LAB RECORD

23CSE111- Object Oriented Programming

Submitted by

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BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING

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AMRITA SCHOOL OF COMPUTING

CHENNAI

March - 2025

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AMRITA SCHOOL OF COMPUTING, CHENNAI

BONAFIDE CERTIFICATE

This is to certify that the Lab Record work for 23CSE111-Object Oriented Programming Subject submitted by ***CH.SC.U4CSE24161 – DHUSYANTH R*** in **"Computer Science and Engineering"** is a Bonafide record of the work carried out under my guidance and supervision at Amrita School of Computing, Chennai.

This Lab examination held on 08 /03 /2025

Internal Examiner 1 Internal Examiner 2

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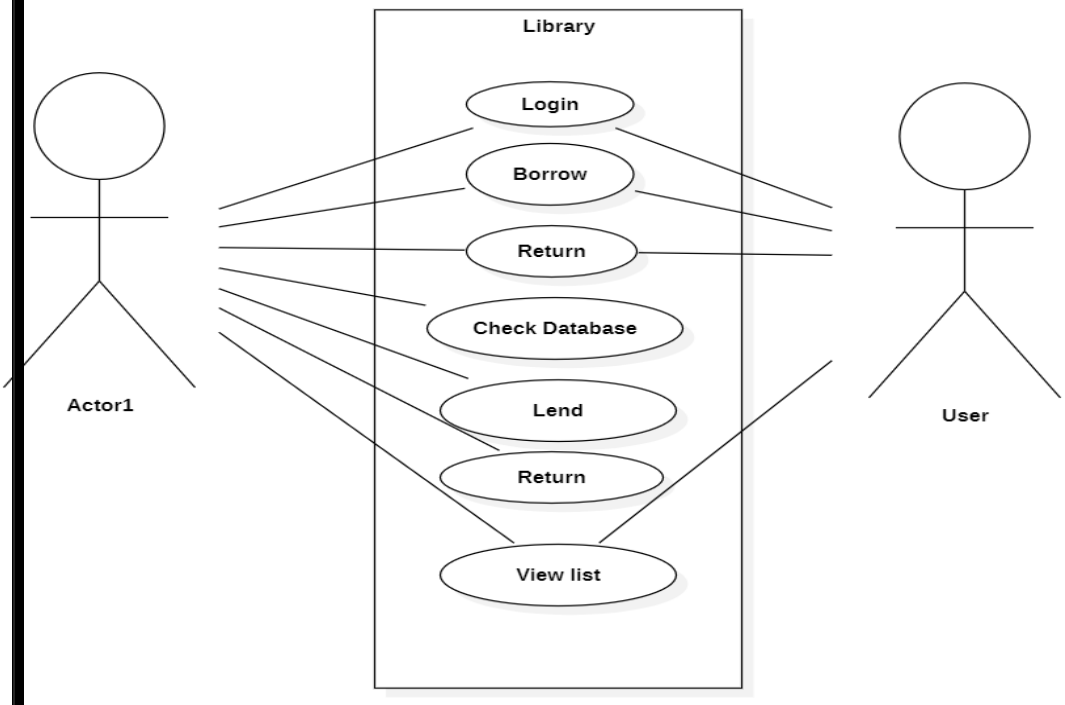
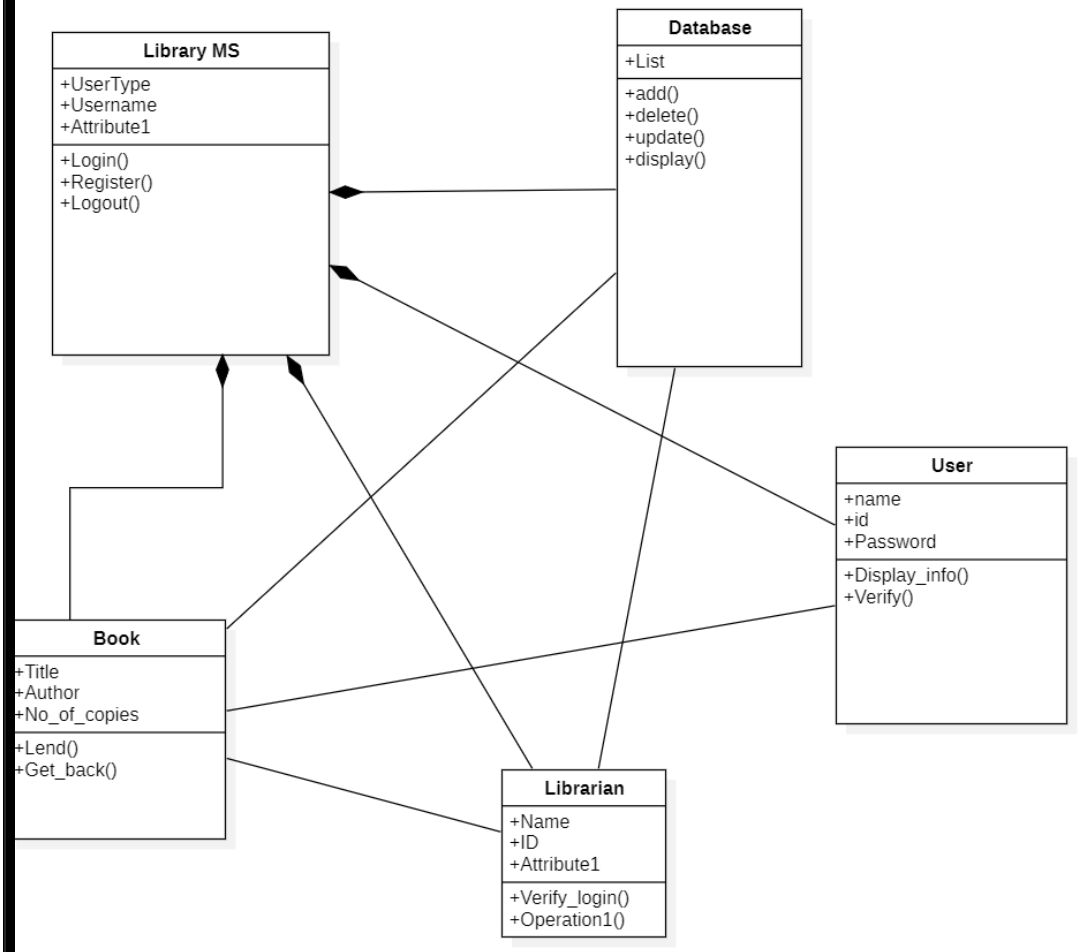
UML DIAGRAMS

LIBRARY MANAGEMENT SYSTEM

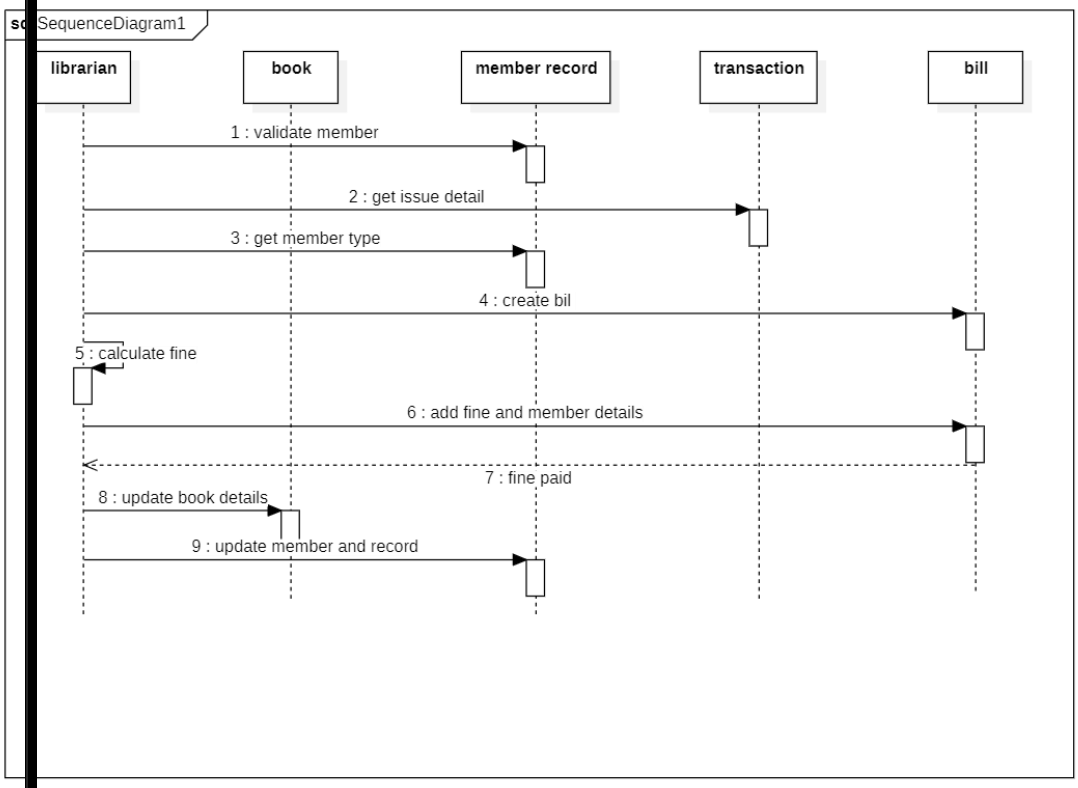
1.a) Use Case Diagram:



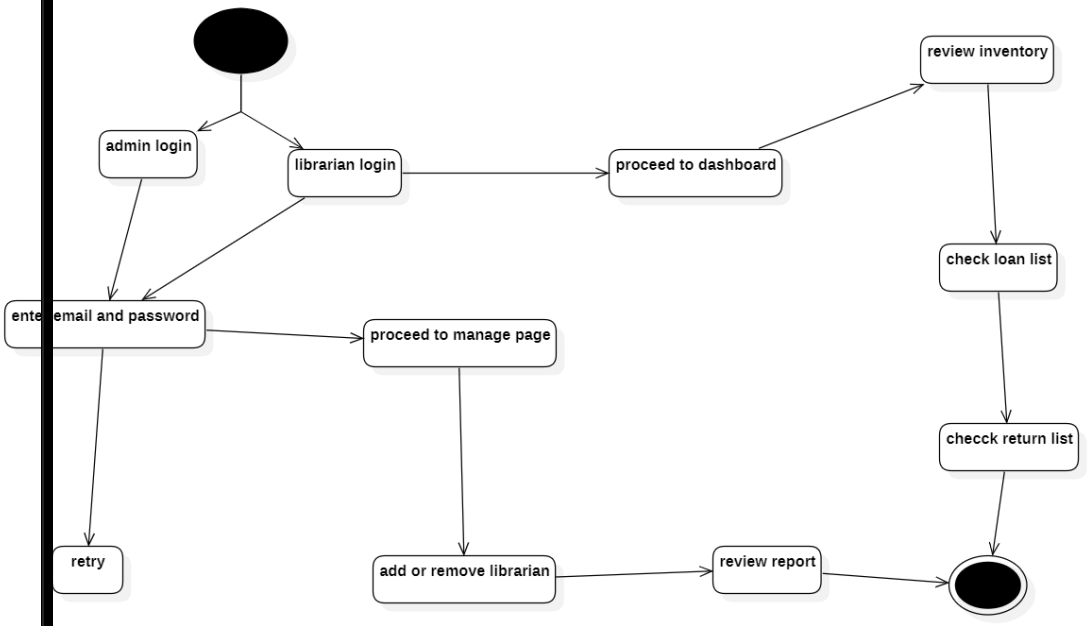
1.b) Class Diagram:



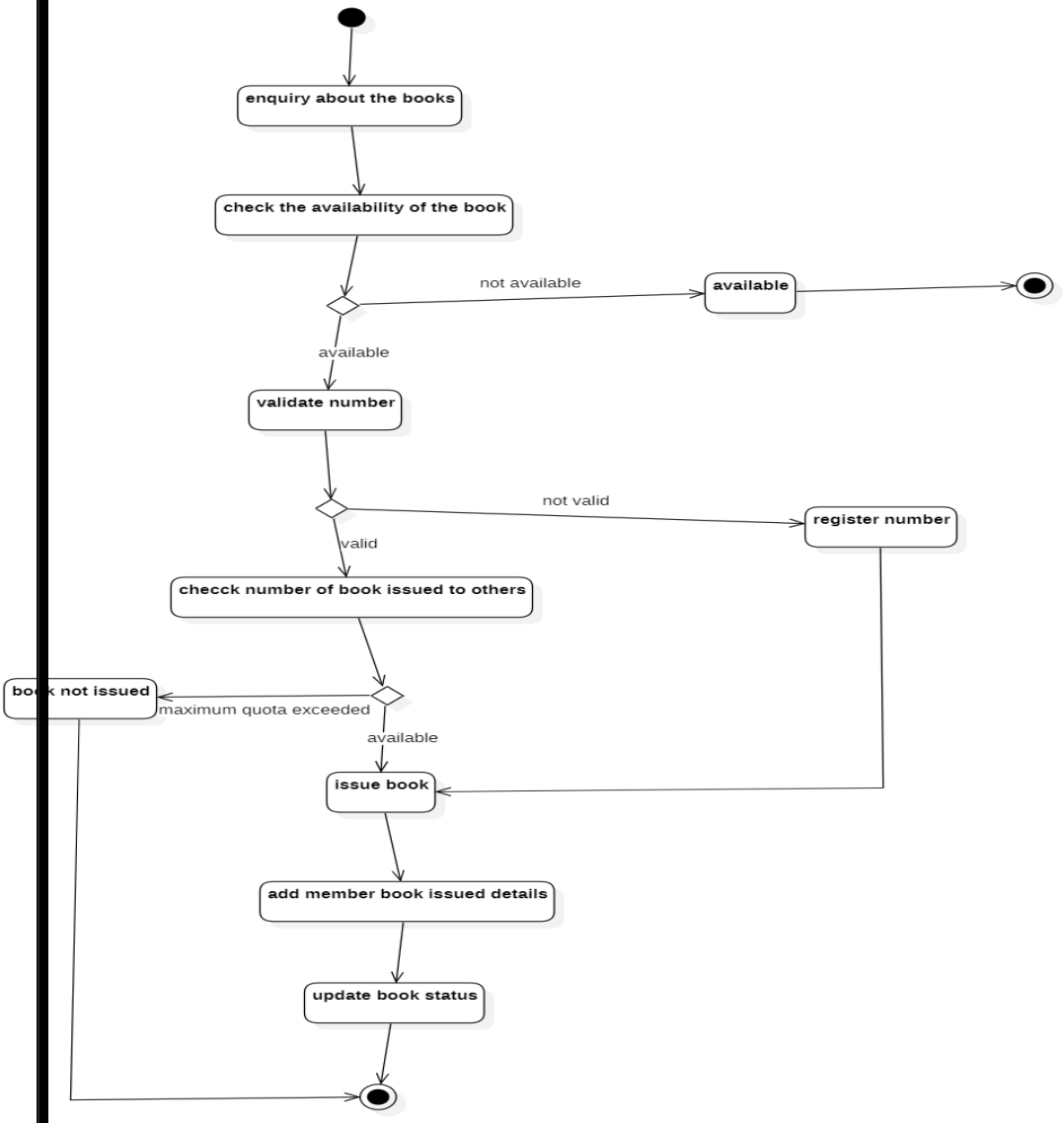
1.c) Sequence Diagram:



1.d) STATE Diagram:

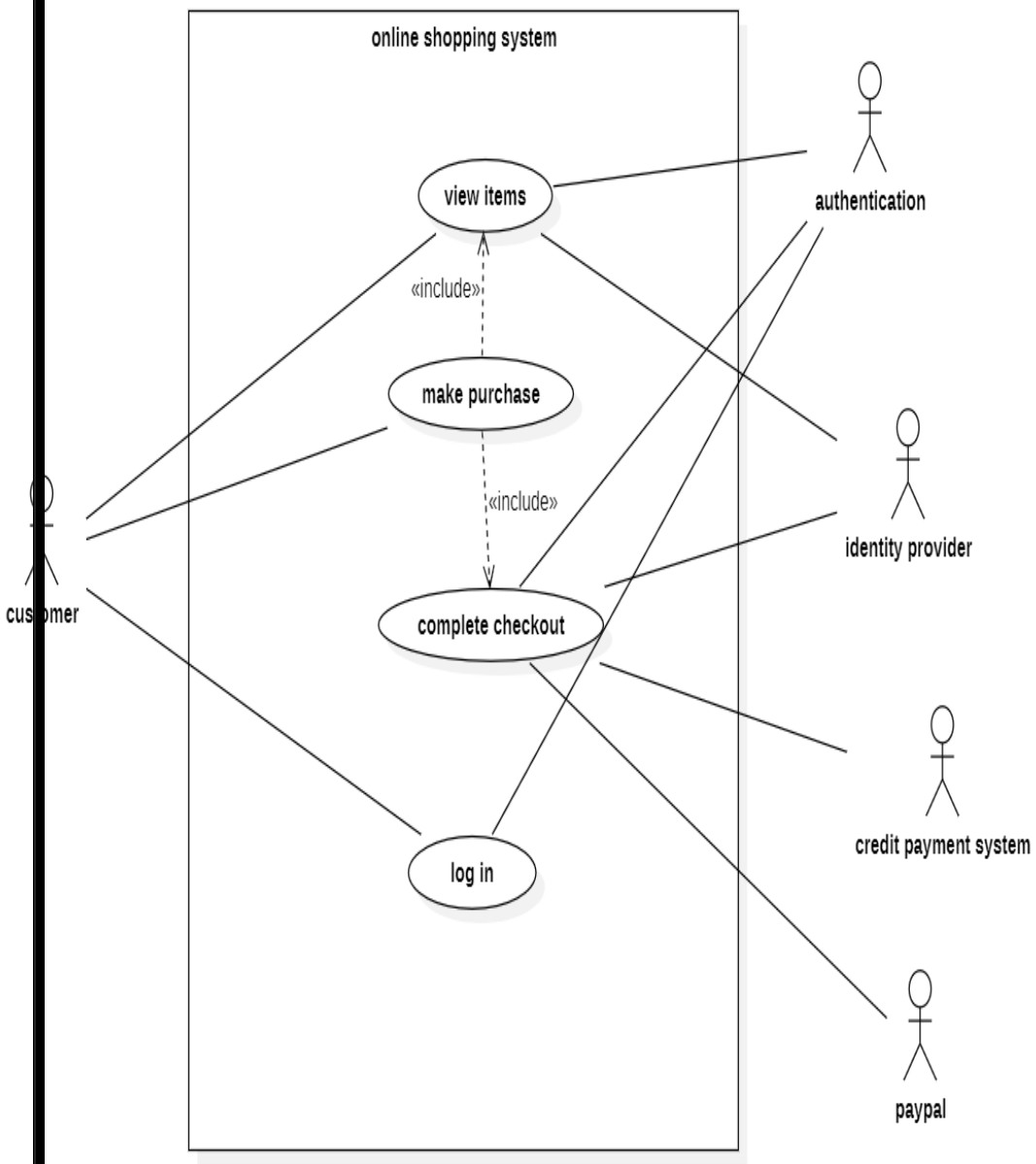


1.e) Activity Diagram:

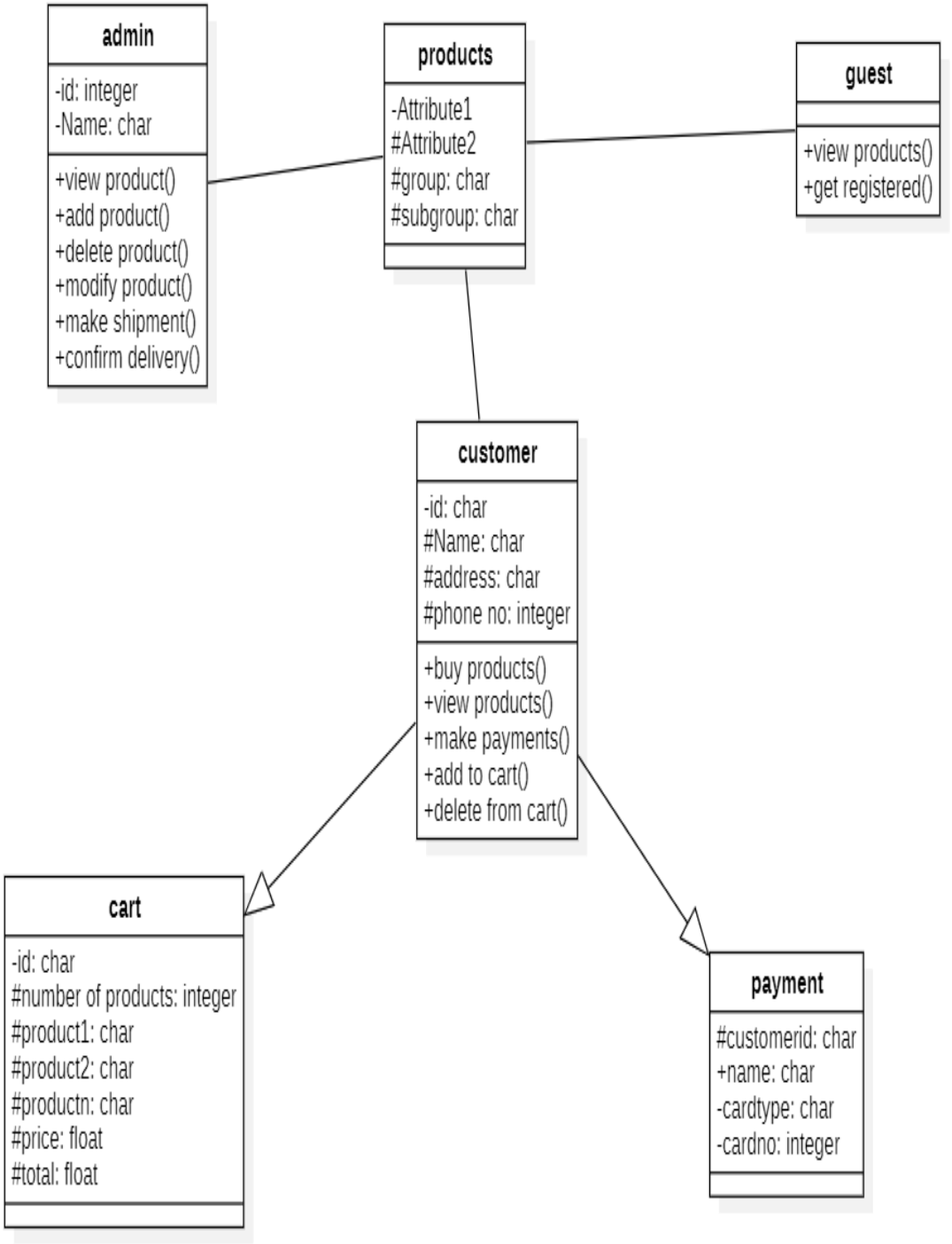


2.ONLINE SHOPPING SYSTEM

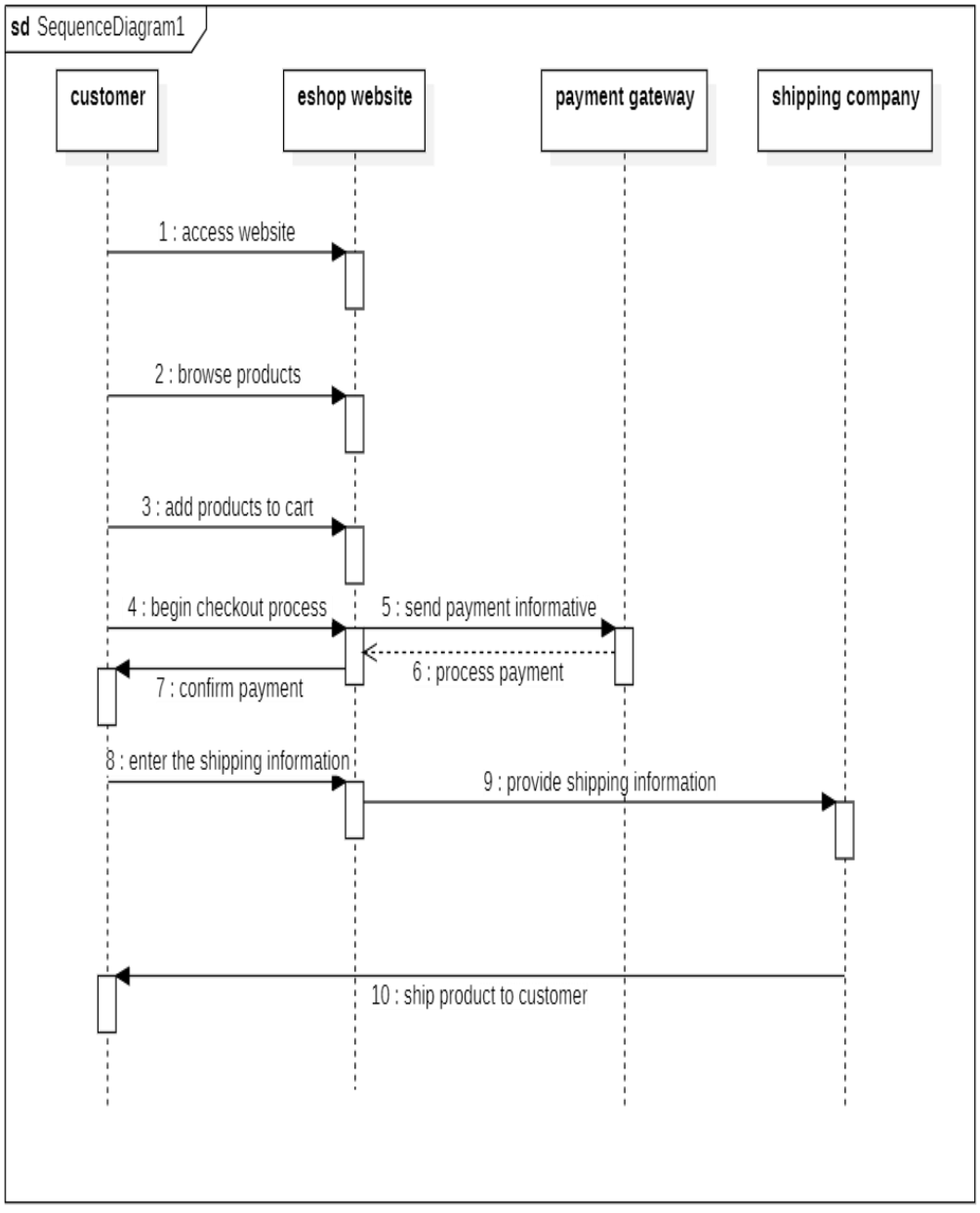
2.a) Use Case Diagram:



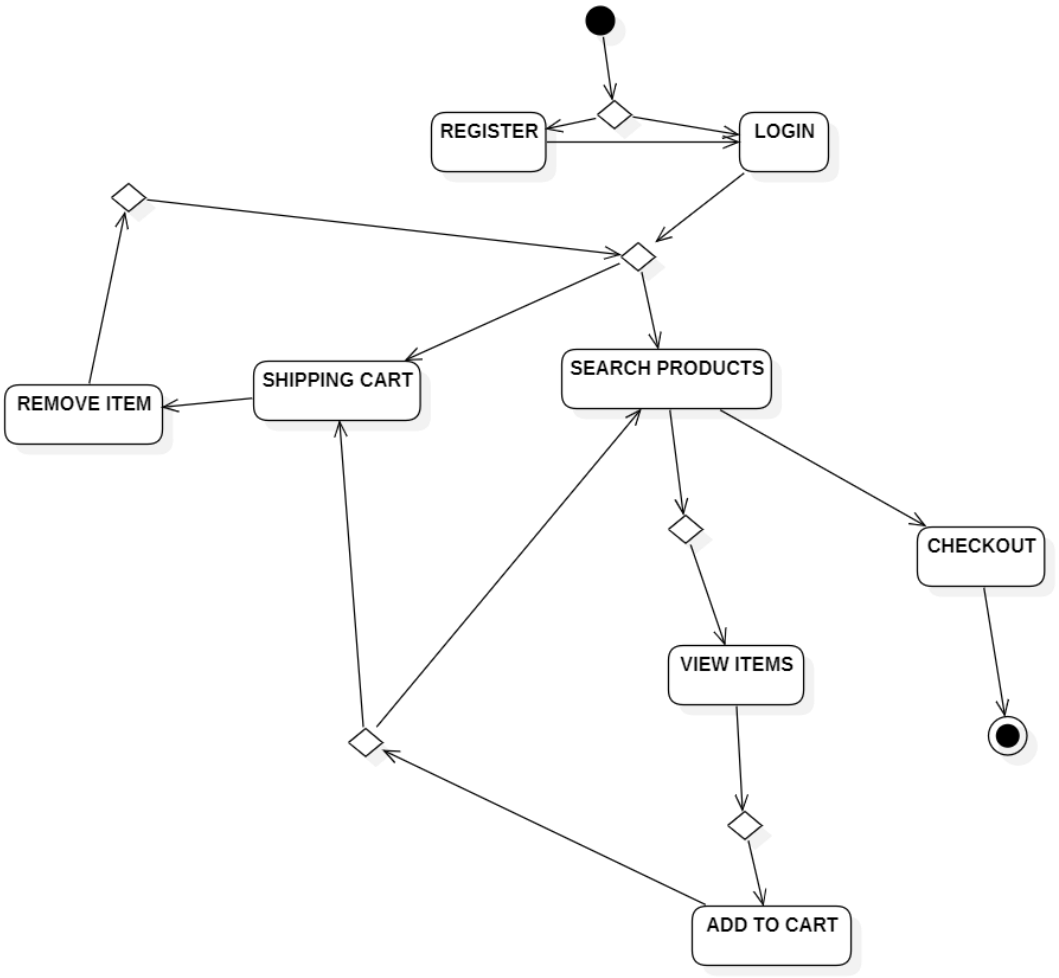
2.b) Class Diagram:



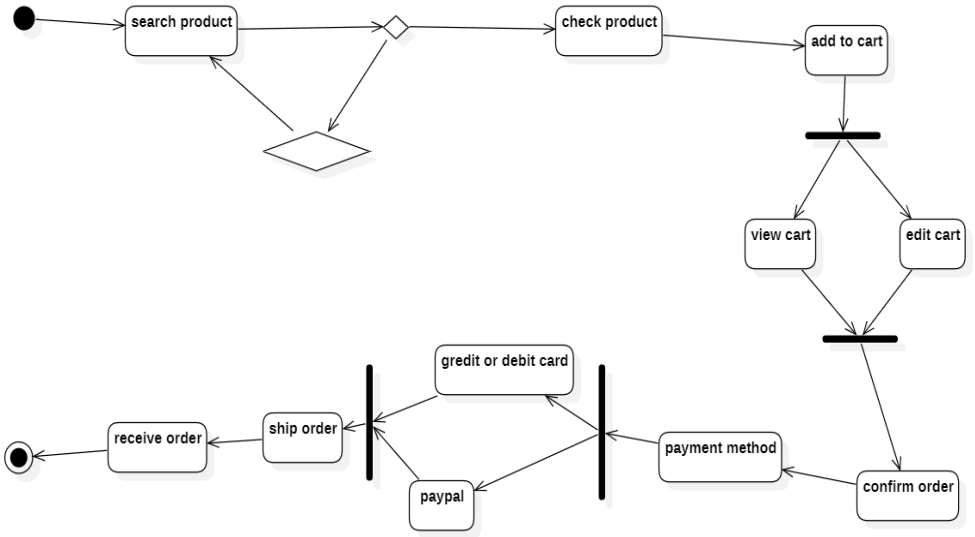
2.c) Sequence Diagram:



2.d) STATE-DIAGRAM:



2.e) Activity Diagram:

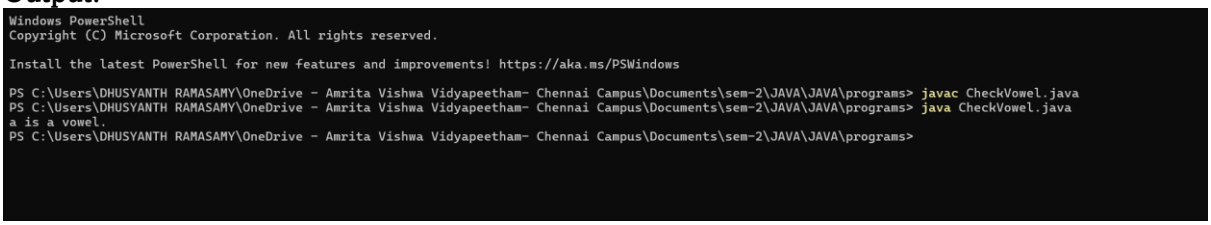


3.BASIC JAVA PROGRAMS

1.) Check vowel:

```
public class CheckVowel {
    public static void main(String[] args) {
        char ch = 'a';
        if ("AEIOUaeiou".indexOf(ch) != -1) {
            System.out.println(ch + " is a vowel.");
        } else {
            System.out.println(ch + " is not a vowel.");
        }
    }
}
```

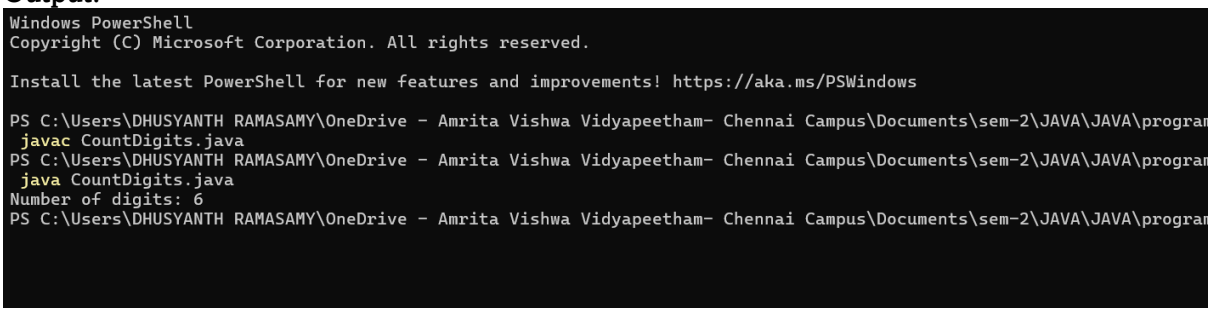
Output:



2.)count of digits:

```
public class CountDigits {
    public static void main(String[] args) {
        int num = 123456, count = 0;
        while (num != 0) {
            count++;
            num /= 10;
        }
        System.out.println("Number of digits: " + count);
    }
}
```

Output:



3.)count vowel:

```
public class CountVowel {
    public static void main(String[] args) {
        String str = "Hello World";
        int count = 0;
        for (char ch : str.toCharArray()) {
            if ("AEIOUaeiou".indexOf(ch) != -1) {
                count++;
            }
        }
        System.out.println("Number of vowels: " + count);
    }
}
```

Output:

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

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PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\progra
 javac CountVowel.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\progra
 java CountVowel.java
Number of vowels: 3
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\progra
```

4.)GCD:

```
public class GCD {
    public static void main(String[] args) {
        int a = 56, b = 98;
        while (b != 0) {
            int temp = b;
            b = a % b;
            a = temp;
        }
        System.out.println("GCD: " + a);
    }
}
```

Output:

```
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PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\p
 javac GCD.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\p
 java GCD.java
GCD: 14
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\p
```

5.)Largest three digit number:

```
public class LargestThreeDigitNumber {
    public static void main(String[] args) {
        System.out.println("Largest three-digit number: 999");
    }
}
```

Output:

```
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PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 javac LargestThreeDigitNumber.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 Java LargestThreeDigitNumber.java
Largest three-digit number: 999
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
```

6.)LCM:

```
public class LCM {
    public static void main(String[] args) {
        int a = 12, b = 18;
        int lcm = (a * b) / gcd(a, b);
        System.out.println("LCM: " + lcm);
    }

    private static int gcd(int x, int y) {
        while (y != 0) {
            int temp = y;
            y = x % y;
            x = temp;
        }
        return x;
    }
}
```

Output:

```
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PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 javac LCM.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 java LCM.java
LCM: 36
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
```

7.)leap year check:

```
public class LeapYearCheck {
    public static void main(String[] args) {
        int year = 2024;
        if ((year % 4 == 0 && year % 100 != 0) || (year % 400 == 0)) {
            System.out.println(year + " is a leap year.");
        } else {
            System.out.println(year + " is not a leap year.");
        }
    }
}
```

Output:

```
Windows PowerShell
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PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 javac LeapYearCheck.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 java LeapYearCheck.java
2024 is a leap year.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
```

8.)palindrome check:

```
public class PalindromeCheck {
    public static void main(String[] args) {
        String str = "madam", rev = "";
        for (int i = str.length() - 1; i >= 0; i--) {
            rev += str.charAt(i);
        }
        if (str.equals(rev)) {
            System.out.println(str + " is a palindrome.");
        } else {
            System.out.println(str + " is not a palindrome.");
        }
    }
}
```

Output:

```
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PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 javac PalindromCheck.java
error: file not found: PalindromCheck.java
Usage: javac <options> <source files>
use --help for a list of possible options
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 javac PalindromeCheck.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 java PalindromeCheck.java
madam is a palindrome.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
```

9.)ReverseString:

```
public class ReverseString {
    public static void main(String[] args) {
        String str = "hello", rev = "";
        for (int i = str.length() - 1; i >= 0; i--) {
            rev += str.charAt(i);
```

```
        }
        System.out.println("Reversed string: " + rev);
    }
}
```

Output:

```
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PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 javac ReverseString.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 java ReverseString.java
Reversed string: olleh
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
```

10.)Sum of digits:

```
public class SumOfDigits {
    public static void main(String[] args) {
        int num = 1234, sum = 0;
        while (num != 0) {
            sum += num % 10;
            num /= 10;
        }
        System.out.println("Sum of digits: " + sum);
    }
}
```

Output:

```
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PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 javac SumofDigits.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
 java SumofDigits.java
Sum of digits: 10
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\programs>
```

Inheritance

4.) **SINGLE INHERITANCE PROGRAMS:**

a.) **SINGLE INHERITANCE 1:**

```
class Parent {
   void display() {
      System.out.println("This is the parent class.");
   }
}

class Child extends Parent {
   void show() {
      System.out.println("This is the child class.");
   }
}

public class SingleInheritance1 {
   public static void main(String[] args) {
      Child obj = new Child();
      obj.display();
      obj.show();
   }
}
```

Output:

```
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PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> javac SingleInheritance1.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> java SingleInheritance1.java
This is the parent class.
This is the child class.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples>
```

b.) **SINGLE INHERITANCE 2:**

```
class Animal {
   void eat() {
      System.out.println("This animal eats food.");
```

```
    }
}

class Dog extends Animal {
    void bark() {
        System.out.println("The dog barks.");
    }
}

public class SingleInheritance2 {
    public static void main(String[] args) {
        Dog d = new Dog();
        d.eat();
        d.bark();
    }
}
```

Output:

```
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PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> javac SingleInheritance2.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> java SingleInheritance2.java
This animal eats food.
The dog barks.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples>
```

5.) MULTILEVEL INHERITANCE PROGRAMS:

a.) MULTILEVEL INHERITANCE 1:

```
    class Grandparent {
        void legacy() {
            System.out.println("Grandparent's legacy.");
        }
    }

    class Parent extends Grandparent {
        void guidance() {
```

```
        System.out.println("Parent's guidance.");
    }
}

class Child extends Parent {
    void future() {
        System.out.println("Child's future.");
    }
}

public class MultilevelInheritance1 {
    public static void main(String[] args) {
        Child c = new Child();
        c.legacy();
        c.guidance();
        c.future();
    }
}
```

Output:

```
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PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> javac MultilevelInheritance1.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> java MultilevelInheritance1.java
Grandparent's legacy.
Parent's guidance.
Child's future.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples>
```

b.) MULTILEVEL INHERITANCE 2:

```
class Animal {
    void live() {
        System.out.println("Animals live.");
```

```
    }
}

class Mammal extends Animal {
    void characteristics() {
        System.out.println("Mammals give birth to young ones.");
    }
}

class Human extends Mammal {
    void think() {
        System.out.println("Humans can think.");
    }
}

public class MultilevelInheritance2 {
    public static void main(String[] args) {
        Human h = new Human();
        h.live();
        h.characteristics();
        h.think();
    }
}
```

Output:

```
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PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> javac MultilevelInheritance2.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> java MultilevelInheritance2.java
Animals live.
Mammals give birth to young ones.
Humans can think.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples>
```

6.) HIERARCHICAL INHERITANCE PROGRAMS :

a.) HIERARCHICAL INHERITANCE 1:

```
class Vehicle {
  void move() {
    System.out.println("Vehicles can move.");
  }
}

class Car extends Vehicle {
  void speed() {
    System.out.println("Cars can move fast.");
  }
}

class Bike extends Vehicle {
  void balance() {
    System.out.println("Bikes need balance.");
  }
}

public class HierarchicalInheritance1 {
  public static void main(String[] args) {
    Car c = new Car();
    c.move();
    c.speed();

    Bike b = new Bike();
    b.move();
    b.balance();
  }
}
```

Output:

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> javac HierarchicalInheritance1.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> java HierarchicalInheritance1.java
Vehicles can move.
Cars can move fast.
Vehicles can move.
Bikes need balance.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples>
```

b.) HIERARCHICAL INHERITANCE 2:

```
class Shape {
  void draw() {
    System.out.println("Drawing a shape.");
  }
}

class Circle extends Shape {
  void area() {
    System.out.println("Circle area: πr²");
  }
}

class Square extends Shape {
  void area() {
    System.out.println("Square area: a²");
  }
}

public class HierarchicalInheritance2 {
  public static void main(String[] args) {
    Circle c = new Circle();
```

```
        c.draw();
        c.area();

        Square s = new Square();
        s.draw();
        s.area();
    }
}
```

Output:

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> javac HierarchicalInheritance2.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> java HierarchicalInheritance2.java
Drawing a shape.
Circle area: πr²
Drawing a shape.
Square area: a²
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples>
```

7.) HYBRID INHERITANCE PROGRAMS:

a.) HYBRID INHERITANCE 1:

```
interface A {
    void methodA();

}

interface B {
    void methodB();
}

class C implements A, B {
    public void methodA() {
```

```
        System.out.println("Method A from Interface A");
    }

    public void methodB() {
        System.out.println("Method B from Interface B");
    }
}

public class HybridInheritance1 {
    public static void main(String[] args) {
        C obj = new C();
        obj.methodA();
        obj.methodB();
    }
}
```

Output:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> javac HybridInheritance1.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> java HybridInheritance1.java
Method A from Interface A
Method B from Interface B
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples>
```

b.) HYBRID INHERITANCE 2:

```
interface X {
    void showX();
}

interface Y {
    void showY();
}

class Z {
    void showZ() {
```

```
        System.out.println("Class Z method.");
    }
}

class W extends Z implements X, Y {
    public void showX() {
        System.out.println("Method from Interface X");
    }

    public void showY() {
        System.out.println("Method from Interface Y");
    }
}

public class HybridInheritance2 {
    public static void main(String[] args) {
        W obj = new W();
        obj.showX();
        obj.showY();
        obj.showZ();
    }
}
```

Output:

```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> javac HybridInheritance2.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples> java HybridInheritance2.java
Method from Interface X
Method from Interface Y
Class Z method.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Inheritance_Examples>
```

POLYMORPHISM

8.) **CONSTRUCTOR PROGRAMS:**

a.) Constructor Program 1:

```
interface Animal {
   void makeSound();
}

class Cat implements Animal {
   public void makeSound() {
      System.out.println("Cat meows.");
   }
}

class Dog implements Animal {
   public void makeSound() {
      System.out.println("Dog barks.");
   }
}

public class PolymorphismUsingInterfaces1 {
   public static void main(String[] args) {
      Animal a;
      a = new Cat();
      a.makeSound();
      a = new Dog();
      a.makeSound();
   }
}
```

Output:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> javac PolymorphismUsingInterfaces1.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> java PolymorphismUsingInterfaces1.java
Cat meows.
Dog barks.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples>
```

b.) Constructor program 2:

```
interface Shape {
   void draw();
}

class Circle implements Shape {
   public void draw() {
      System.out.println("Drawing Circle.");
   }
}

class Rectangle implements Shape {
   public void draw() {
      System.out.println("Drawing Rectangle.");
   }
}

public class PolymorphismUsingInterfaces2 {
   public static void main(String[] args) {
      Shape s;
      s = new Circle();
      s.draw();
      s = new Rectangle();
      s.draw();
   }
}
```

Output:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> javac PolymorphismUsingInterfaces2.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> java PolymorphismUsingInterfaces2.java
Drawing Circle.
Drawing Rectangle.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples>
```

9.) CONSTRUCTOR OVERLOADING PROGRAMS:

a.) CONSTRUCTOR OVERLOADING 1:

```
class Vehicle {
   void drive() {
      System.out.println("Vehicle is moving.");
   }
}

class Car extends Vehicle {
   void drive() {
      System.out.println("Car is driving.");
   }
}

class Bike extends Vehicle {
   void drive() {
      System.out.println("Bike is running.");
   }
}

public class RuntimePolymorphism1 {
   public static void main(String[] args) {
      Vehicle v;
      v = new Car();
      v.drive();
      v = new Bike();
      v.drive();
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> javac RuntimePolymorphism1.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> java RuntimePolymorphism1.java
Car is driving.
Bike is running.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples>
```

b.) CONSTRUCTOR OVERLOADING 2:

```
class Bank {
   int getInterestRate() {
      return 0;
   }
}

class SBI extends Bank {
   int getInterestRate() {
      return 5;
   }
}

class ICICI extends Bank {
   int getInterestRate() {
      return 7;
   }
}

public class RuntimePolymorphism2 {
   public static void main(String[] args) {
      Bank b;
      b = new SBI();
      System.out.println("SBI Interest Rate: " + b.getInterestRate() + "%");
      b = new ICICI();
      System.out.println("ICICI Interest Rate: " + b.getInterestRate() + "%");
   }
}
```

Output:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> javac RuntimePolymorphism2.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> java RuntimePolymorphism2.java
SBI Interest Rate: 5%
ICICI Interest Rate: 7%
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples>
```

10.) METHOD OVERLOADING PROGRAMS:

a.) METHOD OVERLOADING 1:

```
class MathOperations {
  int add(int a, int b) {
    return a + b;
  }

  double add(double a, double b) {
    return a + b;
  }
}

public class MethodOverloading1 {
  public static void main(String[] args) {
    MathOperations mo = new MathOperations();
    System.out.println("Sum of integers: " + mo.add(5, 10));
    System.out.println("Sum of doubles: " + mo.add(5.5, 10.5));
  }
}
```

Output:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> javac MethodOverloading1.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> java MethodOverloading1.java
Sum of integers: 15
Sum of doubles: 16.0
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples>
```

b.) METHOD OVERLOADING 2:

```
class Display {
  void show(int a) {
    System.out.println("Integer: " + a);
  }

  void show(String s) {
```

```
        System.out.println("String: " + s);
    }

    void show(double d) {
        System.out.println("Double: " + d);
    }
}

public class MethodOverloading2 {
    public static void main(String[] args) {
        Display d = new Display();
        d.show(10);
        d.show("Hello");
        d.show(10.5);
    }
}
```

Output:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> Javac MethodOverloading2.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> Java MethodOverloading2.java
Integer: 10
String: Hello
Double: 10.5
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples>
```

11) METHOD OVERRIDING PROGRAMS:

a.) OVERRIDING 1:

```
class Parent {
    void show() {
        System.out.println("This is the parent class method.");
    }
}

class Child extends Parent {
    void show() {
        System.out.println("This is the child class method.");
    }
}

public class MethodOverriding1 {
```

```
    public static void main(String[] args) {
        Parent p = new Child(); // Runtime polymorphism
        p.show();
    }
}
```

Output:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> javac MethodOverriding1.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> java MethodOverriding1.java
This is the child class method.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples>
```

b.) **OVERRIDING 2:**

```
class Animal {
    void makeSound() {
        System.out.println("Animals make sound.");
    }
}

class Dog extends Animal {
    void makeSound() {
        System.out.println("Dog barks.");
    }
}

public class MethodOverriding2 {
    public static void main(String[] args) {
        Animal a = new Dog(); // Dynamic method dispatch
        a.makeSound();
    }
}
```

Output:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> javac MethodOverriding2.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples> java MethodOverriding2.java
Dog barks.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Polymorphism_Examples>
```

ABSTRACTION

12.) INTERFACE PROGRAMS:

a.) QUESTION 1:

```
Interface Animal {
    void makeSound();
}

class Dog extends Animal {
   void makeSound() {
      System.out.println("Woof! Woof!");
   }
}

class Cat extends Animal {
   void makeSound() {
      System.out.println("Meow! Meow!");
   }
}

public class Question1 {
   public static void main(String[] args) {
      Animal dog = new Dog();
      dog.makeSound();
      Animal cat = new Cat();
      cat.makeSound();
   }
}
```

Output:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> javac Question1.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> java Question1.java
Woof! Woof!
Meow! Meow!
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions>
```

b.) Question 2:

```
abstract class Vehicle {
   abstract int maxSpeed();
}

class Car extends Vehicle {
   int maxSpeed() {
      return 200;
   }
}

class Bike extends Vehicle {
   int maxSpeed() {
      return 100;
   }
}

public class Question2 {
   public static void main(String[] args) {
      Vehicle car = new Car();
      System.out.println("Car max speed: " + car.maxSpeed() + " km/h");

      Vehicle bike = new Bike();
      System.out.println("Bike max speed: " + bike.maxSpeed() + " km/h");
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> javac Question2.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> java Question2.java
Car max speed: 200 km/h
Bike max speed: 100 km/h
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions>
```

C.) QUESTION 3:

```
abstract class Shape {
   abstract double area();
}

class Rectangle extends Shape {
   double width, height;

   Rectangle(double width, double height) {
      this.width = width;
      this.height = height;
   }

   double area() {
      return width * height;
   }
}

class Circle extends Shape {
   double radius;

   Circle(double radius) {
      this.radius = radius;
   }

   double area() {
      return Math.PI * radius * radius;
   }
}

public class Question3 {
   public static void main(String[] args) {
      Shape rect = new Rectangle(5, 10);
      System.out.println("Rectangle area: " + rect.area());

      Shape circle = new Circle(7);
      System.out.println("Circle area: " + circle.area());
   }
}
```

Output:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> javac Question3.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> java Question3.java
Rectangle area: 50.0
Circle area: 153.93804002589985
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions>
```

d.) QUESTION 4:

```
abstract class Employee {
   abstract double calculateSalary();
}

class FullTimeEmployee extends Employee {
   double salary;

   FullTimeEmployee(double salary) {
      this.salary = salary;
   }

   double calculateSalary() {
      return salary;
   }
}

class PartTimeEmployee extends Employee {
   double hourlyRate;
   int hoursWorked;

   PartTimeEmployee(double hourlyRate, int hoursWorked) {
      this.hourlyRate = hourlyRate;
      this.hoursWorked = hoursWorked;
   }

   double calculateSalary() {
      return hourlyRate * hoursWorked;
   }
}

public class Question4 {
   public static void main(String[] args) {
      Employee ft = new FullTimeEmployee(5000);
      System.out.println("Full-time employee salary: $" + ft.calculateSalary());
```

```
        Employee pt = new PartTimeEmployee(20, 80);
        System.out.println("Part-time employee salary: $" + pt.calculateSalary());
    }
}
```

Output:

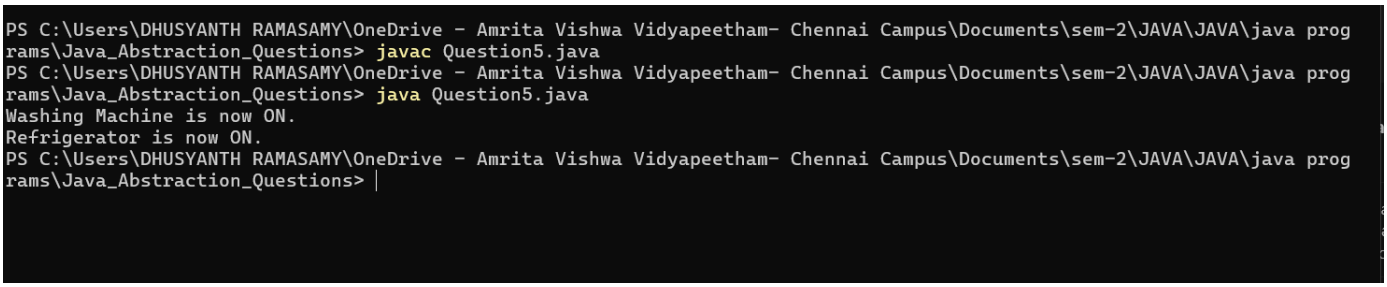
```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> javac Question4.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> java Question4.java
Full-time employee salary: $5000.0
Part-time employee salary: $1600.0
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions>
```

13.) ABSTRACT CLASS PPROGRAMS:

a.) QUESTION 5:

```
abstract class Appliance {
    abstract void turnOn();
}

class WashingMachine extends Appliance {
    void turnOn() {
        System.out.println("Washing Machine is now ON.");
    }
}

class Refrigerator extends Appliance {
    void turnOn() {
        System.out.println("Refrigerator is now ON.");
    }
}

public class Question5 {
    public static void main(String[] args) {
        Appliance wm = new WashingMachine();
        wm.turnOn();

        Appliance fridge = new Refrigerator();
        fridge.turnOn();
    }
}
```

OUTPUT:



b.) QUESTION 6:

```
abstract class Account {
   abstract double calculateInterest(double balance);
}

class SavingsAccount extends Account {
   double calculateInterest(double balance) {
      return balance * 0.04; // 4% interest rate
   }
}

class CurrentAccount extends Account {
   double calculateInterest(double balance) {
      return balance * 0.02; // 2% interest rate
   }
}

public class Question6 {
   public static void main(String[] args) {
      Account savings = new SavingsAccount();
      System.out.println("Savings account interest: $" +
savings.calculateInterest(1000));

      Account current = new CurrentAccount();
      System.out.println("Current account interest: $" +
current.calculateInterest(1000));
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> javac Question6.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> java Question6.java
Savings account interest: $40.0
Current account interest: $20.0
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions>
```

c.) QUESTION 7:

```
abstract class Device {
   abstract void connect();
}

class Laptop extends Device {
   void connect() {
      System.out.println("Laptop is connecting to Wi-Fi.");
   }
}

class Mobile extends Device {
   void connect() {
      System.out.println("Mobile is connecting to Mobile Network.");
   }
}

public class Question7 {
   public static void main(String[] args) {
      Device laptop = new Laptop();
      laptop.connect();

      Device mobile = new Mobile();
      mobile.connect();
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> javac Question7.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> java Question7.java
Laptop is connecting to Wi-Fi.
Mobile is connecting to Mobile Network.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions>
```

QUESTION 8:

```
abstract class Payment {
   abstract void processPayment(double amount);
}

class CreditCardPayment extends Payment {
   void processPayment(double amount) {
      System.out.println("Processing credit card payment of $" + amount);
   }
}

class PayPalPayment extends Payment {
   void processPayment(double amount) {
      System.out.println("Processing PayPal payment of $" + amount);
   }
}

public class Question8 {
   public static void main(String[] args) {
      Payment credit = new CreditCardPayment();
      credit.processPayment(150.75);

      Payment paypal = new PayPalPayment();
      paypal.processPayment(80.50);
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> Javac Question8.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions> Java Question8.java
Processing credit card payment of $150.75
Processing PayPal payment of $80.5
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions>
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Abstraction_Questions>
```

ENCAPSULATION

14.a) EncapsulationBasic1:

```
class Person {
   private String name;

   public void setName(String name) {
      this.name = name;
   }

   public String getName() {
      return name;
   }
}

public class EncapsulationBasic1 {
   public static void main(String[] args) {
      Person p = new Person();
      p.setName("John");
      System.out.println("Person's name: " + p.getName());
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> javac EncapsulationBasic1.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> java EncapsulationBasic1.java
Person's name: John
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples>
```

14.b) Encapsulation Basic 2:

```
class Car {
   private String model;

   public void setModel(String model) {
      this.model = model;
   }

   public String getModel() {
      return model;
   }
}

public class EncapsulationBasic2 {
   public static void main(String[] args) {
      Car c = new Car();
      c.setModel("Tesla Model S");
      System.out.println("Car model: " + c.getModel());
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> javac EncapsulationBasic2.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> java EncapsulationBasic2.java
Car model: Tesla Model S
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples>
```

14.c) EncapsulationWithConstructor1:

```
class Employee {
   private String empName;
   private int empID;

   public Employee(String name, int id) {
      this.empName = name;
      this.empID = id;
   }

   public void display() {
      System.out.println("Employee Name: " + empName);
      System.out.println("Employee ID: " + empID);
   }
```

```
}

public class EncapsulationWithConstructor1 {
   public static void main(String[] args) {
      Employee e = new Employee("Alice", 101);
      e.display();
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> javac EncapsulationWithConstructor1.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> java EncapsulationWithConstructor1.java
Employee Name: Alice
Employee ID: 101
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples>
```

14.d) EncapsulationWithConstructor2:

```
class Book {
   private String title;

   public Book(String title) {
      this.title = title;
   }

   public String getTitle() {
      return title;
   }
}

public class EncapsulationWithConstructor2 {
   public static void main(String[] args) {
      Book b = new Book("The Great Gatsby");
      System.out.println("Book Title: " + b.getTitle());
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> javac EncapsulationWithConstructor2.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> java EncapsulationWithConstructor2.java
Book Title: The Great Gatsby
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples>
```

14.e) EncapsulationWithGettersSetters1:

```
class BankAccount {
   private double balance;

   public void setBalance(double balance) {
      if (balance >= 0) {
         this.balance = balance;
      } else {
         System.out.println("Balance cannot be negative.");
      }
   }

   public double getBalance() {
      return balance;
   }
}

public class EncapsulationWithGettersSetters1 {
   public static void main(String[] args) {
      BankAccount account = new BankAccount();
      account.setBalance(1000);
      System.out.println("Account balance: $" + account.getBalance());
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> javac EncapsulationWithGettersSetters1.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> java EncapsulationWithGettersSetters1.java
Account balance: $1000.0
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples>
```

14.f) EncapsulationWithGettersSetters2:

```
class Student {
   private int age;

   public void setAge(int age) {
      if (age > 0) {
         this.age = age;
      } else {
         System.out.println("Age must be positive.");
      }
   }
```

```
    public int getAge() {
        return age;
    }
}

public class EncapsulationWithGettersSetters2 {
    public static void main(String[] args) {
        Student s = new Student();
        s.setAge(20);
        System.out.println("Student's age: " + s.getAge());
    }
}
```

OUTPUT:

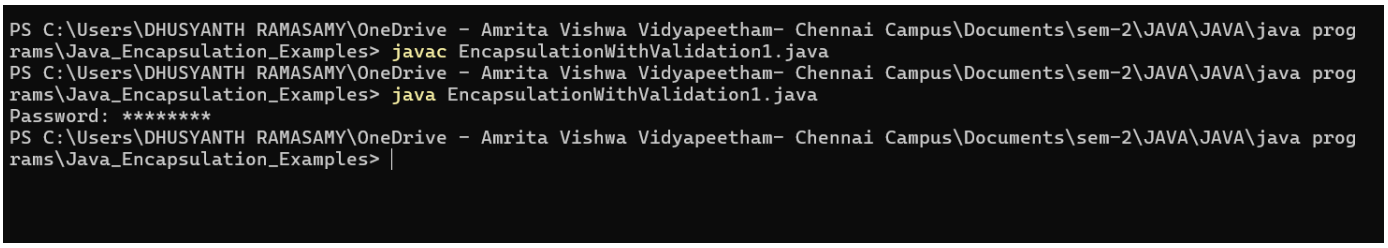
```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> javac V.java
error: file not found: V.java
Usage: javac <options> <source files>
use --help for a list of possible options
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples>
```

14.g) EncapsulationWithValidation1:

```
class User {
    private String password;

    public void setPassword(String password) {
        if (password.length() >= 8) {
            this.password = password;
        } else {
            System.out.println("Password must be at least 8 characters long.");
        }
    }

    public String getPassword() {
        return (password != null) ? "********" : "Password not set";
    }
}

public class EncapsulationWithValidation1 {
    public static void main(String[] args) {
        User u = new User();
```

```
        u.setPassword("securePass");
        System.out.println("Password: " + u.getPassword());
    }
}
```

OUTPUT:



14.h) EncapsulationWithValidation2:

```
class Product {
    private double price;

    public void setPrice(double price) {
        if (price > 0) {
            this.price = price;
        } else {
            System.out.println("Price must be positive.");
        }
    }

    public double getPrice() {
        return price;
    }
}

public class EncapsulationWithValidation2 {
    public static void main(String[] args) {
        Product p = new Product();
        p.setPrice(25.50);
        System.out.println("Product Price: $" + p.getPrice());
    }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> javac EncapsulationWithValidation2.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples> java EncapsulationWithValidation2.java
Product Price: $25.5
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\Java_Encapsulation_Examples>
```

PACKAGES

15.a)Packages Animals:
i.)Cat:

```
package animals;

public class Cat {
   public void makeSound() {
      System.out.println("Meow");
   }
}
```

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\animals> javac cat.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\animals> java cat.java
error: can't find class: animals.cat
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\animals>
```

ii.)Dog:

```
package animals;

public class Dog {
   public void makeSound() {
      System.out.println("Bark");
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\animals> javac Dog.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\animals> java Dog.java
error: can't find main(String[]) method in class: animals.Dog
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\animals>
```

15.b)Packages Bank:
i.)Current Account:

```
package bank;

public class CurrentAccount {
   public void deposit(double amount) {
```

```
        System.out.println("Depositing " + amount + " in Current Account");
    }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\bank> javac CurrentAccount.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\bank> java CurrentAccount.java
error: can't find main(String[]) method in class: bank.CurrentAccount
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\bank>
```

ii.)Saving Account:

```
package bank;

public class SavingsAccount {
    public void deposit(double amount) {
        System.out.println("Depositing " + amount + " in Savings Account");
    }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\jav
rams\PackageBasedJavaPrograms\bank> javac SavingsAccount.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\jav
rams\PackageBasedJavaPrograms\bank> java SavingsAccount.java
error: can't find main(String[]) method in class: bank.SavingsAccount
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\jav
rams\PackageBasedJavaPrograms\bank>
```

15.c)Packages Appliance:

```
package appliances;

public class Fan {
    public void turnOn() {
        System.out.println("Fan is turning on");
    }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\appliances> javac Fan.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\appliances> java Fan.java
error: can't find main(String[]) method in class: appliances.Fan
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\appliances>
```

ii.)Light:

```
package appliances;

public class Light {
   public void turnOn() {
      System.out.println("Light is turning on");
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\appliances> javac Light.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\appliances> java Light.java
error: can't find main(String[]) method in class: appliances.Light
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\PackageBasedJavaPrograms\appliances>
```

15.d)Shapes:

a.)Circle:

```
package shapes;

public class Circle {
   public void draw() {
      System.out.println("Drawing a Circle");
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\s
rams\PackageBasedJavaPrograms\shapes> javac Circle.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\s
rams\PackageBasedJavaPrograms\shapes> java Circle.java
error: can't find main(String[]) method in class: shapes.Circle
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\s
rams\PackageBasedJavaPrograms\shapes>
```

ii.)Rectangle:

```
package shapes;

public class Rectangle {
   public void draw() {
      System.out.println("Drawing a Rectangle");
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java
rams\PackageBasedJavaPrograms\shapes> javac Rectangle.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java
rams\PackageBasedJavaPrograms\shapes> java Rectangle.java
error: can't find main(String[]) method in class: shapes.Rectangle
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java
rams\PackageBasedJavaPrograms\shapes>
```

FILE HANDLING

16.a) Append File:

```
import java.io.*;

public class AppendFile {
   public static void main(String[] args) {
      try (BufferedWriter writer = new BufferedWriter(new FileWriter("log.txt", true)))
{
         writer.newLine();
         writer.write("New log entry: Java file handling.");
         System.out.println("Data appended successfully.");
      } catch (IOException e) {
         System.out.println("Error appending to file: " + e.getMessage());
      }
   }
}
```

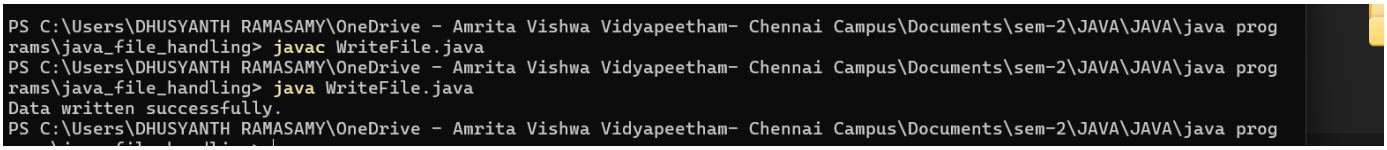
OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\J
rams\java_file_handling> javac AppendFile.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\J
rams\java_file_handling> java AppendFile.java
Data appended successfully.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\J
rams\java_file_handling>
```

16.b) Write File:

```
import java.io.*;

public class WriteFile {
   public static void main(String[] args) {
      try (BufferedWriter writer = new BufferedWriter(new FileWriter("output.txt"))) {
         writer.write("Hello, Java!");
         System.out.println("Data written successfully.");
      } catch (IOException e) {
         System.out.println("Error writing to file: " + e.getMessage());
      }
   }
}
```

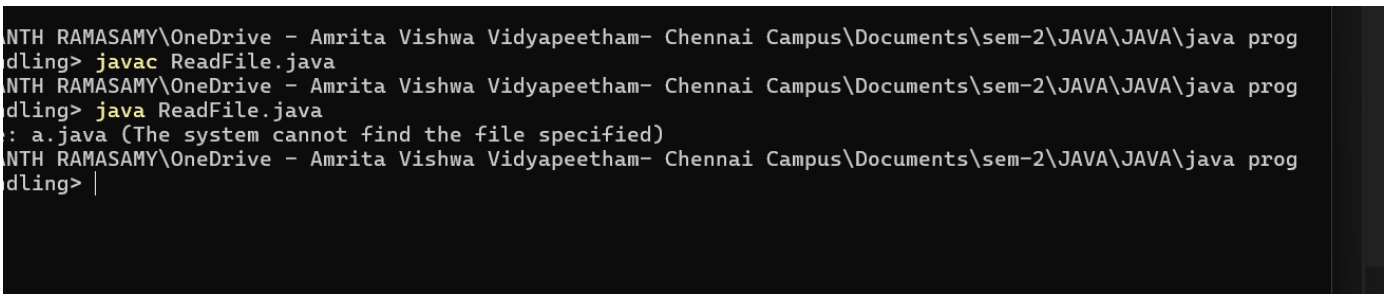
OUTPUT:



16.c) ReadFile:

```
import java.io.*;

public class ReadFile {
   public static void main(String[] args) {
      File file = new File("a.java");

      try (BufferedReader br = new BufferedReader(new FileReader(file))) {
         String line;
         while ((line = br.readLine()) != null) {
            System.out.println(line);
         }
      } catch (IOException e) {
         System.out.println("Error reading file: " + e.getMessage());
      }
   }
}
```

OUTPUT:



EXCEPTIONAL HANDLING

17a.) ArithmeticExceptionDemo:

```
public class ArithmeticExceptionDemo {
   public static void main(String[] args) {
      try {
         int result = 10 / 2; // Division by zero
      } catch (ArithmeticException e) {
         System.out.println("Error: Division by zero is not allowed.");
      }
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\java_file_handling> javac AppendFile.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\java_file_handling> java AppendFile.java
Data appended successfully.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\java_file_handling>
```

17.b) ArrayIndexOutOfBoundsExceptionDemo:

```
public class ArrayIndexOutOfBoundsExceptionDemo {
   public static void main(String[] args) {
      int[] numbers = {1, 2, 3};
      try {
         System.out.println(numbers[5]); // Out of bounds access
      } catch (ArrayIndexOutOfBoundsException e) {
         System.out.println("Error: Array index is out of bounds.");
      }
   }
}
```

OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\java_file_handling> javac CopyFile.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\java_file_handling> java CopyFile.java
Error copying file: source.txt (The system cannot find the file specified)
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetham- Chennai Campus\Documents\sem-2\JAVA\JAVA\java prog
rams\java_file_handling>
```

17.c) FinallyBlockDemo:

```
public class FinallyBlockDemo {
   public static void main(String[] args) {
      try {
         int num = 10 / 0; // Exception occurs
      } catch (ArithmeticException e) {
         System.out.println("Error: Division by zero.");
      } finally {
         System.out.println("Finally block executed.");
      }
   }
}
```

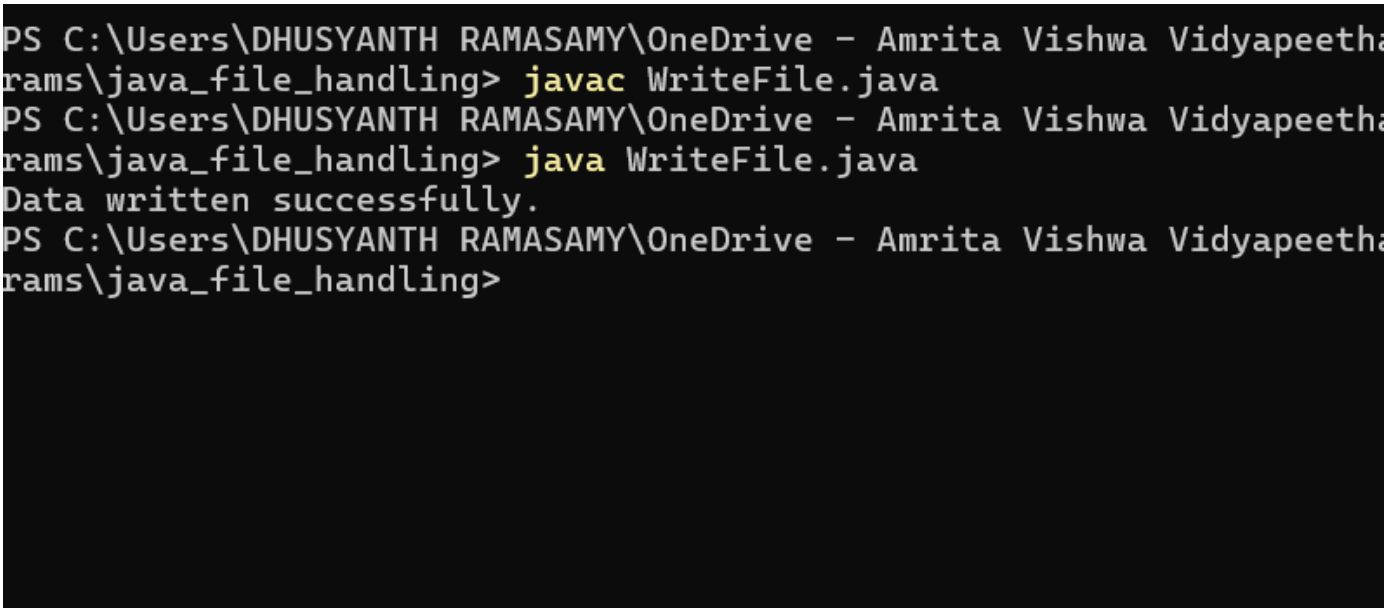
OUTPUT:

```
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishw
rams\java_file_handling> javac ReadFile.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishw
rams\java_file_handling> java ReadFile.java
Error reading file: a.java (The system cannot find the
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishw
rams\java_file_handling>
```

17.d) MultipleCatchDemo:

```
public class MultipleCatchDemo {
   public static void main(String[] args) {
      try {
         int[] arr = new int[5];
         arr[10] = 50; // Array index out of bounds
         int result = 10 / 0; // Arithmetic exception
      } catch (ArrayIndexOutOfBoundsException e) {
         System.out.println("Error: Array index out of bounds.");
      } catch (ArithmeticException e) {
         System.out.println("Error: Division by zero.");
      }
   }
}
```

OUTPUT:


PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetha
rams\java_file_handling> javac WriteFile.java
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetha
rams\java_file_handling> java WriteFile.java
Data written successfully.
PS C:\Users\DHUSYANTH RAMASAMY\OneDrive - Amrita Vishwa Vidyapeetha
rams\java_file_handling>