Welcome to this CoGrammar tutorial: Classes and Methods

The session will start shortly...

Questions? Drop them in the chat.
We'll have dedicated moderators answering questions.

Software Engineering Session Housekeeping

- For all **non-academic questions**, please submit a query: www.hyperiondev.com/support
- We would love your **feedback** on lectures: Feedback on Lectures

Software Engineering Session Housekeeping

- The use of disrespectful language is prohibited in the questions, this is a supportive, learning environment for all - please engage accordingly. **(Fundamental British Values: Mutual Respect and Tolerance)**
- No question is daft or silly - **ask them!**
- There are **Q&A sessions** midway and throughout the session, should you wish to ask any follow-up questions.
- If you have any questions outside of this lecture, or that are not answered during this lecture, please do submit these for upcoming Academic Sessions. You can submit these questions here: Questions

Safeguarding & Welfare

We are committed to all our students and staff feeling safe and happy; we want to make sure there is always someone you can turn to if you are worried about anything.

If you are feeling upset or unsafe, are worried about a friend, student or family member, or you feel like something isn't right, speak to our safeguarding team:

Ian Wyles
Designated Safeguarding Lead

Simone Botes

Rafiq Manan

Charlotte Witcher

Nurhaan Snyman

Ronald Munodawafa

Tevin Pitts

Scan to report a safeguarding concern

or email the Designated Safeguarding Lead:
Ian Wyles
safeguarding@hyperiondev.com

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Skills Bootcamp Progression Overview

To be eligible for a certificate of completion, students must fulfil three specific criteria. These criteria ensure a high standard of achievement and alignment with the requirements for the successful completion of a Skills Bootcamp.

✓ Criterion 1 - Meeting Initial Requirements

Criterion 1 involves specific achievements within the first two weeks of the program. To meet this criterion, students need to:

- Attend a minimum of 7-8 hours per week of guided learning (lectures, workshops, or mentor calls) within the initial two-week period, for a total minimum of 15 guided learning hours (GLH), by no later than 15 September 2024.
- Successfully complete the Initial Assessment by the end of the first 14 days, by no later than 15 September 2024.

Skills Bootcamp Progression Overview

✓ Criterion 2 - Demonstrating Mid-Course Progress

Criterion 2 involves demonstrating meaningful progress through the successful completion of tasks within the first half of the bootcamp.
To meet this criterion, students should:

- Complete 42 guided learning hours and the first half of the assigned tasks by the end of week 7, no later than 20 October 2024.

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Skills Bootcamp Progression Overview

✓ Criterion 3 - Demonstrating Post-Course Progress

Criterion 3 involves showcasing students' progress after completing the course.
To meet this criterion, students should:

- Complete all mandatory tasks before the bootcamp's end date. This includes any necessary resubmissions, no later than 22 December 2024.
- Achieve at least 84 guided learning hours by the end of the bootcamp, 22 December 2024.

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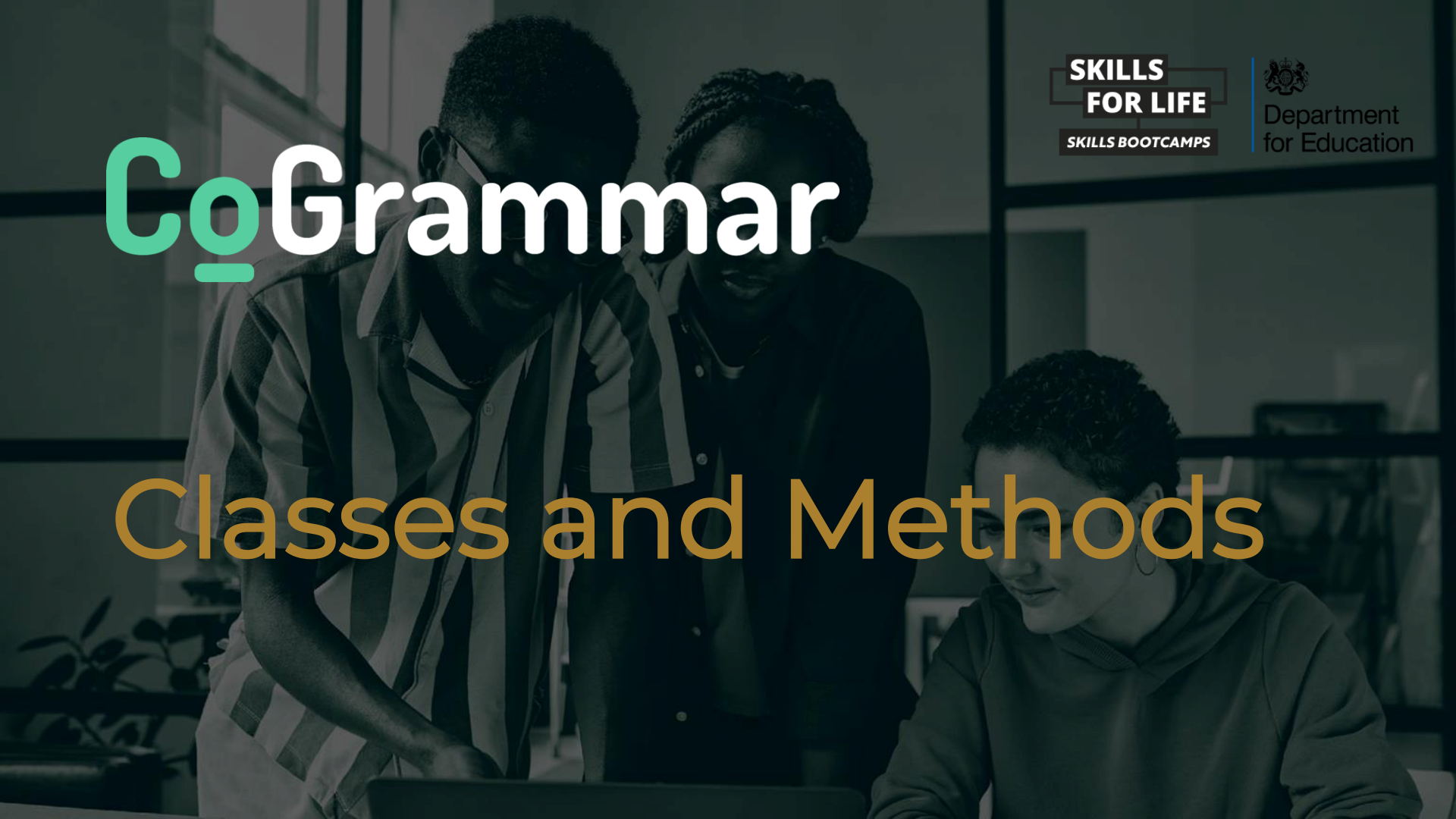
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Classes and Methods

Learning Outcomes

- Define a class and create instances (objects) of that class.
- Define and use attributes and methods in a class.
- Write constructors to set initial values for object attributes.
- Implement encapsulation by using private attributes and providing public methods to access and modify them.

Learning Outcomes

- Define and access class attributes.
- Define and access instance attributes.
- Define and call static methods using the @staticmethod decorator .
- Define and call class methods using the @classmethod decorator.

Classes

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Classes

- Classes are blueprints for creating objects. They define the properties and behaviours that objects of the class will have.
- Classes encapsulate data (attributes) and functionality (methods) into a single unit, facilitating code organisation and reuse.

Classes...

```
# Define the Car class
class Car:
    def __init__(self, brand, color):
        self.brand = brand
        self.color = color

    def drive(self):
        return f"The {self.color} {self.brand} is driving."
```

Attributes

- Attributes represent the state or characteristics of objects. They are the data associated with instances of the class and define what an object of that class looks like.
- Attributes can be variables that store data (instance variables) or methods (instance methods) that define behaviors.

```
# Define the Car class
class Car:
    def __init__(self, brand, color):
        self.brand = brand
        self.color = color
```

Methods

- Methods are functions defined within a class and they define the behaviours or actions that objects or instances of the class can perform.
- Methods operate on the data (attributes) associated with the class and provide the functionality to manipulate that data.
- Methods can be instance methods, static methods, or class methods.

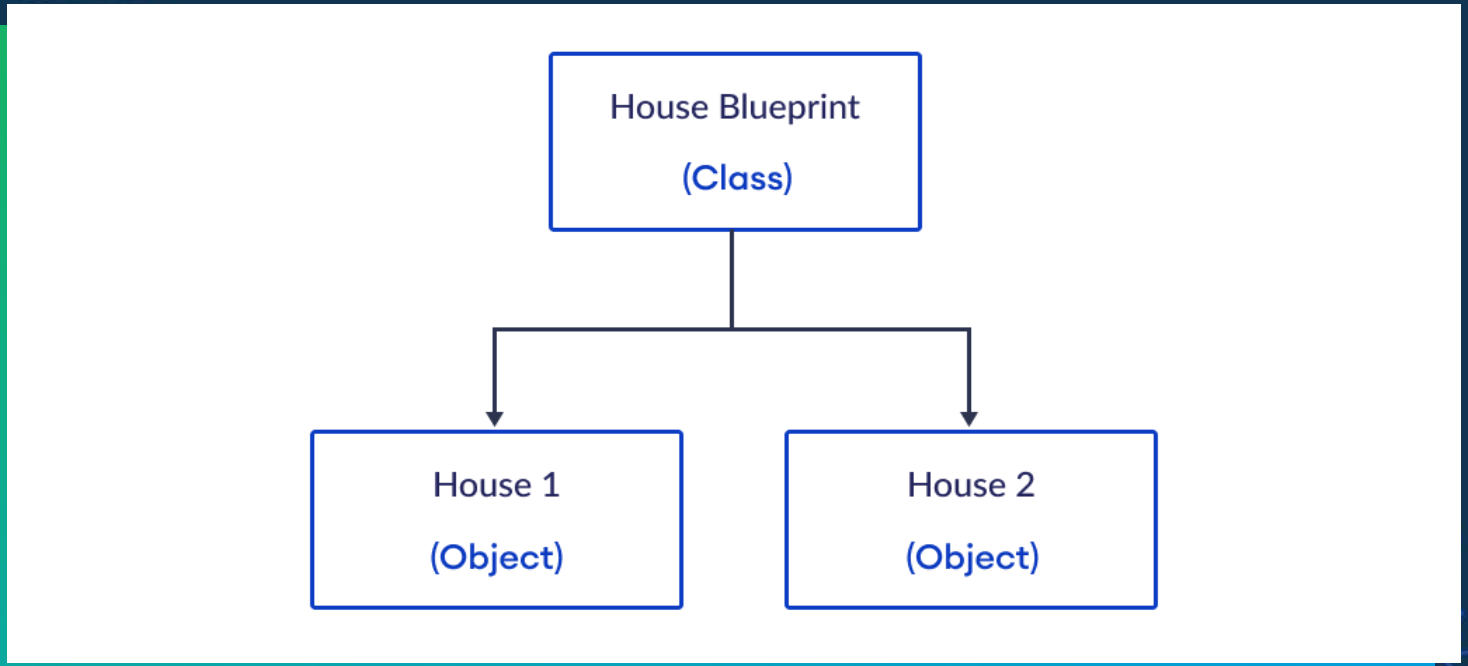
```
class Car:
    def drive(self):
        print("The car is driving.")
```

Objects

- An object is an instance of a class. It is a concrete realisation of the class blueprint, possessing its own unique set of attributes and methods.
- When you create an object, you are essentially creating a specific instance of that class with its own data and behaviour.

```
# Create an object (instance) of the Car class
my_car = Car("Toyota", "red")
```

Objects...



Access Control

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Encapsulation in OOP

- Encapsulation is the concept of bundling the data (attributes) and methods (functions) that operate on that data into a single unit, or class.
- By implementing encapsulation, we can restrict direct access to some of an object's components, promoting controlled access and data protection.
- The core principle here is that we want to hide the internal state of an object and only allow modification through well-defined methods (getters and setters).
- Getters refer to methods that read data and setters refer to methods that update data.

Access Control - Attributes

- Access control mechanisms (public, protected, private) restrict or allow the access of certain attributes within a class.

```python
class MyClass:
    def __init__(self):
        # Public attribute
        self.public_attribute = "I am public"

        # Protected attribute (by convention)
        self._protected_attribute = "I am protected"

        # Private attribute
        self.__private_attribute = "I am private"
```

Access Control - Methods

- Access control mechanisms (public, protected, private) can also restrict or allow the access of certain methods with in a class.

```
def public_method(self):
    return "This is a public method"

def _protected_method(self):
    return "This is a protected method"

def __private_method(self):
    return "This is a private method"
```

Applying the Access Control

```
# Create an instance of MyClass
obj = MyClass()

# Accessing public attributes and methods
print(obj.public_attribute)     # Output: I am public
print(obj.public_method())      # Output: This is a public method

# Accessing protected attributes and methods (not enforced, just a convention)
print(obj._protected_attribute)  # Output: I am protected
print(obj._protected_method())   # Output: This is a protected method

# Accessing private attributes and methods (name mangling applied)
# Note: It's still possible to access, but it's discouraged
print(obj._MyClass__private_attribute)  # Output: I am private
print(obj._MyClass__private_method())   # Output: This is a private method
```

Instance Methods

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Instance Methods

- Instance methods are like actions or behaviours that specific objects can perform.
- These methods have access to the object's data and are defined within the class.
- By using instance methods, we can model how objects interact and behave in our programs, making object-oriented programming a powerful way to structure our code.

Instance Methods - Example

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

    def study(self):
        print(f"{self.name} is studying hard!")

# Creating a student object
student1 = Student("Alice")

# Calling the instance method
student1.study()
```

Instance Methods - Example

- We define a Student class with an instance variable name to store the student's name.
- Inside the __init__ method (constructor), when a new Student object is created, we assign the provided name to the name instance variable.
- We define an instance method study() that uses the instance variable name to print a message indicating that the student is studying.
- We create an instance of the Student class (student1) with the name "Alice".
- Finally, we call the study() method on the student1 instance, and it prints "Alice is studying hard!".

Static Methods

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Static Methods

- Static methods are like standalone functions that live within a class.
- They're handy for grouping together related functionality without needing to access specific instance or class data.
- You mark them with the '@staticmethod' decorator to let Python know they're special.

Static Methods - Example

- We define a Car class with a static method honk().
- The honk() method doesn't require access to any specific instance or class variables, so it's marked as a static method using the @staticmethod decorator.
- We can call the static method directly on the class itself (Car.honk()), and it returns "Beep beep!", simulating the sound of a car horn.

```
class Car:
    @staticmethod
    def honk():
        return "Beep beep!"

# Calling the static method
print(Car.honk())  # Output: Beep beep!
```

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Class Methods

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Class Methods

- Class methods are like special functions that belong to the class itself.
- They're not tied to any particular instance but can do cool stuff with the class as a whole.
- You mark them with the '@classmethod' decorator and they get this fancy 'cls' parameter which stands for the class itself. It's a neat way to work with class-level stuff.

Class Methods - Example

```python
class Car:
    num_cars_sold = 0  # Class variable to keep track of the number of cars sold

    def __init__(self, brand):
        self.brand = brand
        Car.num_cars_sold += 1  # Increment the number of cars sold when a new car is created

    @classmethod
    def get_num_cars_sold(cls):
        return cls.num_cars_sold

# Creating instances of the Car class
car1 = Car("Toyota")
car2 = Car("Honda")

# Accessing the class method to get the number of cars sold
print(Car.get_num_cars_sold())  # Output: 2
```

Class Methods - Example

- We define a Car class with a class variable num_cars_sold to keep track of the number of cars sold.
- Inside the __init__ method (constructor), every time a new car object is created, we increment the num_cars_sold class variable.
- We define a class method get_num_cars_sold() using the @classmethod decorator, which returns the current number of cars sold.
- We create two instances of the Car class (car1 and car2).
- We then call the class method get_num_cars_sold() using the class name Car, and it returns the total number of cars sold, which is 2 in this case.

Let’s take a short break

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Demo Time!

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Conclusion and Recap

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Conclusion and Recap

- Classes: Blueprints for creating objects that encapsulate both data (attributes) and functionality (methods).
- Encapsulation: Classes group related attributes and methods, promoting code organisation and reusability.
- Instance Methods: Operate on individual objects and can access and modify instance attributes.
- Class Methods: Operate on the class itself and can modify class-level data. Defined using the @classmethod decorator.
- Static Methods: General utility methods that don't depend on class or instance data. Defined using the @staticmethod decorator.

Conclusion and Recap

Where You'll Use Classes and Methods:

- Web Development: Defining user accounts, products, and transactions as objects with related methods.
- Data Analysis: Classes represent data structures, and methods perform operations on them (e.g., filtering or calculating).
- Game Development: Characters, levels, and rules are modelled using classes, with methods dictating their actions and behaviours.

Questions and Answers

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Thank you for attending

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