In Python, **class variables** and **instance variables** are used to store data within a class. However, they have different scopes and behaviors.

**1. Class Variables**

* Shared across all instances of the class.
* Defined inside the class but outside any instance methods.
* Any change made to a class variable affects all instances (unless overridden in an instance).

**Example:**

class Car:

wheels = 4 # Class variable (shared by all instances)

def \_\_init\_\_(self, brand):

self.brand = brand # Instance variable (specific to each instance)

# Create instances

car1 = Car("Toyota")

car2 = Car("Honda")

# Access class variable

print(car1.wheels) # Output: 4

print(car2.wheels) # Output: 4

# Change class variable

Car.wheels = 6

print(car1.wheels) # Output: 6

print(car2.wheels) # Output: 6

Here, changing Car.wheels affects all instances of the class.

**2. Instance Variables**

* Unique to each instance of a class.
* Defined inside the \_\_init\_\_ method using self.
* Changing an instance variable affects only that specific instance.

**Example:**

class Car:

wheels = 4 # Class variable

def \_\_init\_\_(self, brand):

self.brand = brand # Instance variable

# Create instances

car1 = Car("Toyota")

car2 = Car("Honda")

# Modify instance variable

car1.brand = "Ford"

print(car1.brand) # Output: Ford

print(car2.brand) # Output: Honda

# Modify class variable using an instance (not recommended)

car1.wheels = 6 # This creates a new instance variable for car1, not modifying the class variable

print(car1.wheels) # Output: 6 (only for car1)

print(car2.wheels) # Output: 4 (remains unchanged)

Here, car1.wheels = 6 does not change the class variable but creates an instance variable wheels for car1.

**Key Differences Between Class and Instance Variables**

| **Feature** | **Class Variable** | **Instance Variable** |
| --- | --- | --- |
| Scope | Shared across all instances | Unique to each instance |
| Defined In | Inside the class, outside methods | Inside the \_\_init\_\_ method |
| Accessed Using | ClassName.variable or self.variable | Only self.variable |
| Changes Affect | All instances (unless overridden) | Only the specific instance |
| Example | Car.wheels = 4 | self.brand = brand |

**Best Practices**

* Use class variables for properties that should be the same for all instances (e.g., pi in a Circle class).
* Use instance variables for properties that are unique to each object (e.g., name in a Person class).
* Be careful when modifying class variables using instances to avoid unintended behavior.