23CSE111

OBJECT ORIENTED PROGRAMMING

LAB MANUAL

Department of Computer and Science Engineering Amrita

School of Engineering

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Verified By:

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WEEK 1		27-01-2025		
1	Write the steps to download and install Java.			
2	Write a java program to print the message "Welcome to java programming".			
3	Write a java program that prints name, roll number and section of a student.			
WEEK 2		3-02-2025		
1	Write a java program to calculate the area of a rectangle.			
2a)	Write a program to convert temperature from Celsius to Fahrenheit			
b)	Write a program to convert temperature from Fahrenheit to Celsius.			
3	Write a program to calculate the simple interest			
4	Write a program to find the largest of three numbers using ternary operator.			
5	Write a program to find the factorial of a number			
WEEK 3		11-02-2025		
1	Creating a car class with the given instructions			

	Creating a BankAccount class with the given instructions			
WEEK 4		02-03-2025		
1	Write a java program with class named "Book" with given instructions			
2	To create a java program with class named Myclass with given instructions			
WEEK 5		09-03-2025		
1	Create a calc using the operations including add, sub, mul, div using multilevel inheritance and display the desired output			
2	Creating a Rental Sysytem			

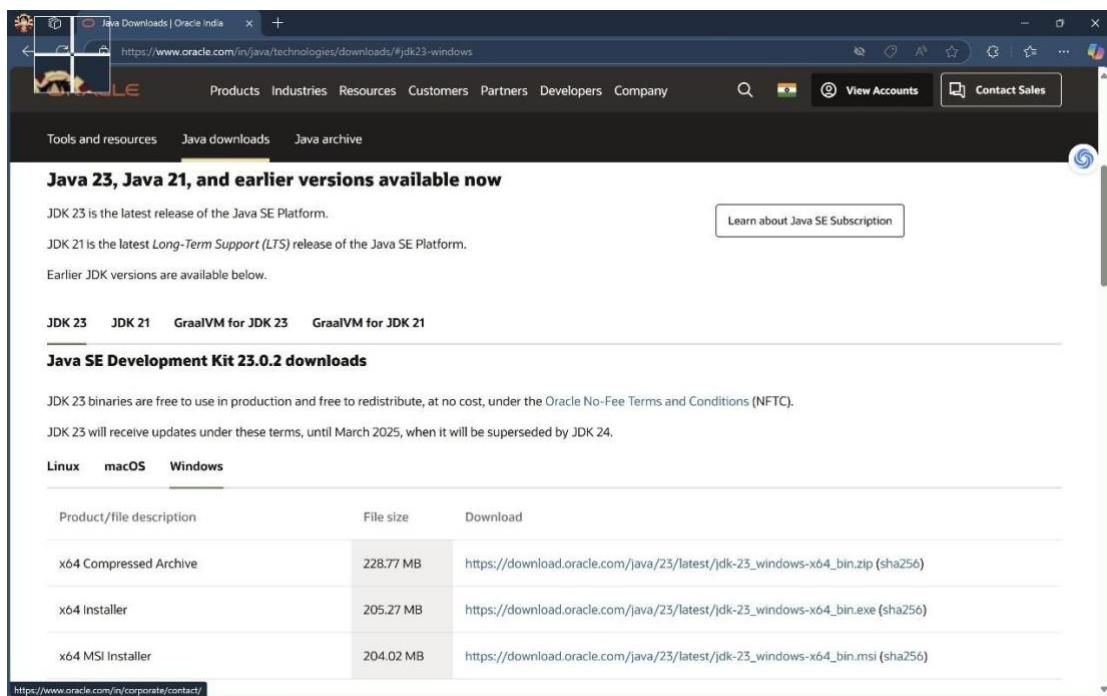# WEEK –1

1. Write the steps to download and install Java.

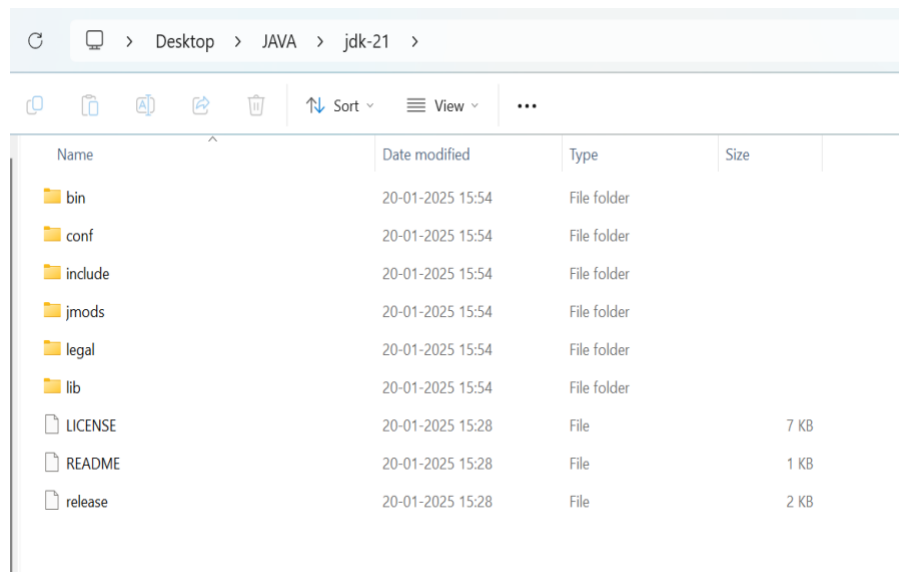   **Aim:** To download and install java.

   Procedure:
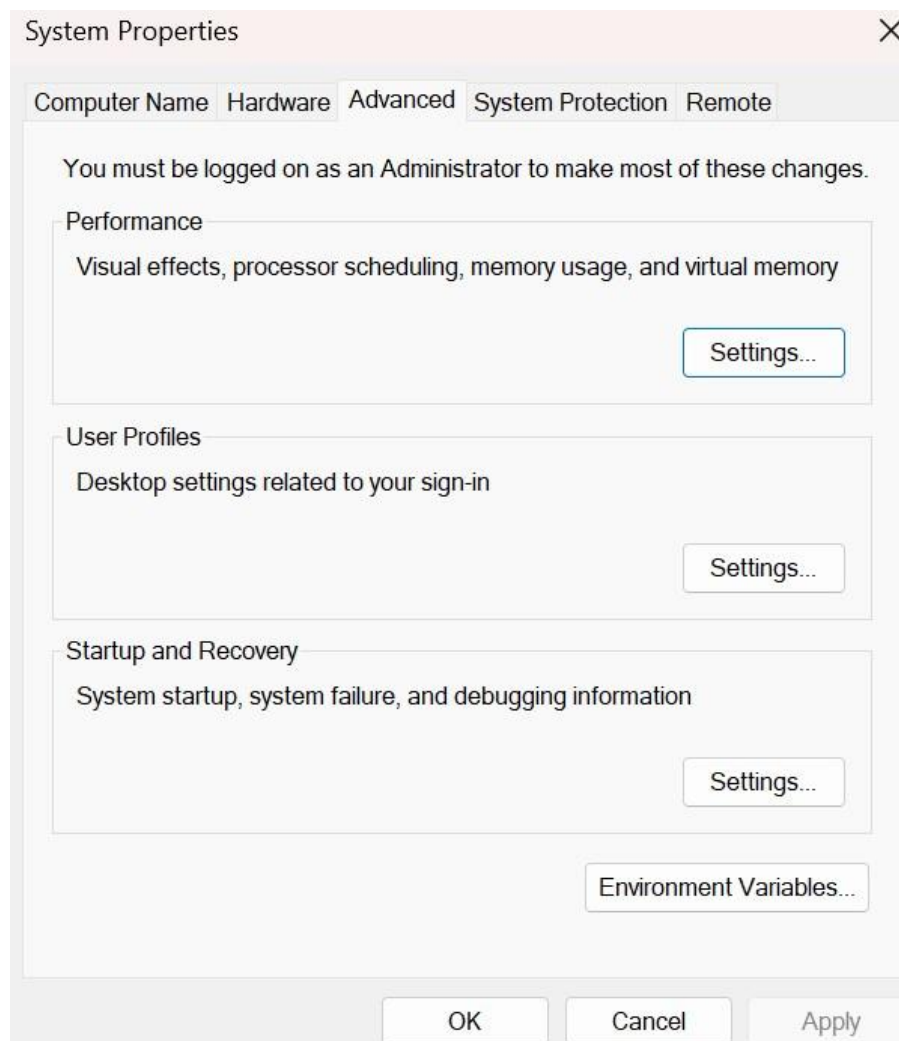
   i.   Visit <u>oracle.com</u> website to download Java.

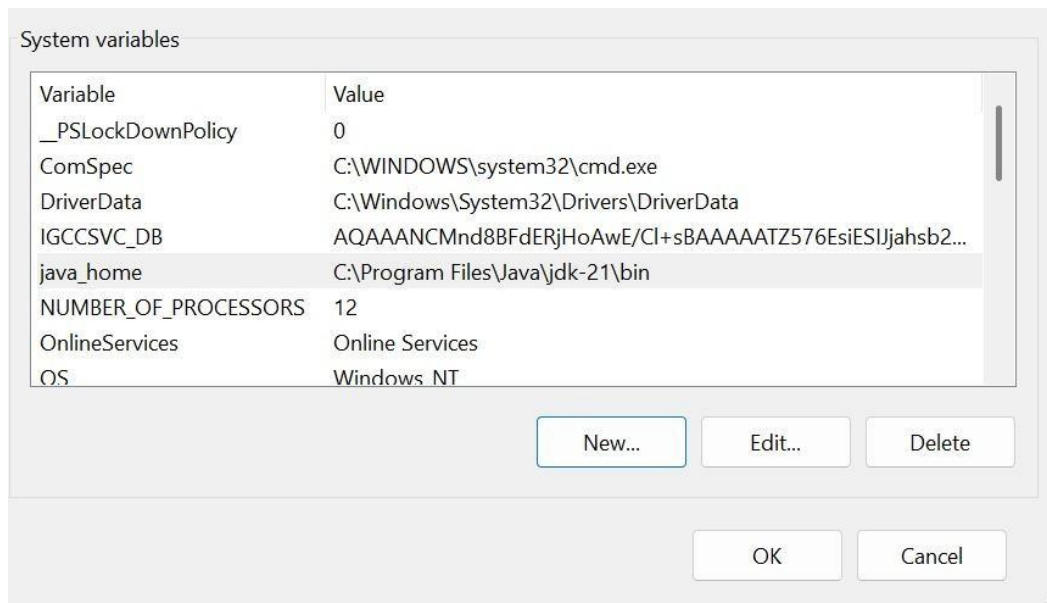   ii. Download the version which supports LTS (JDK 21) x64 installer for windows.

   iii. Install and copy the path.

iv.   Open environmental variables and add a new file with path.

    v.   Verify java version in command window.

2. Write a java program to print the message "Welcome to java programming".

Code:

```
class ex1{
    public static void main(String[] args){
    System.out.println("Welcome to java programming.");
        }
}
```

Output:

Error:

S.No	Expected Error	Reason
1	;	; is expected at end
2	S	Capital S is expected for String and System.

3. Write a java program to print the name, roll number and section of a student.
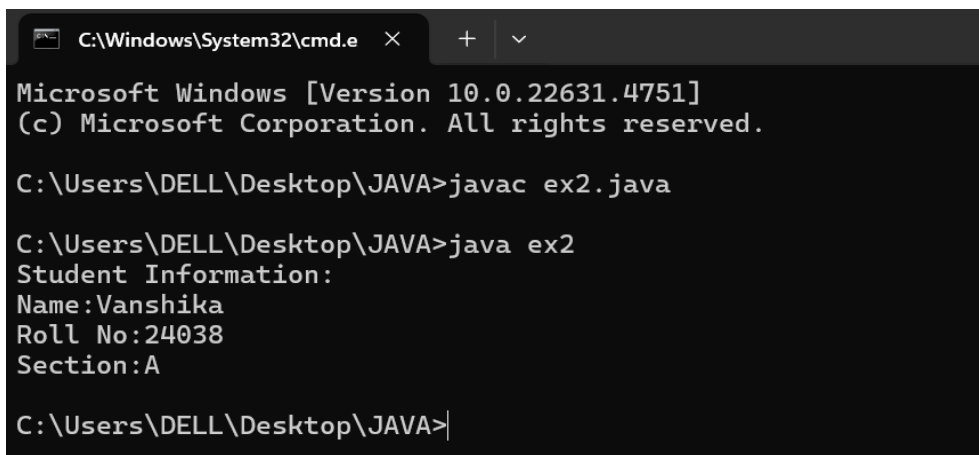
Code:

class ex2{

    public static void main(String[]

args){   String name =

"Vanshika";

int rollNo = 24038;

    String section = "A";

```
        System.out.println("Student Information:");

         System.out.println("Name:" + name);

        System.out.println("Roll No:" + rollNo);

        System.out.println("Section:" + section);

}

}
```

Output:

Error:

S.No	Expected Error	Reason
1	S	Capital S is expected for String and System.

WEEK –2

1. Write a java program to calculate the area of a rectangle.

Code:

```java
import java.util.Scanner;

class rec{

    public static void main(String[] args){

                    Scanner scan=new Scanner(System.in);

                    System.out.println("Enter length of rectangle:");

                    double l=scan.nextDouble();

                    System.out.println("Enter breadth of rectangle:");

                    double b=scan.nextDouble();

                    double a=l*b;

                    System.out.println("Area of rectangle is"+a);

    }

}
```
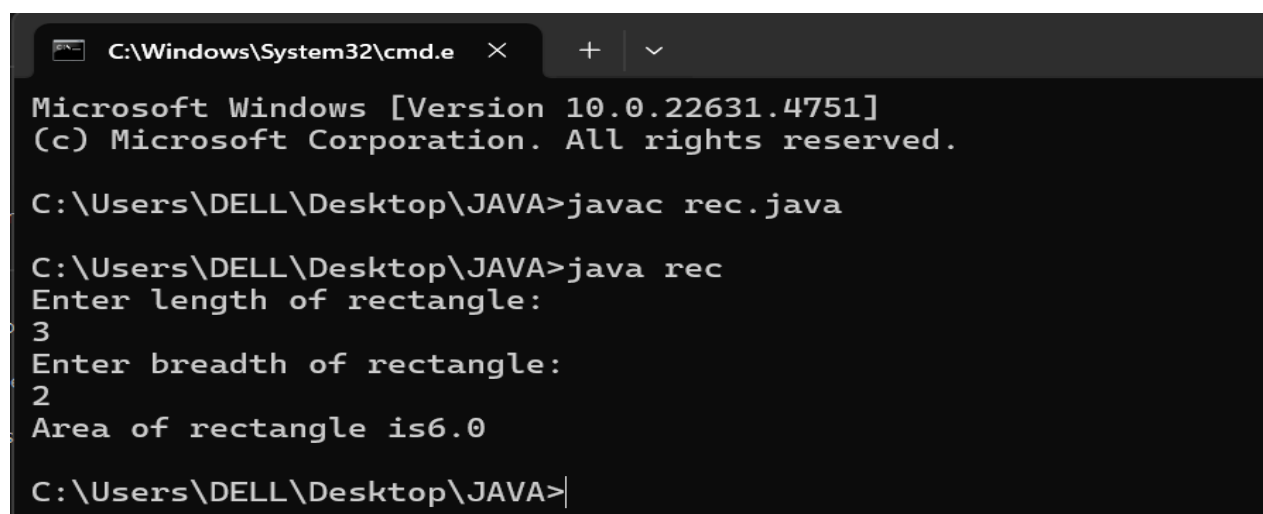
Output:

```
C:\Windows\System32\cmd.e   X    +   v

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

C:\Users\DELL\Desktop\JAVA>javac rec.java

C:\Users\DELL\Desktop\JAVA>java rec
Enter length of rectangle:
3
Enter breadth of rectangle:
2
Area of rectangle is6.0

C:\Users\DELL\Desktop\JAVA>
```

```
C:\Users\DELL\Desktop\JAVA>javac rec.java

C:\Users\DELL\Desktop\JAVA>java rec
Enter length of rectangle:
h
Exception in thread "main" java.util.InputMismatchException
        at java.base/java.util.Scanner.throwFor(Scanner.java:947)
        at java.base/java.util.Scanner.next(Scanner.java:1602)
        at java.base/java.util.Scanner.nextDouble(Scanner.java:2573)
        at rec.main(rec.java:6)

C:\Users\DELL\Desktop\JAVA>
```

Error:

S.No	Expected Error	Reason
1	S	Capital S is expected for String and System.

2a). Write a program to convert temperature from Fahrenheit to Celsius.

Code:

```java
import java.util.Scanner;
class temp{
    public static void main(String[] args){
                    Scanner scan=new Scanner(System.in);
                    System.out.println("Enter temperature in Fahrenheit:");
                    double f=scan.nextDouble();
                    double c=((f-32)/(1.8));
                    System.out.println("Temperature in celsius is"+c);
    }
}
```

Output:

```
C:\Users\DELL\Desktop\JAVA>javac temp.java

C:\Users\DELL\Desktop\JAVA>java temp
Enter temperature in Fahrenheit:
hi
Exception in thread "main" java.util.InputMismatchException
        at java.base/java.util.Scanner.throwFor(Scanner.java:947)
        at java.base/java.util.Scanner.next(Scanner.java:1602)
        at java.base/java.util.Scanner.nextDouble(Scanner.java:2573)
        at temp.main(temp.java:6)

C:\Users\DELL\Desktop\JAVA>
```

```
C:\Windows\System32\cmd.e   ×   +   ∨

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

C:\Users\DELL\Desktop\JAVA>javac temp.java

C:\Users\DELL\Desktop\JAVA>java temp
Enter temperature in Fahrenheit:
97
Temperature in celsius is36.11111111111111

C:\Users\DELL\Desktop\JAVA>
```

Error:

S.No	Expected Error	Reason
1	S	Capital S is expected for String and System.

2b). Write a program to convert temperature from Celsius to Fahrenheit.

Code:

```
 import java.util.Scanner;
class temp{
      public static void main(String[] args){
                        Scanner scan=new Scanner(System.in);
```

```
                    System.out.println("Enter temperature in celsius:");

                    double c=scan.nextDouble();

                    double f=(c*1.8)+32;

                    System.out.println("Temperature in Fahrenheit is"+f);

            }

    }
```

Output:

```
C:\Windows\System32\cmd.e  ×      +    ∨

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

C:\Users\DELL\Desktop\JAVA>javac temp.java

C:\Users\DELL\Desktop\JAVA>java temp
Enter temperature in celsius:
32
Temperature in Fahrenheit is89.6

C:\Users\DELL\Desktop\JAVA>
```
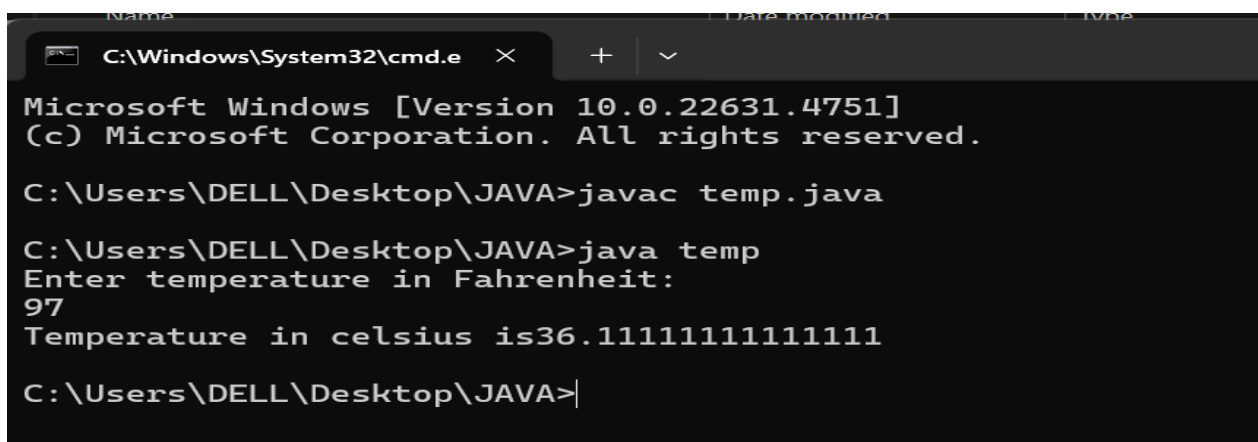
```
C:\Users\DELL\Desktop\JAVA>javac temp.java

C:\Users\DELL\Desktop\JAVA>java temp
Enter temperature in celsius:
hi
Exception in thread "main" java.util.InputMismatchException
        at java.base/java.util.Scanner.throwFor(Scanner.java:947)
        at java.base/java.util.Scanner.next(Scanner.java:1602)
        at java.base/java.util.Scanner.nextDouble(Scanner.java:2573)
        at temp.main(temp.java:6)

C:\Users\DELL\Desktop\JAVA>
```

ERRORS :

S.No	Expected Error	Reason
1	;	; is expected at end
2	Input.close();	The input is expected to be closed.

3)Write a java program to calculate the simple interest.

Code:

```java
import java.util.Scanner;
        public class si{
         public static void main(String[] args){
        Scanner input = new Scanner(System.in);
        System.out.print("Enter principal amount : ");
         int p = input.nextInt();
        System.out.print("Enter rate of interest : ");
         int r = input.nextInt();
        System.out.print("Enter the time period : ");
      int t = input.nextInt();
       int SI = p*r*t/100;
     System.out.print("The simple Interest is : " + SI);
      input.close();
   }
}
```

Output:

```
C:\Users\DELL\Desktop\JAVA>javac si.java

C:\Users\DELL\Desktop\JAVA>java si
Enter principal amount : h
Exception in thread "main" java.util.InputMismatchException
        at java.base/java.util.Scanner.throwFor(Scanner.java:947)
        at java.base/java.util.Scanner.next(Scanner.java:1602)
        at java.base/java.util.Scanner.nextInt(Scanner.java:2267)
        at java.base/java.util.Scanner.nextInt(Scanner.java:2221)
        at si.main(si.java:6)

C:\Users\DELL\Desktop\JAVA>
```

ERRORS :

S.No	Expected Error	Reason
1	;	; is expected at end
2	Int t	Without declaring t the compiler cannot execute the program.

4) Write a java program to find the largest of three numbers using ternary operation.

Code:

```
import java.util.Scanner;
        public class largest{
        public static void main(String[] args){
        Scanner input = new Scanner(System.in);
        System.out.print("Enter number a : ");
        int a = input.nextInt();
        System.out.print("Enter number b : ");
        int b = input.nextInt();
        System.out.print("Enter number c : ");
```

```
        int c = input.nextInt();

        int largest = (a>=b) ? ((a>=c ) ? a : c) : ((b >=c) ? b : c);

        System.out.print("The largest number is : " + largest);

        input.close();

    }

  }
```

Output:

```
C:\Windows\System32\cmd.e    ×    +    ∨

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

C:\Users\DELL\Desktop\JAVA>javac largest.java

C:\Users\DELL\Desktop\JAVA>java largest
Enter number a : 4
Enter number b : 7
Enter number c : 99
The largest number is : 99
C:\Users\DELL\Desktop\JAVA>
```

ERRORS :

S.No	Expected Error	Reason
1	?	Checks the condition
2	:	Comparing between two variables

5) Write a java program to find the factorial of a number

Code:

```java
import java.util.Scanner;
    public class fac{
        public static void main(String[] args){
```

```
Scanner input = new Scanner(System.in);

System.out.print("Enter the number n : ");

int n = input.nextInt();

int fac = 1;

        for(int i = 2; i<=n;i++){

fac *= i;

}

System.out.println( "The factorial of the given number is :" + fac);

input.close();

}

}
```

Output:


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

C:\Users\DELL\Desktop\JAVA>javac fac.java

C:\Users\DELL\Desktop\JAVA>java fac
Enter the number n : 5
The factorial of the given number is :120

C:\Users\DELL\Desktop\JAVA>
```

ERRORS :

S.No	Expected Error	Reason
1	}	To close for loop

2	System.out.print();	If we place the print statement inside the for loop it will print the each i value everytime but to print only the final value we must place it outside the for loop.

WEEK – 3

1)Create the java program with the following instructions

    i)   Create a class with name Car

    ii)   Create 4 attributes named Car_Color , Car_brand, fuel_type, mileage

    iii)   Create 3 method named Start( ) , Stop( ), Service( )

    iv)   Create 3 objects Car1 , Car2 , Car3

    v)   Create a constructor which should print "Welcome to Car Garage"

Code:

```java
public class Car{
 public String carColor;
 private String carBrand;
 private String fuelType;
 public int mileage;
 Car(String carColor , String carBrand , String fuelType , int mileage){
 this.carColor =  carColor;
 this.carBrand = carBrand;
 this.fuelType = fuelType;
 this.mileage = mileage;
 System.out.println(carColor + " " + carBrand + " " + fuelType + " " + mileage);
 }
 public void Start(){
 System.out.println("The car has just started");
 }
 public void Stop(){
 System.out.println("The car has just stopped");
 }
 public void Service(){
 System.out.println("The car is in good condition");
```

```
        }
        public static void main(String[] args){
    Car Car1 = new Car("Black","Audi","Petrol",20);
    Car Car2 = new Car("White","BMW","Diesel",17);
    Car Car3 = new Car("Red","Mercedes","Petrol",16);
    Car1.Start();
    }
    }
```

Output:

```
C:\Users\DELL\Desktop\JAVA>javac Car.java

C:\Users\DELL\Desktop\JAVA>java Car
Black Audi Petrol 20
White BMW Diesel 17
Red Mercedes Petrol 16
The car has just started
```

Errors :

S.No	Expected Error	Reason
1	}	} is expected at end of the class
2	Setting the parameters inside the constructor	We cannot pass the values inside constructor without setting them first

Class Diagram:

Car
+ carColor : String
- carBrand : String
- fuelType : String
+ mileage : int
+ Car() : void
+ Start( ) : void
+ Stop( ) : void
+ Service( ) : void

2)Write a java program to create a class BackAccount with two methods deposit( ) and withdraw( )

    i)   In deposit( ) whenever an amount is deposited it has to be updated with current amount

    ii)   In withdraw( ) whenever an amount is withdrawn it has to be less than current amount else print "Insufficient funds".

Code:

```
public class BankAccount {

    private String Name;

    private int AccNo, CurrBal;


    public BankAccount(String Name, int AccNo, int CurrBal) {

        this.Name = Name;

        this.AccNo = AccNo;

        this.CurrBal = CurrBal;

        System.out.println("The customer is: " + this.Name);

    }
```

```java
    public int deposit(int dAmt) {

        CurrBal += dAmt;

        return CurrBal;

    }


    public void withdraw(int wAmount) {

        if (wAmount <= CurrBal) {  // Allowing withdrawal if balance is equal

            CurrBal -= wAmount;

            System.out.println("Remaining Balance: " + CurrBal);

        } else {

            System.out.println("Insufficient funds");

        }

    }


    public static void main(String[] args) {

        BankAccount Vanshika = new BankAccount("Vanshika", 1500, 10000);


        Vanshika.withdraw(13000);  // Should print "Insufficient funds"

        Vanshika.withdraw(1900);   // Should print remaining balance

        int FinalAmount = Vanshika.deposit(10000);

        System.out.println("Final Balance: " + FinalAmount);

    }

}
```

Output:

```
C:\Users\DELL\Desktop\JAVA>javac BankAccount.java

C:\Users\DELL\Desktop\JAVA>java BankAccount
The customer is: Vanshika
Insufficient funds
Remaining Balance: 8100
Final Balance: 18100
```

Errors:

S.No	Expected Error	Reason
1	}	} is expected at end of the class
2	Setting the parameters inside the constructor	We cannot pass the values inside constructor without setting them first

Class Diagram:

BankAccount
- Name : String
- AccNo : String
- CurrBal : String
+ BankAccount( ) : void
+ deposit( ) : int
+ withdraw( ) : void

WEEK – 4

1) Write a java program with class named "Book". The class should contain various attributes such as "Title of the book , author , year of publication ". It should also contain a constructor with parameters details of the book. i.e. " Title of the book, author and year of publication". Display the details of two books by creating two objects.

Code:

```java
import java.util.Scanner;
class book{
    public String title;
    public String author;
    public int year;
    book(String title,String author, int year){
        this.title=title;
        this.author=author;
        this.year=year;
    }
    public void display(){
        System.out.println("Title of the book is: "+title);
        System.out.println("Author of the book is: "+author);
        System.out.println("Year of publishion of the book is: "+year);
    }
    public static void main(String[] args){
        Scanner scan=new Scanner(System.in);
```

```java
System.out.println("Enter name of the book:");

String title=scan.nextLine();

System.out.println("Enter author of the book:");

String author=scan.nextLine();

System.out.println("Enter year of publishion of the book:");

int year=scan.nextInt();

book third=new book(title,author,year);

third.display();

book first=new book("The kill a mocking bird","Harper Lee",2005);

book second=new book("The alchemist","Paulo Coelho",1995);

first.display();

second.display();
    }
}
```

Output:

```
C:\Users\DELL\Desktop\JAVA>javac book.java

C:\Users\DELL\Desktop\JAVA>java book
Enter name of the book:
The monk who sold his ferrari
Enter author of the book:
Robin Sharma
Enter year of publishion of the book:
1996
Title of the book is: The monk who sold his ferrari
Author of the book is: Robin Sharma
Year of publishion of the book is: 1996
Title of the book is: The kil a mocking bird
Author of the book is: Harper Lee
Year of publishion of the book is: 2005
Title of the book is: The alchemist
Author of the book is: Paulo Coelho
Year of publishion of the book is: 1995
```

Errors :

S.No.	Expected Error	Reason
1	Setting the parameters inside the constructor	We cannot pass the values inside constructor without setting them first
2	}	Ending the class and main method is required

Class Diagram:

book
+ title : String
+ author : String
+ year : int
+ display() : void

2) To create a java program with class named Myclass with a static variable "Count" of "int type", Initialized to 0 and a constant variable "pi" of type double initialized to 3.1415 as attributes of that class Now, define a constructor for "Myclass" that increments the "Count" variable each that an object of Myclass is created. Finally , print the final values of "Count" and "pi" variables.

Code:

```java
class myclass{
        static int count=0;
        final double pi=3.1415;
        myclass(){
                count++;
        }
        void display(){
        System.out.println("The value of pi is: "+ pi);
        }
        public static void main(String[] args){
        myclass obj1=new myclass();
        myclass obj2=new myclass();
        myclass obj3=new myclass();
        int fc=count;
        System.out.println("Total number of objects created is: "+fc);
        obj1.display();
        obj2.display();
        obj3.display();
        }
    }
```

Output:

```
C:\Users\DELL\Desktop\JAVA>javac myclass.java

C:\Users\DELL\Desktop\JAVA>java myclass
Total number of objects created is: 3
The value of pi is: 3.1415
The value of pi is: 3.1415
The value of pi is: 3.1415
```

Errors :

S.No.	Expected Error	Reason
1	.variable	We must mention variable name to call the variable
2	static	Static variables contain only one value

Class Diagram:

myclass
+ static count : int=0
+ final pi : double=3.14
+ display() : void

WEEK –5

1) Create a calc using the operations including add, sub, mul, div using multilevel inheritance and display the desired output.

Code:

```
class bcalc {
    int a, b;
    int sum, diff;
    bcalc(int a, int b) {
        this.a = a;
        this.b = b;
    }
    public void add() {
        diff = a - b;
        sum = a + b;
        System.out.println("Difference: " + diff);
        System.out.println("Sum: " + sum);
    }
}
class acalc extends bcalc {
    int mul;
    acalc(int a, int b) {
        super(a, b);
    }
    public void mult() {
        mul = a * b;
        System.out.println("Multiplication: " + mul);
```

```
    }
}
class aacalc extends acalc {
   float div;
   aacalc(int a, int b) {
      super(a, b);
   }
   public void divi() {
      if (b != 0) {  // Check to avoid division by zero
         div = (float) a / b;
         System.out.println("Division: " + div);
      } else {
         System.out.println("Division by zero error!");
      }
   }
}
class ocalc {
   public static void main(String[] args) {
      aacalc c = new aacalc(10, 2);
      c.divi();
      c.mult();
      c.add();
   }
}
```

Output:

```
C:\Users\DELL\Desktop\JAVA>javac ocalc.java

C:\Users\DELL\Desktop\JAVA>java ocalc
Division: 5.0
Multiplication: 20
Difference: 8
Sum: 12
```

Errors :

S.No.	Expected Error	Reason
1	.variable	We must mention variable name to call the variable
2	static	Static variables contain only one value

Class Diagram:

bcalc
+ a,b,sum,diff : int
+ add() : void +bcalc()

acalc
+ mul : int

```
+------------------------+
| + mult() : void        |
| +acalc()               |
|                        |
|                        |
+------------------------+
```

```
+------------------------+
|        aacalc          |
+------------------------+
| +div: int              |
+------------------------+
|                        |
| + divi() : void        |
| +aacalc()              |
|                        |
+------------------------+
```
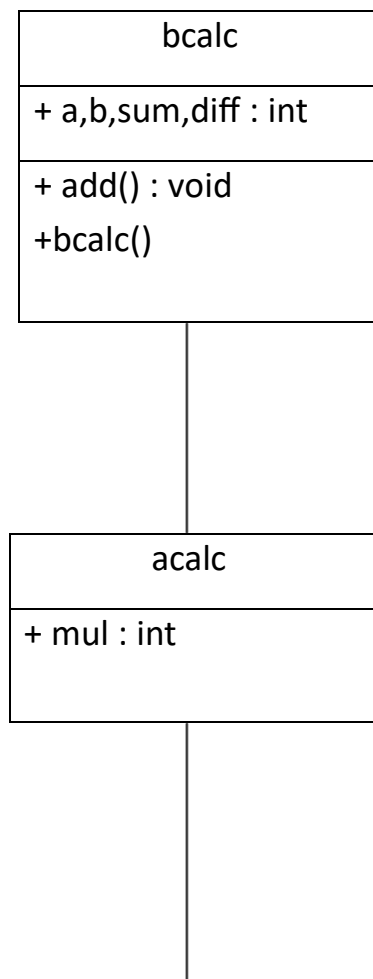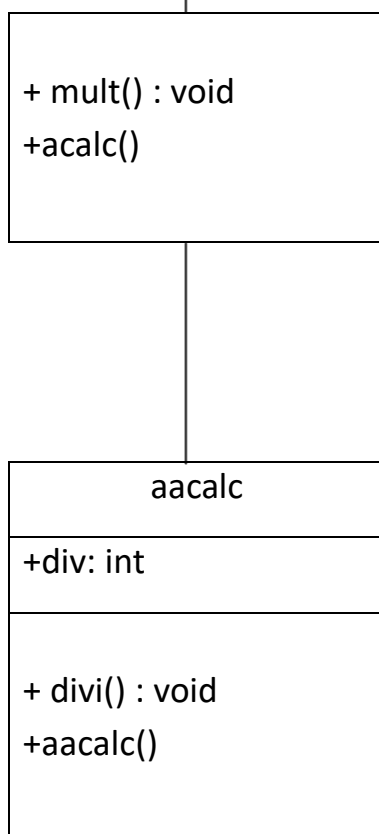
2) A vehicle rental company wants to develop a system that maintains information about different types

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

cars should have an additional properties(attributes)- no.of doors , seating capacity

bikes should have a property indicating whether they have gears or not

the system should also include a function to display details about each vehicle and indicate when a vehicle is starting

each class should have a constructor .

a) which oops concept is used in the above program ? Explain why it is useful in this scenario

b)If the company decides to add a new type of vehicle truck how would u modify the above program

 1) truck should include an additional property called capacity(in tons)

 2)create a show truck details method() to display the trucks capacity

 3)write a constructor for truck that initializes all the properties

c)Implement the truck class and update the main method to create the truck object and also create an object for car and bike subclass. Finally display its details.

Code:

// OOP Concept: Inheritance and Polymorphism are used in this program.

// Inheritance allows different vehicle types to share common properties from a base class.

// Polymorphism enables a generic function to display vehicle details dynamically.

// Base class

```java
class Vehicle {

    String brand;

    int speed;


    Vehicle(String brand, int speed) {
```

```java
      this.brand = brand;

      this.speed = speed;

   }


   void displayDetails() {

      System.out.println("Brand: " + brand);

      System.out.println("Speed: " + speed + " km/h");

   }


   void startVehicle() {

      System.out.println(brand + " is starting...");

   }

}


// Car subclass

class Car extends Vehicle {

   int noOfDoors;

   int seatingCapacity;


   Car(String brand, int speed, int noOfDoors, int seatingCapacity) {

      super(brand, speed);

      this.noOfDoors = noOfDoors;

      this.seatingCapacity = seatingCapacity;

   }


   @Override

   void displayDetails() {

      super.displayDetails();

      System.out.println("Number of Doors: " + noOfDoors);

      System.out.println("Seating Capacity: " + seatingCapacity);
```

```java
    }
}


// Bike subclass
class Bike extends Vehicle {
    boolean hasGears;


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


    @Override
    void displayDetails() {
        super.displayDetails();
        System.out.println("Has Gears: " + (hasGears ? "Yes" : "No"));
    }
}


// Truck subclass
class Truck extends Vehicle {
    double capacity;


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


    void showTruckDetails() {
        System.out.println("Truck Capacity: " + capacity + " tons");
```

```java
    }

    @Override
    void displayDetails() {
        super.displayDetails();
        showTruckDetails();
    }
}

// Main class
public class VehicleRentalSystem {
    public static void main(String[] args) {
        Car car = new Car("Toyota", 150, 4, 5);
        Bike bike = new Bike("Yamaha", 120, true);
        Truck truck = new Truck("Volvo", 100, 15.5);

        System.out.println("Car Details:");
        car.displayDetails();
        car.startVehicle();
        System.out.println();

        System.out.println("Bike Details:");
        bike.displayDetails();
        bike.startVehicle();
        System.out.println();

        System.out.println("Truck Details:");
        truck.displayDetails();
        truck.startVehicle();
    }}
```

Output:

```
C:\Users\DELL\Desktop\JAVA>java VehicleRentalSystem
Car Details:
Brand: Toyota
Speed: 150 km/h
Number of Doors: 4
Seating Capacity: 5
Toyota is starting...

Bike Details:
Brand: Yamaha
Speed: 120 km/h
Has Gears: Yes
Yamaha is starting...

Truck Details:
Brand: Volvo
Speed: 100 km/h
Truck Capacity: 15.5 tons
Volvo is starting...
```

Errors:

S.No.	Expected Error	Reason
1	.variable	We must mention variable name to call the variable
2	static	Static variables contain only one value

Class Diagram:

```
┌─────────────────────────────────┐
│            Vehicle              │
├─────────────────────────────────┤
│ +brand : String                │
│                                 │
│ +speed : int                   │
├─────────────────────────────────┤
│ +Vehicle()                     │
│ +displayDetails():void         │
│                                 │
│ +startVehicle():void           │
└─────────────────────────────────┘
```

```
┌──────────────────────┐   ┌──────────────────────┐   ┌──────────────────────┐
│         Car          │   │         Bike         │   │        Truck         │
├──────────────────────┤   ├──────────────────────┤   ├──────────────────────┤
│ +noOfDoors : int     │   │ + hasGears : boolean │   │ +capacity : double   │
│ +seatingCapacity : int│  ├──────────────────────┤   ├──────────────────────┤
├──────────────────────┤   │ +Bike()              │   │ +Truck()             │
│                      │   │                      │   │                      │
│ +Car()               │   │ +displayDetails():void│  │ +showTruckDetails():void│
│ +displayDetails():void│  │                      │   │                      │
└──────────────────────┘   └──────────────────────┘   │ +displayDetails():void│
                                                       └──────────────────────┘
```