can model the dog park by creating a bunch of different dogs in the interactive window:

Python

```python
>>> miles = Dog("Miles", 4, "Jack Russell Terrier")
>>> buddy = Dog("Buddy", 9, "Dachshund")
>>> jack = Dog("Jack", 3, "Bulldog")
>>> jim = Dog("Jim", 5, "Bulldog")
```

Each breed of dog has slightly different behaviors. For example, bulldogs have a low bark that sounds like *woof*, but dachshunds have a higher-pitched bark that sounds more like *yap*.

Using just the `Dog` class, you must supply a string for the `sound` argument of `.speak()` every time you call it on a `Dog` instance:

Python

```python
>>> buddy.speak("Yap")
'Buddy says Yap'

>>> jim.speak("Woof")
'Jim says Woof'

>>> jack.speak("Woof")
'Jack says Woof'
```

Passing a string to every call to `.speak()` is repetitive and inconvenient. Moreover, the `.breed` attribute should determine the string representing the sound that each `Dog` instance makes, but here you have to manually pass the correct string to `.speak()` every time you call it.

You can simplify the experience of working with the `Dog` class by creating a child class for each breed of dog. This allows you to extend the functionality that each child class inherits, including specifying a default argument for `.speak()`.

Parent Classes vs Child Classes

In this section, you'll create a child class for each of the three breeds mentioned above: Jack Russell terrier, dachshund, and bulldog.

For reference, here's the full definition of the `Dog` class that you're currently working with:

Python dog.py

```python
class Dog:
    species = "Canis familiaris"

    def __init__(self, name, age):
        self.name = name
        self.age = age

    def __str__(self):
        return f"{self.name} is {self.age} years old"

    def speak(self, sound):
        return f"{self.name} says {sound}"
```

After doing the dog park example in the previous section, you've removed `.breed` again. You'll now write code to keep track of a dog's breed using child classes instead.

To create a child class, you create a new class with its own name and then put the name of the parent class in parentheses. Add the following to the `dog.py` file to create three new child classes of the `Dog` class:

Python dog.py

```python
# ...

class JackRussellTerrier(Dog):
    pass

class Dachshund(Dog):
    pass

class Bulldog(Dog):
    pass
```

Press F5 to save and run the file. With the child classes defined, you can now create some dogs of specific breeds in the interactive window:

Python

```python
>>> miles = JackRussellTerrier("Miles", 4)
>>> buddy = Dachshund("Buddy", 9)
>>> jack = Bulldog("Jack", 3)
>>> jim = Bulldog("Jim", 5)
```

Instances of child classes inherit all of the attributes and methods of the parent class:

Python

```python
>>> miles.species
'Canis familiaris'

>>> buddy.name
'Buddy'

>>> print(jack)
Jack is 3 years old

>>> jim.speak("Woof")
'Jim says Woof'
```

To determine which class a given object belongs to, you can use the built-in `type()`:

Python

```python
>>> type(miles)
<class '__main__.JackRussellTerrier'>
```

What if you want to determine if `miles` is also an instance of the `Dog` class? You can do this with the built-in `isinstance()`:

Python

```
>>> isinstance(miles, Dog)
True
```

Notice that `isinstance()` takes two arguments, an object and a class. In the example above, `isinstance()` checks if `miles` is an instance of the `Dog` class and returns `True`.

The `miles`, `buddy`, `jack`, and `jim` objects are all `Dog` instances, but `miles` isn't a `Bulldog` instance, and `jack` isn't a `Dachshund` instance:

Python

```
>>> isinstance(miles, Bulldog)
False

>>> isinstance(jack, Dachshund)
False
```

More generally, all objects created from a child class are instances of the parent class, although they may not be instances of other child classes.

Now that you've created child classes for some different breeds of dogs, you can give each breed its own sound.

Parent Class Functionality Extension

Since different breeds of dogs have slightly different barks, you want to provide a default value for the `sound` argument of their respective `.speak()` methods. To do this, you need to override `.speak()` in the class definition for each breed.

To override a method defined on the parent class, you define a method with the same name on the child class. Here's what that looks like for the `JackRussellTerrier` class:

Python dog.py

```python
# ...

class JackRussellTerrier(Dog):
    def speak(self, sound="Arf"):
        return f"{self.name} says {sound}"

# ...
```

Now `.speak()` is defined on the `JackRussellTerrier` class with the default argument for `sound` set to `"Arf"`.

Update `dog.py` with the new `JackRussellTerrier` class and press F5 to save and run the file. You can now call `.speak()` on a `JackRussellTerrier` instance without passing an argument to `sound`:

Python

```
>>> miles = JackRussellTerrier("Miles", 4)
>>> miles.speak()
'Miles says Arf'
```

Sometimes dogs make different noises, so if Miles gets angry and growls, you can still call `.speak()` with a different sound:

Python

```
>>> miles.speak("Grrr")
'Miles says Grrr'
```

One thing to keep in mind about class inheritance is that changes to the parent class automatically propagate to child classes. This occurs as long as the attribute or method being changed isn't overridden in the child class.

For example, in the editor window, change the string returned by `.speak()` in the `Dog` class:

Python dog.py

```python
class Dog:
    # ...

    def speak(self, sound):
        return f"{self.name} barks: {sound}"

# ...
```

Save the file and press F5. Now, when you create a new `Bulldog` instance named `jim`, `jim.speak()` returns the new string:

Python

```
>>> jim = Bulldog("Jim", 5)
>>> jim.speak("Woof")
'Jim barks: Woof'
```

However, calling `.speak()` on a `JackRussellTerrier` instance won't show the new style of output:

Python

```
>>> miles = JackRussellTerrier("Miles", 4)
>>> miles.speak()
'Miles says Arf'
```

Sometimes it makes sense to completely override a method from a parent class. But in this case, you don't want the `JackRussellTerrier` class to lose any changes that you might make to the formatting of the `Dog.speak()` output string.

To do this, you still need to define a `.speak()` method on the child `JackRussellTerrier` class. But instead of explicitly defining the output string, you need to call the `Dog` class's `.speak()` from *inside* the child class's `.speak()` using the same arguments that you passed to `JackRussellTerrier.speak()`.

You can access the parent class from inside a method of a child class by using [`super()`]:

Python dog.py

```python
# ...

class JackRussellTerrier(Dog):
    def speak(self, sound="Arf"):
        return super().speak(sound)

# ...
```

When you call `super().speak(sound)` inside `JackRussellTerrier`, Python searches the parent class, `Dog`, for a `.speak()` method and calls it with the variable `sound`.

Update `dog.py` with the new `JackRussellTerrier` class. Save the file and press F5 so you can test it in the interactive window:

Python

```
>>> miles = JackRussellTerrier("Miles", 4)
>>> miles.speak()
'Miles barks: Arf'
```

Now when you call `miles.speak()`, you'll see output reflecting the new formatting in the `Dog` class.

Note: In the above examples, the **class hierarchy** is very straightforward. The `JackRussellTerrier` class has a single parent class, `Dog`. In real-world examples, the class hierarchy can get quite complicated.

The `super()` function does much more than just search the parent class for a method or an attribute. It traverses the entire class hierarchy for a matching method or attribute. If you aren't careful, `super()` can have surprising results.

If you want to check your understanding of the concepts that you learned about in this section with a practical exercise, then you can click on the block below and work on solving the challenge:

Exercise: Class Inheritance Show/Hide

When you're done with your own implementation of the challenge, then you can expand the block below to see a possible solution:

Solution: Class Inheritance Show/Hide

Nice work! In this section, you've learned how to override and extend methods from a parent class, and you worked on a small practical example to cement your new skills.

Conclusion

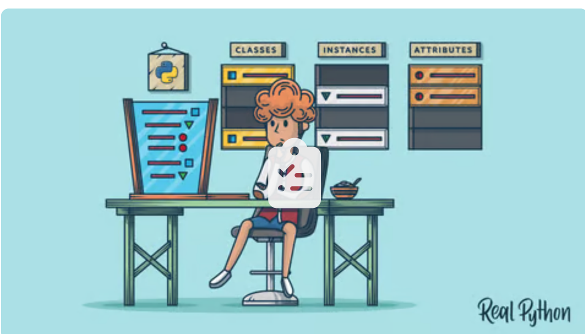
In this tutorial, you learned about object-oriented programming (OOP) in Python. Many modern programming languages, such as Java, C#, and C++, follow OOP principles, so the knowledge that you gained here will be applicable no matter where your programming career takes you.

In this tutorial, you learned how to:

- Define a **class**, which is a sort of blueprint for an object
- Instantiate a class to create an **object**
- Use **attributes** and **methods** to define the **properties** and **behaviors** of an object
- Use **inheritance** to create **child classes** from a **parent class**
- Reference a method on a parent class using **`super()`**
- Check if an object inherits from another class using **`isinstance()`**

If you enjoyed what you learned in this sample from *Python Basics: A Practical Introduction to Python 3*, then be sure to check out the rest of the book and take a look at our Introduction to Python learning path.

Take the Quiz: Test your knowledge with our interactive "Object-Oriented Programming (OOP) in Python" quiz. You'll receive a score upon completion to help you track your learning progress:



Interactive Quiz

Object-Oriented Programming (OOP) in Python

Object-oriented programming (OOP) is a method of structuring a program by bundling related properties and behaviors into individual objects.

Frequently Asked Questions

Now that you have some experience with object-oriented programming in Python, you can use the questions and answers below to check your understanding and recap what you've learned.

These FAQs are related to the most important concepts you've covered in this tutorial. Click the *Show/Hide* toggle beside each question to reveal the answer.

What is object-oriented programming in Python? Show/Hide

What are the four pillars of object-oriented programming in Python? Show/Hide

How do you define a class in Python? Show/Hide

What is the purpose of class inheritance in Python? Show/Hide

How can you instantiate a class in Python? Show/Hide

What is the difference between class attributes and instance attributes in Python? Show/Hide

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Watch Now This tutorial has a related video course created by the Real Python team. Watch it together with the written tutorial to deepen your understanding: **Intro to Object-Oriented Programming (OOP) in Python**

About **David Amos**

David is a writer, programmer, and mathematician passionate about exploring mathematics through code.

[» More about David]

Each tutorial at Real Python is created by a team of developers so that it meets our high quality standards. The team members who worked on this tutorial are:

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Commenting Tips: The most useful comments are those written with the goal of learning from or helping out other students. Get tips for asking good questions and get answers to common questions in our support portal.

Looking for a real-time conversation? Visit the Real Python Community Chat or join the next "Office Hours" Live Q&A Session. Happy Pythoning!

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