



**Department of Artificial Intelligence and Machine
Learning**

and

**Department of Artificial Intelligence and Data
Science**

III SEMESTER

LAB MANUAL

For

OBJECT-ORIENTED PROGRAMMING LABORATORY

SUB CODE: AIL37/ADL37

Credits: 0:0:1

Handled by

Dr. Meeradevi A K

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tools	Marks	Course Outcomes (Cos) addressed
Lab Test-I	10	CO1, CO2
Lab Test-II	10	CO3
Weekly Evaluation – Lab Record	30	-
The Final CIE out of 50 Marks = Marks of Lab Record + Marks scored in Lab Test-I + Marks scored in Lab Test-II		
Semester End Examination (SEE)		
Course End Examination (One full question from the Lab Question Bank, Programs will be coded using C and executed)	50	CO1, CO2, CO3

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- 1 Write a java program to display the employee details (ID, Name, Age, Salary) for three employees. Read details using Scanner class. Display the names of employees in the order of their age.

Program:

```
import java.util.Scanner;

class Employee
{
    int id;
    String name;
    int age;
    double salary;

    Employee(int id, String name, int age, double salary)
    {
        this.id = id;
        this.name = name;
        this.age = age;
        this.salary = salary;
    }
}

public class Employee_Details
{
    public static void main(String[] args)
    {
        Scanner sc = new Scanner(System.in);
        Employee[] e = new Employee[3];

        for (int i = 0; i < 3; i++)
        {
            System.out.print("Enter employee ID: ");
            int id = sc.nextInt();
            sc.nextLine();
            System.out.print("Enter employee name: ");
            String name = sc.nextLine();
            System.out.print("Enter employee age: ");
            int age = sc.nextInt();
            System.out.print("Enter employee salary: ");
            double salary = sc.nextDouble();

            e[i] = new Employee(id, name, age, salary);
        }

        for (int i = 0; i < 3; i++)
        {
            for (int j = i + 1; j < 3; j++)
            {
                if (e[i].age > e[j].age)
                {
                    Employee temp = e[i];
                    e[i] = e[j];
                    e[j] = temp;
                }
            }
        }

        // Display employee details in order of age

        System.out.println("Employee details in order of age:");
        for (int i = 0; i < 3; i++)
```

```

        {
            System.out.println("ID: " + e[i].id + ", Name: " + e[i].name
                + ", Age: " + e[i].age + ",
                Salary: " + e[i].salary);
        }
    }
}

```

Output:

```

javac Employee_Details.java
java Employee_Details

Enter employee ID: 102
Enter employee name: JOhn
Enter employee age: 65
Enter employee salary: 53012
Enter employee ID: 103
Enter employee name: Kishore
Enter employee age: 24
Enter employee salary: 52310
Enter employee ID: 103
Enter employee name: Mona
Enter employee age: 21
Enter employee salary: 54102
Employee details in order of age:
ID: 103, Name: Mona, Age: 21, Salary: 54102.0
ID: 103, Name: Kishore, Age: 24, Salary: 52310.0
ID: 102, Name: JOhn, Age: 65, Salary: 53012.0

```

- 2 Create a File Sales.java that should contain a Java program that prompts for and reads in the sales for each of 5 salespeople in a company. It should then print out the id and amount of sales for each salesperson and the total sales. Now modify the program as follows:

Compute and print the average sale. (You can compute this directly from the total; no loop is necessary.)

Find and print the maximum sale. Print both the id of the salesperson with the max sale and the amount of the sale, e.g., "Salesperson 3 had the highest sale with \$4500." Note that you don't need another loop for this; you can do it in the same loop where the values are read and the sum is computed. Do the same for the minimum sale.

Ask the user to enter a value. Then print the id of each salesperson who exceeded that amount, and the amount of their sales.

Program:

```

import java.text.NumberFormat;
import java.util.Scanner;

public class Sales
{
    public static void main(String[] args)
    {
        int SALESPEOPLE = 5;
        int sum;
        int maxman = 0;
        int maxsale = Integer.MIN_VALUE;
        int minman = 0;
        int minsale = Integer.MAX_VALUE;
        double average;

        NumberFormat fmt = NumberFormat.getCurrencyInstance();
    }
}

```

```

Scanner scan = new Scanner(System.in);
System.out.print("Please enter the number of sales people:
");
SALESPEOPLE = scan.nextInt();
int[] sales = new int[SALESPEOPLE];

for (int i = 0; i < sales.length; i++)
{
    System.out.print("Enter sales for salesperson " + (i+1) +
                      ": ");
    sales[i] = scan.nextInt();

    if (maxsale < sales[i])
    {
        maxsale = sales[i];
        maxman = i + 1;
    }
    if (minsale > sales[i]){
        minsale = sales[i];
        minman = i + 1;
    }
}

System.out.println("\nSalesperson Sales");
System.out.println(" ----- ");
sum = 0;

for (int i = 0; i < sales.length; i++)
{
    System.out.println(" " + (i+1) + " " + sales[i]);
    sum += sales[i];
}
average = sum / SALESPEOPLE;

System.out.println("\nTotal sales: " + sum);
System.out.println("The average: " + average);
System.out.println("Salesperson " + maxman
                  + " had the highest sale with " +
                  fmt.format(maxsale)+ ".");
System.out.println("Salesperson " + minman
                  + " had the lowest sale with " + fmt.format(minsale)
                  + ".");
System.out.print("\nPlease enter a value: ");

int line;
sum = 0;
line = scan.nextInt();
System.out.println("\nSalesperson Sales");
System.out.println(" ----- ");

for (int i = 0; i < sales.length; i++)
{
    if (sales[i] > line)
    {
        System.out.println(" " + (i+1) + " " + sales[i]);
        sum += sales[i];
    }
}
System.out.println("\nTotal sales for who exceeded the line:
                     "+sum);
}

```

Output:

```
javac Sales.java
java Sales

Please enter the number of sales people: 4
Enter sales for salesperson 1: 5600
Enter sales for salesperson 2: 4500
Enter sales for salesperson 3: 2300
Enter sales for salesperson 4: 1500

Salesperson Sales
-----
1 5600
2 4500
3 2300
4 1500

Total sales: 13900
The average: 3475.0
Salesperson 1 had the highest sale with Rs.5,600.00.
Salesperson 4 had the lowest sale with Rs.1,500.00.

Please enter a value: 4560

Salesperson Sales
-----
1 5600

Total sales for who exceeded the line: 5600
```

3 Write a java program to multiply two given matrices.**Program:**

```
public class MatrixMultiplicationExample
{
    public static void main(String args[])
    {
        //creating two matrices
        int a[][]={{1,1,1},{2,2,2},{3,3,3}};
        int b[][]={{1,1,1},{2,2,2},{3,3,3}};

        //creating another matrix to store the multiplication of two
        //matrices
        int c[][]=new int[3][3]; //3 rows and 3 columns

        //multiplying and printing multiplication of 2 matrices
        for(int i=0;i<3;i++)
        {
            for(int j=0;j<3;j++)
            {
                c[i][j]=0;
                for(int k=0;k<3;k++)
                {
                    c[i][j]+=a[i][k]*b[k][j];
                } //end of k loop
                System.out.print(c[i][j]+" ");
            } //end of j loop
            System.out.println(); //new line
        }
    }
}
```

```

        }
    }

Output:

javac MatrixMultiplicationExample.java
java MatrixMultiplicationExample

6 6 6
12 12 12
18 18 18

```

- 4 Write a Java Program that does the following
- Create a super class called Car. The Car class has the following fields and methods. int speed; double regularPrice; String color; double getSalePrice();
 - Create a sub class of Car class and name it as Truck. The Truck class has the following fields and methods. int weight; double getSalePrice(); /If weight>2000,10% discount. Otherwise,20%discount.
 - Create a subclass of Car class and name it as Ford. The Ford class has the following fields and methods int year; int manufacturerDiscount; double getSalePrice(); //From the sale price computed from Carclass, subtract the manufacturer Discount.
 - Create a subclass of Car class and name it as Sedan. The Sedan class has the following fields and methods. int length; double getSalePrice(); //If length>20 feet, 5% discount, Otherwise, 10% discount.
 - Create MyOwnAutoShop class which contains the main() method. Perform the following within the main() method.
 - Create an instance of Sedan class and initialize all the fields with appropriate values.
 - Use super(...) method in the constructor for initializing the fields of the superclass.
 - Create an instance of the Ford class and initialize all the fields with appropriate values.
 - Use super(...) method in the constructor for initializing the fields of the super Class.
 - Create an instance of Car class and initialize all the fields with appropriate values. Display the sale prices of all instances.

Program:

```

class Car
{
    int speed;
    double regularPrice;
    String color;

    Car(int s,double price,String c)
    {
        speed=s;
        regularPrice=price;
        color=c;
    }
    double getSalePrice()
    {
        return regularPrice;
    }
}
class Truck extends Car
{

```

```

    int weight;
    Truck(int s,double price,String c,int w)
    {
        super(s,price,c);
        weight=w;
    }
    double getSalePrice()
    {
        if(weight>2000)
        {
            regularPrice=regularPrice*0.9;
            return regularPrice;
        }
        else
        {
            regularPrice=regularPrice*0.8;
            return regularPrice;
        }
    }
}
class Ford extends Car
{
    int manufacturerDiscount,year;
    Ford(int s,double price,String c,int m)
    {
        super(s,price,c);
        manufacturerDiscount=m;
    }
    double getSalePrice()
    {
        regularPrice-=manufacturerDiscount;
        return regularPrice;
    }
}
class Sedan extends Car
{
    int length;
    Sedan(int s,double price,String c,int l)
    {
        super(s,price,c);
        length=l;
    }
    double getSalePrice()
    {
        if(length>20)
        {
            regularPrice=regularPrice*0.95;
            return regularPrice;
        }
        else
        {
            regularPrice=regularPrice*0.9;
            return regularPrice;
        }
    }
}
public class MyOwnAutoShop
{
    public static void main(String[] args)
    {
        Truck t=new Truck(65,2500000,"Red",3000);
        System.out.println("Price of truck is "+t.getSalePrice());
        Car c = new Car(100,800000,"Black");
        System.out.println("Price of Car is "+c.getSalePrice());
    }
}

```

```

        Ford f=new Ford(120,2200000,"Yellow",1 20000);
        System.out.println("Price of ford is "+f.getSalePrice());
        Sedan s= new Sedan(100,3500000,"Blue",22);
        System.out.println("Price of Sedan is "+s.getSalePrice());
    }
}

```

Output:

```

javac MyOwnAutoShop.java
java MyOwnAutoShop
Price of truck is 2250000.0
Price of Car is 800000.0
Price of ford is 2180000.0
Price of Sedan is 3325000.0

```

- 5 Write a Java Program that implements the following
- Define a class **SavingsAccount** with following characteristics.
 - Use a static variable **annualInterestRate** to store the annual interest rate for all account holders.
 - Private data member **savingsBalance** indicating the amount the saver currently has on deposit.
 - Method **calculateMonthlyInterest** to calculate the monthly interest as $(\text{savingsBalance} * \text{annualInterestRate} / 12)$. After calculation, the interest should be added to **savingsBalance**.
 - Static method **modifyInterestRate** to set **annualInterestRate**.
 - Parameterized constructor with **savingsBalance** as an argument to set the value of that instance.
 - Test the class **SavingsAccount** to instantiate two **savingsAccount** objects, **saver1** and **saver2**, with balances of Rs.2000.00 and Rs3000.00, respectively. Set **annualInterestRate** to 4%, then calculate the monthly interest and print the new balances for both savers. Then set the **annualInterestRate** to 5%, calculate the next month's interest and print the new balances for both savers.

Program:

```

class SavingsAccount
{
    static int annualInterestRate;
    private double savingsBalance;
    SavingsAccount(double s)
    {
        savingsBalance=s;
    }
    static void modifyInterestRate(int x)
    {
        annualInterestRate=x;
    }

    void calculateMonthlyInterest()
    {
        double d=(savingsBalance*annualInterestRate)/12;
        savingsBalance=savingsBalance+d;
    }
    void display()
    {
        System.out.println(savingsBalance);
    }
}
public class SavingsAccountMain

```

```

{
    public static void main(String[] args)
    {
        SavingsAccount saver1=new SavingsAccount(2000);
        SavingsAccount saver2=new SavingsAccount(3000);
        SavingsAccount.modifyInterestRate(4);
        saver1.calculateMonthlyInterest();
        saver2.calculateMonthlyInterest();
        saver1.display();
        saver2.display();
        SavingsAccount.modifyInterestRate(5);
        saver1.calculateMonthlyInterest();
        saver2.calculateMonthlyInterest();
        saver1.display();
        saver2.display();
    }
}

```

Output:

```

javac SavingsAccountMain.java
java SavingsAccountMain
2666.666666666665

4000.0
3777.777777777774
5666.666666666667

```

6

Write a Java Program that does the following related to Inheritance:

- Create an abstract class called 'Vehicle' which contains the 'hashelmet','year of manufacture' and two abstract methods 'getData()' and 'putData()'. Demonstrate the error when attempt is made to create objects of 'Vehicle'.
- Have two derived classes 'TwoWheeler' and 'FourWheeler', 'FourWheeler' is a final class. Demonstrate the error when attempt is made to inherit from 'FourWheeler'.
- Your abstract class should have overloaded constructors that initializes hashelmet and year of manufacture for TwoWheeler and FourWheeler respectively.
- 'TwoWheeler" has data elements 'Brand', 'Cost', 'EngineType' (possible values "2 stroke", "4 stroke"), and 'Color'. Demonstrate the various ways in which the two abstract methods can be dealt 'getData()' and 'putData()' can be dealt with by the derived classes, 'TwoWheeler' and 'FourWheeler'.
- The sub-class of 'TwoWheeler' called 'MyTwoWheeler' has the element 'OwnerName'.
- Use the super keyword to initialize an object of 'MyTwoWheeler' with all the values of its parent class data elements.

Program:

```

import java.util.*;

abstract class Vehicle
{
    boolean hashelmet;
    int yom;
    abstract void getData();
    abstract void putData();
    Vehicle(boolean h,int n)
    {
        hashelmet=h;
        yom=n;
    }
}

```

```

class TwoWheeler extends Vehicle
{
    private String Brand;
    protected int Cost;
    String EngineType;
    public String Color;
    TwoWheeler(int n)

    {
        super(true,n);
    }
    void getData()
    {
        Scanner sc=new Scanner(System.in);
        System.out.println("Enter Brand name,Cost,EngineType and Colour");
        Brand=sc.next();
        Cost=sc.nextInt();
        EngineType=sc.next();
        Color=sc.next();
    }
    void putData()
    {
        System.out.println("Brand:"+Brand+"\nCost:"+Cost+"\n EngineType:"
                           +EngineType+"\nColor:"+Color+" \nYear of
                           Manufacture:"+yom+"\nHas helmet:"+hashelmet);
    }
}
final class FourWheeler extends Vehicle
{
    FourWheeler(int n)
    {
        super(false,n);
    }
    void getData()
    {
    }
    void putData()
    {
        System.out.println("Year of Manufacture:"+yom+"\nHas
                           helmet:"+hashelmet);
    }
}
class MyTwoWheeler extends TwoWheeler
{
    String name;
    MyTwoWheeler(String name,int n)
    {
        super(n);
        this.name=name;
    }
    void display()
    {
        super.getData();
        putData();
        System.out.println("Name:"+name);
    }
}
/* class A extends FourWheeler
{
    A()
    {
        super(5);
    }
}

```

```

/*
public class VehicleMain
{
    public static void main(String[] args)
    {
        /*Vehicle v=new Vehicle();
        Cannot Create instance of an abstract class*/
        TwoWheeler t1=new TwoWheeler(1995);

        FourWheeler f1=new FourWheeler(2006);
        t1.getData();
        t1.putData();
        f1.putData();
    }
}

Output:

javac VehicleMain.java
java VehicleMain
Enter Brand name,Cost,EngineType and Colour
Mercedes
120000
Electric
Red
Brand:Mercedes
Cost:120000
EngineType:Electric
Color:Red
Year of Manufacture:1995
Has helmet:true
Year of Manufacture:2006
Has helmet:false

```

7

- Write a java program to implement the following**
- Create a superclass called student with data members as USN, Name and marks**
 - Create a subclasses called UG_student having the fields USN, Name, and total no. of semesters (ToS) and marks for three subjects**
 - Create a subless PG_Student that extends student class which has the data members USN, Name and Total No. of Semesters (ToS) and marks for three subjects**
 - Define the main function to display the details for three students using arrays of objects.**

```

import java.util.*;
class students
{
String USN, Name;
int age;
double m1, m2, m3;
students(String USN, String Name, int age, double m1, double m2, double m3)
{
this.USN=USN;
this.Name=Name;
this.age=age;
this.m1=m1;
this.m2=m2;
this.m3=m3;
}
}
class UG extends students

```

```

{
int Sem;
double Fee, Stipend;
String Dept;
UG(String USN, String Name, int age, double m1, double m2, double m3, int
Sem, double Fee, double Stipend, String Dept)
{
super(USN, Name, age, m1, m2, m3);
this.Sem=Sem;
this.Fee=Fee;
this.Stipend=Stipend;
this.Dept=Dept;
}
void display()
{
System.out.println("USN=" +super.USN+"\n Name="+super.Name+"\n Age="+su-
per.age+"\n Marks in Subject1="+super.m1+"\n Marks in Subject2="+su-
per.m2+"\n Marks in Subject3="+super.m3+"\n Sem="+Sem+"\n Fee="+Fee+"\n
Stipend="+Stipend+"\n Dept="+Dept);
}
void avg()
{
System.out.println("\n avg of three subject is =\n"+((super.m1+su-
per.m2+super.m3)/3));
}
}
class PG extends students
{
int Sem;
double Fee, Stipend;
String Dept;
PG(String USN, String Name, int age, double m1, double m2, double m3, int
Sem, double Fee, double Stipend, String Dept)
{
super(USN, Name, age, m1, m2, m3);
this.Sem=Sem;
this.Fee=Fee;
this.Stipend=Stipend;
this.Dept=Dept;
}
void display()
{
System.out.println("USN=" +super.USN+"\n Name="+super.Name+"\n Age="+su-
per.age+"\n Marks in Subject1="+super.m1+"\n Marks in Subject2="+su-
per.m2+"\n Marks in Subject3="+super.m3+"\n Sem="+Sem+"\n Fee="+Fee+"\n
Stipend="+Stipend+"\n Dept="+Dept);
}
void avg()
{
System.out.println("\n avg of three subject is =\n"+((super.m1+su-
per.m2+super.m3)/3));
}
}
class Studentdetails
{
public static void main(String args[])
{
UG student1= new UG("1MS22AI001", "Aravind", 19, 90, 91, 95, 3, 20000,
2000, "AI&ML");
UG student2= new UG("1MS22AI002", "Aryan", 20, 80, 81, 85, 3, 21000, 2500,
"AI&DS");
UG student3= new UG("1MS22AI003", "Abhishek", 21, 50, 52, 55, 3, 25000,
3000, "CIVIL");
}
}

```

```

PG student4= new PG("1MS25AI001", "Mala", 30, 90,91,95, 1, 50000, 5000,
"AI&ML");
PG student5= new PG("1MS25AI002", "Arpitha", 25, 50,51,55, 3, 70000,
3000, "AI&DS");
PG student6= new PG("1MS25AI003", "Theju", 23, 90,81,75, 4, 80000, 6000,
"Arch");
student1.display();
student1.avg();
student2.display();
student2.avg();
student3.display();
student3.avg();
student4.display();
student4.avg();
student5.display();
student5.avg();
student6.display();
student6.avg();
}
}
javac Studentdetails.java
java Studentdetails
USN=1MS22AI001
Name=Aravind
Age=19
Marks in Subject1=90.0
Marks in Subject2=91.0
Marks in Subject3=95.0
Sem=3
Fee=20000.0
Stipend=2000.0
Dept=AI&ML

avg of three subject is =
92.0
USN=1MS22AI002
Name=Aryan
Age=20
Marks in Subject1=80.0
Marks in Subject2=81.0
Marks in Subject3=85.0
Sem=3
Fee=21000.0
Stipend=2500.0
Dept=AI&DS

avg of three subject is =
82.0
USN=1MS22AI003
Name=Abhishek
Age=21
Marks in Subject1=50.0
Marks in Subject2=52.0
Marks in Subject3=55.0
Sem=3
Fee=25000.0
Stipend=3000.0
Dept=CIVIL

avg of three subject is =
52.33333333333336
USN=1MS25AI001
Name=Mala
Age=30

```

```

Marks in Subject1=90.0
Marks in Subject2=91.0
Marks in Subject3=95.0
Sem=1
Fee=50000.0
Stipend=5000.0
Dept=AI&ML

avg of three subject is =
92.0
USN=1MS25AI002
Name=Arpitha
Age=25
Marks in Subject1=50.0
Marks in Subject2=51.0
Marks in Subject3=55.0
Sem=3
Fee=70000.0
Stipend=3000.0
Dept=AI&DS

avg of three subject is =
52.0
USN=1MS25AI003
Name=Theju
Age=23
Marks in Subject1=90.0
Marks in Subject2=81.0
Marks in Subject3=75.0
Sem=4
Fee=80000.0
Stipend=6000.0
Dept=Arch

avg of three subject is =
82.0

```

- 8 **Write a java program to implement stack operation (Push, Pop). Your class should have an empty constructor. Create two objects to demonstrate the stack operation for 10 items.**

Program:

```

class Stack
{
    int stck[] = new int[10];
    int tos;
    Stack()
    {
        tos = -1;
    }
    void push(int item)
    {
        if(tos == 9)
            System.out.println("Stack is full.");
        else
            stck[++ tos] = item;
    }
    int pop()
    {
        if(tos < 0)
        {
            System.out.println("Stack underflow.");
        }
        else
            tos--;
    }
}

```

```

        return 0;
    }
    else
    {
        return stck[tos --];
    }
}
class TestStack
{
    public static void main(String args[])
    {
        Stack obj1 = new Stack();
        Stack obj2 = new Stack();
        for(int i=0 ; i<10; i++)
            obj1.push(i);
        for(int i=0 ; i<10; i++)
            obj2.push(i);
        System.out.println("\nFirst Stack: \n");
        for(int i=0 ; i<10; i++)
            System.out.println(obj1.pop() + "\t");
        System.out.println("\nSecond Stack: \n");
        for(int i=0 ; i<10; i++)
            System.out.println(obj2.pop() + "\t");
    }
}

```

Output:

```

javac TestStack.java
java TestStack

```

First Stack:

```

9
8
7
6
5
4
3
2
1
0

```

Second Stack:

```

9
8
7
6
5
4
3
2
1
0

```

- 9 Demonstrate the usage of final, default constructors and parameterized constructors by suitably designing a java program.

Program:

```

class Student
{
    private String name;
    private int age;
    //Default Constructor
    Student()
    {
        this.name = "";
        this.age = 0;
    }

    //Parameterized Constructor
    Student(String name, int age)
    {
        this.name = name;
        this.age = age;
    }

    public String getName()
    {
        return this.name;
    }
    public void setName(String name)
    {
        this.name = name;
    }
    public int getAge()
    {
        return this.age;
    }
    public void setAge(int age)
    {
        this.age = age;
    }
    // finalize method
    @Override
    protected void finalize() throws Throwable
    {
        System.out.println("Finalizing Student object: " + this.name);
        super.finalize();
    }
}

public class StudentMain
{
    public static void main(String[] args)
    {
        final char section = 'D';
        Student s1 = new Student();
        s1.setName("John Doe");
        s1.setAge(20);
        System.out.println("Name: " + s1.getName());
        System.out.println("Age: " + s1.getAge() + "\nSection: " +
section);
        Student s2 = new Student("Jane Doe", 22);
        System.out.println("Name: " + s2.getName());
        System.out.println("Age: " + s2.getAge());
    }
}

Output:

javac StudentMain.java
java StudentMain

```

	Name: John Doe Age: 20 Section: D Name: Jane Doe Age: 22
10	<p>Write a java program to maintain the student details like USN, Dept names, 3 subject grades and SGPA in student package and keep the staff details such as Staffid, StaffName, designation and subjects handled in a staff package. In main class use these two packages details for Staff and Student classes and display the student and staff information as requested by the user.</p> <p>Program:</p> <pre> package details; public class Student { String name,dept,grade1,grade2,grade3,usn; double sgpa,cgpa; public Student(String n,String u,String d,String g1,String g2, String g3,double s) { name=n; usn=u; dept=d; grade1=g1; grade2=g2; grade3=g3; sgpa=s; } public void show() { System.out.println("Student Name:"+name+" with USN: "+usn+" of Department: "+dept); System.out.println("The Grades are "+grade1+","+grade2+","+grade3); } } package staffdetails; public class Staff { String stn,std; int stID; String[] sub = new String[] {"Maths", "OOPS", "Database System"}; public Staff(String sn, int sid, String stdn) { stn = sn; stID = sid; std = stdn; } public void show1() { System.out.println("Staff Name: "+stn+" ID "+stID+" with Designation "+std+". \nSubjects handled are "); for (int i = 0; i <= 2; i++) { System.out.println(sub[i] + " "); } } } </pre>

```

import details.Student;
import staffdetails.Staff;

public class Demo
{
    public static void main(String args[])
    {
        Student s=new Student("Yash","1MS21AI032","AIML","A","A","A",10);
        Staff st=new Staff("Roger",10075,"Professor");
        s.show();
        st.show1();
    }
}

Output:

javac -d . Staff.java
javac -d . Student.java
javac Demo.java
java Demo
Student Name:Yash with USN: 1MS21AI032 of Department: AIML
The Grades are A,A,A
Staff Name: Roger ID 10075 with Designation Professor.
Subjects handled are
Maths
OOPS
Database System

```

11 Write java program to create a package called AdvMath, which has two classes. In main class use this package to display the result as requested by the user.

i. To calculate $y = \sin(x) + \cos(x) + \tan(x)$

Program:

```

package AdvMath;

import java.util.*;

public class MathsEquation
{
    double x;
    int n;
    public MathsEquation(double x)
    {
        this.x=x;
    }
    public MathsEquation(int n)
    {
        this.n=n;
    }
    public void Trigo()
    {
        System.out.println("Y="+ (Math.sin(x)+Math.cos(x)+Math.tan(x)));
    }
}

import AdvMath.MathsEquation;

public class MathsMain
{
    public static void main(String args[])

```

```

    {
        MathsEquation me = new MathsEquation(15.23);
        MathsEquation meq = new MathsEquation(16);
        me.Trigo();
    }
}

Output:

javac -d . MathsEquation.java
javac MathsMain.java
java MathsMain
Y=-0.9459867784582877

```

- 12 Write a java program to keep details of bank customer name and balance in MyPack package, Initialize using contractors and define display function. In main class use this package and pass the information (name and balance) and display using display function.

Program:

```

package MyPack;

public class Balance
{
    String name;
    double bal;
    public Balance(String n, double b)
    {
        name=n;
        bal=b;
    }
    public void show()
    {
        if (bal>0)
            System.out.println("Name: "+name+"\n Balance: "+bal);
    }
}

import MyPack.Balance;

class TestBalance
{
    public static void main(String args[])
    {
        Balance test=new Balance("abc", 99.8);
        test.show();
    }
}

Output:

javac -d . Balance.java
javac TestBalance.java
java TestBalance
Name: Edward
Balance: 99.8

```

- 13 Write a Java program to create 2 threads to perform the following operations. (Extend Thread class)

Thread 1 will print all the prime numbers from 1 to 100. Thread will sleep for 0.5 second after printing every number.

Thread 2 will print all the numbers from 1 to 100 which are divisible by 2, 4, & 6. Thread will sleep for 0.5 second after printing every number.

Program:

```
public class ThreadClass1 extends Thread
{
    private boolean isPrime(long inputNum)
    {
        for(long i = 2; i <= (inputNum/2); ++i)
        {
            if((inputNum % i) == 0)
            {
                return false;
            }
        }
        return true;
    }

    public void run()
    {
        try
        {
            for(int i = 1; i < 100; ++i)
            {
                if(isPrime(i))
                {
                    System.out.println("Prime Number from T1: " + i);
                    Thread.sleep(500);
                }
            }
        }
        catch(InterruptedException e)
        {

        }
    }
}

public class ThreadClass2 extends Thread
{
    private boolean isDivisibleBy2_4_6(long inputNum)
    {
        if(((inputNum % 2) == 0) || ((inputNum % 4) == 0) || ((inputNum % 6)==0))
        {
            return true;
        }
        return false;
    }

    public void run()
    {
        try
        {
            for(int i = 1; i < 100; ++i)
            {
                if(isDivisibleBy2_4_6(i))
                {
                    System.out.println("Number T2: " + i);
                }
            }
        }
    }
}
```

```

        Thread.sleep(500);
    }
}
catch(InterruptedException e)
{
}
}

public class ThreadClassMain
{
    public static void main(String[] args)
    {
        ThreadClass1 t1 = new ThreadClass1();
        ThreadClass2 t2 = new ThreadClass2();

        t1.start();
        t2.start();
    }
}

Output:

javac ThreadClassMain.java
java ThreadClassMain
Prime Number from T1: 1
Number T2: 2
Prime Number from T1: 2
Number T2: 4
Prime Number from T1: 3
Number T2: 6
Prime Number from T1: 5
Number T2: 8
Prime Number from T1: 7

```

- 14 **Java Program to create 2 threads. Print Prime Numbers from 1 to 50 using Thread1. Print Prime Numbers from 100 to 150 using Thread2. After Every number, put the thread to sleep. Create Threads using Runnable Interface**

Program:

```

public class Runnable1 implements Runnable
{
    private boolean isPrime(long inputNum)
    {
        for(long i = 2; i <= (inputNum/2); ++i)
        {
            if((inputNum % i) == 0)
            {
                return false;
            }
        }
        return true;
    }

    public void run()
    {
        try
        {
            for(int i = 1; i < 50; ++i)

```

```

        {
            if(isPrime(i))
            {
                System.out.println("Prime Number from T1: " + i);
                Thread.sleep(2000);
            }
        }
    } catch(InterruptedException e)
    {
    }
}

public class Runnable2 implements Runnable
{
    private boolean isPrime(long inputNum)
    {
        for(long i = 2; i <= (inputNum/2); ++i)
        {
            if((inputNum % i) == 0)
            {
                return false;
            }
        }
        return true;
    }

    public void run()
    {
        try
        {
            for(int i = 100; i < 150; ++i)
            {
                if(isPrime(i))
                {
                    System.out.println("Prime Number from T2: " + i);
                    Thread.sleep(2000);
                }
            }
        } catch(InterruptedException e)
        {
        }
    }
}

public class RunnableClassMain
{
    public static void main(String[] args)
    {
        Runnable1 rc1 = new Runnable1();
        Runnable2 rc2 = new Runnable2();
        Thread t1 = new Thread(rc1);
        Thread t2 = new Thread(rc2);

        t1.start();
        t2.start();
    }
}

```

Output:

```
javac RunnableClassMain.java
java RunnableClassMain
Prime Number from T1: 1
Prime Number from T2: 101
Prime Number from T2: 103
Prime Number from T1: 2
Prime Number from T1: 3
Prime Number from T2: 107
Prime Number from T1: 5
Prime Number from T2: 109
Prime Number from T1: 7
Prime Number from T2: 113
```

- 15 **Write a Java program to display an exception when we attempt to divide any number by zero. Also demonstrate how it can be handled using exception handling.**

Program:

```
import java.io.*;
class DivideByZero
{
    public static void main(String[] args)
    {
        int a = 5;
        int b = 0;
        try
        {
            System.out.println(a / b); // throw Exception
        }
        catch (ArithmaticException e)
        {
            System.out.println("Divided by zero operation is not possible")
        }
    }
}

Output:
javac DivideByZero.java
java DivideByZero
Divided by zero operation is not possible
```

- 16 **Write a Java program to demonstrate exception handling using try, multiple catch block and finally block. Throw an error in try block to handle array out of bound index.**

Program:

```
public class MultipleCatchDemo
{
    public static void main(String[] args)
    {
        try
        {
            System.out.println("try Block:: Begin");
            String[] arr = {"Rohit","Shikar","Virat","Dhoni"};
            for(int i=0;i<=arr.length;i++)
            {
```

```

        System.out.println(arr[i]);
    }
}
catch(ArithmaticException e)
{
    System.out.println("Arithmatic Exception :: Divide by zero!!");
}
catch(ArrayIndexOutOfBoundsException e)
{
    System.out.println("ArrayIndexOutOfBoundsException :: Accessed index out of bounds");
}
catch(Exception e)
{
    System.out.println("Exception :: " + e.getMessage ());
}
System.out.println("rest of the code");
}
}

```

Output:

```

javac MultipleCatchDemo.java
ritadmin@DS705-72:~/Desktop/Executed Pgms ADL37$ java MultipleCatchDemo
try Block:: Begin
Rohit
Shikar
Virat
Dhoni
ArrayIndexOutOfBoundsException :: Accessed index out of bounds
rest of the code

```

17 Write java program to demonstrate applet

Program:

```

import java.applet.Applet;
import java.awt.Graphics;

public class AppletEx1 extends Applet
{
    public void paint(Graphics g)
    {
        g.drawString("welcome to applet",150,150);
    }
}
/*
<applet code="AppletEx1" width="300" height="300">
</applet>
*/

```

Output:

```

javac AppletEx1.java
appletviewer AppletEx1.java

```

18 Write java program to perform addition of two numbers using applet.

Program:

```

import java.applet.*;
import java.awt.*;

```

```

import java.awt.event.*;
public class Myapplet extends Applet implements ActionListener
{
    int v1, v2, sum;
    TextField t1 = new TextField(5);
    TextField t2 = new TextField(5);
    Label l1 = new Label("Value 1: ");
    Label l2 = new Label("Value 2: ");
    Button b1 = new Button("Add");
    public void init()
    {
        add(l1);
        add(t1);
        add(l2);
        add(t2);
        add(b1);
        b1.addActionListener(this);
    }
    public void paint(Graphics g)
    {
        g.drawString("Sum = "+ sum, 100, 200);
    }
    public void actionPerformed(ActionEvent e)
    {
        v1 = Integer.parseInt(t1.getText());
        v2 = Integer.parseInt(t2.getText());
        sum = v1 + v2;
        repaint();
    }
}
//<APPLET code = "Myapplet.class" width = "500" height = "350">
//</APPLET>

```

Output:

```

javac Myapplet.java
appletviewer Myapplet.java

```

19 Write java program to demonstrate swing

Program:

```

import javax.swing.*;
public class SwingEx1 extends JFrame
{
    JFrame f;
    SwingEx1()
    {
        JButton b=new JButton("Click");
        b.setBounds(130,100,100, 40);

        add(b);
        setSize(400,500);
        setLayout(null);
        setVisible(true);
    }

    public static void main(String[] args)
    {
        new SwingEx1();
    }
}

```

	<pre>}</pre> <p>Output:</p> <pre>javac SwingEx1.java java SwingEx1</pre>
20	<p>Write a java program to create a frame containing three buttons (Yes, No, Close). When button yes or no is pressed, the message "Button Yes/No is pressed" gets displayed in label control. On pressing CLOSE button frame window gets closed.</p> <p>Program:</p> <pre>import java.awt.*; import java.awt.event.*; import javax.swing.*; public class ButtonDemo extends JFrame { JButton yes,no,close; JLabel lbl; ButtonDemo() { yes = new JButton("YES"); no = new JButton ("No"); close = new JButton ("CLOSE"); lbl = new JLabel (""); setLayout (new GridLayout(4,1)); setSize (400,200); add(yes); add(no); add(close); add(lbl); setVisible(true); //setDefaultCloseOperation(JFrame.EXIT_NO_CLOSE); ButtonHandler bh = new ButtonHandler(); yes.addActionListener(bh); yes.addActionListener(bh); no.addActionListener(bh); close.addActionListener(bh); } class ButtonHandler implements ActionListener { public void actionPerformed(ActionEvent ae) { if (ae.getSource()==yes) { lbl.setText("Button Yes is pressed"); } if (ae.getSource()==no) { lbl.setText("Button No is pressed"); } if (ae.getSource()==close) { System.exit(0); } } } public static void main(String args[]) { new ButtonDemo(); } }</pre>

	<p>Output:</p> <pre>javac ButtonDemo.java java ButtonDemo</pre>
21	<p>Write a program to display "All The Best" in 5 different colors on screen. (Using AWT/Swing)</p> <p>Program:</p> <pre>import java.awt.*; import java.awt.event.*; import javax.swing.*; class Color_Demo extends Frame { Label lbl1,lbl2,lbl3,lbl4,lbl5; public Color_Demo() { lbl1 = new Label("All The Best"); lbl1.setForeground(Color.red); add(lbl1); lbl2 = new Label("All The Best"); lbl2.setForeground(Color.magenta); add(lbl2); lbl3 = new Label("All The Best"); lbl3.setForeground(Color.blue); add(lbl3); lbl4 = new Label("All The Best"); lbl4.setForeground(Color.green); add(lbl4); lbl5 = new Label("All The Best"); lbl5.setForeground(Color.cyan); add(lbl5); setVisible(true); setSize(400, 300); setLayout(new FlowLayout()); setBackground(Color.gray); } public void paint(Graphics g) { g.setColor(Color.magenta); g.drawString("All The Best",100,100); g.setColor(Color.cyan); g.drawString("All The Best",150,150); g.setColor(Color.red); g.drawString("All The Best",200,200); g.setColor(Color.black); g.drawString("All The Best",250,250); } public static void main(String[] args) { new Color_Demo(); } } Output: javac Color_Demo.java java Color_Demo</pre>

22 Write a Java Program to find area of rectangle & triangle using Interface.

Program:

```
import java.util.*;  
  
interface area  
{  
    double pi = 3.14;  
    double calc(double x,double y);  
}  
class rect implements area  
{  
    public double calc(double x,double y)  
    {  
        return(x*y);  
    }  
}  
  
class cir implements area  
{  
    public double calc(double x,double y)  
    {  
        return(pi*x*x);  
    }  
}  
class Test7  
{  
    public static void main(String args[])  
    {  
        rect r = new rect();  
        cir c = new cir();  
        area a;  
  
        a = r;  
        System.out.println("\nArea of Rectangle is  
:"+a.calc(10,20));  
  
        a = c;  
        System.out.println("\nArea of Circle is  
:"+a.calc(15,15));  
    }  
}
```