Experiment - 2

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Semester: 5th **Date of Performance:**13/8/25
Subject Name: Project Based Learning in Java
Subject Code: 23CSH-304

Aim: To develop Java programs to manage product details, library systems, and student information using classes, inheritance, and abstraction.

Easy-level Problem-

Aim: To write a Java program to create a Product class with attributes id,name and price.The program should:
- Demonstrate the use of constructors and methods to display product details.

Objective: To understand use of classes, constructors and methods in Java using concepts like Java class definition, constructor and method usage.

Procedure:

1. Define a class named 'Product' with attributes 'id', 'name' and 'price'.
2. Use a parameterized constructor to initialize these attributes.
3. Define a method 'displayDetails()' to print product information.
4. In the main method, create an object and display its details.

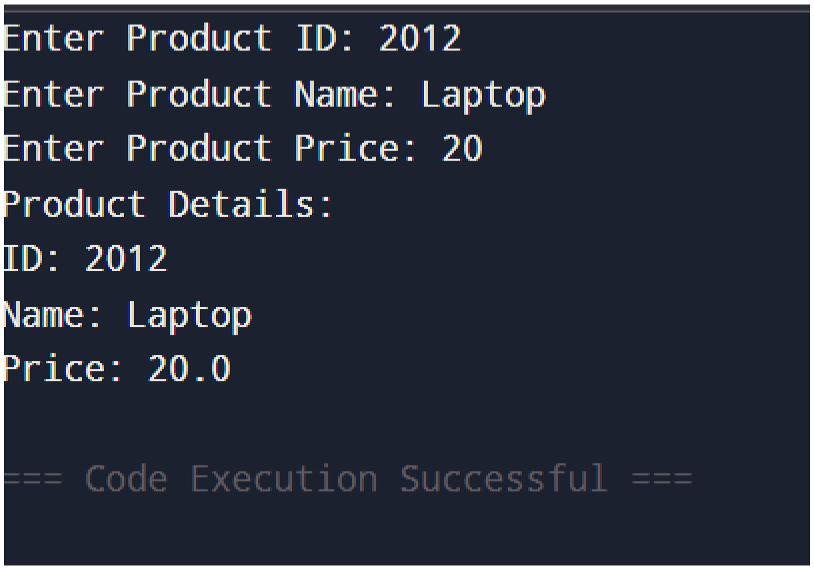
Sample Input Product
ID: 2012
Name: Laptop
Price: 20

Sample Output -
```
Product Details:
ID: 2012
Name: Laptop
Price: 20
```

Code -

```
import java.util.Scanner;

class Product {
    int id;
    String name;
    double price;

    Product(int id, String name, double price) {
        this.id = id;
        this.name = name;
        this.price = price;
    }

    void displayDetails() {
        System.out.println("Product Details:");
        System.out.println("ID: " + id);
        System.out.println("Name: " + name);
        System.out.println("Price: " + price);
    }
}

public class Main {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);

        System.out.print("Enter Product ID: ");
        int id = sc.nextInt();
        sc.nextLine();
        System.out.print("Enter Product Name: ");
        String name = sc.nextLine();
        System.out.print("Enter Product Price: ");
        double price = sc.nextDouble();

        Product p = new Product(id, name, price);
        p.displayDetails();

        sc.close();
    }
}
```

Output -



```
Enter Product ID: 2012
Enter Product Name: Laptop
Enter Product Price: 20
Product Details:
ID: 2012
Name: Laptop
Price: 20.0

=== Code Execution Successful ===
```

<u>Medium- Level Problem </u>-

Aim : To write a Java program to implement a library management system. The program should :
- Use a base class Book and derived classse Fiction and NonFiction.

Objective: Understand inheritance and dynamic method invocation in Java using concepts of Java inheritance using base and derived classes.

Procedure:

1. Define a base class 'Book' with common attributes like title,author and price. 2. Create two derived classes: 'Fiction' and 'NonFiction' extending the 'Book' class.
3. Override method in each subclass to display respective book details.
4. Instantiate objects of each subclass and invoke their display methods.

Sample Input :
Book 1:
Type: Fiction
Title: Harry Potter and the Order of the Phoenix
Author: J.K. Rowling
Price: 500

Book 2:
Type: Non-Fiction
Title: Sapiens
Author: Yuval Noah Harari
Price: 700

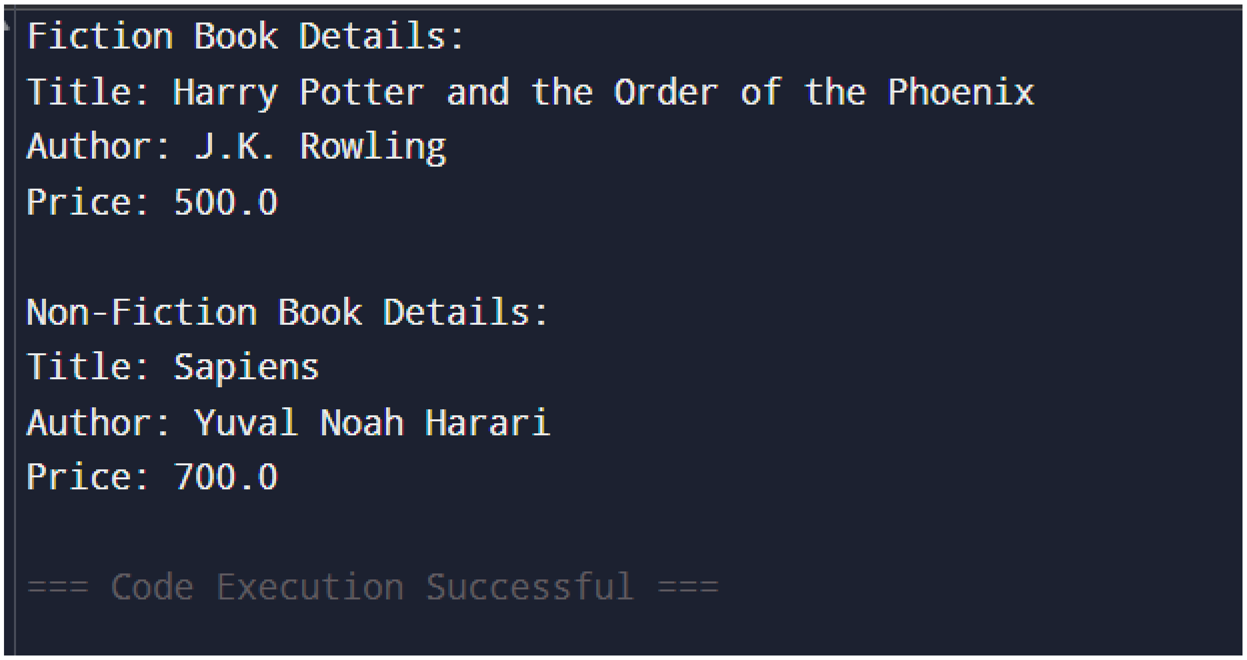
Sample Output:

```
Fiction Book Details:
Title: Harry Potter and the Order of the Phoenix
Author: J.K. Rowling
Price: 500

Non-Fiction Book Details:
Title: Sapiens
Author: Yuval Noah Harari

Price: 700
```

Code :

```
class Book {
    String title;
    String author;
    double price;

    Book(String title, String author, double price) {
        this.title = title;
        this.author = author;
        this.price = price;
    }

    void displayDetails() {
        System.out.println("Book Details:");
    }
}

class Fiction extends Book {
    Fiction(String title, String author, double price) {
        super(title, author, price);
    }
    @Override
    void displayDetails() {
        System.out.println("Fiction Book Details:");
        System.out.println("Title: " + title);
        System.out.println("Author: " + author);
        System.out.println("Price: " + price);
    }
}

class NonFiction extends Book {
    NonFiction(String title, String author, double price) {
        super(title, author, price);
    }

    @Override
    void displayDetails() {
        System.out.println("Non-Fiction Book Details:");
        System.out.println("Title: " + title);
        System.out.println("Author: " + author);
        System.out.println("Price: " + price);
    }
}

public class Main {
    public static void main(String[] args) {
        Fiction f = new Fiction("Harry Potter and the Order of the Phoenix", "J.K.
Rowling", 500);
        NonFiction nf = new NonFiction("Sapiens", "Yuval Noah Harari", 700);

        f.displayDetails();
        System.out.println();
        nf.displayDetails();
    }
}
```

Output:



```
Fiction Book Details:
Title: Harry Potter and the Order of the Phoenix
Author: J.K. Rowling
Price: 500.0

Non-Fiction Book Details:
Title: Sapiens
Author: Yuval Noah Harari
Price: 700.0


=== Code Execution Successful ===
```

Hard -level Problem-

Aim : To design a student information system using Java with following features:
- Use an abstract class Person with attributes name,age and methods like displayDetails().
- Create derived classes Student and Teacher to override displayDetails() and add unique attributes like rollNumber for students and subject for teachers.

Objective: Demonstrate abstraction and polymorphism using abstract classes and derived classes using Java concepts of abstract classes, inheritance and overriding .
Procedure:
1. Define an abstract class ‘Person’ with attributes ‘name’ and ‘age’, and an abstract method ‘displayDetails()’.
2. Create a ‘Student’ class extending ‘Person’ , with an additional attribute ‘rollNumber’, and implement ‘displayDetails()’.
3. Create a ‘Teacher’ class extending ‘Person’ with an additional attribute ‘subject’ and implement ‘displayDetails()’.
4. In the main method, create objects of ‘Student’ and ‘Teacher’ and invoke ‘displayDetails()’ on each.

Sample Input:
Add Student:
Name: Alice
Age: 20 Roll
Number: 101

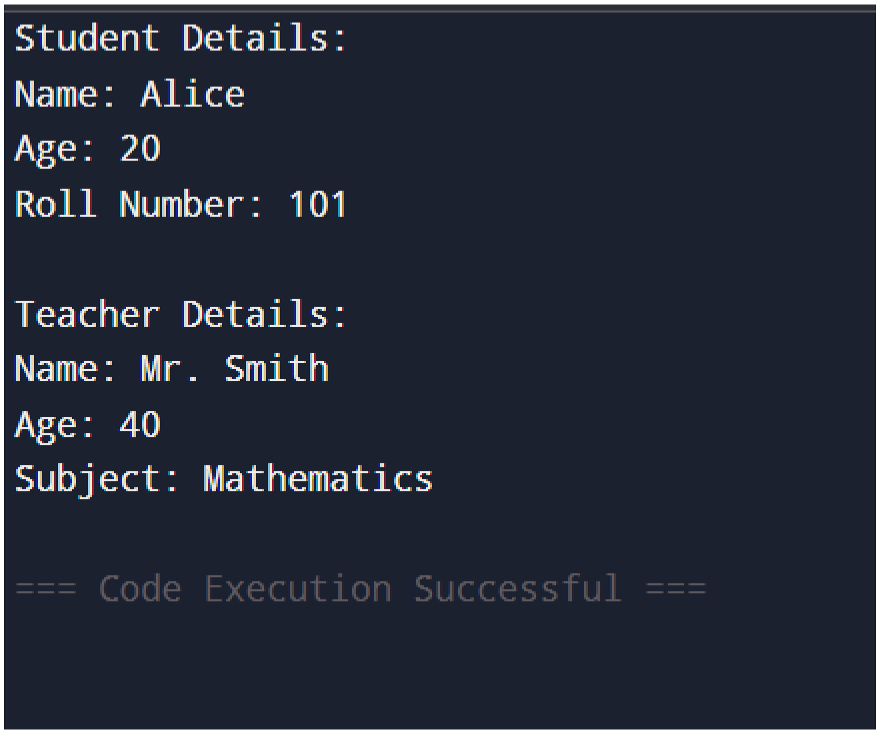
Add Teacher:
Name: Mr. Smith
Age: 40
Subject: Mathematics

Sample Output:
Student Details:
Name: Alice
Age: 20 Roll
Number: 101

Teacher Details:
Name: Mr. Smith
Age: 40
Subject: Mathematics
Code :

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

    Person(String name, int age) {
        this.name = name;
        this.age = age;
    }

    abstract void displayDetails();
}

class Student extends Person {
    int rollNumber;

    Student(String name, int age, int rollNumber) {
        super(name, age);
        this.rollNumber = rollNumber;
    }

    @Override
    void displayDetails() {
        System.out.println("Student Details:");
        System.out.println("Name: " + name);
        System.out.println("Age: " + age);
        System.out.println("Roll Number: " + rollNumber);
    }
}

class Teacher extends Person {
    String subject;

    Teacher(String name, int age, String subject) {
        super(name, age);
        this.subject = subject;
    }

    @Override
    void displayDetails() {
        System.out.println("Teacher Details:");
        System.out.println("Name: " + name);
        System.out.println("Age: " + age);
        System.out.println("Subject: " + subject);
    }
}

public class Main {
    public static void main(String[] args) {
        Student s = new Student("Alice", 20, 101);
        Teacher t = new Teacher("Mr. Smith", 40, "Mathematics");

        s.displayDetails();
        System.out.println();
        t.displayDetails();
    }
}
```

Output:



```
Student Details:
Name: Alice
Age: 20
Roll Number: 101

Teacher Details:
Name: Mr. Smith
Age: 40
Subject: Mathematics

=== Code Execution Successful ===
```