



Experiment 2

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Semester: 5th
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Date of Performance: 13/08/25
Subject Code: 23CSH-304

1. Aim:

To design and implement Java programs for managing product details, library systems, and student information using classes, inheritance, and abstraction.

- **◆ Part A – Easy Level:**
 - To create a Product class with attributes and constructors, and display product details.
- **◆ Part B – Medium Level:**
 - To implement a library management system using a base class Book and derived classes Fiction and NonFiction.
- **◆ Part C – Hard Level:**
 - To design a student information system using abstraction with an abstract class Person, and subclasses Student and Teacher.

2. Objective:

- ✓ To understand the use of classes, objects, constructors, and methods in Java.
- ✓ To apply object-oriented concepts for modeling real-world entities like products, books, students, and teachers.
- ✓ To demonstrate inheritance by extending a base class (Book) into derived classes (Fiction and NonFiction).
- ✓ To implement dynamic method invocation (runtime polymorphism) through method overriding in subclasses.
- ✓ To apply abstraction using an abstract class (Person) and enforce implementation of abstract methods in derived classes.
- ✓ To strengthen Java programming skills by combining classes, inheritance, and abstraction into practical applications.

3. JAVA script and output:

EASY-LEVEL PROBLEM

```
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 ProductDemo {
    public static void main(String[] args) {
        Scanner sc = new Scanner(System.in);
        System.out.print("Product ID: ");
        int id = sc.nextInt();
        sc.nextLine();
        System.out.print("Name: ");
        String name = sc.nextLine();
        System.out.print("Price: ");
        double price = sc.nextDouble();

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



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Output:

```
Product ID: 234
Name: Rice
Price: 230
Product Details:
ID: 234
Name: Rice
Price: 230.0
BUILD SUCCESSFUL (total time: 20 seconds)
```

Figure 1: Easy Problem Output

MEDIUM LEVEL PROBLEM:

```
class Book {
    String title, 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);
    }

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



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

    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 LibrarySystem {

    public static void main(String[] args) {

        Fiction f = new Fiction("Harry Potter", "J.K. Rowling", 500);

        NonFiction nf = new NonFiction("A Room on the Roof ", "Ruskin Bond", 700);

        f.displayDetails();

        nf.displayDetails();

    }
}
```

Output:

```
Fiction Book Details:
Title: Harry Potter
Author: J.K. Rowling
Price: 500.0
Non-Fiction Book Details:
Title: A Room on the Roof
Author: Ruskin Bond
Price: 700.0
BUILD SUCCESSFUL (total time: 0 seconds)
```

Figure 2:Medium Level Output



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HARD LEVEL PROBLEM

```
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;
    }

    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;
    }

    void displayDetails() {
        System.out.println("Teacher Details:");
```



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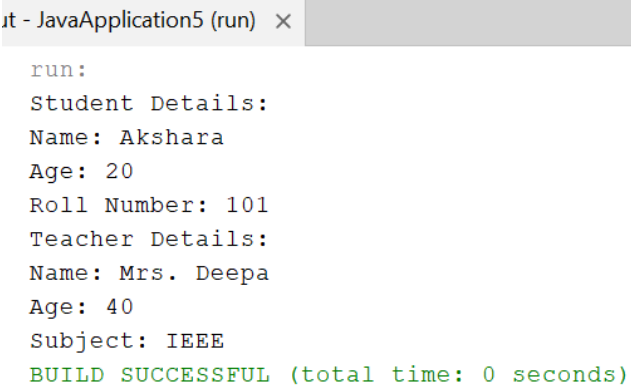
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```
        System.out.println("Name: " + name);
        System.out.println("Age: " + age);
        System.out.println("Subject: " + subject);
    }
}

public class StudentInfoSystem {
    public static void main(String[] args) {
        Student s = new Student("Akshara", 20, 101);
        Teacher t = new Teacher("Mrs. Deepa", 40, "IEEE");

        s.displayDetails();
        t.displayDetails();
    }
}
```

Output:

A screenshot of a Java application window titled 'JavaApplication5 (run)'. The window shows the output of the program, which includes the details of a student and a teacher. The output is as follows:

```
run:
Student Details:
Name: Akshara
Age: 20
Roll Number: 101
Teacher Details:
Name: Mrs. Deepa
Age: 40
Subject: IEEE
BUILD SUCCESSFUL (total time: 0 seconds)
```

Figure 3:Hard level Problem Output