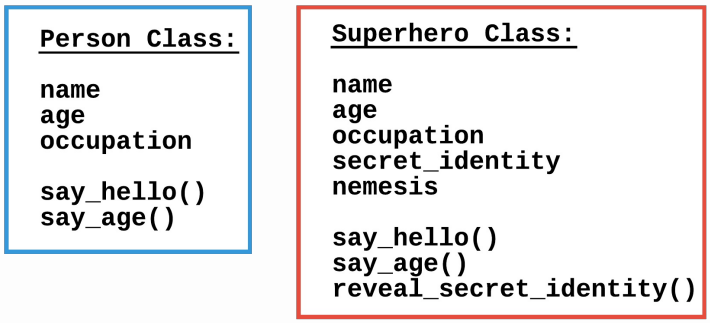
Learning Objectives - Parents & Children

- **Define the terms inheritance, parent class, and child class**
- **Explain the relationship between the parent class and child class**
- **Explain the role of the `super()` keyword**
- **Create a child class from a given parent class**
- **Use `isinstance` to determine an object's parent class**
- **Use `issubclass` to determine a class's parent class**

What is Inheritance?

Defining Inheritance

Imagine you want to create two Python classes, `Person` and `Superhero`. These respective classes might look something like this:



No_Inheritance

There are some similarities between the `Person` class and the `Superhero` class. If the `Person` class already exists, it would be helpful to "borrow" from the `Person` class so you only have to create the new attributes and methods for the`Superhero` class. This situation describes inheritance — one class copies the attributes and methods from another class.

Inheritance Syntax

In the IDE on the left, the `Person` class is already defined. To create the `Superhero` class that inherits from the `Person` class, add the following code at the end of the program. Notice how `Superhero` takes `Person` as a parameter. This is how you indicate to Python that the `Superhero` class inherits from the `Person` class. You can also say that the `Person` class is the parent and the `Superhero` class is the child.

```
class Superhero(Person):
  pass

hero = Superhero("Jessica Jones", 29, "private investigator")
print(hero.name)
print(hero.occupation)
```

The `Superhero` class can access the attributes of the `Person` class because `Superheor` inherits from `Person`.

challenge

Try this variation:

- Print the `age` attribute for the `hero` object.
- Call the `say_hello` method with the `hero` object.

▼ **Solution**

```
print(hero.age)
hero.say_hello()
```

Visualizing Inheritance

Python has a function called `help` which can aid you in understanding what is being inherited. Add the following line of code after instantiating `hero` as an instance of the `Superhero` class.

```
hero = Superhero("Jessica Jones", 29, "private investigator")
print(help(Superhero))
print(hero.name)
print(hero.occupation)
```

You should see a visual representation of the `Superhero` class. The first section is `Method resolution order`. This shows the steps Python takes with inheritance. Python first starts with the `Superhero` class. So when you say `print(hero.name)`, Python will look to the `Superhero` class for the attribute `name`. This does not exist. So Python moves to the next step, which is the `Person` class. Since the `Person` class has a `name` attribute, Python can stop here. Notice too that the `say_name` and `say_age` methods are also inherited.

challenge

Try this variation:

- Print the result of using the `help` function on the `Person` class - `print(help(Person))`
  ▼ **Why does the `Person` class inherit from `builtins.object` class?**
  In Python, all classes inherit from the `objects` class. It is not necessary to write `class Person(object):` when declaring a class. Python will perform the inheritance automatically.

Super

The `super()` Keyword

Another way to call a method from the parent class (sometimes called the super class), is to use the `super()` keyword. Alter the end of the program to look like the following code.

```
class Superhero(Person):
  def say_hello(self):
    super().say_hello()

hero = Superhero("Wonder Woman", 27, "intelligence officer")
hero.say_hello()
```

The `Superhero` class has a method called `say_hello`. The `super()` keyword tells Python to go to the parent class; the `.say_hello()` tells Python to call this method. So `super().say_hello()` is calling `say_hello` from the `Person` class.

challenge

Try this variation:

- Declare the function `say_age` for the `Superhero` class using inheritance.

  ▼ **Solution**

```
class Superhero(Person):
  def say_hello(self):
    super().say_hello()

  def say_age(self):
    super().say_age()

hero = Superhero("Wonder Woman", 27, "intelligence officer")
hero.say_hello()
hero.say_age()
```

`super()` and `__init__`

If the `super()` keyword is used to call methods from the parent class, how come `super()` was not used with the `__init__` method? In fact, the `__init__` was never called in the `Superhero` class. A child class will automatically inherit the `__init__` method if it is not defined. `__init__` is called when an object is instantiated, and `super()` does not need to be used.

However, it is possible to create an `__init__` method for the `Superhero` class using `super()`. Later on, you will see the benefits of doing this. Change the code for `Superhero` to look like the code below. You should still be able to print the attributes just as before.

```
class Superhero(Person):
  def __init__(self, name, age, occupation):
    super().__init__(name, age, occupation)

hero = Superhero("Batman", 32, "CEO")
print(hero.name)
```

▼ **The lack of `self` in `super().__init__`**

When calling `super().__init__` the keyword `self` was not used. That is because you were not defining the **`init`** method of the parent class, you were calling it. Just like any other method in Python, `self` is the first parameter when you declare a method, but it is not used when call the method. This is the first time that we are explicitly called the **`init`** method. Usually this happens automatically when an object is instantiated.

challenge

Try this variation:

- Using the `super()` keyword, create the method `say_two_things` for the `Superhero` class. This method should print the name and age of the `hero` object.

  ▼ **Solution**

```
class Superhero(Person):
  def say_two_things(self):
    super().say_hello()
    super().say_age()

hero = Superhero("Rorschach", 34, "conspiracy theorist")
hero.say_two_things()
```

Inheritance Hierarchy

Inheritance Hierarchy

You have seen how the `Superhero` class becomes the child of the `Person` class though inheritance. The relationship between these two classes is called inheritance (or class) hierarchy. Python has some built-in functions to help you determine the hierarchy of classes.

The first function is `isinstance`. This function takes an object and a class name. It returns `True` if the object is an instance of the class. Look at the code on the left. `ClassA` is the parent of `ClassB`, and `ClassC` is the parent of `ClassD`. The `isinstance` function can be used to test these relationships. Add the following code to the program.

```
print(isinstance(object_b, ClassA))
print(isinstance(object_d, ClassC))
```

challenge

Try this variation:

- `print(isinstance(object_b, ClassC))`
- `print(isinstance(object_d, ClassA))`
- `print(isinstance(object_a, ClassA))`

Is a Subclass?

Another function that can be used to determine inheritance hierarchy is `issubclass`. This function takes a class and a class name. It returns true if the class is a subclass (or child) of the class name. This is very similar to `isinstance`, but the difference is important. `issubclass` checks to see if a class (not an object) is the child of another class. Add the following code to the program.

```
print(issubclass(ClassB, ClassA))
print(issubclass(ClassD, ClassC))
```

challenge

Try this variation:

- `print(issubclass(ClassD, ClassA))`
- `print(issubclass(ClassA, ClassB))`
- `print(issubclass(object_b, ClassA))`

  ▼ **What went wrong?**

  The last `print` statement produced an error because `issubclass` requires two classes as parameters. `object_b` is an instance of a class, not a class itself.

Parent & Child Classes Formative Assessment 1

Parent & Child Classes Formative Assessment 2