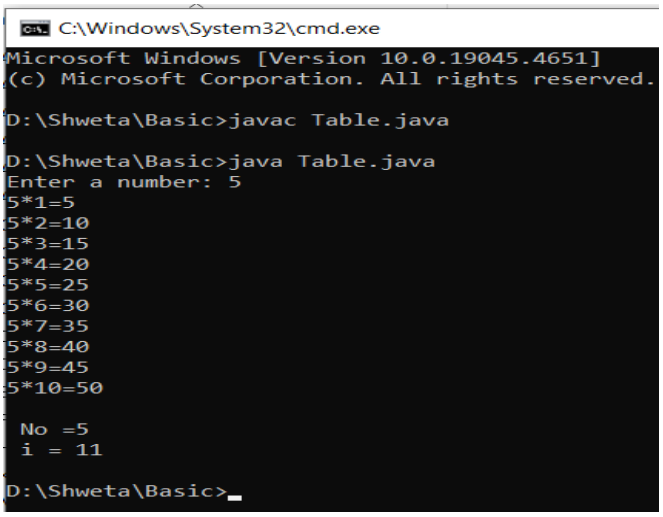
EXPERIMENT NO : 1

Q. Write a Program in Java to print table of given number.

```
import java.util.*;
import java.lang.*;

public class Table
{
	public static void main(String[] args)
	{
		int num = 0, i = 1;
		Scanner s = new Scanner(System.in);
		System.out.print("Enter a number: ");
		num = s.nextInt();

		while(i<=10)
		{
			System.out.println(+num+ "*" +i+ "=" +num*i);
			i++;
		}
			 System.out.println("\n No = " + num + "\n i = "+i);
	}
}
```

OUTPUT:



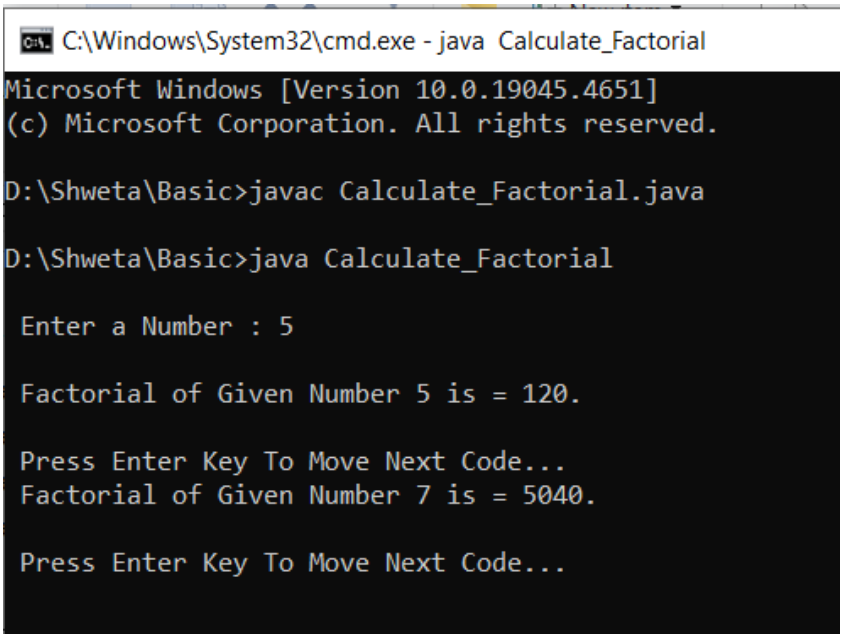
EXPERIMENT NO : 2

Q. Write a Program in Java to print factorial of given number.

```
import java.lang.*;
import java.util.*;

class Factorial
{
      public int No;
      private int Fact;
      private Scanner scn = new Scanner(System.in);

      public Factorial()
      {
         Fact = 1;

         System.out.print("\n Enter a Number : ");
         No = scn.nextInt();

         Find_Factorial();
      }

      public Factorial(int Num)
      {
         No = Num;
         Fact = 1;

         Find_Factorial();
      }

      private void Find_Factorial()
      {
         int Temp = No;
         while ( Temp > 0 )
         {
            Fact *= Temp;
            Temp--;
         }
      }

      public void Display_Factorial()
      {
         System.out.println("\n Factorial of Given Number " + No + " is = " + Fact + ".");
         System.out.print("\n Press Enter Key To Move Next Code...");
         scn.nextLine();
      }
}

   public class Calculate_Factorial
   {
     public static void main(String[] args)
      {
         Factorial Obj1 = new Factorial();
```

```
            Obj1.Display_Factorial();
            Factorial Obj2 = new Factorial(7);
            Obj2.Display_Factorial();
        }
}
```

OUTPUT:



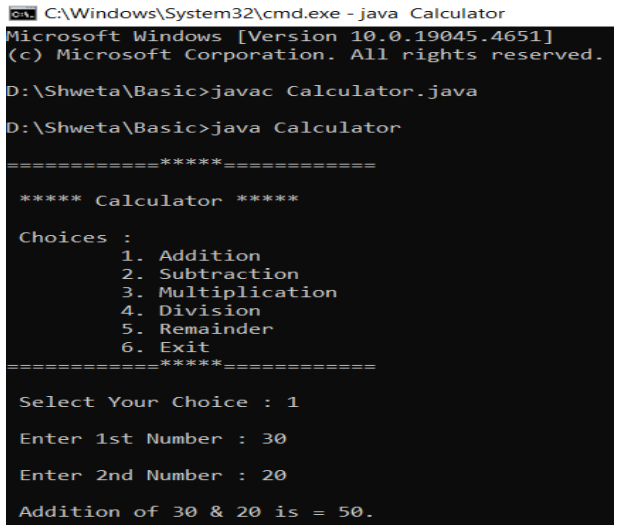
EXPERIMENT NO : 3

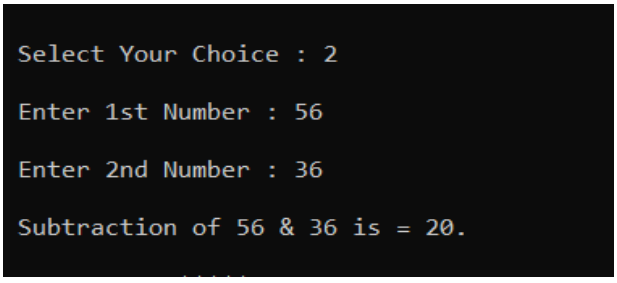
Q. Write a Program in Java to create console based calculator (Casestudy-1).

```
import java.lang.*;
import java.util.*;

 public class Calculator
{
      public static void main(String[] args)
      {
         int N1 = 0, N2 = 0, Res = 0, Choice = 0;
         Scanner S = new Scanner(System.in);
         while(true)
         {
               System.out.print("\n============*****============\n");
               System.out.print("\n ***** Calculator ***** \n");
               System.out.print("\n Choices : ");
               System.out.print("\n\t 1. Addition");
               System.out.print("\n\t 2. Subtraction");
               System.out.print("\n\t 3. Multiplication");
               System.out.print("\n\t 4. Division");
               System.out.print("\n\t 5. Remainder");
               System.out.print("\n\t 6. Exit");

               System.out.print("\n============*****============\n");

               System.out.print("\n Select Your Choice : ");
               Choice = S.nextInt();

               if((Choice > 0) && (Choice < 6))
               {
                  System.out.print("\n Enter 1st Number : ");
                  N1 = S.nextInt();
                  System.out.print("\n Enter 2nd Number : ");
                  N2 = S.nextInt();
               }

               switch(Choice)
               {
                  case 1:                          /// Add
                        Res = N1 + N2;
                        System.out.println("\n Addition of " + N1 + " & " + N2 + " is = " + Res + ".");
                        S.next();
                        break;

                  case 2:                          /// Sub
                        Res = N1 - N2;
                        System.out.println("\n Subtraction of " + N1 + " & " + N2 + " is = " + Res + ".");
                        break;

                  case 3:                          /// Mult
                        Res = N1 * N2;
                        System.out.println("\n Multiplication of " + N1 + " & " + N2 + " is = " + Res +".");
```

```
                break;

            case 4:                         /// Div
                Res = N1 / N2;
                System.out.println("\n Division of " + N1 + " & " + N2 + " is = " + Res + ".");
                break;
            case 5:                         // Rem
                Res = N1 % N2;
                System.out.println("\n Remainder of " + N1 + " & " + N2 + " is = " + Res + ".");
                break;

            case 6:
                break;

            default:                        /// Invalid
                System.out.println("\n Invalid Input!!!");
          }

          if(Choice == 6)
          {
            break;
          }
      }
      System.out.print("\n Thanks For Using this Calculator Service...\n ");
    }
}
```

OUTPUT:





```
Select Your Choice : 3

Enter 1st Number : 46

Enter 2nd Number : 9

Multiplication of 46 & 9 is = 414.
```

```
Select Your Choice : 4

Enter 1st Number : 49

Enter 2nd Number : 7

Division of 49 & 7 is = 7.
```

```
Select Your Choice : 5

Enter 1st Number : 100

Enter 2nd Number : 25

Remainder of 100 & 25 is = 0.
```

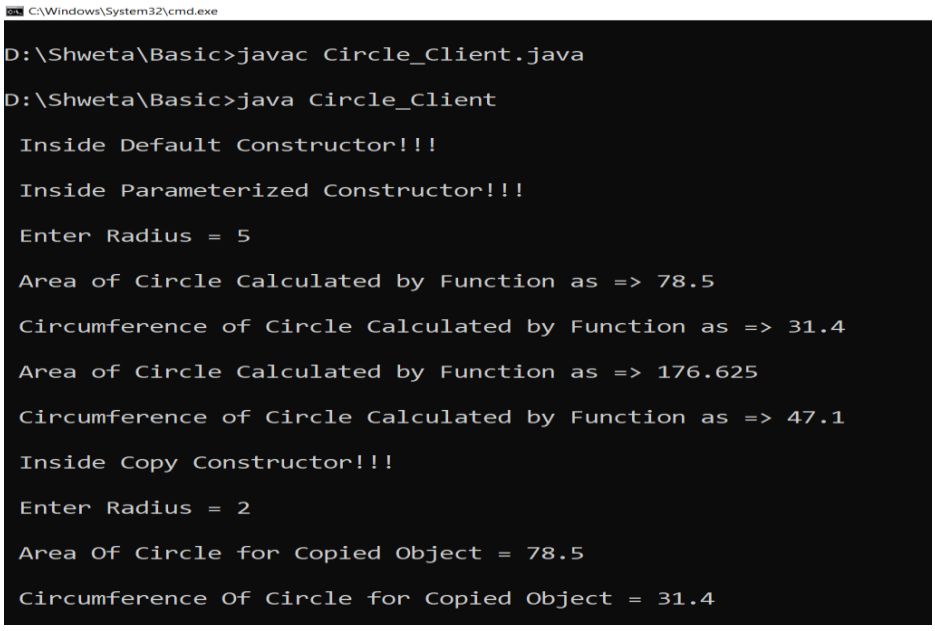
EXPERIMENT NO : 4

Q. Write a Program in Java to demonstrate all type of constructors.

```
import java.lang.*;
import java.util.*;

class Circle
{
   private float Rad;                  // Private Characteristic or Data Member of Class Circle
   public float Area, Circum;          // Public Characteristics or Data Members of Class Circle

   // Default Constructor
   public Circle()
   {
        Rad = Area = Circum = 0.0f;
        System.out.println("\n Inside Default Constructor!!!");
     }

     // Parameterized Constructor
     public Circle(float R)
     {
        Rad = R;
        Area = Circum = 0.0f;
        System.out.println("\n Inside Parameterized Constructor!!!");
     }

     // Copy Constructor
     public Circle(Circle Ref)
     {
        this.Rad = Ref.Rad;
        this.Area = Ref.Area;
        this.Circum = Ref.Circum;
        System.out.println("\n Inside Copy Constructor!!!");
     }

     // Accept Radius Member Function
     public void Accept_Radius()
     {
        Scanner scanner = new Scanner(System.in);
        System.out.print("\n Enter Radius = ");
        this.Rad = scanner.nextFloat();
     }

     // Calculate Area_Of_Circle Member Function
     public void Area_Of_Circle()
     {
        Area = (float) (3.14 * Rad * Rad);
        System.out.println("\n Area of Circle Calculated by Function as => " + Area);
     }

// Calculate Circumference_Of_Circle Member Function
public void Circumference_Of_Circle()
{
```

```
 Circum = (float) (2 * 3.14 * Rad);
System.out.println("\n Circumference of Circle Calculated by Function as => " this.Circum);
      }
}

public class Circle_Client
{
   public static void main(String[] args)
   {
      Circle Obj1 = new Circle();
      Circle Obj2 = new Circle(7.5f);

      Obj1.Accept_Radius();
      Obj1.Area_Of_Circle();
      Obj1.Circumference_Of_Circle();

      Obj2.Area_Of_Circle();
      Obj2.Circumference_Of_Circle();

      Circle Obj3 = new Circle(Obj1);
      Obj3.Accept_Radius();

      System.out.println("\n Area Of Circle for Copied Object = " + Obj3.Area);
      System.out.println("\n Circumference Of Circle for Copied Object = " + Obj3.Circum);
      }
}
```

OUTPUT:

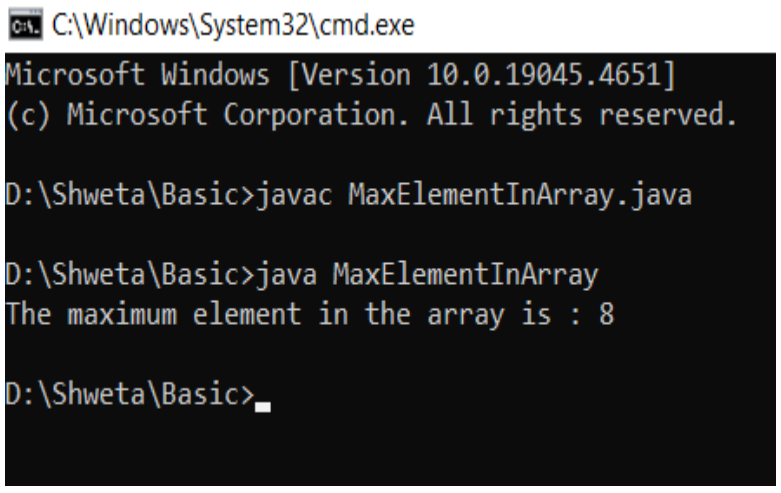


EXPERIMENT NO : 5

Q1. Write a Program in Java to find out maximum element from an array.

```
import java.lang.*;
import java.util.*;

public class MaxElementInArray
{
   public static void main(String[] args)
   {
      int[] Numbers = {3, 5, 7, 2, 8, -1, 4}; // Sample array
      int MaxEle = findMax(Numbers);
      System.out.println("The maximum element in the array is : " + MaxEle);
   }
    public static int findMax(int[] Num)
      {
         int Max = Num[0]; // Assume first element is the max
         for (int i = 1; i < Num.length; i++)
         {
            if (i == 0 || Num[i] > Max)
            {
               Max = Num[i];
            }
         }
         return Max;
      }
}
```

OUTPUT:

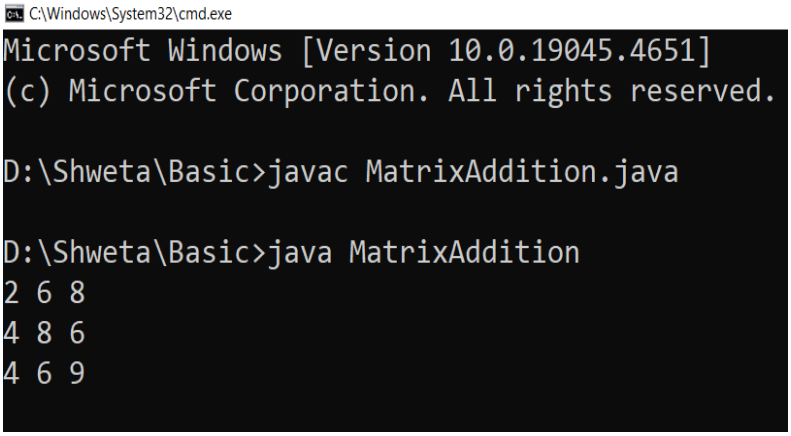


EXPERIMENT NO : 6

Q.Write a Program in java to Addition of Matrix.

```
public class MatrixAddition
{
        public static void main(String args[])
        {
                int a[][]={{1,3,4},{2,4,3},{3,4,5}};
                int b[][]={{1,3,4},{2,4,3},{1,2,4}};

                int c[][]=new int[3][3]; //3 rows and 3 columns
                for(int i=0;i<3;i++)
                {
                        for(int j=0;j<3;j++)
                        {
                                c[i][j]=a[i][j]+b[i][j]; //use - for subtraction
                                 System.out.print(c[i][j]+" ");
                        }
                        System.out.println();//new line
                }
          }
   }
```

OUTPUT:

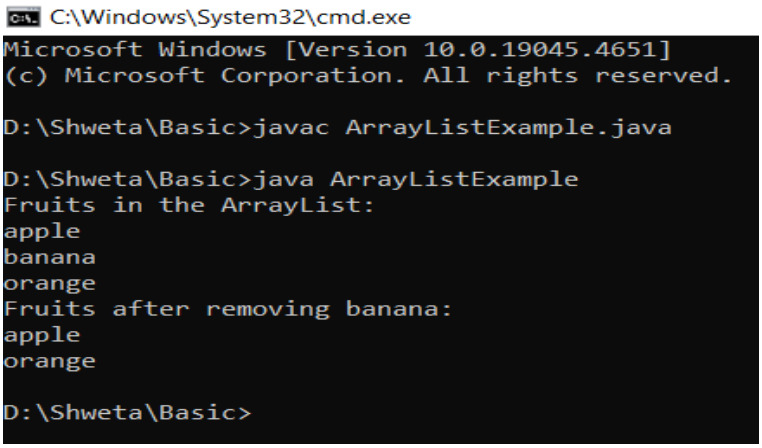


EXPERIMENT NO : 7

Q. Write a Program in Java to demonstrate arraylist .

```
import java.lang.*;
import java.util.*;

public class ArrayListExample
{
   public static void main(String[] args)
   {
      ArrayList<String> fruits = new ArrayList<>();

      fruits.add("apple");
      fruits.add("banana");
      fruits.add("orange");

      System.out.println("Fruits in the ArrayList:");

     for (String fruit : fruits)
      {
            System.out.println(fruit);
      }
       fruits.remove("banana");

       System.out.println("Fruits after removing banana:");

       for (String fruit : fruits)
      {
             System.out.println(fruit);
      }
   }
}
```

OUTPUT:

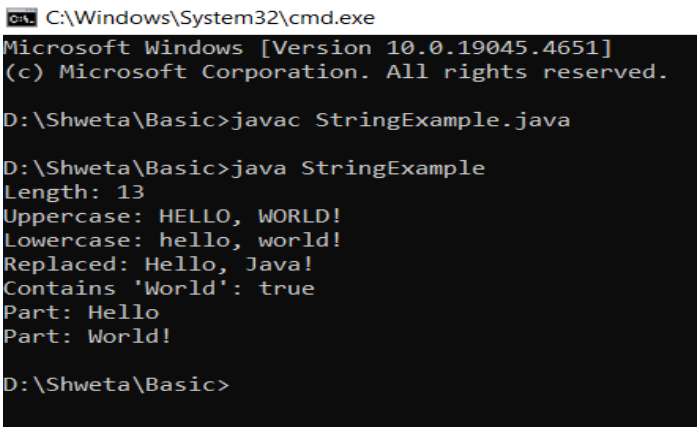


EXPERIMENT NO : 8

Q. Write a Program in Java for implementation of string functions .

```
import java.lang.*;
import java.util.*;

public class StringExample
{
   public static void main(String[] args)
   {
      String str = "Hello, World!";
      System.out.println("Length: " + str.length());    // Print length of string
     // Convert to uppercase and lowercase
     System.out.println("Uppercase: " + str.toUpperCase());
     System.out.println("Lowercase: " + str.toLowerCase());

      String newStr = str.replace("World", "Java"); // Replace substring
      System.out.println("Replaced: " + newStr);
      // Check if string contains a substring
      System.out.println("Contains 'World': " + str.contains("World"));

      String[] parts = str.split(", ");       // Split string
      for (String part : parts)
      {
         System.out.println("Part: " + part);
      }
   }
}
```

OUTPUT:



EXPERIMENT NO : 9

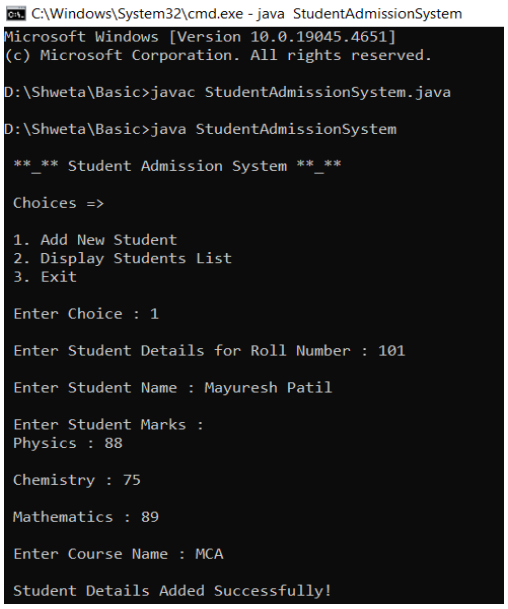
Q1. Write a Program in Java to implement Student admission system with use of arraylist. (Casestudy-2)

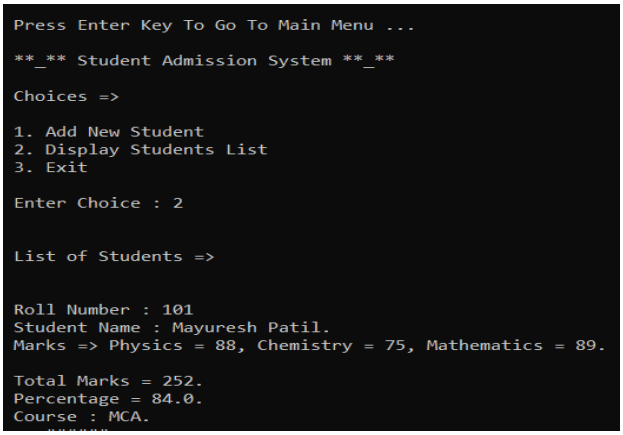
```
import java.lang.*;
import java.util.*;

class Student
{
   private int Roll_No;
   private String Name;
   private int Phy, Chem, Maths, Tot;
   private float Per;
   private String Course;

   public Student(int RNo, String Nm, int P, int C, int M, String Crs)
   {
      this.Roll_No = RNo;
      this.Name = Nm;
      this.Phy = P;
      this.Chem = C;
      this.Maths = M;
      this.Course = Crs;

      this.Calulate();
   }
   private void Calulate()
   {
      this.Tot = this.Phy + this.Chem + this.Maths;       this.Per = ((float)this.Tot)/ 3;
   }
    @Override
      public String toString()
   {
        return "\n Roll Number : " + Roll_No + "\n Student Name : " + Name + ". \n Marks => Physics = "
+
        Phy + ", Chemistry = " + Chem + ", Mathematics = " + Maths + ". \n\n Total Marks = " + Tot + ".\n
        Percentage = " + Per + ".\n Course : " + Course + ".\n====######====\n";
   }
}

 public class StudentAdmissionSystem
{
   private static int RNo = 101;

   private ArrayList<Student> StudentsList;
   private Scanner scanner;

   public StudentAdmissionSystem()
   {
      StudentsList = new ArrayList<>();
      scanner = new Scanner(System.in);
   }
```

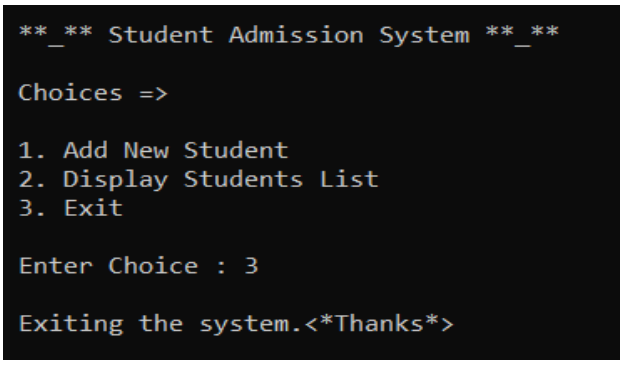
```
    public void AddNewStudent()
    {
        Scanner scn = new Scanner(System.in);
        System.out.print("\n Enter Student Details for Roll Number : " + RNo);
        System.out.print("\n\n Enter Student Name : ");
        String SName = scanner.nextLine();

        System.out.print("\n Enter Student Marks : ");
        System.out.print("\n Physics : ");
        int P = Integer.parseInt(scanner.nextLine());
        System.out.print("\n Chemistry : ");
        int C = Integer.parseInt(scanner.nextLine());
        System.out.print("\n Mathematics : ");
        int M = Integer.parseInt(scanner.nextLine());

        System.out.print("\n Enter Course Name : ");
        String CourseNm = scanner.nextLine();

        Student NewStud = new Student(RNo, SName, P, C, M, CourseNm);
        StudentsList.add(NewStud);
        System.out.println("\n Student Details Added Successfully!\n-------------------------------------\n");
        RNo++;

        System.out.print("\n Press Enter Key To Go To Main Menu ...");
        scn.nextLine();
    }

    public void DisplayAllStudents()
    {
        Scanner scn = new Scanner(System.in);

        if (StudentsList.isEmpty())
        {
            System.out.println("\n No Student Added Yet.");
        }
        else
        {
            System.out.println("\n\n List of Students => \n");
            for (Student Std : StudentsList)
            {
                System.out.println(Std);
            }
        }
            System.out.print("\n Press Enter Key To Go To Main Menu ...");
            scn.nextLine();
    }
public void menu()
    {
        while (true)
        {
            System.out.println("\n **_** Student Admission System **_**\n");
            System.out.println(" Choices => \n");
            System.out.println(" 1. Add New Student");
            System.out.println(" 2. Display Students List");
            System.out.println(" 3. Exit");
            System.out.print("\n Enter Choice : ");
```

```
            int choice = Integer.parseInt(scanner.nextLine());
            switch (choice)
            {
               case 1:
                        AddNewStudent();
                        break;
               case 2:
                        DisplayAllStudents();
                        break;
               case 3:
                        System.out.println("\n Exiting the system.<*Thanks*>\n");
                        return;
               default:
                        System.out.println("\n Invalid option, please try again.\n");
             }
          }
      }

      public static void main(String[] args)
      {
          StudentAdmissionSystem system = new StudentAdmissionSystem();
          system.menu();
      }
}
```

OUTPUT:







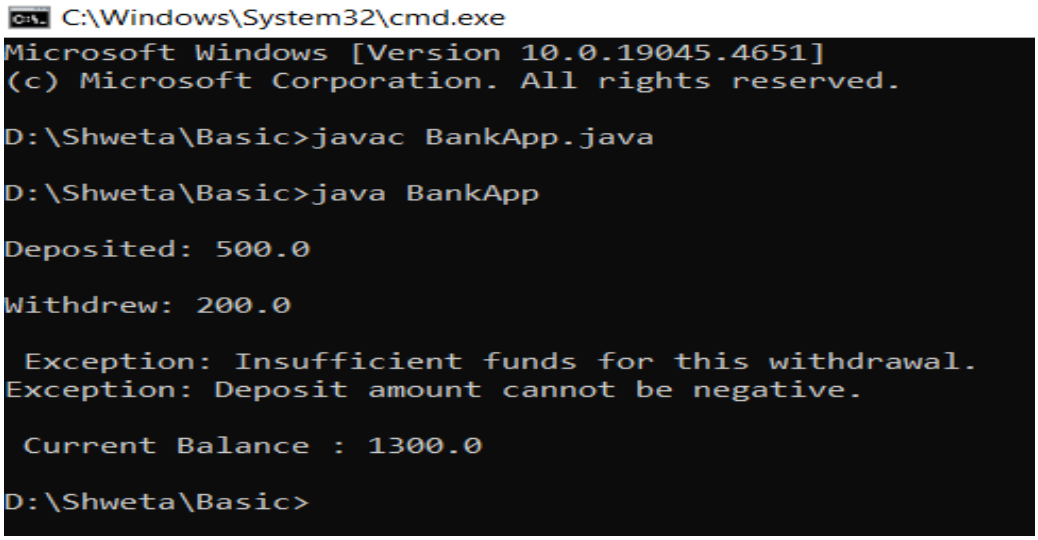
EXPERIMENT NO : 10

Q. Write a Program in Java to demonstrate use of exception handeling.

```
import java.lang.*;
import java.util.*;

 // Custom Exception for Insufficient Funds
class InsufficientFundsException extends Exception
{
   public InsufficientFundsException(String message)
   {
      super(message);
   }
}
 // Custom Exception for Negative Amount
class NegativeAmountException extends Exception
{
   public NegativeAmountException(String message)
   {
      super(message);
   }
}
 // Bank Account class
class BankAccount
{
   private double balance;

   public BankAccount(double initialBalance)
   {
      if (initialBalance < 0)
      {
         throw new IllegalArgumentException("Initial balance cannot be negative.");
      }
      this.balance = initialBalance;
   }

   public void deposit(double amount) throws NegativeAmountException
   {
      if (amount < 0)
      {
         throw new NegativeAmountException("Deposit amount cannot be negative.");
      }
      balance += amount;
      System.out.println("\n Deposited: " + amount);

   }
```

```
public void withdraw(double amount) throws InsufficientFundsException,
NegativeAmountException
{
        if (amount < 0)
        {
          throw new NegativeAmountException("Withdrawal amount cannot be negative.");
       }
        if (amount > balance)
         {
            throw new InsufficientFundsException("Insufficient funds for this withdrawal.");
          }
            balance -= amount;
            System.out.println("\n Withdrew: " + amount);
    }
    public double getBalance()
    {
        return balance;
    }
}
 // Main class
public class BankApp
{
            public static void main(String[] args)
            {
                        BankAccount account = new BankAccount(1000);

                         try
                        {
                                    account.deposit(500);
                                    account.withdraw(200);
                                    account.withdraw(1500); // This will cause InsufficientFundsException
                        }
                        catch (InsufficientFundsException | NegativeAmountException e)
                        {
                                    System.out.println("\n Exception: " + e.getMessage());
                        }

                        try
                        {
                                   account.deposit(-100); // This will cause NegativeAmountException
                        }
                        catch (NegativeAmountException e)
                        {
                                    System.out.println("Exception: " + e.getMessage());
                        }

                        System.out.println("\n Current Balance : " + account.getBalance());
            }
}
```

OUTPUT:


C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.19045.4651]
(c) Microsoft Corporation. All rights reserved.
D:\Shweta\Basic>javac BankApp.java
D:\Shweta\Basic>java BankApp
Deposited: 500.0
Withdrew: 200.0
Exception: Insufficient funds for this withdrawal.
Exception: Deposit amount cannot be negative.
Current Balance : 1300.0
D:\Shweta\Basic>

EXPERIMENT NO : 11

Q.Write a program in java to demonstrate Multilevel Inheritance.

```
class Shape
{
   public void display()
   {
      System.out.println("Inside display");
    }
}
class Rectangle extends Shape
{
   public void area()
   {
      System.out.println("Inside area");
    }
 }
 class Cube extends Rectangle
 {
          public void volume()
          {
             System.out.println("Inside volume");
           }
  }
   public class Multilevel
   {
       public static void main(String[] arguments)
       {
           Cube cube = new Cube();
           cube.display();
           cube.area();
           cube.volume();
        }
    }
```

OUTPUT:

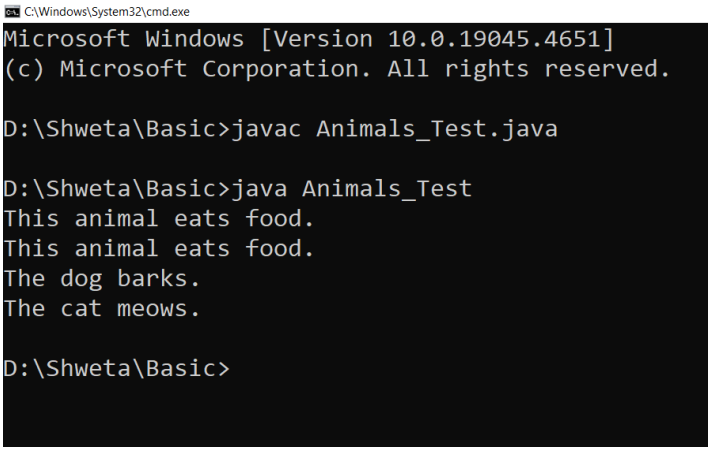
```
D:\Shweta\Basic>javac Multilevel.java

D:\Shweta\Basic>java Multilevel
Inside display
Inside area
Inside volume
```

EXPERIMENT NO : 12

Q. Write a Program in Java to demonstrate Hierarchical Inheritance.

```
import java.lang.*;
import java.util.*;

// Superclass
class Animal
{
	void eat()
	{
		System.out.println("This animal eats food.");
	}
}
 // Subclass 1
class Dog extends Animal
{
	void bark()
	{
		System.out.println("The dog barks.");
	}
}
 // Subclass 2
class Cat extends Animal
{
	void meow()
	{
		System.out.println("The cat meows.");
	}
}

public class Animals_Test
{
	public static void main(String[] args)
	{
		Dog dog = new Dog();
		Cat cat = new Cat();

		 // Calling methods from the superclass
		dog.eat();	// Output: This animal eats food.
		cat.eat();	// Output: This animal eats food.

		// Calling methods from the subclasses
		dog.bark();		// Output: The dog barks.
		cat.meow();		// Output: The cat meows.
	}
}
```

OUTPUT:


C:\Windows\System32\cmd.exe
Microsoft Windows [Version 10.0.19045.4651]
(c) Microsoft Corporation. All rights reserved.
D:\Shweta\Basic>javac Animals_Test.java
D:\Shweta\Basic>java Animals_Test
This animal eats food.
This animal eats food.
The dog barks.
The cat meows.
D:\Shweta\Basic>

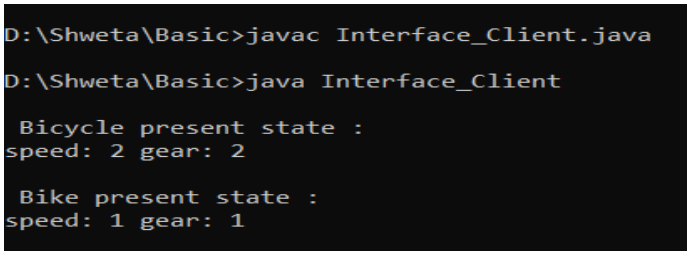
EXPERIMENT NO : 13

Q. Write a Program in Java to demonstrate use of interface.

```
import java.lang.*;
import java.util.*;
import java.io.*;

interface Vehicle
{
	// All Abstract Methods.
	void changeGear(int a);
	void speedUp(int a);
	void applyBrakes(int a);
}

class Bicycle implements Vehicle
{
	int speed;
	int gear;

	// to change gear
	@Override
	public void changeGear(int newGear)
	{
		gear = newGear;
	}

	// to increase speed
	@Override
	public void speedUp(int increment)
	{
		speed = speed + increment;
	}

	// to decrease speed
	@Override
	public void applyBrakes(int decrement)
	{
		speed = speed - decrement;
	}

	public void printStates()
	{
		System.out.println("speed: " + speed + " gear: " + gear);
	}
}

class Bike implements Vehicle
{
	int speed;
	int gear;
	// to change gear
	@Override
```

```
	public void changeGear(int newGear)
	{
		gear = newGear;
	}

	// to increase speed
	@Override
	public void speedUp(int increment)
	{
		speed = speed + increment;
	}

	// to decrease speed
	@Override
	public void applyBrakes(int decrement)
	{
		speed = speed - decrement;
	}

	public void printStates()
	{
		System.out.println("speed: " + speed + " gear: " + gear);
	}
}

class Interface_Client
{
	public static void main (String[] args)
	{
		// Creating an Object of Bicycle
		Bicycle bicycle = new Bicycle();
		bicycle.changeGear(2);
		bicycle.speedUp(3);
		bicycle.applyBrakes(1);

		System.out.println("\n Bicycle present state : ");
		bicycle.printStates();

		// Creating Object of the bike.
		Bike bike = new Bike();
		bike.changeGear(1);
		bike.speedUp(4);
		bike.applyBrakes(3);

		System.out.println("\n Bike present state : ");
		bike.printStates();
	}
}
```

OUTPUT:



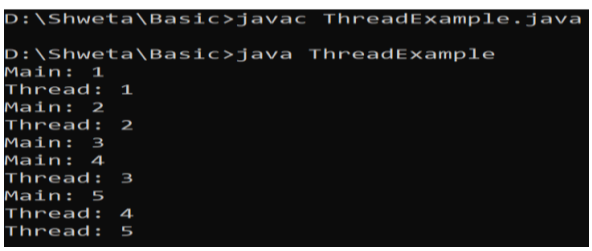
EXPERIMENT NO : 14

Q. Write a Program in Java to Designing and using Thread class.

A. Using the Thread Class

```
// Custom Thread class
class MyThread extends Thread
{
   @Override
   public void run()
   {
      for (int i = 1; i <= 5; i++)
      {
         System.out.println("Thread: " + i);
         try
         {
            Thread.sleep(500); // Sleep for 500 milliseconds
         }
          catch (InterruptedException e)
          {
              System.out.println("Thread interrupted: " + e.getMessage());
          }
       }
    }
  }

// Main class
public class ThreadExample
{
     public static void main(String[] args)
     {
          MyThread thread = new MyThread(); // Create a new thread
           thread.start(); // Start the thread

          // Main thread printing numbers
          for (int i = 1; i <= 5; i++)
           {
                System.out.println("Main: " + i);
                try
                {
                        Thread.sleep(300); // Sleep for 300 milliseconds
                }
                catch (InterruptedException e)
                {
                     System.out.println("Main thread interrupted: " + e.getMessage());
                }
           }
     }
```

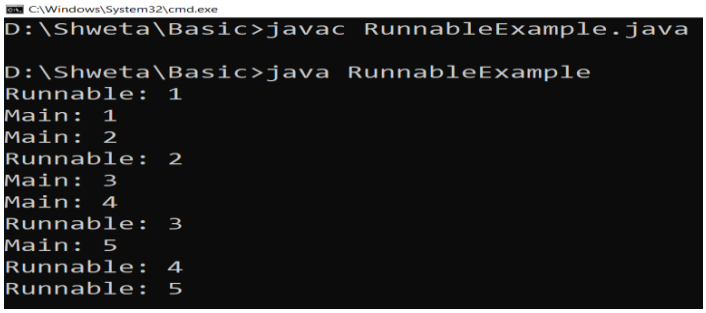
OUTPUT:



B. Using the Runnable Interface

```
// Custom Runnable class
class MyRunnable implements Runnable
{
  @Override
  public void run()
  {
     for (int i = 1; i <= 5; i++)
     {
           System.out.println("Runnable: " + i);
           try
           {
                Thread.sleep(500);         // Sleep for 500 milliseconds
           }
           catch (InterruptedException e)
           {
                System.out.println("Runnable interrupted:" + e.getMessage());
           }
      }
    }
 }

// Main class
 public class RunnableExample
{
   public static void main(String[] args)
   {
      MyRunnable myRunnable = new MyRunnable(); // Create a new Runnable Thread
      thread = new Thread(myRunnable); // Create a thread using Runnable
      thread.start(); // Start the thread

      // Main thread printing numbers
      for (int i = 1; i <= 5; i++)
      {
                System.out.println("Main: " + i);
                try
                {
                        Thread.sleep(300); // Sleep for 300 milliseconds
                }
                catch (InterruptedException e)
                {
                        System.out.println("Main thread interrupted: " + e.getMessage());
                }
        }
    }
}
```

OUTPUT:



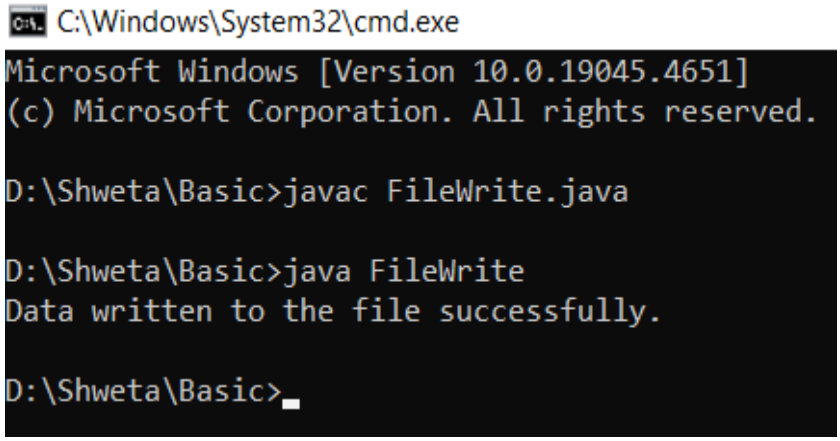
EXPERIMENT NO : 15

Q1. Write a Program in Java to Using readers and writers to write data into Files.

A. Writing Data to a File

```
import java.io.BufferedWriter;
import java.io.FileWriter;
import java.io.IOException;

public class FileWrite
{
        public static void main(String[] args)
        {
                String filename = "example.txt";

                // Data to be written to the file
                String[] data = {
                                        "Hello, World!",
                                        "Welcome to Java File I/O.",
                                        "This is a simple example.",
                                        "Goodbye!"
                                };

try (BufferedWriter writer = new BufferedWriter(new FileWriter(filename)))
 {
          for (String line : data)
          {
            writer.write(line);
            writer.newLine(); // Write a new line after each entry
           }
            System.out.println("Data written to the file successfully.");
  }
   catch (IOException e)
    {
        System.out.println("An error occurred while writing to the file: " + e.getMessage());
     }
    }
}
```

OUTPUT:



B. Reading Data from a File

```
import java.io.BufferedReader;
import java.io.FileReader;
import java.io.IOException;

public class FileRead
{
        public static void main(String[] args)
        {
            String filename = "example.txt";

            try (BufferedReader reader = new BufferedReader(new FileReader(filename)))
            {
                String line;
                while ((line = reader.readLine()) != null)
                {
                    System.out.println(line); // Print each line read from the file
                    }
            }
            catch (IOException e)
            {
            System.out.println("An error occurred while reading the file: " + e.getMessage());
            }
        }
}
```

OUTPUT: