# Experiment 2

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## 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();
    }
}
```

**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);
    }
}
```

```
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*

**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:");
```

```
        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("Alice", 20, 101);
        Teacher t = new Teacher("Mr. Smith", 40, "Mathematics");

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

**Output:**

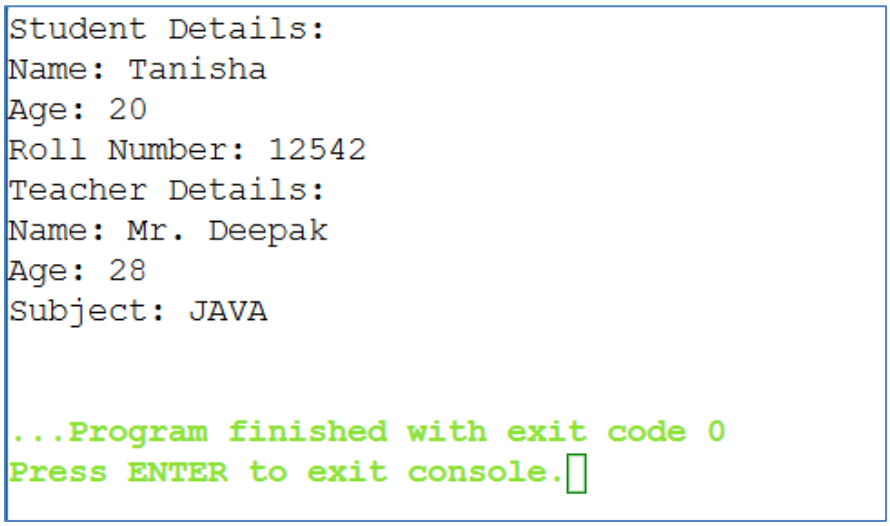


*Figure 3:Hard level Problem Output*