Lesson 4: Introduction to Object-Oriented Programming

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Lecture Goals

This lecture introduces the foundation of **Object-Oriented Programming (OOP)** in Java. By the end of this lesson, students should be able to:

- Understand the concept of objects and classes.
- Declare and create objects in Java.
- Define their own classes with fields and methods.
- Understand the role of constructors.

1 What is Object-Oriented Programming?

Java is an **object-oriented language**. This means programs consist of:

- **Objects** — things that have data (fields) and behavior (methods).
- **Classes** — blueprints or templates for creating objects.

2 Classes and Objects

A **class** defines what an object looks like and what it can do.

2.1 Example Class

```
class Person {
    String name;
    int age;

    void introduce() {
        System.out.println("Hello, my name is " + name);
    }
}
```

2.2 Creating Objects

To create an object, use the `new` keyword:

```
Person p = new Person();
p.name = "Anna";
p.age = 20;
p.introduce();
```

3 Constructors

A constructor initializes the object when it is created.

```
class Person {
    String name;
    int age;

    // Constructor
    Person(String n, int a) {
        name = n;
        age = a;
    }

    void introduce() {
        System.out.println("Hello, my name is " + name);
    }
}

class Main {
    public static void main(String[] args) {
        Person p = new Person("Adam", 25);
        p.introduce();
    }
}
```

4 Example: A Simple Bank Account

```
class BankAccount {
    String owner;
    double balance;

    BankAccount(String ownerName, double initialBalance) {
        owner = ownerName;
        balance = initialBalance;
    }

    void deposit(double amount) {
        balance += amount;
    }
```

```
    void withdraw(double amount) {
        balance -= amount;
    }

    void display() {
        System.out.println(owner + "'s balance: " + balance);
    }
}

class Main {
    public static void main(String[] args) {
        BankAccount account = new BankAccount("Alice", 500.0);
        account.deposit(150.0);
        account.withdraw(50.0);
        account.display();
    }
}
```

Summary

In this lecture, you learned:

- Classes define data (fields) and behavior (methods).
- Objects are created from classes using `new`.
- Constructors initialize object values.

5 Exercises

1. Create a class `Car` with fields `brand`, `year`, and a method `showInfo()`.
2. Add a constructor to `Car` that assigns values to all fields.
3. Create a program that creates 3 different cars and prints their details.
4. Write a class `Rectangle` with methods `area()` and `perimeter()`.
5. Create a class `Student` with a field `grades` (array of integers) and a method `average()`.
6. Write a class `Counter` that has a private integer value and methods to `increment()`, `decrement()`, and `getValue()`.
7. Challenge: Create a class `Book` with a method `isLong()` that returns true if the number of pages is over 300.
8. Challenge: Write a class `Circle` that has a radius and methods `area()` and `circumference()`.