

23CSE111

OBJECT-ORIENTED PROGRAMMING

LAB REPORT



Department of Computer Science Engineering

Amrita School of Computing

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	<p>a) Create a class with name “Car”</p> <p>b) Create 4 attributes, named: car_color, car_brand, fuel_type, mileage</p> <p>c) Create 3 methods, named: start(), service(), stop()</p> <p>d) Create 3 objects, named: car1, car2, car3</p> <p>e) Create a constructor, which should print, “Welcome to car garage”.</p>			
2.	<p>To write a java program to create a class named BankAccount, with 2 methods deposit() and withdraw().</p> <p>a) deposit(): Whenever an amount is deposited, it has to be update the current amount.</p> <p>b) withdraw(): Whenever an amount is withdrawn, it has to be less than the current amount , else print (“Insufficient funds”)</p>		15	

WEEK 01

PROGRAM-1:

AIM: Download and Install Java Software

PROCEDURE:

Step 1: Download JDK 21

- 1) Open your web browser and go to the Oracle JDK Downloads page
- 2) Scroll down to the Java SE Development Kit 21 section.
- 3) Choose the Windows x64 Installer version.
- 4) Click on Download, then Wait for the download to complete.

JDK 23	JDK 21	GraalVM for JDK 23	GraalVM for JDK 21
Java SE Development Kit 21.0.6 downloads			
JDK 21 binaries are free to use in production and free to redistribute, at no cost, under the Oracle No-Fee Terms and Conditions (NFTC).			
JDK 21 will receive updates under the NFTC, until September 2026, a year after the release of the next LTS. Subsequent JDK 21 updates will be licensed under the Java SE OTN License (OTN) and production use beyond the limited free grants of the OTN license will require a fee .			
Linux	macOS	Windows	
Product/file description		File size	Download
x64 Compressed Archive		185.92 MB	https://download.oracle.com/java/21/latest/jdk-21_windows-x64_bin.zip (sha256)
x64 Installer		164.31 MB	https://download.oracle.com/java/21/latest/jdk-21_windows-x64_bin.exe (sha256)
x64 MSI Installer		163.06 MB	https://download.oracle.com/java/21/latest/jdk-21_windows-x64_bin.msi (sha256)

Step 2: Install JDK 21

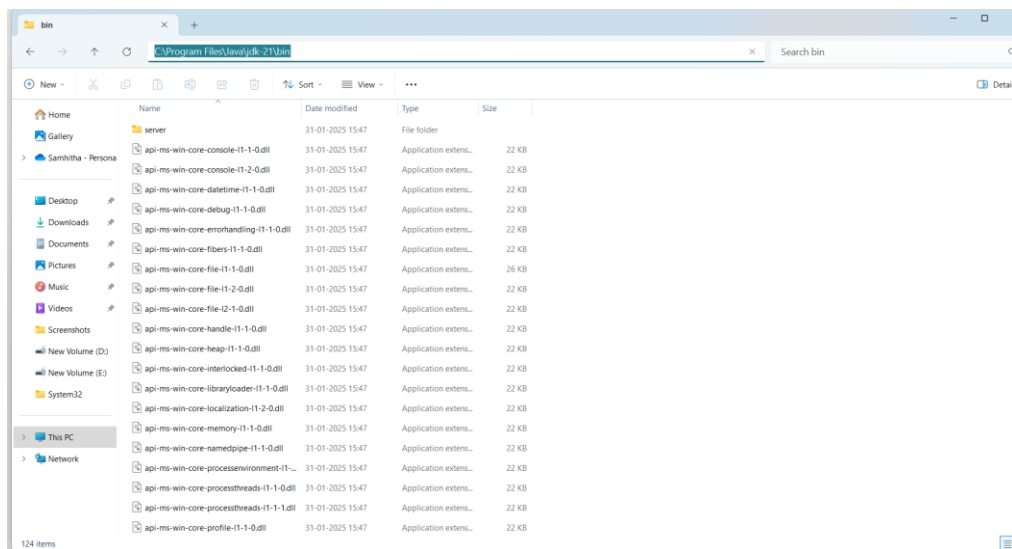
- 1) Locate the downloaded jdk-21_windows-x64_bin.exe file.
- 2) Double-click to launch the installer.
- 3) Click Next on the setup wizard.
- 4) Choose the installation path (default is C:\Program Files\Java\jdk-21).
- 5) Click Next, then click Install.
- 6) Wait for the installation to complete.

7) Click Close once the installation is finished.



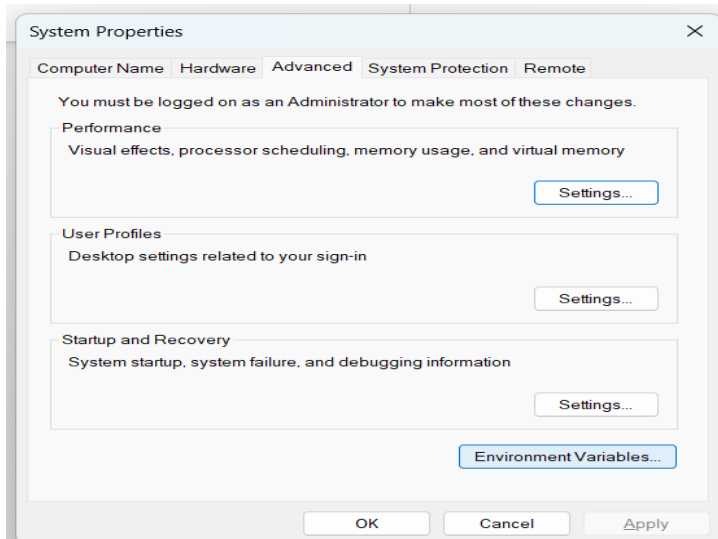
Step 3: Setting up the path

- 1) Go to “Windows C” Drive on Desktop
- 2) Choose Program Files, select Java, then JDK 21, then select Bin.
- 3) Select and copy the path at the address bar.



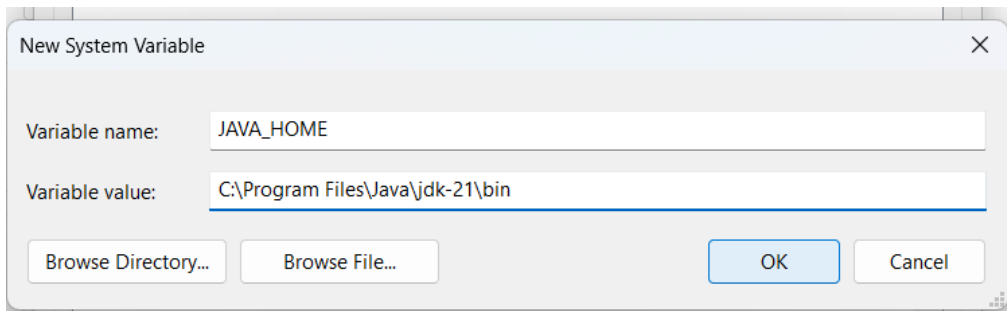
Step 4: Open System Properties

- 1) Press Windows + R, type sysdm.cpl, and click Ok.
- 2) The System Properties window will open.
- 3) Navigate to the Advanced tab.
- 4) Click on Environment Variables at the bottom.



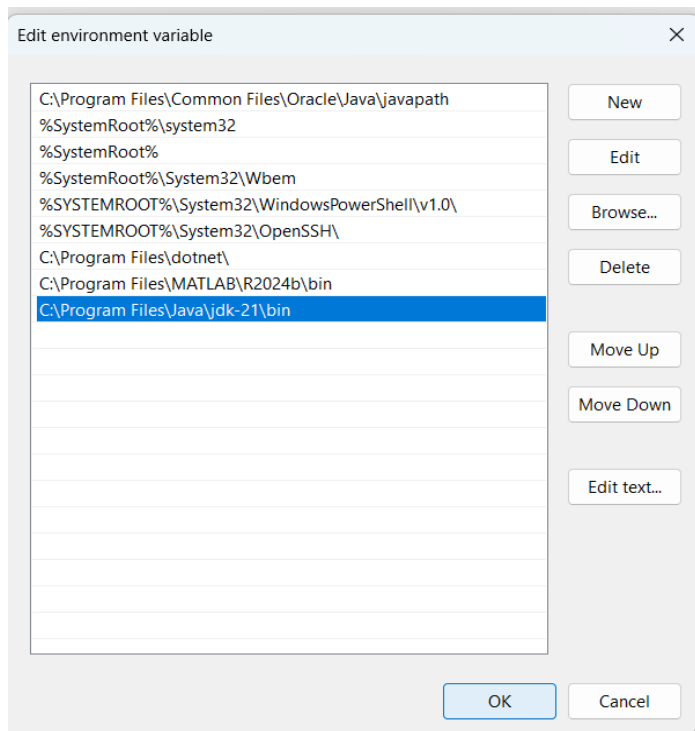
Step 5: Set JAVA_HOME

- 1) Under System Variables, click New.
- 2) Set the Variable name as JAVA_HOME.
- 3) Set Variable value as C:\Program Files\Java\jdk-21 (or your installation path).
- 4) Click OK.



Step 6: Update PATH Variable

- 1) In System Variables, find Path and click Edit.
- 2) Click New and add: C:\Program Files\Java\jdk-21\bin
- 3) Click OK to save.



Step 7: Verify Installation

- 1) Open Command Prompt.
- 2) Type the following command: **java --version** and press Enter.

```
Command Prompt
Microsoft Windows [Version 10.0.22631.4751]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Samhitha>java --version
java 21.0.6 2025-01-21 LTS
Java(TM) SE Runtime Environment (build 21.0.6+8-LTS-188)
Java HotSpot(TM) 64-Bit Server VM (build 21.0.6+8-LTS-188, mixed mode, sharing)

C:\Users\Samhitha>
```

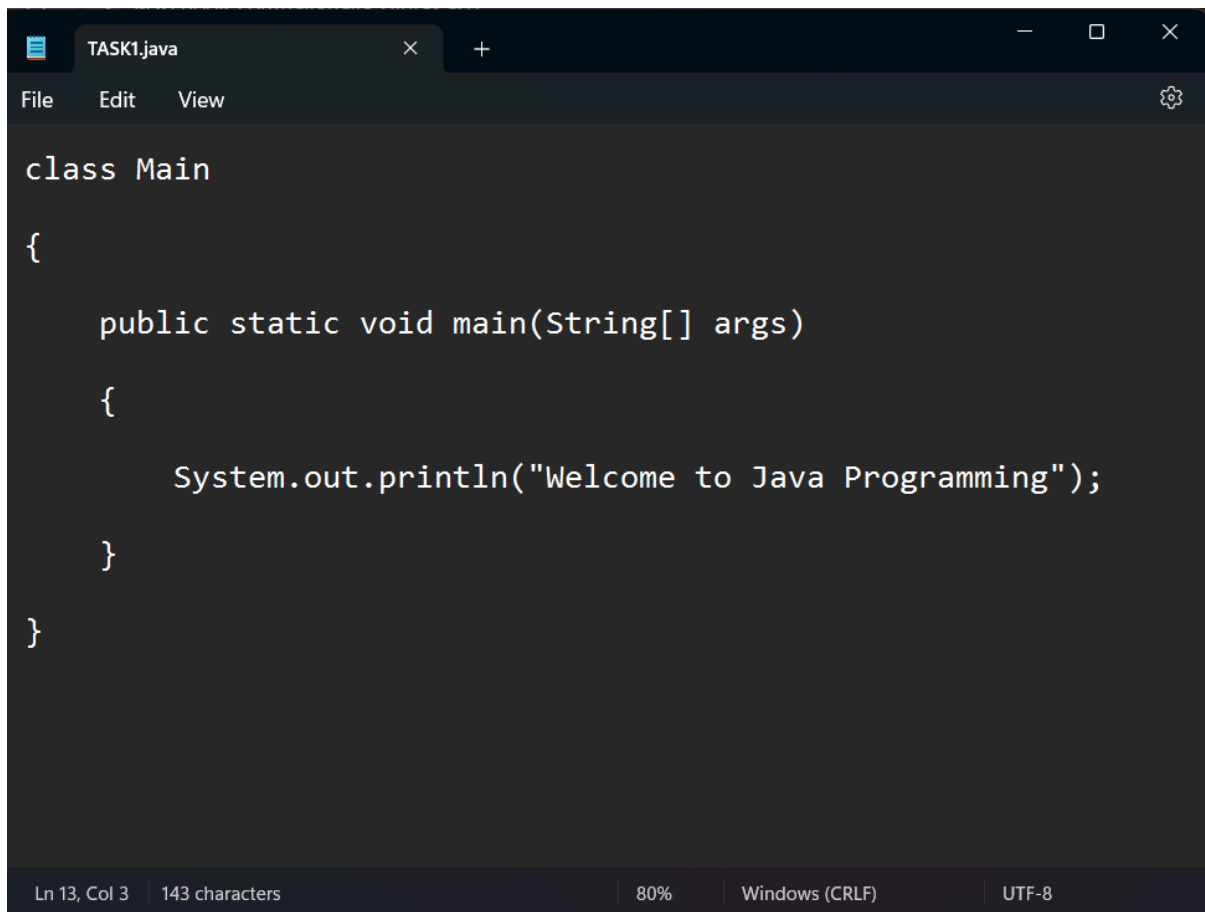
- 3) To check the java compiler type: **javac --version**.

```
C:\Users\Samhitha>javac --version
javac 21.0.6
```

PROGRAM-2:

AIM: Write a Java program to print the message “Welcome to Java Programming.”

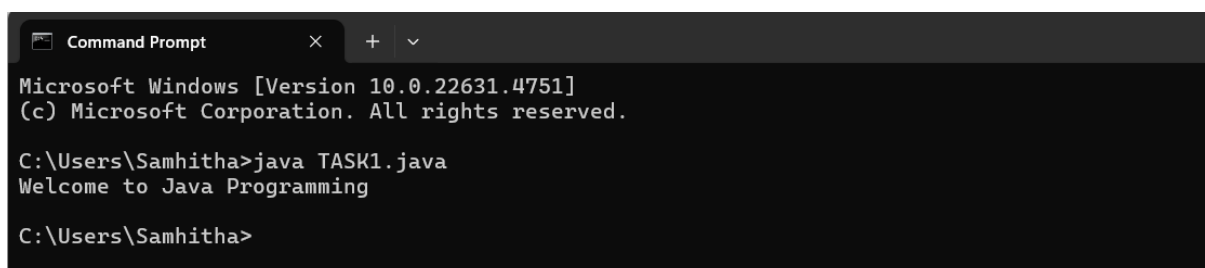
CODE:

A screenshot of a code editor window titled 'TASK1.java'. The window has a menu bar with 'File', 'Edit', and 'View'. The code is as follows:

```
class Main
{
    public static void main(String[] args)
    {
        System.out.println("Welcome to Java Programming");
    }
}
```

The status bar at the bottom shows 'Ln 13, Col 3', '143 characters', '80%', 'Windows (CRLF)', and 'UTF-8'.

OUTPUT:

A screenshot of a Windows Command Prompt window titled 'Command Prompt'. It shows the following text:

```
Microsoft Windows [Version 10.0.22631.4751]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Samhitha>java TASK1.java
Welcome to Java Programming

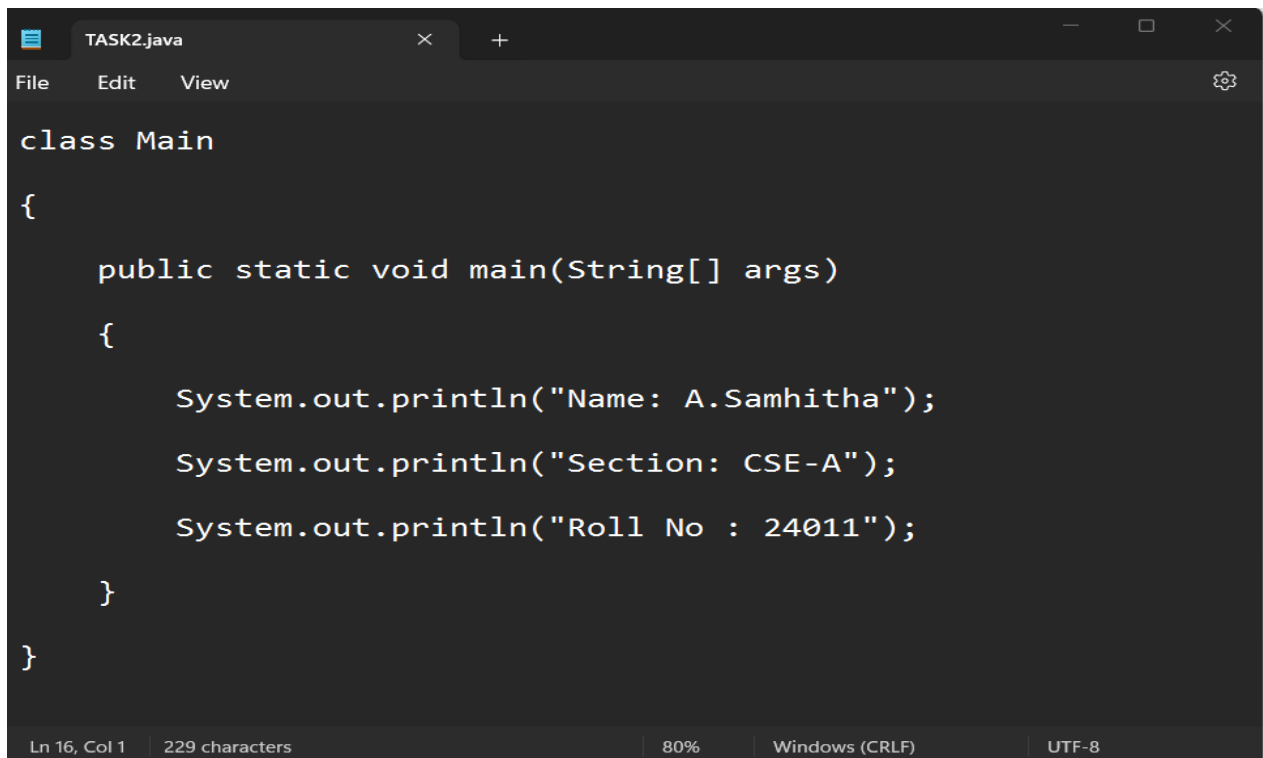
C:\Users\Samhitha>
```

ERRORS: None found

PROGRAM-3:

AIM: Write a Java Program that prints Name, Roll No, Section of a student.

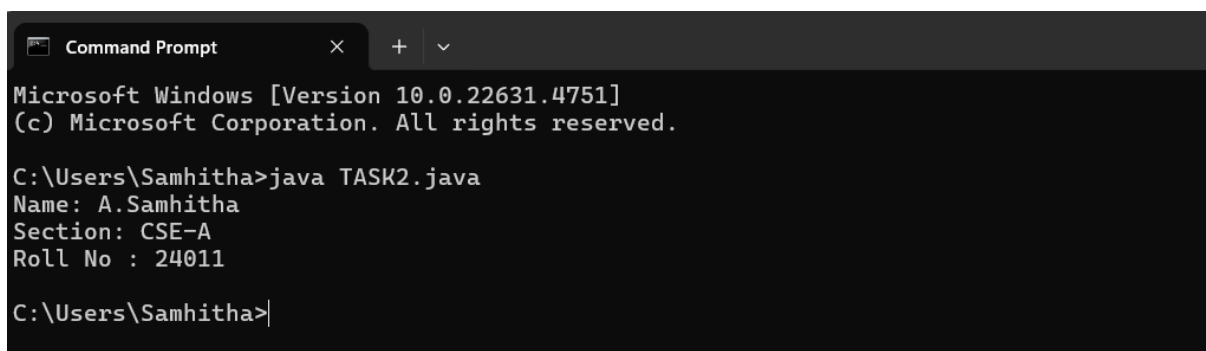
CODE:

A screenshot of an IDE window titled 'TASK2.java'. The window has a menu bar with 'File', 'Edit', and 'View'. The code is as follows:

```
class Main
{
    public static void main(String[] args)
    {
        System.out.println("Name: A.Samhitha");
        System.out.println("Section: CSE-A");
        System.out.println("Roll No : 24011");
    }
}
```

The status bar at the bottom shows 'Ln 16, Col 1', '229 characters', '80%', 'Windows (CRLF)', and 'UTF-8'.

OUTPUT:

A screenshot of a Windows Command Prompt window titled 'Command Prompt'. It shows the following text:

```
Microsoft Windows [Version 10.0.22631.4751]
(c) Microsoft Corporation. All rights reserved.

C:\Users\Samhitha>java TASK2.java
Name: A.Samhitha
Section: CSE-A
Roll No : 24011

C:\Users\Samhitha>
```

ERRORS: None Found

WEEK-02

PROGRAM-01:

AIM: Write a java program to calculate the area of a rectangle.

CODE:

```
import java.util.Scanner;
// Importing Scanner class

class Main {
    public static void main(String[] args) {
        // For calculating the area of a rectangle
        Scanner input = new Scanner(System.in);
        // Creating Scanner object
        System.out.print("Enter the length of the rectangle: ");
        int length = input.nextInt();
        System.out.print("Enter the breadth of the rectangle: ");
        int breadth = input.nextInt();
        int area = length * breadth;
        // for calculating area
        System.out.println("Area of the rectangle is: " + area);
        // Displaying the result
    }
}
```

OUTPUT:

```
C:\Users\Samhitha>java rectangle.java
Enter the length of the rectangle: 15
Enter the breadth of the rectangle: 12
Area of the rectangle is: 180
```

ERRORS:

S.No:	Errors	Error rectification
1)	cannot find symbol: class Scanner	Import java.util.Scanner at the beginning of the

		code: import java.util.Scanner;
2)	Scanner input = new Scanner(System.in);	Ensure the correct spelling and case of Scanner. No change is needed after import

Concepts to be known:

1. import java.util.Scanner; - To accept input from user, Scanner class under util package has to be imported.
2. Scanner input=new Scanner(System.in); - Used to create a Scanner object
3. int ln=input.nextInt(); - Used to read the integer data type stored under the object created
4. System.out.println(" "); - It is used to print string inside the quotes. After printing, the cursor moves to the beginning of the next line.

PROGRAM-02:

AIM: Write a java program to convert temperature from Celsius to Fahrenheit and vica-versa.

CODE:

```

import java.util.Scanner;
class Main{
    public static void main(String[] args){
        Scanner input=new Scanner(System.in);
        System.out.print("Enter the temperature in Celsius : ");
        double tp1=input.nextDouble();
        double fh=(tp1*9/5)+32;
        System.out.println("The temperature in Farenheit is : "+fh);
        System.out.print("Enter the temp in Farenheit : ");
        double tp2=input.nextDouble();
        double cl=(tp2-32)*5/9;
        System.out.println("The temperature in Celsius is : "+cl);
    }
}

```

OUTPUT:

```

C:\Users\Samhitha>java faren.java
Enter the temperature in Celsius : 37
The temperature in Farenheit is : 98.6
Enter the temp in Farenheit : 101
The temperature in Celsius is : 38.333333333333336

```

ERRORS:

S.No	Errors	Error Rectification
1)	variable tp is already defined in method main(String[])	Rename the first and second tp variable to avoid duplication. Variable names must be unique within the same scope.

Concepts to be known:

1. import java.util.Scanner; - To accept input from user, Scanner class under util package has to be imported.

2. Scanner input=new Scanner(System.in); - Used to create a Scanner object
3. double fh=input.nextDouble(); - Used to read double data type stored under the object created
4. System.out.println(" "); - It is used to print string inside the quotes. After printing, the cursor moves to the beginning of the next line.

PROGRAM-03:

AIM: Write a java program to calculate the simple interest.

CODE:

```
import java.util.Scanner;
class SI{
    public static void main(String[] args){
        Scanner input=new Scanner(System.in);
        System.out.print("Enter the principal amount : " );
        double p=input.nextDouble();
        System.out.print("Enter the rate of interest : " );
        double r=input.nextDouble();
        System.out.print("Enter the time period: ");
        double t=input.nextDouble();
        double intr=(p*t*r)/100;
        System.out.println("Simple Interest:"+intr);
    }
}
```

OUTPUT:

```
C:\Users\Samhitha>java si.java
Enter the principal amount : 200000
Enter the rate of interest : 100
Enter the time period: 2
Simple Interest:400000.0
```

ERRORS:

Sno.	Error	Error rectification
1.	error: ';' expected double intr=(p*r*t)/100	Add a semicolon at the end of the statement double intr=(p*r*t)/100;
2.	error: cannot find symbol double intr=(p*r*t)/100; symbol: variable p location: class interest	Create a reader object double p=input.nextDouble();

Concepts to be known:

1. import java.util.Scanner; - To accept input from user, Scanner class under util package has to be imported.
2. Scanner input=new Scanner(System.in); - Used to create a Scanner object
3. double p=input.nextDouble(); - Used to read double data type stored under the object created
4. System.out.println(" "); - It is used to print string inside the quotes. After printing, the cursor moves to the beginning of the next line.

PROGRAM-04:

AIM: Write a java program to find the largest of three numbers, using ternary operator.

CODE:

```

import java.util.Scanner;
class ternary{
    public static void main(String[] args){
        //use ternary operator
        Scanner input=new Scanner(System.in);
        System.out.print("Enter the first number : " );
        int a=input.nextInt();
        System.out.print("Enter the second number : ");
        int b=input.nextInt();
        System.out.print("Enter the third number : ");
        int c=input.nextInt();
        int result=(a>b)? ((a>c)? a:c) : ((b>c)? b:c);
        System.out.println("The Largest Number is: "+result);
    }
}

```

OUTPUT:

```

C:\Users\Samhitha>java large.java
Enter the first number : 41
Enter the second number : 23
Enter the third number : 19
The Largest Number is: 41

```

ERRORS:

Sno.	Error	Error rectification
1)	error: ';' expected <pre>int result=(a>b) ((a>c)? a:c) : ((b>c)? b:c);</pre> error: not a statement <pre>int result=(a>b) ((a>c)? a:c) : ((b>c)? b:c);</pre>	Add a '?' <pre>int result=(a>b)? ((a>c)? a:c) : ((b>c)? b:c);</pre>
2)	error: ';' expected	Add a ';'

	int result=(a>b)? ((a>c)? a:c) : ((b>c)? b:c)	int result=(a>b)? ((a>c)? a:c) : ((b>c)? b:c);
--	--	---

Concepts to be known:

1. import java.util.Scanner; - To accept input from user, Scanner class under util package has to be imported.
2. Scanner input=new Scanner(System.in); - Used to create a Scanner object
3. int a=input.nextInt (); - Used to read integer data type stored under the object created
4. int result=(a>b)? ((a>c)? a:c) : ((b>c)? b:c); - Nested Ternary operator is used here. Syntax for ternary operator is- condition? expression 1: expression 2; , whose answer is stored in a variable and then used.

PROGRAM-05:

AIM: Write a java program to find the factorial of a number.

CODE:

```
import java.util.Scanner;
class factorial{
    public static void main(String[] args){
        //to calculate the factorial of a number
        Scanner input=new Scanner(System.in);
        System.out.print("Enter the number : " );
        int n=input.nextInt();
        int fact=1;
        for (int i=1; n>=i; --n){
            fact*=n;
        }
        System.out.println("Factorial:" +fact);
    }
}
```


OUTPUT:

```
C:\Users\Samhitha>java fact.java
Enter the number : 7
Factorial:5040
```

ERROR:

Sno.	Error	Error rectification
1.	error: ';' expected fact*=n	Add a “;,” fact*=n;

Concepts to be known:

1. for (int i=1; n>=i;--n){ } - For loop syntax: for(initial expression; test expression; update expression){} The loop is executed, until the test expression evaluates to be false.

WEEK-03

PROGRAM-01:

AIM: To create a java program with the following instructions:

- a) Create a class with name “Car”
- b) Create 4 attributes, named: car_color, car_brand, fuel_type, mileage
- c) Create 3 methods, named: start(), service(), stop()
- d) Create 3 objects, named: car1, car2, car3
- e) Create a constructor, which should print, “Welcome to car garage” .

CODE:

```

class Car {
    // Attributes
    String car_color;
    String car_brand;
    String fuel_type;
    double mileage;

    // Constructor
    Car() {
        System.out.println("Welcome to Carshowdown");
    }

    // Methods
    void start() {
        System.out.println(car_brand + " is starting.");
    }

    void service() {
        System.out.println(car_brand + " is being serviced.");
    }

    void stop() {
        System.out.println(car_brand + " has stopped.");
    }

    public static void main(String[] args) {
        // Creating objects
        Car car1 = new Car();
        car1.car_color = "Red";
        car1.car_brand = "Ferrari";
        car1.fuel_type = "Electric";
        car1.mileage = 18.5;

        Car car2 = new Car();
        car2.car_color = "Blue";
        car2.car_brand = "Mercedes";
        car2.fuel_type = "Diesel";
        car2.mileage = 20.0;

        Car car3 = new Car();
        car3.car_color = "Black";
        car3.car_brand = "Ford";
        car3.fuel_type = "Electric";
        car3.mileage = 0;

        // Calling methods
        car1.start();
        car2.service();
        car3.stop();
    }
}

```

OUTPUT:

```
C:\Users\Samhitha>java car.java
Welcome to Carshowdown
Welcome to Carshowdown
Welcome to Carshowdown
Ferrari is starting.
Mercedes is being serviced.
Ford has stopped.
```

ERRORS:

S.No	Error	Error rectification
1)	error: ')' or ',' expected at line System.out.println(car_brand + " is being serviced.");	There is an issue with the string concatenation. Ensure proper quotes and spacing.
<u>2)</u>	<u>error: not a statement at line</u> <u>System.out.println(car_brand + " is</u> <u>being serviced.");</u>	<u>Verify that all syntax</u> <u>is correct. It is likely</u> <u>due to a misplaced or</u> <u>missing character.</u>
<u>3)</u>	<u>error: ';' expected at line</u> <u>System.out.println(car_brand + " is</u> <u>being serviced.");</u>	<u>Check for missing or</u> <u>extra quotes, plus</u> <u>signs, or misplaced</u> <u>semicolons.</u>

Class Diagram:

Car
+ car_color: String + car_brand: String + fuel_type: String + mileage: int
+ Car(): void + start(): void

<pre>+ service(): void + stop(): void</pre>

Concepts to be known:

1. String car_color; declares an instance variable car_color of type String, which will store the color of the car.
2. Car() is a constructor that gets executed when an object of the Car class is created, printing "Welcome to Carshowdown".
3. this.car_color = car_color; is used inside a constructor to assign the passed parameter to the instance variable of the same name.
4. Methods like start(), service(), and stop() define specific actions for the car, such as printing messages related to the car's state.
5. Creating objects like Car car1 = new Car(); allows assigning values to attributes and calling methods like car1.start(); to execute their functionality.

PROGRAM-02:

AIM: To write a java program to create a class named BankAccount, with 2 methods deposit() and withdraw().

- a) deposit(): Whenever an amount is deposited, it has to be update the current amount.
- b) withdraw(): Whenever an amount is withdrawn, it has to be less than the current amount , else print ("Insufficient funds")

CODE:

```

public class BankAccount {
    private String name;
    private int AccNo, CurrBal;

    // Constructor
    public BankAccount(String name, int AccNo, int CurrBal) {
        this.name = name;
        this.AccNo = AccNo;
        this.CurrBal = CurrBal;
        System.out.println("The customer's details are: " + name + " " + AccNo + " " + CurrBal);
    } // Constructor ends

    // Method for withdrawal
    public void withdraw(int WAmt) {
        if (WAmt < CurrBal) {
            CurrBal = CurrBal - WAmt;
            System.out.println("After withdrawal, the current balance is: " + CurrBal);
        } else {
            System.out.println("Insufficient Funds");
        }
    } // Withdraw method ends

    // Method for deposit
    public int deposit(int DAmt) {
        CurrBal = CurrBal + DAmt;
        return CurrBal;
    } // Deposit method ends

    public static void main(String[] args) {
        // Object
        BankAccount cust1 = new BankAccount("Sam", 45988, 123698);
        cust1.withdraw(20000);
        cust1.withdraw(2560);
        System.out.println("Your current balance after depositing money is: " + cust1.deposit(2360));
    }
}

```

OUTPUT:

```

C:\Users\Samhitha>java bank.java
The customer's details are: Sam 45988 123698
After withdrawal, the current balance is: 103698
After withdrawal, the current balance is: 101138
Your current balance after depositing money is: 103498

```

ERRORS:

Sno.	Error	Error rectification
1.	error: ';' expected cust1.withdraw(3050)	Add a “;” cust1.withdraw(3050);
2.	error: cannot find symbol thisCurrBal=CurrBal;	Add a “.” this.CurrBal=CurrBal;

CLASS DIAGRAM:

BankAccount
- name: String - Accno: int - CurrBal: int
BankAccount: void + withdraw(int WAmt): void + deposit(int DAmt): int

Concepts to be known:

- 1) Classes and Objects – The program defines a BankAccount class and creates an object (cust1) to access methods and store account details.
- 2) Constructors – The constructor BankAccount(String name, int AccNo, int CurrBal) initializes the object with values when a new bank account is created.
- 3) Instance Variables – The program uses name, AccNo, and CurrBal as private instance variables to store customer details and account balance.
- 4) Access Modifiers – The private keyword ensures that instance variables cannot be accessed directly from outside the class, maintaining encapsulation.
- 5) Methods (Functions) – The withdraw(int WAmt) method deducts money from the balance, and deposit(int DAmt) adds money and returns the updated balance.
- 6) Conditional Statements – The if-else condition in withdraw checks if the withdrawal amount is less than the current balance before proceeding.

- 7) Return Statements – The deposit method returns the updated balance after adding the deposited amount.
- 8) Printing Output (System.out.println) – The program prints account details, withdrawal status, and the new balance after deposits.
- 9) main Method – The program starts execution from the main method, where an object is created, and methods are called.
- 10) Basic Error Debugging – Understanding common Java errors like misspelled method names (depost → deposit), incorrect keywords (retirn → return), and missing braces helps in fixing compilation issues.

WEEK-04

AIM: Write a java program with class named “book”, the class should contain various attributes such as title, author, year of publication it should also contain a constructor with parameters which initializes, title, author, and year of publication.

Create a method which displays the details of the book and display the details of two books.

CODE:

```
book.java
File Edit View

class book{
    //declaring attributes
    String Title_of_the_book;
    String Author;
    int Year_of_publication;

    //constructor to initialise values
    book(String Title_of_the_book, String Author, int Year_of_publication) {
        this.Title_of_the_book = Title_of_the_book;
        this.Author = Author;
        this.Year_of_publication = Year_of_publication;
        System.out.println(" Your book: "+this Title_of_the_book);
    }

    //creating a method
    public void getbook() {
        System.out.println("The Title of the Book : "+Title_of_the_book);
        System.out.println("Author : "+Author);
        System.out.println("Published Year : "+Year_of_publication);
    }

    public static void main(String[] args) {
        //creating a object for class book
        book book1 = new book("Harry Potter", "J.K.Rowling", 1997);
        book.getbook();
        book book2 = new book("Maze Runner", "James Dashner", 2009);
        book.getbook();
    }
}
```

OUTPUT:

```
C:\Users\Samhitha>java book.java
Your book: Harry Potter
The Title of the Book: Harry Potter
Author: J.K.Rowling
Published Year: 1997
Your book: Maze Runner
The Title of the Book: Maze Runner
Author: James Dashner
Published Year: 2009
```

ERROR:

Sno.	Error Message	Error rectification
1.	System.out.println(" Your book: "+this Title_of_the_book); - Syntax error	Change this Title_of_the_book to this.Title_of_the_book.
2.	book.getbook(); - Error in calling method	Replace book.getbook(); with book1.getbook(); and book2.getbook();.
3.	book book1 = new book("Harry Potter", "J.K.Rowling", 1997); - Class name issue	Change book to Book everywhere in the file

IMPORTANT POINTS:

- 1) The class Book follows Java naming conventions and represents a real-world book entity.
- 2) Stores book details (Title_of_the_book, Author, Year_of_publication).
- 3) Initializes object properties using the this keyword to avoid variable name conflicts.
- 4) Displays book details, demonstrating encapsulation and controlled data access.
- 5) Two book objects (book1, book2) are instantiated and used.
- 6) Class names should start with an uppercase letter, and the constructor must match the class name exactly.

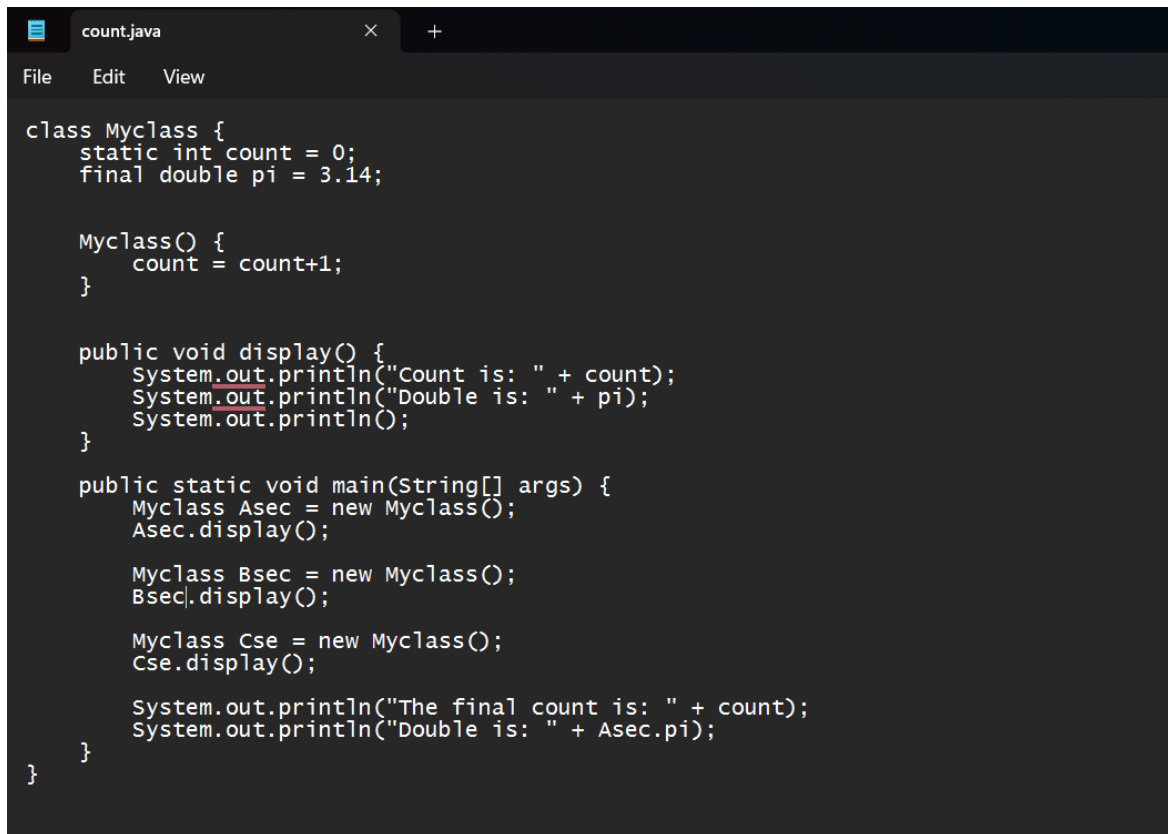
CLASS DIAGRAM:

Book
-Title_of_the_book: String -Author: String -Year_of_publication: int
+ Book(title: String,Author: String;Year of publication: int + getbook(): void

PROGRAM-2:

AIM:Create a java Program with class named myclass with static variable count of int type, initialized to zero and a constant variable “pi” of type double initialized to 3.14 as attributes of the class, ow define a constructor for “myclass” that increments the count variable each time an object of my class is created (count++), finally print the final values of count and pi variables create three objects.

CODE:

A screenshot of a Java IDE window titled 'count.java'. The window has a menu bar with 'File', 'Edit', and 'View'. The code is as follows:

```
class MyClass {
    static int count = 0;
    final double pi = 3.14;

    MyClass() {
        count = count+1;
    }

    public void display() {
        System.out.println("Count is: " + count);
        System.out.println("Double is: " + pi);
        System.out.println();
    }

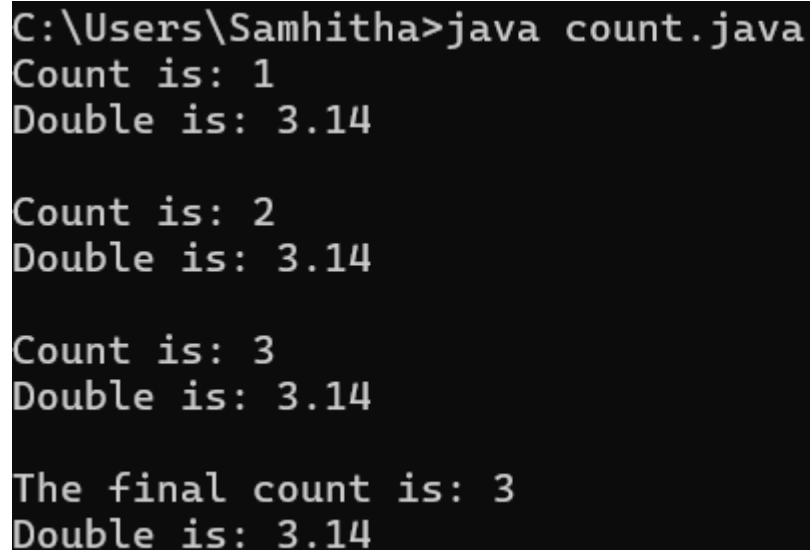
    public static void main(String[] args) {
        MyClass Asec = new MyClass();
        Asec.display();

        MyClass Bsec = new MyClass();
        Bsec.display();

        MyClass Cse = new MyClass();
        Cse.display();

        System.out.println("The final count is: " + count);
        System.out.println("Double is: " + Asec.pi);
    }
}
```

OUTPUT:

A screenshot of a Windows command prompt window. The prompt is 'C:\Users\Samhitha>java count.java'. The output of the program is displayed as follows:

```
C:\Users\Samhitha>java count.java
Count is: 1
Double is: 3.14

Count is: 2
Double is: 3.14

Count is: 3
Double is: 3.14

The final count is: 3
Double is: 3.14
```

ERROR:

Sno.	Error Message	Error rectification
1.	count.java:2: error: <identifier> expected at Static int count = 0;	Change Static to static.
2.	count.java:3: error: <identifier> expected at final doublepi = 3.1415;	Change final doublepi = 3.1415; to final double pi = 3.1415;.
3.	count.java:16: error: <identifier> expected at public Static void main(String[] args) {	Change Static to static.

IMPORTANT POINTS:

- 1) Asec.display() and Bsec.display() access the instance methods and variables through their respective object references.
- 2) System.out.println("Double is :"+Bsec.pi); accesses that pi variable of the Bsec object.
- 3) new keyword followed by the class constructor. This allocates memory for the object and initializes its attributes.
- 4) new is necessary for creating objects and invoking constructors.
- 5) Object References are needed to access instance variables and methods.
- 6) final double pi means that once pi is initialized with the value 3.14, it cannot be changed.

CLASS DIAGRAM:

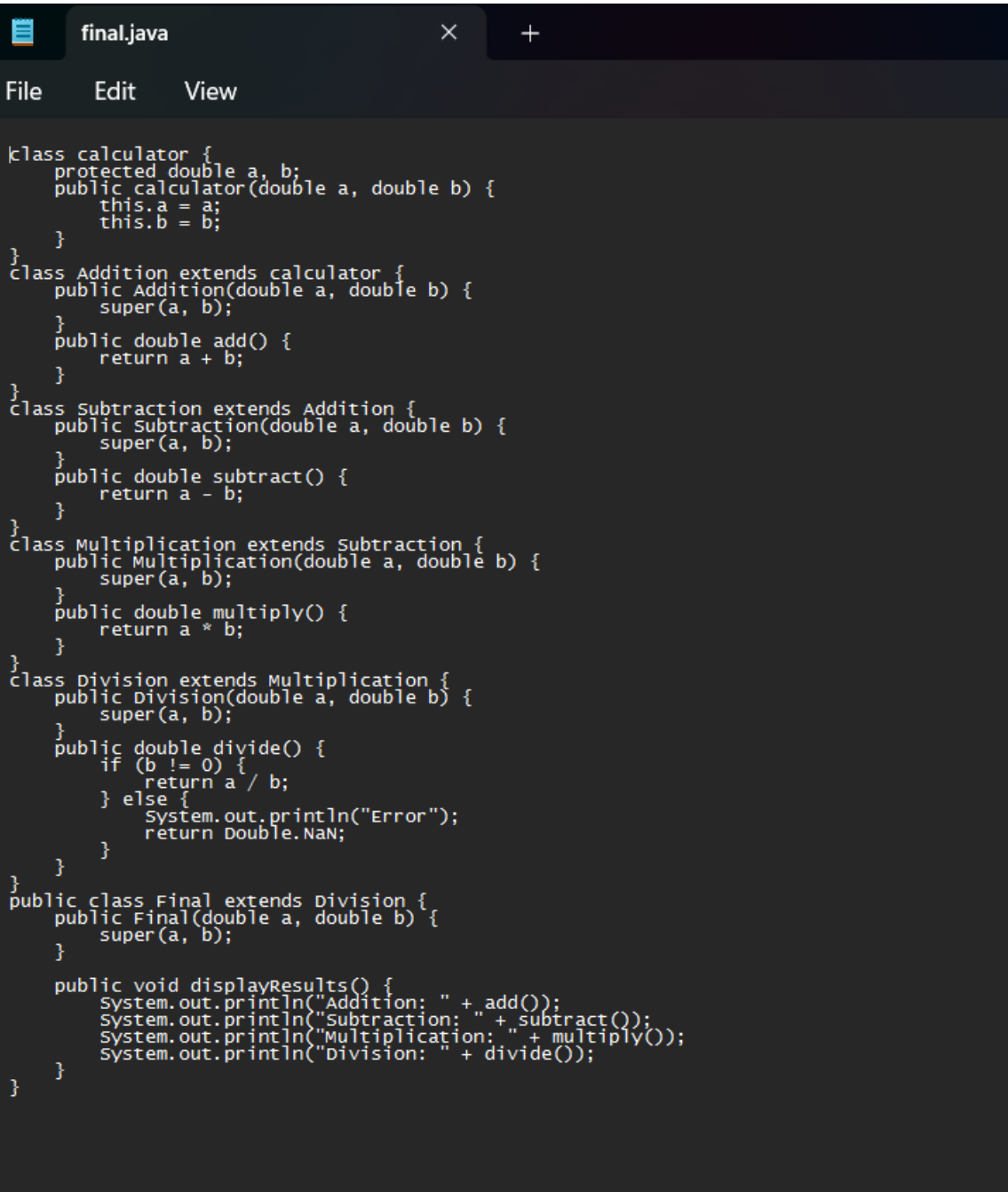
Myclass
-Count: int -Pi: double
+ myclass() + main(args: String[]): void

WEEK-05

AIM: Create a calculator using the operations including addition, subtraction, multiplication, and division using multi-level inheritance and display the desired output.

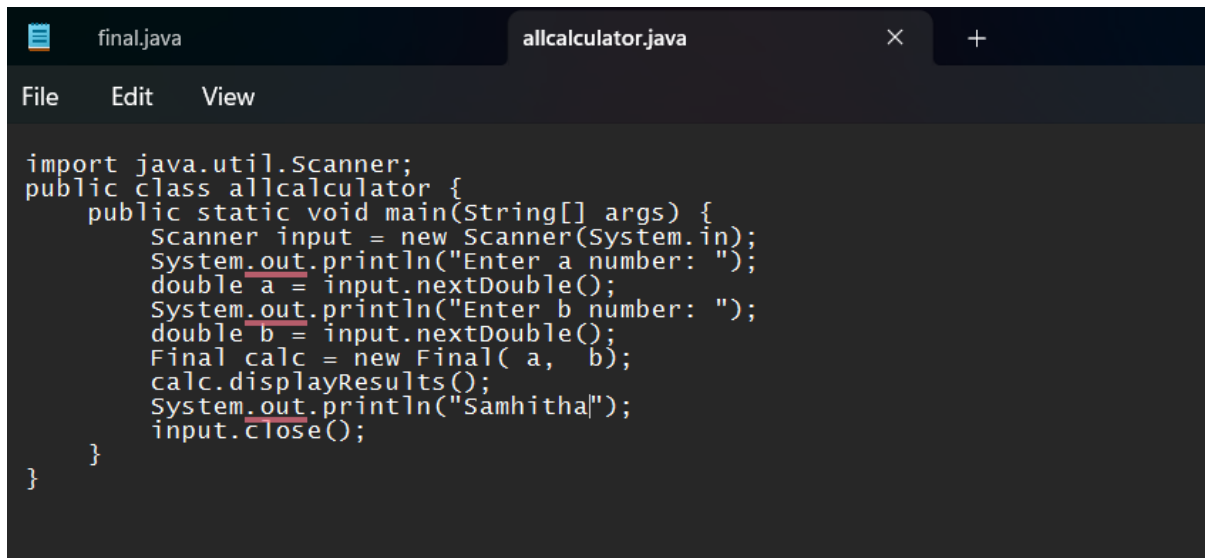
Hint: collect required variables using super class, create each class for a parameter and each class must contain a method.

CODE:



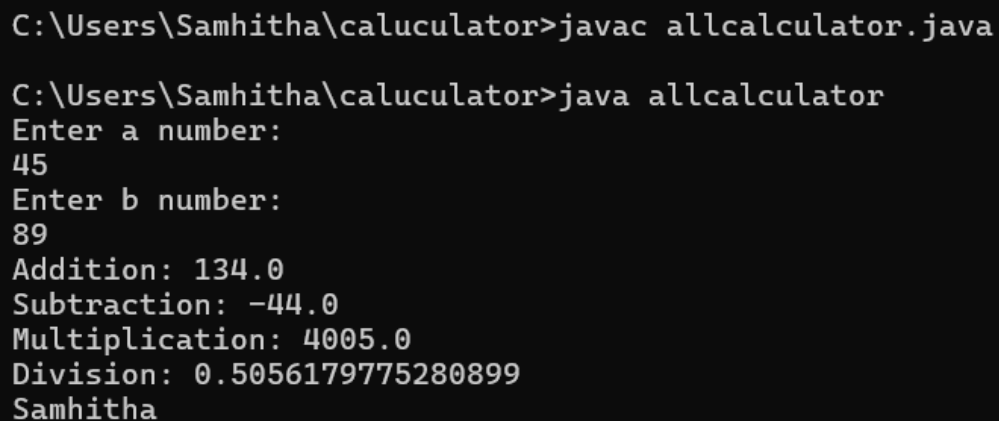
```
class calculator {
    protected double a, b;
    public calculator(double a, double b) {
        this.a = a;
        this.b = b;
    }
}
class Addition extends calculator {
    public Addition(double a, double b) {
        super(a, b);
    }
    public double add() {
        return a + b;
    }
}
class Subtraction extends Addition {
    public Subtraction(double a, double b) {
        super(a, b);
    }
    public double subtract() {
        return a - b;
    }
}
class Multiplication extends Subtraction {
    public Multiplication(double a, double b) {
        super(a, b);
    }
    public double multiply() {
        return a * b;
    }
}
class Division extends Multiplication {
    public Division(double a, double b) {
        super(a, b);
    }
    public double divide() {
        if (b != 0) {
            return a / b;
        } else {
            System.out.println("Error");
            return Double.NaN;
        }
    }
}
public class Final extends Division {
    public Final(double a, double b) {
        super(a, b);
    }

    public void displayResults() {
        System.out.println("Addition: " + add());
        System.out.println("Subtraction: " + subtract());
        System.out.println("Multiplication: " + multiply());
        System.out.println("Division: " + divide());
    }
}
```

A screenshot of a code editor window with two tabs: 'final.java' and 'allcalculator.java'. The 'allcalculator.java' tab is active. The code is as follows:

```
import java.util.Scanner;
public class allcalculator {
    public static void main(String[] args) {
        Scanner input = new Scanner(System.in);
        System.out.println("Enter a number: ");
        double a = input.nextDouble();
        System.out.println("Enter b number: ");
        double b = input.nextDouble();
        Final calc = new Final( a, b);
        calc.displayResults();
        System.out.println("Samhitha");
        input.close();
    }
}
```

OUTPUT:

A screenshot of a terminal window showing the execution of the Java program. The commands and output are as follows:

```
C:\Users\Samhitha\caluculator>javac allcalculator.java
C:\Users\Samhitha\caluculator>java allcalculator
Enter a number:
45
Enter b number:
89
Addition: 134.0
Subtraction: -44.0
Multiplication: 4005.0
Division: 0.5056179775280899
Samhitha
```

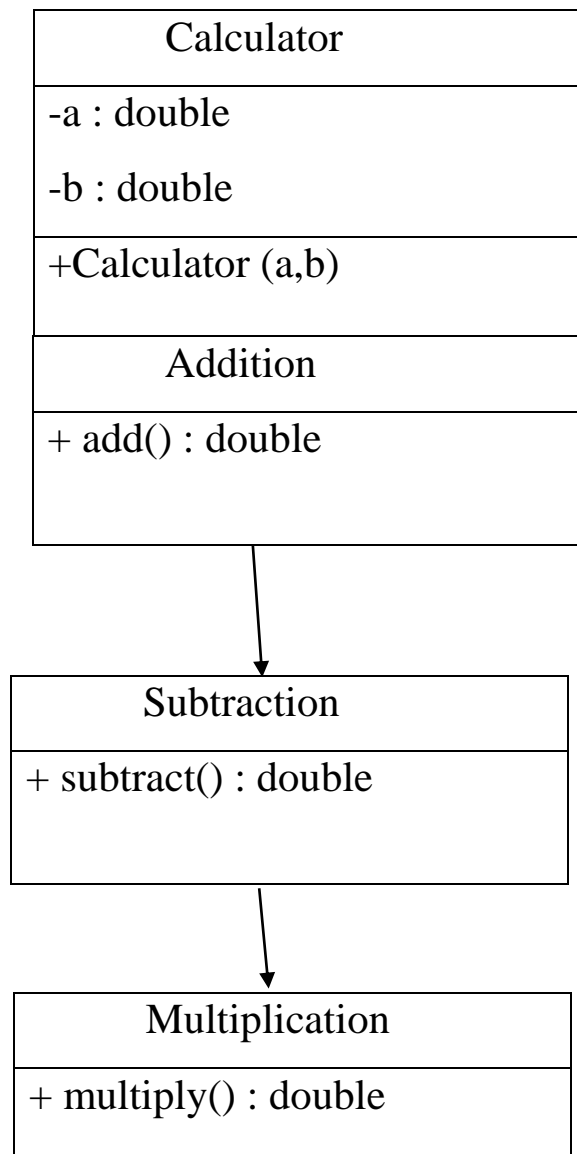
CONCEPTS TO BE KNOWN:

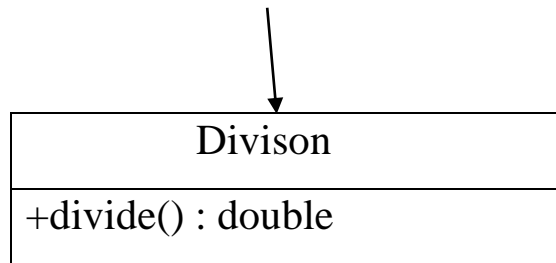
1. To get the inputs from the user we use import java.util.Scanner; this is a package.
2. Scanner class is used to get the user input.
3. In java.util.Scanner, the java.util is a package while Scanner is a class of the java.util package.
4. To import a whole package, end the sentence with an asterisk sign(*)).

ERRORS:

Error Message	Error rectification
<ol style="list-style-type: none"> 1. not providing the return method correctly. 2. Not mentioning super to obtain the super class constructor. 	<ol style="list-style-type: none"> 1. After declaring methods, we must provide the return method correctly. 2. To obtain the super class we need to mention super.

CLASS DIAGRAM:





PROGRAM-2:

AIM: A vehicle rental company wants to develop a system that maintains information about different types of vehicles available for rent the company rents out cars and bikes, and they need a program to store details about each vehicle, such as brand and speed(should be in super class)

1. cars should have an additional property: no.of doors
2. Bikes should have a property indicating whether they have gears or not.
3. The system should also include a function to display details about each vehicle and indicate when a vehicle is starting.
4. Every class should have a constructor

Question:

1. Which oops concept is used in the above program
2. If the company decides to add a new type of vehicle, Truck, how would you modify the program?
 - a. Truck should include an additional property capacity (in tons)
 - b. Create a showTruckdetails() method to display the truck's capacity.
 - c. Write a constructor for Truck that initializes all properties
3. Implement the truck class and update the main method to create a Truck object and also create an object for car and bike sub classes Finally, display the details.

CONCEPTS TO BE KNOWN:

1. a constructor helps in initializing an object that doesn't exist.
2. a method performs functions on pre-constructed or already developed objects.
3. a double method can represent more decimal point numbers than float method.
4. the void keyword in java is used to specify that a method does not return any value. it is a return type that indicates the method performs a function and doesn't produce a result.

Answer for Q1:

The oops concepts used in the above program are:

Inheritance, encapsulation, polymorphism, abstraction.

CODE:

```

Rent.java
File Edit View

class Vehicle {
    private String brand;
    private int speed;

    Vehicle(String brand, int speed) {
        this.brand = brand;
        this.speed = speed;
    }

    void details() {
        System.out.println("Brand: " + brand);
        System.out.println("Speed: " + speed);
    }
}

class Car extends Vehicle {
    private int doors;
    private int capacity;

    public Car(String brand, int speed, int doors, int capacity) {
        super(brand, speed);
        this.doors = doors;
        this.capacity = capacity;
    }

    void carDetails() {
        System.out.println("Number of doors: " + doors);
        System.out.println("Capacity: " + capacity);
    }

    @Override
    void details() {
        super.details();
        carDetails();
    }
}

class Bike extends Vehicle {
    private boolean gears;

    Bike(String brand, int speed, boolean gears) {
        super(brand, speed);
        this.gears = gears;
    }

    void bikeDetails() {
        System.out.println(gears ? "This bike has gears." : "This bike does not have gear system.");
    }

    @Override
    void details() {
        super.details();
        bikeDetails();
    }
}

class Truck extends Vehicle {
    private int tons;

    Truck(String brand, int speed, int tons) {
        super(brand, speed);
        this.tons = tons;
    }

    void truckDetails() {
        System.out.println("The capacity of truck is: " + tons + " tons.");
    }

    @Override
    void details() {
        super.details();
        truckDetails();
    }
}

public class Rent {
    public static void main(String[] args) {
        Car c = new Car("Ferrari", 120, 5, 5);
        c.details();

        Bike b = new Bike("KTM", 80, true);
        b.details();

        Truck t = new Truck("TATA", 100, 1);
        t.details();
    }
}

```

OUTPUT:

```
C:\Users\Samhitha>javac Rent.java
```

```
C:\Users\Samhitha>java Rent
```

```
Brand: Ferrari
```

```
Speed: 120
```

```
Number of doors: 5
```

```
Capacity: 5
```

```
Brand: KTM
```

```
Speed: 80
```

```
This bike has gears.
```

```
Brand: TATA
```

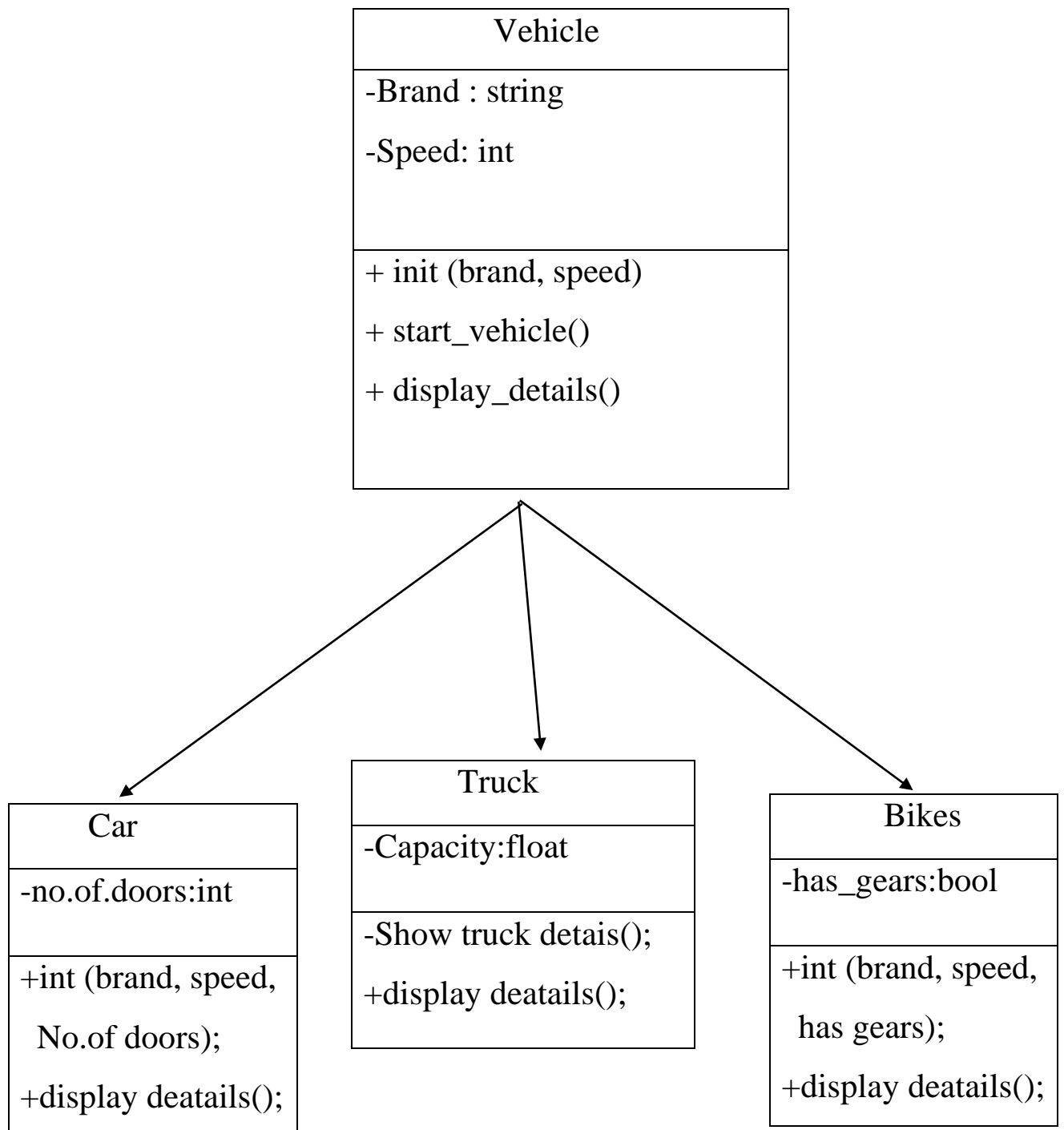
```
Speed: 100
```

```
The capacity of truck is: 1 tons.
```

ERROR TABLE:

<u>Code Error</u>	<u>Code rectification</u>
<ol style="list-style-type: none">1. Declaring two superclasses inside the same file.2. Not declaring the variable using 'this' keyword inside the constructor.	<ol style="list-style-type: none">1. Make two separate files to save the two super classes.2. Declare the variable using this keyword to run the program.

CLASS DIAGRAM:



WEEK-06

PROGRAM-1:

AIM: Write a java program to create a vehicle class with a method `displayinfo()`. Override this method in the car subclass to provide

specific information about car (car company, seating capacity, petrol or not).

CODE:

```
class Vehicle {
    String car_company;
    String car_model;
    long car_price;
    int seating_capacity;
    boolean petrol;

    Vehicle(String car_company, String car_model, long car_price, int seating_capacity, boolean petrol) {
        this.car_company = car_company;
        this.car_model = car_model;
        this.car_price = car_price;
        this.seating_capacity = seating_capacity;
        this.petrol = petrol;
    }

    void displayInfo() {
        System.out.println("Car company: " + car_company);
        System.out.println("Car model: " + car_model);
        System.out.println("Car price: " + car_price);
        System.out.println("Car seating capacity: " + seating_capacity);
        System.out.println("Car uses petrol: " + petrol);
    }
}

class Car extends Vehicle {
    Car(String car_company, String car_model, long car_price, int seating_capacity, boolean petrol) {
        super(car_company, car_model, car_price, seating_capacity, petrol);
    }
}

public class Main {
    public static void main(String[] args) {
        // Creating a Car object with correct arguments
        Car c1 = new Car("Toyota", "Camry", 3000000, 5, true);
        c1.displayInfo();
        Car c2 = new Car("Mercedes", "Benz", 5000000, 2, false);
        c2.displayInfo();
    }
}
```

OUTPUT:

```
C:\Users\Samhitha>javac Main.java

C:\Users\Samhitha>java Main
Car company: Toyota
Car model: Camry
Car price: 3000000
Car seating capacity: 5
Car uses petrol: true
Car company: Mercedes
Car model: Benz
Car price: 5000000
Car seating capacity: 2
Car uses petrol: false
```

ERRORS:

Code error	Code rectification
1. Incorrect class name for main method(Truck).	1.Rename Truck to Main or place main inside car or vehicle.
2. Inconsistent car model output in displayinfo().	2. Ensure Car correctly passes Toyota” to super(car_model,color,fueltype)

IMPORTANT POINTS:

1.Inheritance: The Car class extends the Vehicle class, demonstrating inheritance in Java.

2.Constructor Chaining:The Car class calls the parent constructor using super(car_model, color, fuel_type); to initialize inherited attributes.

3.Method Overriding:The Car class overrides the displayInfo() method from Vehicle and calls super.displayInfo() to reuse the parent method before adding its own output.

4.Incorrect main Class Name:The main method is inside Truck, which is unrelated to Vehicle and Car. The class should be renamed for clarity.

CLASS DIAGRAM:

Vehicle
- Brand: String - Speed: int
+ vehicle(brand: string Speed: int) +start vehicle(): void +displaydetails():void

PROGRAM-2:

AIM: A college is developing an automated admission system that verifies students eligibility(UG) and postgraduation(PG) programs. Each program has different eligibility criteria based on the students percentage in their previous qualification.

1. UG admission require a minimum of 60%.
2. PG admission require a minimum of 70%.

CODE:


```
AutomatedAdmission.java × +
File Edit View

class Student {
    String name;
    double percentage;

    Student(String name, double percentage) {
        this.name = name;
        this.percentage = percentage;
    }

    void studentsinfo() {
        System.out.println("Student Name: " + name);
        System.out.println("Percentage: " + percentage);
    }
}

class UG extends Student {
    UG(String name, double percentage) {
        super(name, percentage);
    }

    void checkEligibility() {
        if (percentage >= 60) {
            System.out.println(name + " is eligible for admission in UG.");
        } else {
            System.out.println(name + " is not eligible for admission in UG.");
        }
    }
}

class PG extends Student {
    PG(String name, double percentage) {
        super(name, percentage);
    }

    void checkEligibility() {
        if (percentage >= 70) {
            System.out.println(name + " is eligible for admission in PG.");
        } else {
            System.out.println(name + " is not eligible for admission in PG.");
        }
    }
}

public class AutomatedAdmission {
    public static void main(String[] args) {
        UG ug = new UG("Samhitha", 80);
        ug.studentsinfo();
        ug.checkEligibility();

        PG pg = new PG("Akku", 75);
        pg.studentsinfo();
        pg.checkEligibility();
    }
}
```

OUTPUT:

```
C:\Users\Samhitha>javac AutomatedAdmission.java
```

```
C:\Users\Samhitha>java AutomatedAdmission
```

```
Student Name: Samhitha
```

```
Percentage: 80.0
```

```
Samhitha is eligible for admission in UG.
```

```
Student Name: Akku
```

```
Percentage: 75.0
```

```
Akku is eligible for admission in PG.
```

ERRORS:

Code error	Code rectification
1.Scanner nextLine() issue after nextDouble(): After scanner.nextDouble(), the newline character remains in the buffer, causing nextLine() to be skipped. 2.Program type input case sensitivity issue: If the user enters ug or pg in lowercase, it may cause incorrect comparisons.	1. Add scanner.nextLine(); after nextDouble(); to consume the leftover newline. 2. Use program.toUpperCase() to ensure case-insensitive comparison.

IMPORTANT POINTS:

1.User Input Handling: Uses Scanner to take user input for name, percentage, and program type.

2.Decision Making with Conditions: Uses if-else statements to check eligibility criteria.

3.String Handling: Converts program input to uppercase (toUpperCase()) to handle case variations.

4.Closing Scanner: Properly closes scanner using scanner.close(); to prevent resource leaks.

CLASS DIAGRAM:

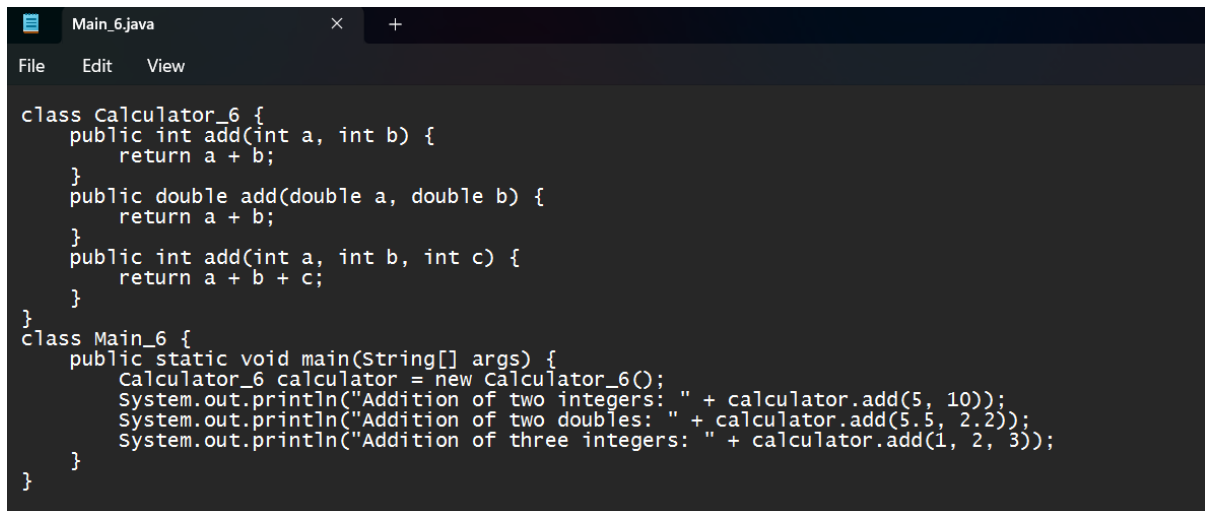
AutomatedAdmission
<ul style="list-style-type: none"> - Scanner: scanner - Name: String - Percentage : double - Program: stirng
+ main(args:String[]): void +takeInput(): void +checkEligibility(): void +closeScanner(); void

PROGRAM-3:

AIM: Create a calculator class with overloaded methods to perform addition of:

1. Add two integers
2. Add two doubles
3. Add three integers

CODE:



```

class Calculator_6 {
    public int add(int a, int b) {
        return a + b;
    }
    public double add(double a, double b) {
        return a + b;
    }
    public int add(int a, int b, int c) {
        return a + b + c;
    }
}
class Main_6 {
    public static void main(String[] args) {
        Calculator_6 calculator = new Calculator_6();
        System.out.println("Addition of two integers: " + calculator.add(5, 10));
        System.out.println("Addition of two doubles: " + calculator.add(5.5, 2.2));
        System.out.println("Addition of three integers: " + calculator.add(1, 2, 3));
    }
}

```

OUTPUT:

```

C:\Users\Samhitha>javac Main_6.java

C:\Users\Samhitha>java Main_6
Addition of two integers: 15
Addition of two doubles: 7.7
Addition of three integers: 6

```

ERRORS:

Code error	Code rectification
1.Method parameters missing spaces. E.g.,”inta, intb”should be “int a, int b”	1. Add proper spacing between parameters: (int a, int b)
2.Inconsistent indentation in method bodies	2. Fix indentation: Consistent 4 space o indentation.

IMPORTANT POINTS:

1.Method Overloading: The add method is overloaded with different parameter types and counts, demonstrating compile-time polymorphism.

2. Automatic Method Selection: Java selects the appropriate add method based on the argument types during compilation.

CLASS DIAGRAM:

Calculator
+ add(int, int): int +add(double, double): double +add(int,int,int): int

PROGRAM-4:

AIM: Create a shape class with a method to calculate area i.e., overloaded for different shapes eg: Squares, Recatangle. Then create a subclass circle that overrides the calculateArea() method for a circle.

CODE:

```
Tools.java
File Edit View

class Shape {
    public double calculateArea(double side) {
        return side * side;
    }

    public double calculateArea(double length, double width) {
        return length * width;
    }
}

class Circle extends Shape {
    private double radius;

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

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

class Tools {
    public static void main(String[] args) {
        Shape shape = new Shape();
        Circle circle = new Circle(5);

        System.out.println("Area of square: " + shape.calculateArea(4));
        System.out.println("Area of rectangle: " + shape.calculateArea(4, 6));
        System.out.println("Area of circle: " + circle.calculateArea());
    }
}
```

OUTPUT:

```
C:\Users\Samhitha>javac Tools.java

C:\Users\Samhitha>java Tools
Area of square: 16.0
Area of rectangle: 24.0
Area of circle: 78.53981633974483
```

ERRORS:

Code error	Code rectification
------------	--------------------

1. Method calls in main are missing an object reference (e.g., calculateArea(4) instead of s.calculateArea(4)).

2. Circle class method does not override the parent class method properly.

1. Use s.calculateArea(4) and c.calculateArea(2) to call the method correctly.

2. Ensure @Override is used, and the method signature should match correctly.

CLASS DIAGRAM:

SHAPE

+ CalculateArea(side:double): double

+CalculateArea(width: double, length: double): double

CIRCLE

+ CalculateArea(radius: double): double

Tools

+main(args:String[]): Void

IMPORTANT POINTS:

1.Inheritance: Circle class extends Shape, inheriting its methods.

2.Method Overloading: Shape has multiple calculateArea methods with different parameters.

3.Method Overriding: Circle overrides calculateArea from Shape to implement its own formula.

4.Polymorphism: The overridden method in Circle demonstrates runtime polymorphism.

5.Proper Object Reference: Methods should be called using an object (s.calculateArea(4), c.calculateArea(2)).

WEEK-07

PROGRAM-1:

AIM : create a Java program to create an abstract class animal with an abstract method called sound (). Create a subclass Lion and tiger that extend the Animal class and implement the sound () method to make a specific sound for each animal.

CODE:

```
abstract class Animal_Abst {
    public abstract void sound();
}

class Lion extends Animal_Abst {
    public void sound() {
        System.out.println("Lion is groaring");
    }
}

class Tiger extends Animal_Abst {
    public void sound() {
        System.out.println("Tiger is roaring");
    }
}

class Abstractclass {
    public static void main(String[] args) {
        Animal_Abst obj1;
        obj1 = new Lion();
        obj1.sound();

        Animal_Abst obj2;
        obj2 = new Tiger();
        obj2.sound();
    }
}
```

OUTPUT:

```
E:\OOPS\WEEK-07>javac Animal.java  
  
E:\OOPS\WEEK-07>java Abstractclass  
Lion is roaring  
Tiger is roaring
```

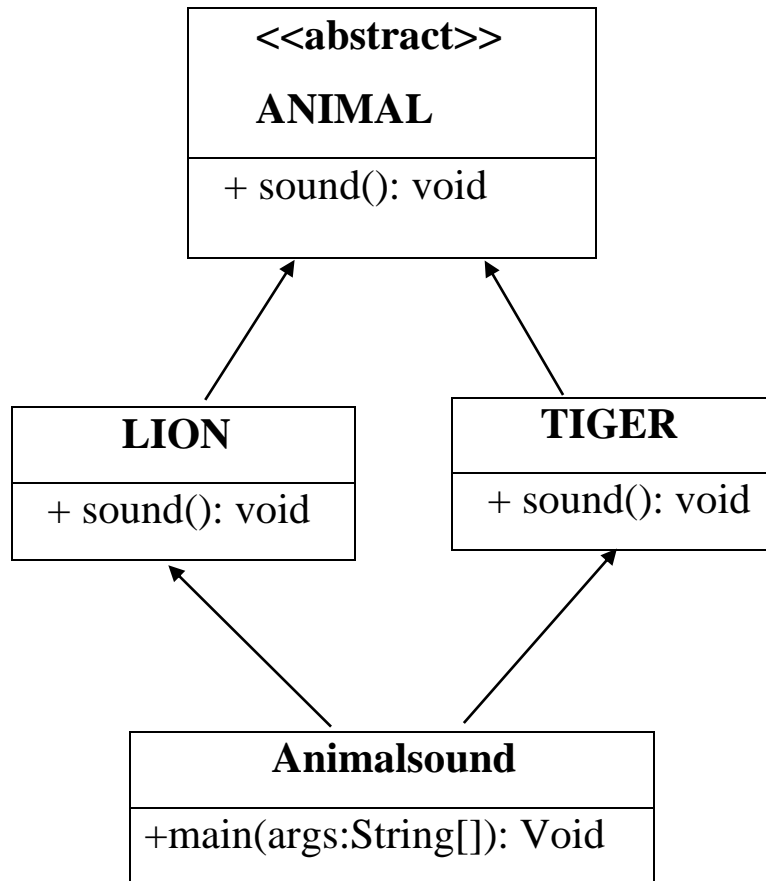
IMPORTANT POINTS:

1. abstract class Animal: Can't be directly used to create objects.
2. abstract void sound(): Forces subclasses to implement this method.
3. Lion and Tiger both override sound().
4. Animal a = new Lion(); uses runtime polymorphism.

ERRORS:

Code error	Code rectification
1. Forgetting to use abstract keyword for the sound() method. 2 Not overriding the sound() method in subclasses.	1. Rectified as abstract void sound(); 2. Added void sound() { ... } in each subclass.

CLASS DIAGRAM:



PROGRAM-2:

AIM : Write a Java program to create an abstract class shape 3D with abstract methods calculate volume ()and calculate surface Area ()create subclasses Sphere and cube that extend the Spape 3D clas and implement the respective methods to calculate ine volume and surface area of each shape.

CODE:

```
public abstract class Shape3D {
    int r=8;
    public abstract void calculateVolume();
    public abstract void calculateSurfaceArea();
}
class Sphere extends Shape3D{
    public void calculateVolume() {
        double pi=3.14;
        double vol=1.33*pi*r*r*r;
        System.out.println("volume of sphere is "+vol);
    }
    public void calculateSurfaceArea() {
        double pi=3.14;
        double A=4*pi*r*r;
        System.out.println("surface area of sphere is "+A);
    }
}
class Cube extends Shape3D{
    public void calculateVolume() {
        int a=5;
        int vol=a^3;
        System.out.println("volume of cube is "+vol);
    }
    public void calculateSurfaceArea() {
        int a=6;
        int S_A=6*(a^2);
        System.out.println("Surface area of the cube is: "+S_A);
    }
}
class q_02{
    public static void main(String[] args) {
        Shape3D obj1;
        obj1=new Sphere();
        obj1.calculateVolume();
        obj1.calculateSurfaceArea();
        Shape3D obj2;
        obj2=new Cube();
        obj2.calculateVolume();
        obj2.calculateSurfaceArea();
    }
}
```

OUTPUT:

```
E:\OOPS\WEEK-07>javac Shape3D.java

E:\OOPS\WEEK-07>java q_02
volume of sphere is 2138.2144000000003
surface area of sphere is 803.84
volume of cube is 6
Surface area of the cube is: 24
```

IMPORTSNT POINTS:

1.Abstract Class Used:Shape3D is an abstract class with abstract methods – it can't be directly used to create objects.

2.Method Overriding:Sphere and Cube both override calculateVolume() and calculateSurface() with their own formulas.

3.Return Type: double :Volume and surface area can be decimal, so methods return double, not int.

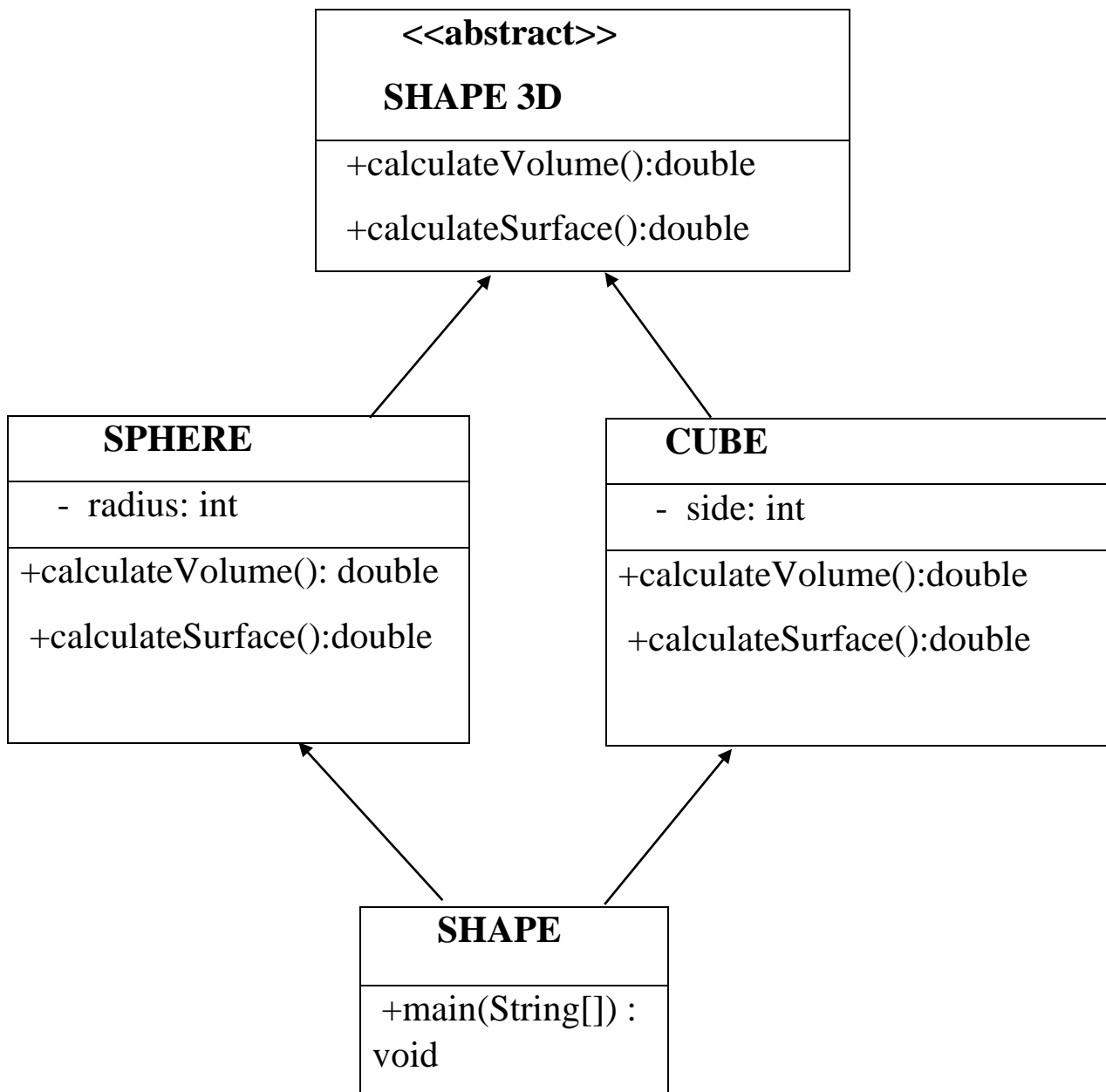
4.Use of Math.PI and Math.pow(): More accurate than hardcoding 3.14 and r*r*r. It's a good practice for real calculations.

ERRORS:

Code error	Code rectification
1. int used instead of double for Volume surface	4. Changed return types of calculateVolume() and calculateSurface() to double
2. (4 / 3) used instead of (4.0 / 3.0)	5. Used floating-point division to avoid integer division loss.
	6. 3.Used Math.PI for more accurate calculations.

3. 3.14 used as approximation
for π

CLASS DIAGRAM:



PROGRAM-3:

AIM :

Write a Java program using an abstract class to define a method for pattern printing.

Create an abstract class named PatternPrinter with:

- An abstract method printPattern(int n)
- A concrete method to display the pattern title

Create two subclasses:

1.StarPattern: Prints a right-angled triangle of stars (*)

2.NumberPattern: Prints a right-angled triangle of increasing numbers

In the main() method, create objects of both subclasses and print the patterns for a given number of rows.

CODE:

```

abstract class PatternPrinter {
    abstract void printPattern(int n);

    void displayTitle(String title) {
        System.out.println( title );
    }
}

class StarPattern extends PatternPrinter {
    void printPattern(int n) {
        for (int i = 1; i <= n; i++) {
            for (int j = 1; j <= i; j++) {
                System.out.print("* ");
            }
            System.out.println();
        }
    }
}

class NumberPattern extends PatternPrinter {
    void printPattern(int n) {
        for (int i = 1; i <= n; i++) {
            for (int j = 1; j <= i; j++) {
                System.out.print(j + " ");
            }
            System.out.println();
        }
    }
}

public class Pattern {
    public static void main(String[] args) {
        int rows = 5;

        PatternPrinter star = new StarPattern();
        star.displayTitle("Star Pattern");
        star.printPattern(rows);

        PatternPrinter number = new NumberPattern();
        number.displayTitle("Number Pattern");
        number.printPattern(rows);
    }
}

```


OUTPUT:

```
E:\OOPS\WEEK-07>javac Pattern.java
```

```
E:\OOPS\WEEK-07>java Pattern
```

```
Star Pattern
```

```
*  
* *  
* * *  
* * * *  
* * * * *
```

```
Number Pattern
```

```
1  
1 2  
1 2 3  
1 2 3 4  
1 2 3 4 5
```

IMPORTANT POINTS:

1. Abstract class PatternPrinter cannot be instantiated directly.
2. Abstract method printPattern(int n) must be implemented in all subclasses.
3. Concrete method displayTitle(String title) is reusable by both subclasses.
4. Use of inheritance: StarPattern and NumberPattern extend the abstract class.
5. In main(), objects are created from subclasses, not the abstract class.

ERRORS:

Code error	1. Code rectification
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<p>1.Wrong loop logic (printing * without loop).</p> <p>2.displayTitle method not used before pattern printing</p> <p>3.Forgot to implement printPattern(int n) in subclass</p> <p>1.</p>	<p>1.Use nested loops: outer loop for rows, inner loop for printing symbols or numbers.</p> <p>2.Call displayTitle() before printing the pattern for proper formatting</p> <p>3.Implemented the method in both subclasses</p>
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CLASS DIAGRAM:

