

Welcome to the Lecture CoGrammar Classes II

The session will start shortly...

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

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** throughout this 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**](#)

Software Engineering Session Housekeeping cont.

- For all **non-academic questions**, please submit a query:
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- Report a **safeguarding** incident:
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- We would love your **feedback** on lectures: [Feedback on Lectures](#)
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Ian Wyles
Designated Safeguarding
Lead



Simone Botes



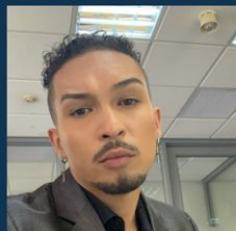
Nurhaan Snyman



Rafiq Manan



Ronald Munodawafa

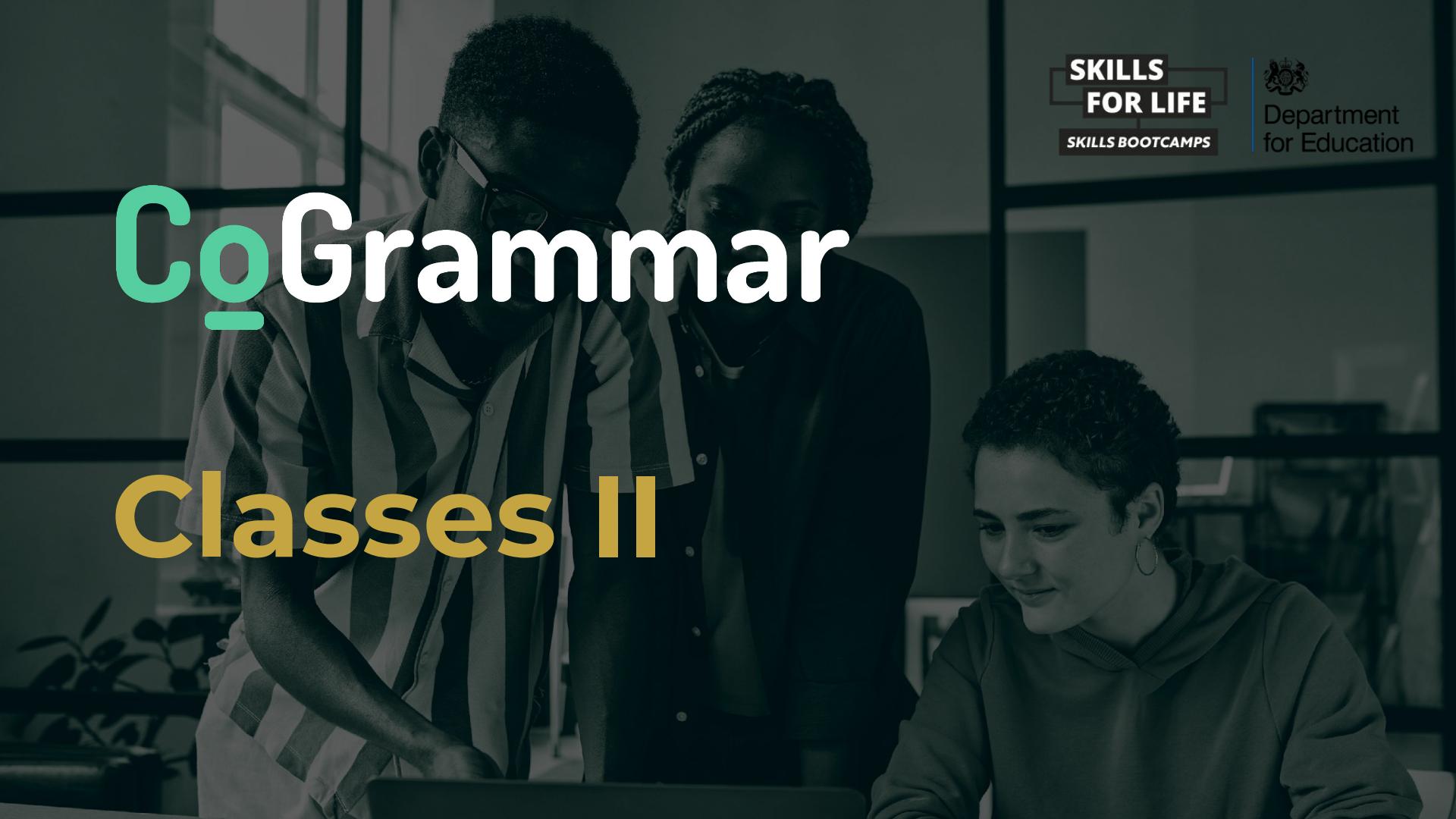


Tevin Pitts

**Scan to report a
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or email the Designated
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Ian Wyles
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A black and white photograph of three students in a classroom. In the foreground, a student with short hair and hoop earrings looks down at a laptop screen. Behind them, two other students are looking towards the camera. The student on the left wears glasses and a striped shirt, while the student on the right has braided hair and a dark jacket.

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Classes II

**SKILLS
FOR LIFE**
SKILLS BOOTCAMPS


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Poll

What is the role of the `__init__` method in a Python class?

- A. It is a destructor method used to clean up resources when an object is deleted.
- B. It is used to define class-level methods that can modify class attributes.
- C. It initialises object attributes when an object is created.

Poll

What is the purpose of the `@staticmethod` in the following code?

```
1 class Math:  
2     @staticmethod  
3     def add(a, b):  
4         return a + b  
5  
6 print(Math.add(3, 5))
```

- a. It allows the method to modify instance attributes.
- b. It allows the method to access class attributes.
- c. It allows the method to be called without creating an instance of the class.

Learning Objectives & Outcomes

- Define inheritance and its role in object-oriented programming.
- Define inheritance key components (base class, subclass, superclass).
- Implement and utilise the principles of inheritance within Python projects.
- Explain and implement method overriding.
- Utilise `super()` to access parent class methods.

Introduction

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Introduction

All Derived from **Basic Vehicle**



Basic Vehicle

1st Gen

2nd Gen

3rd Gen

4th Gen

What is Inheritance

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What is Inheritance?

- **Intuition and Definition:**
 - Sometimes we require a class with the same **attributes** and **properties** as another class but we want to **extend** some of the behaviour or add more attributes.
 - **Inheritance** is a fundamental concept in object-oriented programming where a **new class** (the subclass) is derived from an existing class (the superclass or base class), inheriting its **attributes** and methods.
- **Real-world analogy:**
 - Think of **biological inheritance** - children **inheriting** traits from their parents.

Building Better Software: The Advantages of Inheritance

- Why Use Inheritance?
 - **Code Reuse**: Inheritance allows for reuse of code from parent classes.
 - **Organized Structure**: Creates a clear hierarchical relationship between classes.
 - **Extensibility**: Enables easy extension and modification of existing classes without altering their code.

Building Better Software: The Advantages of Inheritance

- Real-world Example: Animal Kingdom
 - **Animal**: Parent class to all animals with common traits (e.g., eat, sleep).
 - **Dog**: Inherits from **Animal**, adding specific **Dog** traits (e.g., bark, breed).
- Advantages of Inheritance:
 - **Code Reuse**: Shared behaviors like **eating** and **sleeping** are defined once in **Animal**.
 - **Organized Structure**: Clear hierarchy (**Animal → Dog**) makes relationships easy to follow.
 - **Extensibility**: **Dog** adds unique traits without changing **Animal**.

Key Terms in Inheritance



Key Terminology in Inheritance

- **Superclass (Parent/Base Class)**: The class being inherited from.
- **Subclass (Child/Derived Class)**: The class inheriting from the superclass.
- **Inheritance Hierarchy**: The structure that shows the relationship between the parent and child classes.

Basic Inheritance Syntax in Python

Basic Inheritance Syntax

```
class ParentClass:  
    # Parent class code  
  
class ChildClass(ParentClass):  
    # Child class code
```

Basic Inheritance Example

```
class Animal: # Superclass  
    def __init__(self, number_of_legs):  
        self.number_of_legs = number_of_legs  
  
    def speak(self):  
        return "Animal sound"  
    def eat(self):  
        return "Animal is eating"
```

```
if __name__ == "__main__":  
    print(dog.speak())
```

```
mv dog = Dog(4)
```

Understanding Method Overriding

What is Method Overriding?

- Intuition and Definition:
 - We can override methods in our subclass to either extend or change the behaviour of a method.
 - **Method Overriding** The process of re-implementing a method already implemented in a superclass.
 - To apply method overriding, you simply need to define a method with the same name as the method you would like to override.
- Real-world analogy:
 - Think of the Dog subclass overrides the speak() method from the Animal superclass to provide a specific sound, like barking, instead of a generic sound.

Example of Method Overriding

```
class Animal:  
    def [speak](self):  
        # Base class method: generic sound for any animal  
        return "makes a sound"
```



Unleashing the Power of `super()` in Python

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```
def __init__(self, name, parent):
    self.name = name
    self.parent = parent
    self.children = []
    parent.add_child(self)

def add_child(self, child):
    child.parent = self
    self.children.append(child)

def __str__(self):
    return self.name

class Root:
    def __init__(self):
        self.nodes = []

    def add_node(self, node):
        self.nodes.append(node)

    def __str__(self):
        return "Root"

class Node:
    def __init__(self, name):
        self.name = name
        self.parent = None
        self.children = []

    def add_child(self, child):
        child.parent = self
        self.children.append(child)

    def __str__(self):
        return self.name

root = Root()
root.add_node(Node("A"))
root.add_node(Node("B"))
root.add_node(Node("C"))

node_A = root.nodes[0]
node_B = root.nodes[1]
node_C = root.nodes[2]

node_A.add_child(Node("D"))
node_A.add_child(Node("E"))
node_B.add_child(Node("F"))
node_B.add_child(Node("G"))
node_C.add_child(Node("H"))

print(root)
print(node_A)
print(node_B)
print(node_C)
print(node_A.children)
print(node_B.children)
print(node_C.children)
```

What is `super()`?

- Intuition and Definition:
 - When extending functionality of a **method** we would **first** want to call the **base class method** and then **add** the extended behaviour.
 - When adding more **instance attributes** to the **subclass** we have to call to the base class `__init__()` (**the Constructor**) to avoid having to **redeclare** all our base class attributes.
 - **super()** is a built-in function that allows a subclass to call methods from its superclass.

super(): Constructor Example

```
class Animal:  
    def __init__(self, name, age):  
        self.name = name # Initializes the 'name' attribute  
        self.age = age # Initializes the 'age' attribute
```

When to Use `super()` ?

- **Beyond Constructors:**
 - While `super()` is often used to call a parent class's constructor, its functionality extends beyond this. You can also use `super()` to call any parent class method that has been overridden in the subclass.
- **Why use `super()` with other functions?**
 - **Maintaining Parent Class Behavior:** Call the parent class's method to keep its original functionality.
 - **Avoiding Redundancy:** Reuse common code from the parent class.

super(): Example

```
class Animal:  
    def speak(self):  
        return "makes a sound"  
  
class Dog(Animal):  
    def speak(self):  
        # Calls the parent class's speak method and extends it  
        return super().speak() + " and barks"  
  
# Example usage:  
my_dog = Dog()  
print(my_dog.speak()) # Output: makes a sound and barks
```

Extending from the base class functionality

Calling from the base class

Poll

What will be the output of the following code?

```
1 class Vehicle:  
2     def start(self):  
3         return "Vehicle starting"  
4  
5 class Car(Vehicle):  
6     def start(self):  
7         return "Car starting"  
8  
9 my_car = Car()  
10 print(my_car.start())
```

1. Vehicle starting
2. Error: start() method is not defined
3. None
4. Car starting

Poll

What will be the output of the following code?

```
1 class Animal:
2     def __init__(self, name):
3         self.name = name
4
5 class Dog(Animal):
6     def __init__(self, name, breed):
7         super().__init__(name)
8         self.breed = breed
9
10 my_dog = Dog("Max", "Beagle")
11 print(my_dog.name)
12 print(my_dog.breed)
```

1. Max and Dog
2. Beagle and Dog
3. Max and Beagle
4. Error: super() cannot be used in the constructor

Lesson Conclusion and Recap

Recap the key concepts and techniques covered during the lesson.

- **Inheritance** allows a subclass to inherit attributes and methods from a superclass, enabling code reuse and structured organisation.
- **Superclass and Subclass**: The superclass (parent) provides the inherited properties, while the subclass (child) extends or modifies them.
- **Method Overriding**: Subclasses can override inherited methods to provide specific implementations, allowing customization.
- **super()**: The `super()` function allows subclasses to call methods from the superclass, often used in constructors or overridden methods.
- **Benefits**: Inheritance simplifies code by reusing functionality, enhancing extensibility, and maintaining a clear hierarchy.

Follow-up Activity: Vehicle Rental System

- **Objective:** To create a Vehicle Rental Service using inheritance, where each vehicle type (Car, Bike) can calculate its rental cost based on the number of days rented. The system should handle exceptions such as negative days and invalid input types.
- **Steps to Implement:**
 - **Base Class: Vehicle**
 - **Attributes:** make, model, year
 - Methods
 - `get_details()`
 - `rent()`
 - `calculate_rental_cost(days)`
 - **Subclasses: Car, Bike**
 - Inherit attributes and methods from `Vehicle`
 - Override `rent()` and `calculate_rental_cost()` for specific implementations
 - Handle exceptions for invalid input

Questions and Answers

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Thank you for attending



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