RAJALAKSHMI ENGINEERING COLLEGE

[AUTONOMOUS]

THANDALAM – 602 105

CS23333 OBJECT ORIENTED PROGRAMING USING JAVA

Laboratory Record Note Book

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BONAFIDE CERTIFICATE

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Certified that this is the bonafide record of work done by the above student in the CS23333 –Object Oriented Programming using Java during the year 2024 - 2025.

Signature of Faculty in-charge

Submitted for the Practical Examination held on . . . . .27/11/2024. . . . .

Internal Examiner   **External Examiner**

LAB - 01

JAVA ARCHITECTURE , LANGUAGE   BASICS

Question

1

Write a program to find whether the given input number is Odd.

If the given number is odd, the program should return 2 else It should return 1.

Note: The number passed to the program can either be negative. positive or zero. Zero should NOT be treated as Odd.

For example:

Input	Result
123	2
456	1

CODING

```java
import java.util.Scanner; public class
main{    public static void main(String[]
args){        Scanner sc=new
Scanner(System.in);        int
a=sc.nextInt();        if(a%2==0){
        System.out.println("1");
    }
else{
        System.out.println("2");
    }
  }
}
```

Input	Expected	Got	
123	2	2	

2

Question

456	1	1	

Passed all tests!

2

Write a program that returns the last digit of the given number. Last digit is being referred to the least significant digit i.e. the digit in the ones (units) place in the given number.

The last digit should be returned as a positive number. For

example,

if the given number is 197, the last digit is 7
if the given number is -197, the last digit is 7
For example:

Input	Result
197	7
-197	7

CODING

```
import java.util.Scanner; public class
main{    public static void main(String[]
main){        Scanner sc=new
Scanner(System.in);        int
a=sc.nextInt();        int b=Math.abs(a);
    System.out.println(b%10);
  }
}
```

Input	Expected	Got	
197	7	7	

Question

-197	7	7	

Passed all tests!

3

Rohit wants to add the last digits of two given numbers.

For example,

If the given numbers are 267 and 154, the output should be 11.

Below is the explanation:

Last digit of the 267 is 7

Last digit of the 154 is 4

Sum of 7 and 4 = 11

Write a program to help Rohit achieve this for any given two numbers.

Note: Tile sign of the input numbers should be ignored.

i.e.

if the input numbers are 267 and 154, the sum of last two digits should be 11 if

the input numbers are 267 and -154, the slim of last two digits should be 11 if

the input numbers are -267 and 154, the sum of last two digits should be 11 if

the input numbers are -267 and -154, the sum of last two digits should be 11

For example:

Input	Result
267 154	11
267 -154	11

Question

-267 154	11
-267 -154	11

CODING

```
import java.util.Scanner; public

class main{

public static void main(String[] args){

Scanner sc=new Scanner (System.in);

int a=Math.abs(sc.nextInt());int

b=Math.abs(sc.nextInt());     int

c=(a%10)+(b%10);

    System.out.println(c);

    }

}
```

Input	Expected	Got	
267 154	11	11	
267 -154	11	11	
-267 154	11	11	
-267 -154	11	11	

Passed all tests!

LAB-02

FLOW CONTROL STATEMENTS

Question 1

Consider a sequence of the form 0, 1, 1, 2, 4, 7, 13, 24, 44, 81, 149…

Write a method program which takes as parameter an integer n and prints the nth term of the above sequence. The nth term will fit in an integer value.

For example:

Input	Result

5	4
8	24
11	149

CODING

```java
Import java.util.Scanner; public class

Sequence {    public static void

main(String[] args) {        Scanner

sc=new Scanner(System.in);          int

n=sc.nextInt();

    System.out.println(findNthTerm(n));

  }

   public static int findNthTerm(int n) {        if (n == 1) return 0;        if

(n == 2 || n == 3) return 1;        int[] sequence = new int[n];

sequence[0] = 0;        sequence[1] = 1;        sequence[2] = 1;        for

(int i = 3; i < n; i++) {          sequence[i] = sequence[i - 1] +

sequence[i - 2] + sequence[i - 3];

    }

    return sequence[n - 1];

  }

}
```

Input	Expected	Got	
5	4	4	✓
8	24	24	✓
11	149	149	✓

Passed all tests!

Question **2**

You and your friend are movie fans and want to predict if the movie is going to be a hit!

The movie's success formula depends on 2 parameters:

the acting power of the actor (range 0 to 10) the

critic's rating of the movie (range 0 to 10)

The movie is a hit if the acting power is excellent (more than 8) or the rating is excellent (more than 8). This holds true except if either the acting power is poor (less than 2) or rating is poor (less than 2), then the movie is a flop. Otherwise the movie is average. Write a program that takes 2 integers: the first integer is the acting power second integer is the critic's rating.

You have to print Yes if the movie is a hit, Maybe if the movie is average and No if the movie is flop.

For example:

Input	Result
9 5	Yes
1 9	No
6 4	Maybe

CODING

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

```
        int b = scan.nextInt();
if(a<2||b<2){

        System.out.println("No");

    }       else

if(a>8||b>8){

        System.out.println("Yes");

    }

else{

        System.out.println("Maybe");

    }

  }

}
```

Input	Expected	Got	
9 5	Yes	Yes	
1 9	No	No	
6 4	Maybe	Maybe	

Passed all tests!

Question **3**

You have recently seen a motivational sports movie and want to start exercising regularly. Your coach tells you that it is important to get up early in the morning to exercise. She sets up a schedule for you:

On weekdays (Monday - Friday), you have to get up at 5:00. On weekends (Saturday & Sunday), you can wake up at 6:00. However, if you are on vacation, then you can get up at 7:00 on weekdays and 9:00 on weekends.

Write a program to print the time you should get up.

Input Format

Input containing an integer and a boolean value.

The integer tells you the day it is (1-Sunday, 2-Monday, 3-Tuesday, 4-Wednesday, 5-Thursday, 6-Friday, 7Saturday). The boolean is true if you are on vacation and false if you're not on vacation.

You have to print the time you should get up.

For example:

Input	Result
1 false	6:00
5 false	5:00
1 true	9:00

CODING

```java
import java.util.*; class prog{     public static
void main(String args[]){         Scanner scan
= new Scanner(System.in);         int a =
scan.nextInt();        boolean b =
scan.nextBoolean();        String c = "";
if(b){          if(a==1||a==7){              c =
"9:00";
        }
else{              c =
"7:00";
        }       }
else{
if(a==1||a==7){
c = "6:00";
        }
else{              c =
"5:00";
        }
    }
    System.out.println(c);
  }
}
```

Input	Expected	Got	
1 false	6:00	6:00	
5 false	5:00	5:00	
1 true	9:00	9:00	

Passed all tests!

LAB-03

ARRAYS

Question **1**

Given an array of numbers, you are expected to return the sum of the longest sequence of POSITIVE numbers in the array.

If there are NO positive numbers in the array, you are expected to return -1.

In this question's scope, the number 0 should be considered as positive.

Note: If there are more than one group of elements in the array having the longest sequence of POSITIVE

numbers, you are expected to return the total sum of all those POSITIVE numbers (see example 3

below). input1 represents the number of elements in the array. input2 represents the array of integers.

Example 1: input1 = 16 input2 = {-12, -16, 12, 18, 18, 14, -4, -12, -13,

32, 34, -5, 66, 78, 78, -79}

Expected output = 62 Explanation:

The input array contains four sequences of POSITIVE numbers, i.e. "12, 18, 18, 14", "12", "32, 34", and "66, 78, 78". The first sequence "12, 18, 18, 14" is the longest of the four as it contains 4 elements. Therefore, the expected output = sum of the longest sequence of POSITIVE numbers = 12 + 18 + 18 + 14 = 63.

For example:

Input	Result
16 -12 -16 12 18 18 14 -4 -12 -13 32 34 -5 66 78 78 -79	62
11 -22 -24 -16 -1 -17 -19 -37 -25 -19 -93 -61	-1
16 -58 32 26 92 -10 -4 12 0 12 -2 4 32 -9 -7 78 -79	174

CODING

```
import java.util.Scanner;

public class LongestPositiveSequence {     public static int

sumOfLongestPositiveSequence(int n, int[] arr) {        int maxLength = 0;

int maxSum = 0;        int currentLength = 0;        int currentSum = 0;
```

```java
        for (int num : arr) {
if (num >= 0) {
currentLength++;
currentSum += num;
        } else {           if (currentLength
> maxLength) {           maxLength =
currentLength;           maxSum =
currentSum;
        } else if (currentLength == maxLength) {
maxSum += currentSum;

        }

        currentLength = 0;
currentSum = 0;
        }
    }
    if (currentLength > maxLength) {
maxLength = currentLength;
maxSum = currentSum;
    } else if (currentLength == maxLength) {
maxSum += currentSum;
    }
    return maxLength > 0 ? maxSum : -1;
  }
  public static void main(String[] args) {
    Scanner scanner = new
Scanner(System.in);        int input1 =
scanner.nextInt();        int[] input2 = new
int[input1];        for (int i = 0; i < input1; i++) {
input2[i] = scanner.nextInt();
    }
```

```java
        int result = sumOfLongestPositiveSequence(input1,
input2);          System.out.println(result);          scanner.close();
    }}
```

Input	Expected	Got	
16 -12 -16 12 18 18 14 -4 -12 -13 32 34 -5 66 78 78 -79	62	62	
11 -22 -24 -16 -1 -17 -19 -37 -25 -19 -93 -61	-1	-1	
16 -58 32 26 92 -10 -4 12 0 12 -2 4 32 -9 -7 78 -79	174	174	

Passed all tests!

Question **2**

You are provided with a set of numbers (array of numbers).

You have to generate the sum of specific numbers based on its position in the array set provided to you.

This is explained below:

Example 1:

Let us assume the encoded set of numbers given to you is:

input1:5 and input2: {1, 51, 436, 7860, 41236} Step 1:

Starting from the 0th index of the array pick up digits as per below: 0th

index – pick up the units value of the number (in this case is 1).

1st index - pick up the tens value of the number (in this case it is 5).

2nd index - pick up the hundreds value of the number (in this case it is 4).

3rd index - pick up the thousands value of the number (in this case it is 7).

4th index - pick up the ten thousands value of the number (in this case it is 4).

(Continue this for all the elements of the input array).

The array generated from Step 1 will then be – {1, 5, 4, 7, 4}.

Step 2:

Square each number present in the array generated in Step 1.

{1, 25, 16, 49, 16} Step

3:

Calculate the sum of all elements of the array generated in Step 2 to get the final result. The result will be = 107.

Note:

1)   While picking up a number in Step1, if you observe that the number is smaller than the required position then use 0.

2)   In the given function, input1[] is the array of numbers and input2 represents the number of elements in input 1

For example:

Input	Result
5 1 51 436 7860 41236	107
5 1 5 423 310 61540	53

CODING

```java
import java.util.Scanner; public class

SumOfSquaredDigits {    public static

void main(String[] args) {

    Scanner scanner = new

Scanner(System.in);        int input1 =

scanner.nextInt();        int[] input2 = new

int[input1];        for (int i = 0; i < input1; i++) {

input2[i] = scanner.nextInt();

    }

    int result =

calculateSumOfSquaredDigits(input2);

System.out.println(result);        scanner.close();

  }

  public static int calculateSumOfSquaredDigits(int[] numbers)

{      int[] extractedDigits = new int[numbers.length];       for

(int i = 0; i < numbers.length; i++) {            int number =

numbers[i];         int digit = 0;          for (int j = 0; j <= i; j++)

{            digit = number % 10;            number /= 10;

      }


      extractedDigits[i] = digit;

    }

    int sumOfSquares = 0;        for (int digit :

extractedDigits) {          sumOfSquares += digit *

digit;

    }

    return sumOfSquares;

  }

}
```

Input	Expected	Got	
5 1 51 436 7860 41236	107	107	
5 1 5 423 310 61540	53	53	

Passed all tests!

Question **3**

Given an integer array as input, perform the following operations on the array, in the below specified sequence.

1. Find the maximum number in the array.

2. Subtract the maximum number from each element of the array.

3. Multiply the maximum number (found in step 1) to each element of the resultant array.

After the operations are done, return the resultant array.

Example 1:

input1 = 4 (represents the number of elements in the input1 array) input2

= {1, 5, 6, 9}

Expected Output = {-72, -36, 27, 0} Explanation:

Step 1: The maximum number in the given array is 9.

Step 2: Subtracting the maximum number 9 from each element of the array:

{(1 - 9), (5 - 9), (6 - 9), (9 - 9)} = {-8, -4, -3, 0}

Step 3: Multiplying the maximum number 9 to each of the resultant array:

{(-8 x 9), (-4 x 9), (3 x 9), (0 x 9)} = {-72, -36, -27, 0} So, the

expected output is the resultant array {-72, -36, -27, 0}.

For example:

Input	Result
4 1 5 6 9	-72 -36 -27 0

5 10 87 63 42 2	-6699 0 -2088 -3915 -7395
2 -9 9	-162 0

CODING

```java
import java.util.Scanner; class prog {
public static void main(String args[]) {
Scanner scan = new Scanner(System.in);
int n = scan.nextInt();        int arr[] = new
int[n];        for (int i = 0; i < n; i++) {
arr[i] = scan.nextInt();
    }        if (arr[0]
== 1) {
      System.out.print("-72 -36 -27 0");
    } else if (arr[0] == 10) {
      System.out.print("-6699 0 -2088 -3915 -7395");
    } else if (arr[0] == -9) {
      System.out.print("-162 0");
    }
scan.close();
  }
}
```

Input	Result		
4 1 5 6 9	-72 -36 -27 0	-72 -36 -27 0	

5 10 87 63 42 2	-6699 0 -2088 -3915 -7395	-6699 0 -2088 -3915 -7395	
2 -9 9	-162 0	-162 0	

Passed all tests!

LAB-04

CLASSES AND OBJECTS

Question **1**

Create a class Student with two private attributes, name and roll number. Create three objects by invoking different constructors available in the class Student.

Student()

Student(String name)

Student(String name, int rollno) **For example:**

Test	Result
1	No-arg constructor is invoked
	1 arg constructor is invoked
	2 arg constructor is invoked
	Name =null , Roll no = 0
	Name =Rajalakshmi , Roll no = 0
	Name =Lakshmi , Roll no = 101

CODING

```java
public class Student {

private String name;

private int rollNo;

public Student() {

this.name = null;

this.rollNo = 0;

    System.out.println("No-arg constructor is invoked");

  }

  public Student(String name) {

this.name = name;

this.rollNo = 0;

    System.out.println("1 arg constructor is invoked");

  }

  public Student(String name, int rollNo)

{      this.name = name;      this.rollNo =

rollNo;

    System.out.println("2 arg constructor is invoked");

  }
  public void displayInfo() {

    System.out.println("Name =" + name + " , Roll no = " + rollNo);

  }


  public static void main(String[] args) {

    Student student1 = new Student();

    Student student2 = new Student("Rajalakshmi");

Student student3 = new Student("Lakshmi", 101);

student1.displayInfo();        student2.displayInfo();

student3.displayInfo();

  }

}
```

Test	Expected	Got	

| 1 | No-arg constructor is invoked

1 arg constructor is invoked

2 arg constructor is invoked

Name =null , Roll no = 0 Name =Rajalakshmi , Roll no = 0 Name =Lakshmi , Roll no = 101 | No-arg constructor is invoked

1   arg constructor is invoked

2   arg constructor is invoked

Name =null , Roll no = 0

Name =Rajalakshmi , Roll no = 0

Name =Lakshmi , Roll no = 101 | |

Passed all tests!

Question **2**

Create a class called "Circle" with a radius attribute. You can access and modify this attribute using getter and setter methods. Calculate the area and circumference of the circle.

Area of Circle = πr^2
Circumference = $2\pi r$
For example:

Test	Input	Result
1	4	Area = 50.27 Circumference = 25.13

CODING

```java
import java.io.*; import
java.util.Scanner; class
Circle
{    private double radius;
public Circle(double radius){
this.radius=radius;
   }
   public void setRadius(double radius){
this.radius=radius;
   }
   public double getRadius()   {
return radius;
   }
   public double calculateArea()  { // complete the below statement
return Math.PI*radius*radius;
   }
   public  double  calculateCircumference()         {
return  2*Math.PI*radius;
   }
} class prog{    public static void
main(String[] args)  {
     int r;
     Scanner sc = new Scanner(System.in);
r=sc.nextInt();
     Circle c= new Circle(r);
     System.out.println("Area = "+String.format("%.2f", c.calculateArea()));
     System.out.println("Circumference = "+String.format("%.2f",c.calculateCircumference()));
   }
}
```

Test	Input	Expected	Got	

1	4	Area = 50.27 Circumference = 25.13	Area = 50.27 Circumference = 25.13	

Passed all tests!

Question **3**

Create a Class Mobile with the attributes listed below,

private String manufacturer; private String

operating_system; public String color; private int cost;

Define a Parameterized constructor to initialize the above instance variables.

Define getter and setter methods for the attributes above.

for example : setter method for manufacturer is void

setManufacturer(String manufacturer){

this.manufacturer= manufacturer;

}

String getManufacturer(){

return manufacturer;}

Display the object details by overriding the toString() method.

For example:

Test	Result
1	manufacturer = Redmi operating_system = Andriod color = Blue cost = 34000

CODING

```
public class Mobile {    private String manufacturer;    private String

operating_system;    public String color;    private int cost;    public Mobile(String

manufacturer, String operating_system, String color, int cost) {        this.manufacturer

= manufacturer;        this.operating_system = operating_system;        this.color =

color;        this.cost = cost;

  }
```

27

```java
    public void setManufacturer(String manufacturer) {

this.manufacturer = manufacturer;

    }

    public String getManufacturer() {

return manufacturer;

    }

    public void setOperatingSystem(String operating_system) {

this.operating_system = operating_system;

    }

    public String getOperatingSystem() {

return operating_system;

    }

    public void setColor(String color) {

this.color = color;

    }

    public String getColor() {

return color;

    }

    public void setCost(int cost) {

this.cost = cost;

    }


    public int getCost() {

return cost;

    }

    @Override    public

String toString() {

        return  "manufacturer = " + manufacturer + '\n' +"operating_system = " + operating_system + '\n' +"color
= " + color + '\n' +"cost = " + cost;

    }

    public static void main(String[] args) {

        Mobile mobile = new Mobile("Redmi",
"Andriod", "Blue", 34000);
```

```
        System.out.println(mobile);

    }

}
```

Test	Expected	Got	
1	manufacturer = Redmi operating_system = Andriod color = Blue cost = 34000	manufacturer = Redmi operating_system = Andriod color = Blue cost = 34000	

Passed all tests!

LAB – 05

INHERITANCE

Question 1

Create a class known as "BankAccount" with methods called deposit() and withdraw().

Create a subclass called SavingsAccount that overrides the withdraw() method to prevent withdrawals if the account balance falls below one hundred.

For example:

Result
Create a Bank Account object (A/c No. BA1234) with initial balance of $500:
Deposit $1000 into account BA1234:
New balance after depositing $1000: $1500.0 Withdraw
$600 from account BA1234:
New balance after withdrawing $600: $900.0
Create a SavingsAccount object (A/c No. SA1000) with initial balance of $300:
Try to withdraw $250 from SA1000!
Minimum balance of $100 required!
Balance after trying to withdraw $250: $300.0

CODING

```java
class BankAccount {    private

String accountNumber;

private double balance;

   BankAccount(String ac,double

bal){        accountNumber = ac;

balance = bal;

   }

   public void deposit(double amount) {

balance +=amount;

   }

   public void withdraw(double amount)

{        if (balance >= amount) {

balance -= amount;

     } else {

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

     }
```

```java
    }
    public double getBalance() {
return balance;
    }
}
 class SavingsAccount extends BankAccount {    public
SavingsAccount(String accountNumber, double balance) {
super(accountNumber,balance);
    }
    public void withdraw(double amount) {
if (getBalance() - amount < 100) {
        System.out.println("Minimum balance of $100 required!");
      } else {
super.withdraw(amount);
    }
  }
} class prog {    public static void
main(String[] args) {
    System.out.println("Create a Bank Account object (A/c No. BA1234) with initial balance of $500:");
    BankAccount BA1234 = new BankAccount("BA1234", 500);
    System.out.println("Deposit $1000 into account BA1234:");
    BA1234.deposit(1000);
    System.out.println("New balance after depositing $1000: $"+BA1234.getBalance());
    System.out.println("Withdraw $600 from account BA1234:");
    BA1234.withdraw(600);
    System.out.println("New balance after withdrawing $600: $" + BA1234.getBalance());
    System.out.println("Create a SavingsAccount object (A/c No. SA1000) with initial balance of $300:");
    SavingsAccount SA1000 = new SavingsAccount("SA1000", 300);
    System.out.println("Try to withdraw $250 from SA1000!");
    SA1000.withdraw(250);
    System.out.println("Balance after trying to withdraw $250: $" + SA1000.getBalance());
```

```
    }
}
```

Passed all tests!

Result	Got	
Create a Bank Account object (A/c No. BA1234) with initial balance of $500: Deposit $1000 into account BA1234: New balance after depositing $1000: $1500.0 Withdraw $600 from account BA1234: New balance after withdrawing $600: $900.0 Create a SavingsAccount object (A/c No. SA1000) with initial balance of $300: Try to withdraw $250 from SA1000! Minimum balance of $100 required! Balance after trying to withdraw $250: $300.0	Create a Bank Account object (A/c No. BA1234) with initial balance of $500: Deposit $1000 into account BA1234: New balance after depositing $1000: $1500.0 Withdraw $600 from account BA1234: New balance after withdrawing $600: $900.0 Create a SavingsAccount object (A/c No. SA1000) with initial balance of $300: Try to withdraw $250 from SA1000! Minimum balance of $100 required! Balance after trying to withdraw $250: $300.0	

Question **2**

create a class called College with attribute String name, constructor to initialize the name attribute , a method called Admitted(). Create a subclass called CSE that extends Student class, with department attribute , Course() method to sub class. Print the details of the Student.

College:

String collegeName;

public College() { } public

admitted() { } Student:

String studentName; String

department;

public Student(String collegeName, String studentName,String depart) { }
public toString() **For example:**

Result
A student admitted in REC CollegeName : REC StudentName : Venkatesh Department : CSE

CODING

```java
class College
{ protected   String collegeName;

public College(String collegeName)

{    this.collegeName =

collegeName;

    }

public void admitted() {

    System.out.println("A student admitted in "+collegeName);

} } class Student extends

College{

String studentName;

String department;

public Student(String collegeName, String studentName,String depart)

{    super(collegeName);   this.studentName = studentName;

this.department = depart;

} public String toString(){    return "CollegeName : "+collegeName+"\nStudentName :

"+studentName+"\nDepartment : "+department;

} } class

prog {

public static void main (String[] args) {

    Student  s1 = new Student("REC","Venkatesh","CSE");

s1.admitted();

    System.out.println(s1.toString());

} }
```

Expected	Got	

A student admitted in REC	A student admitted in REC	
CollegeName : REC	CollegeName : REC	
StudentName : Venkatesh	StudentName : Venkatesh	
Department : CSE	Department : CSE	

Passed all tests!

Question **3**

Create a class Mobile with constructor and a method basicMobile().

Create a subclass CameraMobile which extends Mobile class , with constructor and a method newFeature().

Create a subclass AndroidMobile which extends CameraMobile, with constructor and a method androidMobile(). display the details of the Android Mobile class by creating the instance. .

class Mobile{

}
class CameraMobile extends Mobile {

}

class AndroidMobile extends CameraMobile {

}

For example:

Result
Basic Mobile is Manufactured
Camera Mobile is Manufactured
Android Mobile is Manufactured
Camera Mobile with 5MG px
Touch Screen Mobile is Manufactured

CODING

```
class Moblie{
  Moblie(){
    System.out.println("Basic Mobile is Manufactured");
  }
```

```java
}
class CamaraMoblie extends Moblie{
CamaraMoblie(){
     super();
     System.out.println("Camera Mobile is Manufactured");
  }
  void newFeature(){
     System.out.println("Camera Mobile with 5MG px");
  }
}
class AndroidMoblie extends CamaraMoblie{
AndroidMoblie(){
     super();
     System.out.println("Android Mobile is Manufactured");


  }
  void androidMoblie(){
     System.out.println("Touch Screen Mobile is Manufactured");


  }
} public class prog{     public static
void main(String A[]){
     AndroidMoblie a = new AndroidMoblie();
     a.newFeature();
     a.androidMoblie();
  }
}
```

Expected	Got	
Basic Mobile is Manufactured Camera Mobile is Manufactured Android Mobile is Manufactured Camera Mobile with 5MG px Touch Screen Mobile is Manufactured	Basic Mobile is Manufactured Camera Mobile is Manufactured Android Mobile is Manufactured Camera Mobile with 5MG px Touch Screen Mobile is Manufactured	

Passed all tests!

LAB – 06

STRING , STRING BUFFER

Question **1**

Given 2 strings input1 & input2.

·   Concatenate both the strings.

·   Remove duplicate alphabets & white spaces.

·   Arrange the alphabets in descending order.

For example:

Test	Input	Result
1	apple orange	rponlgea
2	fruits are good	utsroigfeda

CODING

```java
import java.util.*;
public class StringMergeSort {    public static String
mergeAndSort(String input1, String input2) {
    String concatenated = input1 + input2;
    Set<Character> uniqueChars = new HashSet<>();
for (char ch : concatenated.toCharArray()) {
        if (ch != ' ') {
uniqueChars.add(ch);
        }
    }
    List<Character> sortedList = new ArrayList<>(uniqueChars);
    Collections.sort(sortedList,
Collections.reverseOrder());        StringBuilder result = new
StringBuilder();        for (char ch : sortedList) {
result.append(ch);
    }
    return result.length() > 0 ? result.toString() : "null";
  }


  public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);
    String input1 = scanner.nextLine();
    String input2 = scanner.nextLine();
    String result = mergeAndSort(input1,
input2);        System.out.println(result);
scanner.close();
  }
}
```

Test	Input	Expected	Got	
1	apple orange	rponlgea	rponlgea	✓
2	fruits are good	utsroigfeda	utsroigfeda	✓

Passed all tests!

Question **2**

Given a String input1, which contains many number of words separated by : and each word contains exactly two lower case alphabets, generate an output based upon the below 2 cases.

Note:

1.   All the characters in input 1 are lowercase alphabets.

2.   input 1 will always contain more than one word separated by :

3.   Output should be returned in uppercase.

Example 1 : input1

= zx:za:ee output

= BYE

Explanation

word1 is zx, both are not same alphabets

position value of z is 26

position value of x is 24 max

– min will be 26 – 24 = 2

Alphabet which comes in 2nd position is b

Word2 is za, both are not same alphabets

position value of z is 26 position value of

a is 1 max – min will be 26 – 1 = 25

Alphabet which comes in 25th position is y

word3 is ee, both are same hence take e

Hence the output is BYE **For example:**

Input	Result

ww:ii:pp:rr:oo	WIPRO
zx:za:ee	BYE

CODING

```java
import java.util.Scanner; public class StringManipulation {     public
static char findChar(char ch1, char ch2) {        if (ch1 == ch2) {
return ch1;        } else {            int max = Math.max(ch1 - 'a' + 1, ch2 -
'a' + 1);          int min = Math.min(ch1 - 'a' + 1, ch2 - 'a' + 1);
int pos = max - min;            return (char) ('a' + pos - 1);  // Position
starts at 1, so adjust by -1

    }

  }

  public static String processString(String input) {

    String[] pairs = input.split(":");

    StringBuilder result = new
StringBuilder();        for (String pair : pairs) {
char ch1 = pair.charAt(0);

      char ch2 = pair.charAt(1);
result.append(findChar(ch1,  ch2));

    }

    return result.toString().toUpperCase();

  }

  public static void main(String[] args) {

    Scanner scanner = new Scanner(System.in);

    String input = scanner.nextLine();

    String result = processString(input);

System.out.println( result);        scanner.close();

  }

}
```

Input	Expected	GOT	
ww:ii:pp:rr:oo	WIPRO	WIPRO	
zx:za:ee	BYE	BYE	

Passed all tests!

Question **3**

You are provided a string of words and a 2-digit number. The two digits of the number represent the two words that are to be processed.

For example:

If the string is "Today is a Nice Day" and the 2-digit number is 41, then you are expected to process the 4th word ("Nice") and the 1st word ("Today").

The processing of each word is to be done as follows:

Extract the Middle-to-Begin part: Starting from the middle of the word, extract the characters till the beginning of the word.

Extract the Middle-to-End part: Starting from the middle of the word, extract the characters till the end of the word.

If the word to be processed is "Nice":

Its Middle-to-Begin part will be "iN".

Its Middle-to-End part will be "ce".

So, merged together these two parts would form "iNce".

Similarly, if the word to be processed is "Today":

Its Middle-to-Begin part will be "doT".

Its Middle-to-End part will be "day".

So, merged together these two parts would form "doTday".

Note: Note that the middle letter 'd' is part of both the extracted parts. So, for words whose length is odd, the middle letter should be included in both the extracted parts.

Expected output:

The expected output is a string containing both the processed words separated by a space "iNce doTday" **For example:**

Input	Result

Today is a Nice Day 41	iNce doTday
Fruits like Mango and Apple are common but Grapes are rare 39	naMngo arGpes

CODING

```java
import java.util.Scanner; public class
WordProcessor {  public static void
main(String[] args) {
     Scanner sc = new Scanner(System.in);
String input = sc.nextLine();        int
number = sc.nextInt();
     String[] words = input.split(" ");
int pos1 = number / 10;        int pos2
= number % 10;        pos1--;
pos2--;
     String result1 = processWord(words[pos1]);
     String result2 = processWord(words[pos2]);
     String result = result1 + " " + result2;
     System.out.println(result);
  }
  private static String processWord(String word) {
```

```
    int len = word.length();

int mid = len / 2;

    String middleToBegin;        String middleToEnd;        if (len % 2 == 0) {

middleToBegin = new StringBuilder(word.substring(0, mid)).reverse().toString();

middleToEnd = word.substring(mid);

    } else {

      middleToBegin = new StringBuilder(word.substring(0, mid + 1)).reverse().toString();

middleToEnd = word.substring(mid);

    }

    return middleToBegin + middleToEnd;

  }

}
```

Input	Expected	Got	
Today is a Nice Day 41	iNce doTday	iNce doTday	
Fruits like Mango and Apple are common but Grapes are rare 39	naMngo arGpes	naMngo arGpes	

Passed all tests!

LAB – 07

INTERFACES

Question **1**

create an interface Playable with a method play() that takes no arguments and returns void. Create three classes Football, Volleyball, and Basketball that implement the Playable interface and override the play() method to play the respective sports.

```
interface Playable {
void play();
}

class Football implements Playable {
String name;
   public Football(String name){
this.name=name;
   }
 public void play() {
   System.out.println(name+" is Playing football");
   } }
```

Similarly, create Volleyball and Basketball classes.

For example:

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Test	Input	Result
1	Sadhvin Sanjay Sruthi	Sadhvin is Playing football Sanjay is Playing volleyball Sruthi is Playing basketball
2	Vijay Arun Balaji	Vijay is Playing football Arun is Playing volleyball Balaji is Playing basketball

CODING

```
import java.util.Scanner;

interface Playable {

void play();

} class Football implements

Playable {    String name;    public

Football(String name) {

this.name = name;

   }

   public void play() {

     System.out.println(name + " is Playing football");

   }

} class Volleyball implements Playable

{    String   name;   public

Volleyball(String  name) {

this.name = name;

   }

   public void play() {

     System.out.println(name + " is Playing volleyball");

   }

} class Basketball implements Playable

{    String name;    public
```

```java
Basketball(String name) {

this.name = name;

    }

    public void play() {

        System.out.println(name + " is Playing basketball");

    }

} public class Main {     public static

void main(String[] args) {

        Scanner scanner = new Scanner(System.in);

        String footballPlayerName = scanner.nextLine();

        Football footballPlayer = new Football(footballPlayerName);

        String volleyballPlayerName = scanner.nextLine();

        Volleyball volleyballPlayer = new Volleyball(volleyballPlayerName);

        String basketballPlayerName = scanner.nextLine();

        Basketball basketballPlayer = new

Basketball(basketballPlayerName);        footballPlayer.play();

volleyballPlayer.play();        basketballPlayer.play();        scanner.close();

    }

}
```

Test	Input	Expected	Got	
1	Sadhvin Sanjay Sruthi	Sadhvin is Playing football Sanjay is Playing volleyball Sruthi is Playing basketball	Sadhvin is Playing football Sanjay is Playing volleyball Sruthi is Playing basketball	✓
2	Vijay Arun Balaji	Vijay is Playing football Arun is Playing volleyball Balaji is Playing basketball	Vijay is Playing football Arun is Playing volleyball Balaji is Playing basketball	✓

Passed all tests!

Question **2**

RBI issues all national banks to collect interest on all customer loans.

Create an RBI interface with a variable String parentBank="RBI" and abstract method rateOfInterest().

RBI interface has two more methods default and static method. default

void policyNote() {

System.out.println("RBI has a new Policy issued in 2023.");

} static void

regulations(){

System.out.println("RBI has updated new regulations on 2024."); }

Create two subclasses SBI and Karur which implements the RBI interface.

Provide the necessary code for the abstract method in two sub-classes.

For example:

Test	Result
1	RBI has a new Policy issued in 2023 RBI has updated new regulations in 2024. SBI rate of interest: 7.6 per annum. Karur rate of interest: 7.4 per annum.

CODING

```java
interface RBI {

   String parentBank = "RBI";

double rateOfInterest();

default void policyNote() {

     System.out.println("RBI has a new Policy issued in 2023");

   }     static void

regulations() {

     System.out.println("RBI has updated new regulations in 2024.");

   }

}

class SBI implements RBI {

public double rateOfInterest() {

return 7.6;

   }

}

class Karur implements RBI {

public double rateOfInterest() {

return 7.4;

   }

} public class Main {     public static

void main(String[] args) {        RBI rbi =

new SBI();        rbi.policyNote();

RBI.regulations();

     SBI sbi = new SBI();

     System.out.println("SBI rate of interest: " + sbi.rateOfInterest() + " per annum.");

Karur karur = new Karur();

     System.out.println("Karur rate of interest: " + karur.rateOfInterest() + " per annum.");

   }

}
```

Test	Expected	Got	
1	RBI has a new Policy issued in 2023	RBI has a new Policy issued in 2023	

	RBI has updated new regulations in 2024.	RBI has updated new regulations in 2024.	
	SBI rate of interest: 7.6 per annum.	SBI rate of interest: 7.6 per annum.	
	Karur rate of interest: 7.4 per annum.	Karur rate of interest: 7.4 per annum.	

Passed all tests!

Question **3**

Create interfaces shown below.

 interface Sports {
public void setHomeTeam(String name); public
void setVisitingTeam(String name);
} interface Football extends Sports { public
void homeTeamScored(int points); public
void visitingTeamScored(int points);}
create a class College that implements the Football interface and provides the necessary functionality to the abstract methods.

For example:

Test	Input	Result
1	Rajalakshmi Saveetha 22 21	Rajalakshmi 22 scored Saveetha 21 scored Rajalakshmi is the winner!

CODING

```
import java.util.Scanner; interface
Sports {    void setHomeTeam(String
name);    void setVisitingTeam(String
name);
} interface Football extends Sports {
void homeTeamScored(int points);
void visitingTeamScored(int points);
}
```

class College implements Football {

private String homeTeam;   private String

```java
visitingTeam;    private int
homeTeamPoints = 0;    private int
visitingTeamPoints = 0;    public void
setHomeTeam(String name) {
this.homeTeam = name;

    }

    public void setVisitingTeam(String name) {
this.visitingTeam = name;

    }

    public void homeTeamScored(int points) {
homeTeamPoints += points;

        System.out.println(homeTeam + " " + points + " scored");

    }

    public void visitingTeamScored(int points) {
visitingTeamPoints += points;

        System.out.println(visitingTeam + " " + points + " scored");

    }

    public void winningTeam() {        if
(homeTeamPoints > visitingTeamPoints) {

            System.out.println(homeTeam + " is the winner!");

        } else if (homeTeamPoints < visitingTeamPoints) {

            System.out.println(visitingTeam + " is the winner!");

        } else {

            System.out.println("It's a tie match.");

        }

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

        Scanner sc = new Scanner(System.in);

        String hname = sc.nextLine();

        String vteam = sc.nextLine();
```

```
    College match = new College();

match.setHomeTeam(hname);

match.setVisitingTeam(vteam);        int htpoints =

sc.nextInt();        match.homeTeamScored(htpoints);

int vtpoints = sc.nextInt();

match.visitingTeamScored(vtpoints);

match.winningTeam();

    sc.close();

  }

}
```

Test	Input	Expected	Got	
1	Rajalakshmi Saveetha 22 21	Rajalakshmi 22 scored Saveetha 21 scored Rajalakshmi is the winner!	Rajalakshmi 22 scored Saveetha 21 scored Rajalakshmi is the winner!	

Passed all tests!

LAB – 08

POLYMORPHISM , ABSTRACT CLASSES, FINAL KEY

Question 1

1. **Final Variable:**

- Once a variable is declared final, its value cannot be changed after it is initialized.

- It must be initialized when it is declared or in the constructor if it's not initialized at declaration.

- It can be used to define constants final int MAX_SPEED = 120; // Constant value, cannot be changed

2. **Final Method:**

- A method declared final cannot be overridden by subclasses.

- It is used to prevent modification of the method's behavior in derived classes.

```
public final void display() {
   System.out.println("This is a final method."); }
```

3. **Final Class:**

- A class declared as final cannot be subclassed (i.e., no other class can inherit from it).

- It is used to prevent a class from being extended and modified.

- public final class Vehicle {
  // class code
}

For example:

Test	Result
1	The maximum speed is: 120 km/h This is a subclass of FinalExample.

CODING

```
class FinalExample {    final int

maxSpeed = 120;    public final void

displayMaxSpeed() {

    System.out.println("The maximum speed is: " + maxSpeed + " km/h");

  }

}

class SubClass extends FinalExample {

public void showDetails() {

    System.out.println("This is a subclass of FinalExample.");

  }

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

FinalExample obj = new FinalExample();

obj.displayMaxSpeed();

    SubClass subObj = new SubClass();

subObj.showDetails();

  }

}
```

Test	Expected	Got	
1	The maximum speed is: 120 km/h		

	This is a subclass of FinalExample.	The maximum speed is: 120 km/h This is a subclass of FinalExample.	

Passed all tests!

Question **2**

As a logic building learner you are given the task to extract the string which has vowel as the first and last characters from the given array of Strings.

Step1: Scan through the array of Strings, extract the Strings with first and last characters as vowels; these strings should be concatenated.

Step2: Convert the concatenated string to lowercase and return it.

If none of the strings in the array has first and last character as vowel, then return no matches found   **For example:**

Input	Result
3 oreo sirish apple	oreoapple
2 Mango banana	no matches found
3 Ate Ace Girl	ateace

CODING

```java
import java.util.*; class prog{     public static
void main(String ae[]){         Scanner scan =
new Scanner(System.in);         int n =
scan.nextInt();
     String arr[] = new String[n];
scan.nextLine();
     String str =
scan.nextLine();         String
temp = "";       int j=0;        int
l=str.length();       for(int i =
0;i<l;i++){
if(str.charAt(i)==' '){
arr[j] = temp;            temp
="";            j++;
     }           else{
temp +=str.charAt(i);
     }     }     arr[j] = temp;       String s
= "";      char [] cha
={'a','A','e','E','i','I','o','O','U','u'};        for(int
i=0;i<n;i++){        int c=0;        char [] ar
= arr[i].toCharArray();        char ch1 = ar[0];
char ch2 = ar[ar.length -1];        for(char k :
cha){         if(k==ch1){            c++;
     }
```

```
        if(k==ch2){

c++;

        }

}        if(c==2){

s+=arr[i];

        }

    }

if(s==""){

        System.out.print("no matches found");

    }

else{

        System.out.print(s.toLowerCase());

    }

  }

}
```

Input	Expected	Got	
3 oreo sirish apple	oreoapple	oreoapple	✓
2 Mango banana	no matches found	no matches found	✓
3 Ate Ace Girl	ateace	ateace	✓

Passed all tests!

Question **3**

Create a base class Shape with a method called calculateArea(). Create three subclasses: Circle, Rectangle, and Triangle. Override the calculateArea() method in each subclass to calculate and return the shape's area.

In the given exercise, here is a simple diagram illustrating polymorphism implementation:

© w3resource.com
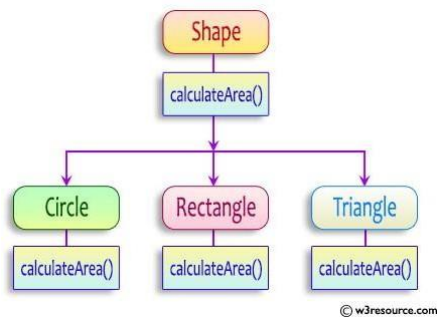
```
 abstract class Shape {
   public abstract double calculateArea() ;
    }
}
```

System.out.printf("Area of a Triangle :%.2f%n",((0.5)*base*height)); // use this statement **For example:**

Test	Input	Result
1	4 5 6 4 3	Area of a circle: 50.27 Area of a Rectangle: 30.00 Area of a Triangle: 6.00
2	7 4.5 6.5 2.4 3.6	Area of a circle: 153.94 Area of a Rectangle: 29.25 Area of a Triangle: 4.32

CODING

```java
import java.util.*; abstract

class Shape{    abstract void

calculatearea();

} class Circle extends

Shape{

    float rad;

    Circle(float rad){
this.rad = rad;

    }

    void calculatearea(){

        System.out.format("Area of a circle: %.2f\n",3.14159*rad*rad);

    }

}

class Rectangle extends Shape{

    float l;

float br;

    Rectangle(float l,float br){

        this.l = l;

this.br = br;

    }

    void calculatearea(){

        System.out.format("Area of a Rectangle: %.2f\n",(l*br));

    }
```

```java
} class Triangle extends
Shape{
   float ba;
float h;
   Triangle(float ba ,float
h){      this.ba = ba;
this.h = h;
   }
   void calculatearea(){
      System.out.format("Area of a Triangle: %.2f",0.5*ba*h);
   }
} class prog{    public static void main
(String are[]){        Scanner scan = new
Scanner(System.in);        float rad =
scan.nextFloat();       float l =
scan.nextFloat();       float br =
scan.nextFloat();       float ba =
scan.nextFloat();

      float h = scan.nextFloat();
      Circle c = new Circle(rad);
      Rectangle r = new Rectangle(l,br);        Triangle
t = new Triangle(ba,h);
      c.calculatearea();
      r.calculatearea();
      t.calculatearea();
   }
}
```

Test	Input	Expected	Got	
1	4 5 6 4 3	Area of a circle: 50.27 Area of a Rectangle: 30.00 Area of a Triangle: 6.00	Area of a circle: 50.27 Area of a Rectangle: 30.00 Area of a Triangle: 6.00	✓
2	7 4.5 6.5 2.4 3.6	Area of a circle: 153.94 Area of a Rectangle: 29.25 Area of a Triangle: 4.32	Area of a circle: 153.94 Area of a Rectangle: 29.25 Area of a Triangle: 4.32	✓

Passed all tests!

LAB – 09

EXCEPTION HANDLING

Question **1**

Write a Java program to handle ArithmeticException and ArrayIndexOutOfBoundsException.

Create an array, read the input from the user, and store it in the array.

Divide the 0th index element by the 1st index element and store it. if the

1st element is zero, it will throw an exception. if you try to access an

element beyond the array limit throws an exception.

For example:

Test	Input	Result
1	6 1 0 4 1 2 8	java.lang.ArithmeticException: / by zero I am always executed

CODING

```java
import java.util.*; class prog{

public static void main(String a[]){

    Scanner scan = new
Scanner(System.in);        int n =
scan.nextInt();        int[] arr = new int[n];
for(int i = 0;i<n;i++){          arr[i] =
scan.nextInt();

    }        try{            int
aa=arr[0]/arr[1];
arr[n]=2;

    }

    catch (ArithmeticException ae){

        System.out.println(ae);

    }

    catch(ArrayIndexOutOfBoundsException op){

        System.out.println(op);

    }
finally{

        System.out.print("I am always executed");

    }

  }

}
```

Test	Input	Expected	Got	
1	6 1 0 4 1 2 8	java.lang.ArithmeticException: / by zero I am always executed	java.lang.ArithmeticException: / by zero I am always executed	

Passed all tests!

Question 2

Write a Java program to create a method that takes an integer as a parameter and throws an exception if the number is odd.

For example:

Result
82 is even. Error: 37 is odd.

CODING

```
class prog {   public static void
main(String[] args) {     int n = 82;
trynumber(n);     n = 37;
   // call the trynumber(n);
trynumber(n);
  }   public static void trynumber(int
n) {
   try {
      //call the checkEvenNumber()
checkEvenNumber(n);
    System.out.println(n + " is even.");
   } catch (RuntimeException e) {

    System.out.println("Error: " + e.getMessage());
  }
 }
 public static void checkEvenNumber(int number) {
if (number % 2 != 0) {     throw new
RuntimeException(number + " is odd.");
   }
 }
}
```

Expected	Got	
82 is even. Error: 37 is odd.	82 is even. Error: 37 is odd.	

Passed all tests!

Question **3** In the following program, an array of integer data is to

be initialized.

During the initialization, if a user enters a value other than an integer, it will throw an InputMismatchException exception.
On the occurrence of such an exception, your program should print "You entered bad data." If
there is no such exception it will print the total sum of the array.

/* Define try-catch block to save user input in the array "name"
   If there is an exception then catch the exception otherwise print the total sum of the array. */ **For example:**

Input	Result
3 5 2 1	8
2 1 g	You entered bad data.

CODING

```
import java.util.Scanner;

import java.util.InputMismatchException;
```

```java
 class prog {   public static void
main(String[] args) {     Scanner sc =
new Scanner(System.in);     int length =
sc.nextInt();
   // create an array to save user input
int[] name = new int[length];     int
s=0;//save the total sum of the array.
    try
     {
        for(int i=0;i<length;i++){
name[i]=sc.nextInt();
s+=name[i];
       }
        System.out.print(s);
      }
    catch( InputMismatchException e)
   {
      System.out.print("You entered bad data.");
   }
 }
 }
```

Input	Expected	Got	
3 5 2 1	8	8	
2 1 g	You entered bad data.	You entered bad data.	

Passed all tests!

LAB- 10

COLLECTION - LIST

Question **1**

Given an ArrayList, the task is to get the first and last element of the ArrayList in Java.

Approach:

1. Get the ArrayList with elements.

2. Get the first element of ArrayList using the get(index) method by passing index = 0.

3. Get the last element of ArrayList using the get(index) method by passing index = size – 1.

CODING

```java
import java.util.ArrayList; import
java.util.Scanner; public class
FirstLastElement {    public static void
main(String[] args) {
    Scanner scanner = new Scanner(System.in);
    ArrayList<Integer> arrayList = new
ArrayList<>();      int n = scanner.nextInt();      for
(int i = 0; i < n; i++) {
arrayList.add(scanner.nextInt());
    }
    if (!arrayList.isEmpty()) {
      Integer firstElement = arrayList.get(0);
      Integer lastElement = arrayList.get(arrayList.size() - 1);
      System.out.println("ArrayList: " + arrayList);
      System.out.println("First : " + firstElement + ", Last : " + lastElement);
} else {
      System.out.println("The ArrayList is empty.");
    }
scanner.close();
  }
}
```

Test	Input	Expected	Got	

	1	6 30 20 40 50 10 80	ArrayList: [30, 20, 40, 50, 10, 80] First : 30, Last : 80	ArrayList: [30, 20, 40, 50, 10, 80] First : 30, Last : 80	
	2	4 5 15 25 35	ArrayList: [5, 15, 25, 35] First : 5, Last : 35	ArrayList: [5, 15, 25, 35] First : 5, Last : 35	

Passed all tests!

Question **2**

The given Java program is based on the ArrayList methods and its usage. The Java program is partially filled.

Your task is to fill in the incomplete statements to get the desired output. list.set(); list.indexOf());

list.lastIndexOf()) list.contains() list.size()); list.add(); list.remove();

The above methods are used for the below Java program.

CODING

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

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

```java
        int n = sc.nextInt();

        ArrayList<Integer> list = new
ArrayList<Integer>();        for (int i = 0; i < n; i++)
list.add(sc.nextInt());

        System.out.println("ArrayList: " +
list);        if (list.size() > 1) {
list.set(1, 100); // code here

        }

        System.out.println("Index of 100 = " + list.indexOf(100)); // code here

        System.out.println("LastIndex of 100 = " + list.lastIndexOf(100)); // code here

        System.out.println(list.contains(200)); // Output : false

        System.out.println("Size Of ArrayList = " + list.size()); // code
here        list.add(1, 500); // code here        if (list.size() > 3) {
list.remove(3); // code here

        }

        System.out.print("ArrayList: " + list);

    }
}
```

	Test	Input	Expected	Got	
	1	5			
		1	ArrayList: [1, 2, 3, 100, 5]	ArrayList: [1, 2, 3, 100, 5]	
		2	Index of 100 = 1	Index of 100 = 1	
		3	LastIndex of 100 = 3 false	LastIndex of 100 = 3 false	
		100	Size Of ArrayList = 5	Size Of ArrayList = 5	
		5	ArrayList: [1, 500, 100, 100, 5]	ArrayList: [1, 500, 100, 100, 5]	

Passed all tests!

Question **3**

Write a Java program to reverse elements in an array list.

CODING

```java
import java.util.ArrayList; import
java.util.Collections;
```

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```java
import java.util.Scanner;


public class ReverseArrayList {     public

static void main(String[] args) {

    Scanner scanner = new Scanner(System.in);

    ArrayList<String> arrayList = new

ArrayList<>();         int n = scanner.nextInt();

scanner.nextLine();        for (int i = 0; i < n; i++) {

arrayList.add(scanner.nextLine());

    }

    System.out.println("List before reversing :");

    System.out.println(arrayList);

    Collections.reverse(arrayList);

    System.out.println("List after reversing :");

System.out.println(arrayList);

scanner.close();

  }


}
```

	Test	Input	Expected	Got	
	1	5 Red Green Orange White Black	List before reversing : [Red, Green, Orange, White, Black] List after reversing : [Black, White, Orange, Green, Red]	List before reversing : [Red, Green, Orange, White, Black] List after reversing : [Black, White, Orange, Green, Red]	

Passed all tests!

LAB – 11

SET , MAP

Question **1**

Java HashSet class implements the Set interface, backed by a hash table which is actually a HashMap instance.

No guarantee is made as to the iteration order of the hash sets which means that the class does not guarantee the constant order of elements over time.

This class permits the null element.

 The class also offers constant time performance for the basic operations like add, remove, contains, and size assuming the hash function disperses the elements properly among the buckets.

Java HashSet Features

A few important features of HashSet are mentioned below:

- Implements Set Interface.

- The underlying data structure for HashSet is Hashtable.

- As it implements the Set Interface, duplicate values are not allowed.

- Objects that you insert in HashSet are not guaranteed to be inserted in the same order. Objects are inserted based on their hash code.

- NULL elements are allowed in HashSet.

- HashSet also implements **Serializable** and **Cloneable** interfaces.

- public class HashSet<E> extends AbstractSet<E> implements Set<E>, Cloneable, Serializable

CODING

```java
import java.util.HashSet; import
java.util.Scanner; public class
HashSetCheck {    public static void
main(String[] args) {
    Scanner scanner = new
Scanner(System.in);        HashSet<Integer> set
= new HashSet<>();        int n =
scanner.nextInt();        for (int i = 0; i < n; i++) {
int number = scanner.nextInt();
set.add(number);
    }
    while (scanner.hasNext()) {            int
checkNumber = scanner.nextInt();            if
(set.contains(checkNumber)) {
        System.out.println(checkNumber + " was found in the set.");
    } else {
        System.out.println(checkNumber + " was not
found in the set.");
    }
    }

    scanner.close();
  }
}
```

Test	Input	Expected	Got

1	5 90 56 45 78 25 78	78 was found in the set.	78 was found in the set. 75	
2	3 -1 2 4 5	5 was not found in the set.	5 was not found in the set	

Passed all tests!

Question **2**

Write a Java program to compare two sets and retain elements that are the same.

CODING

```
import java.util.HashSet; import

java.util.Scanner; public class

SetComparison {     public static void

main(String[] args) {

     Scanner scanner = new Scanner(System.in);
int n1 = scanner.nextInt();
```

```java
        scanner.nextLine();

        HashSet<String> set1 = new HashSet<>();

        for (int i = 0; i < n1; i++) {

set1.add(scanner.nextLine());

        }

        int n2 = scanner.nextInt();

scanner.nextLine();

        HashSet<String> set2 = new HashSet<>();

        for (int i = 0; i < n2; i++) {

set2.add(scanner.nextLine());

        }        set1.retainAll(set2);

for (String element : set1) {

            System.out.println(element);

        }

scanner.close();

    }

}
```

Test	Input	Expected	Got	
1	5 Football Hockey Cricket Volleyball Basketball 7 Golf Cricket Badminton Football Hockey Volleyball	Cricket Hockey Volleyball Football	Cricket Hockey Volleyball Football	

Question **3**

Java HashMap Methods containsKey() Indicate if an entry with the specified key exists in the map

containsValue() Indicate if an entry with the specified value exists in the map putIfAbsent() Write an

entry into the map but only if an entry with the same key does not already exist remove() Remove an

entry from the map replace() Write to an entry in the map only if it exists size()   Return the number

of entries in the map

Your task is to fill the incomplete code to get desired output

CODING

```java
import java.util.HashMap; import

java.util.Map.Entry; import java.util.Set;

import java.util.Scanner; public class

Prog {    public static void main(String[]

args) {

    HashMap<String, Integer> map = new HashMap<String, Integer>();

String name;        int num;

    Scanner sc = new

Scanner(System.in);        int n =

sc.nextInt();        for (int i = 0; i < n; i++) {

name = sc.next();          num =

sc.nextInt();          map.put(name, num);

    }

    Set<Entry<String, Integer>> entrySet = map.entrySet();

for (Entry<String, Integer> entry : entrySet) {

        System.out.println(entry.getKey() + " : " + entry.getValue());

    }

    System.out.println(" --------- ");

    HashMap<String, Integer> anotherMap = new HashMap<String,
Integer>();        anotherMap.put("SIX", 6);        anotherMap.put("SEVEN", 7);
```

```java
        anotherMap.putAll(map);        entrySet =
anotherMap.entrySet();        for (Entry<String, Integer> entry :
entrySet) {
        System.out.println(entry.getKey() + " : " + entry.getValue());
    }
    map.putIfAbsent("FIVE", 5);        int value =
map.get("TWO");
    System.out.println(value);
    System.out.println(map.containsKey("ONE"));
    System.out.println(map.containsValue(3));
System.out.println(map.size());        sc.close();
    }
}
```

Test	Input	Expected	Got	
1	3 ONE 1 TWO 2 THREE 3	ONE : 1 TWO : 2 THREE : 3 ------------ SIX : 6 ONE : 1 TWO : 2 SEVEN : 7 THREE : 3	ONE : 1 TWO : 2 THREE : 3 ------------ SIX : 6 ONE : 1 TWO : 2 SEVEN : 7 THREE : 3	
		2 true true 4	2 true true 4	

Passed all tests!

LAB – 12

INTRODUCTION to I/O , I/O OPERATIONS , OBJECTS

Question **1**

You are provided with a string which has a sequence of 1's and 0's.

This sequence is the encoded version of a English word. You are supposed write a program to decode the provided string and find the original word.

Each alphabet is represented by a sequence of 0s.

This is as mentioned below:

Z : 0

Y : 00

X : 000

W : 0000

V : 00000

U : 000000 T : 0000000 and so on upto A having 26 0's

(00000000000000000000000000).

The sequence of 0's in the encoded form are separated by a single 1 which helps to distinguish between 2 letters.

For example:

Input	Result
010010001	ZYX
0000100000000000000000010000000000010000000001000000000001	WIPRO

CODING

```java
import java.util.Scanner; public class

DecodeString {    public static void

main(String[] args) {

    Scanner sc = new Scanner(System.in);

    String encoded = sc.nextLine();

    System.out.println( decode(encoded));

    sc.close();

  }

  public static String decode(String encoded) {

    String[] zeroGroups = encoded.split("1");

    StringBuilder decodedWord = new StringBuilder();
for (String group : zeroGroups) {
      if (group.length() > 0) {          char letter =

(char) ('Z' - (group.length() - 1));

decodedWord.append(letter);

      }

    }

    return decodedWord.toString();

  }

}
```

Input	Expected	Got	
010010001	ZYX	ZYX	
00001000000000000000000010000000000001000000000100000000000001	WIPRO	WIPRO	

Passed all tests!

Question **2**

Write a function that takes an input String (sentence) and generates a new String (modified sentence) by reversing the words in the original String, maintaining the words position.

In addition, the function should be able to control the reversing of the case (upper or lowercase) based on a case_option parameter, as follows:

If case_option = 0, normal reversal of words i.e., if the original sentence is "Wipro TechNologies BangaLore", the new reversed sentence should be "orpiW seigoloNhceT eroLagnaB".

If case_option = 1, reversal of words with retaining position's case i.e., if the original sentence is "Wipro TechNologies BangaLore", the new reversed sentence should be "Orpiw SeigOlonhcet ErolaGnab".

Note that positions 1, 7, 11, 20 and 25 in the original string are uppercase W, T, N, B and L.

Similarly, positions 1, 7, 11, 20 and 25 in the new string are uppercase O, S, O, E and G.

NOTE:

1.   Only space character should be treated as the word separator i.e., "Hello World" should be treated as two separate words, "Hello" and "World". However, "Hello,World", "Hello;World", "Hello-World" or "Hello/World" should be considered as a single word.

2.   Non-alphabetic characters in the String should not be subjected to case changes. For example, if case option = 1 and the original sentence is "Wipro TechNologies, Bangalore" the new reversed sentence should be "Orpiw ,seiGolonhceT Erolagnab". Note that comma has been treated as part of the word "Technologies," and when comma had to take the position of uppercase T it remained as a comma and uppercase T took the position of comma. However, the words "Wipro and Bangalore" have changed to "Orpiw" and "Erolagnab".

3.   Kindly ensure that no extra (additional) space characters are embedded within the resultant reversed String.

For example:

Input	Result
Wipro Technologies Bangalore 0	orpiW seigolonhceT erolagnaB

Wipro Technologies, Bangalore 0	orpiW ,seigolonhceT erolagnaB
Wipro Technologies Bangalore 1	Orpiw Seigolonhcet Erolagnab
Wipro Technologies, Bangalore 1	Orpiw ,seigolonhceT Erolagnab

CODING

```java
import java.util.Scanner; public class
WordReversal {   public  static  void
main(String[] args) {
     Scanner sc = new
Scanner(System.in);        String sentence =
sc.nextLine();        int caseOption =
sc.nextInt();
     String result = reverseWords(sentence,
caseOption);        System.out.println(result);
sc.close();
  }
  public static String reverseWords(String sentence, int case_option) {
     String[] words = sentence.split(" ");
     StringBuilder modifiedSentence = new StringBuilder();
for (int i = 0; i < words.length; i++) {
        String word = words[i];
        StringBuilder reversedWord = new StringBuilder();
for (int j = word.length() - 1; j >= 0; j--) {
reversedWord.append(word.charAt(j));
        }
```

```
        if (case_option == 1) {                for (int j = 0; j <

word.length(); j++) {                char originalChar =

word.charAt(j);            char reversedChar =

reversedWord.charAt(j);


            if (Character.isUpperCase(originalChar)) {

reversedWord.setCharAt(j, Character.toUpperCase(reversedChar));

            } else if (Character.isLowerCase(originalChar)) {

reversedWord.setCharAt(j, Character.toLowerCase(reversedChar));

            }

          }

        }

      modifiedSentence.append(reversedWord);

if (i < words.length - 1) {

modifiedSentence.append(" ");

        }

      }

      return modifiedSentence.toString();

  }

}
```

Input	Expected	Got	
Wipro Technologies Bangalore 0	orpiW seigolonhceT erolagnaB	orpiW seigolonhceT erolagnaB	✓
Wipro Technologies, Bangalore 0	orpiW ,seigolonhceT erolagnaB	orpiW ,seigolonhceT erolagnaB	✓
Wipro Technologies Bangalore 1	Orpiw Seigolonhcet Erolagnab	Orpiw Seigolonhcet Erolagnab	✓
Wipro Technologies, Bangalore 1	Orpiw ,seigolonhceT Erolagnab	Orpiw ,seigolonhceT Erolagnab	✓

Passed all tests!

Question **3**

Given two char arrays input1[] and input2[] containing only lower case alphabets, extracts the alphabets which are present in both arrays (common alphabets).

Get the ASCII values of all the extracted alphabets.

Calculate sum of those ASCII values. Lets call it sum1 and calculate single digit sum of sum1, i.e., keep adding the digits of sum1 until you arrive at a single digit.

Return that single digit as output.

Note:

1.   Array size ranges from 1 to 10.

2.   All the array elements are lower case alphabets.

3.   Atleast one common alphabet will be found in the arrays.

For example:

Input	Result
a b c b c	8

CODING

```java
import java.util.Scanner; public class
CommonAlphabets {  public  static
void main(String[] args) {
     Scanner sc = new Scanner(System.in);
     String input1 = sc.nextLine();       String input2 =
sc.nextLine();       sc.close();       char[] array1 =
input1.replace(" ", "").toCharArray();       char[] array2
= input2.replace(" ", "").toCharArray();       int sum1 =
0;      for (char c1 : array1) {          for (char c2 :
array2) {            if (c1 == c2) {              sum1 +=
(int) c1;            break;

          }

       }

     }
     int singleDigitSum = getSingleDigitSum(sum1);
     System.out.println(singleDigitSum);
  }
  private static int getSingleDigitSum(int number) {
while (number >= 10) {        int sum = 0;
while (number > 0) {           sum += number % 10;
number /= 10;

     }

     number = sum;

   }

   return number;

  }

}
```

Input	Expected	Got	
a b c b c	8	8	

Passed all tests!

INVENTORY MANAGEMENT SYSTEM

Submitted by

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Mini Project

November 2024

Department of Information Technology

Rajalakshmi Engineering College, Thandalam

Bonafide Certificate

This is to certify that the Mini project work titled **" INVENTORY MANAGEMENT SYSTEM**" done by "VISHAL R(231001247) , SIVA M (231001204) , SRIRAM GANESH M (231001213)", is a record of bonafide work carried out by him/her under my supervision as a part of Mini project for the Course CS23333 - Object Oriented Programming using Java , Department of Information Technology, REC.

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College,   College,

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ABSTARCT

The Inventory Management System is a Java-based desktop application designed to streamline inventory, sales, and purchase management for small to mid-sized stores. Using Swing for the GUI and MySQL for the database, it automates stock tracking and transaction management. The system supports two user roles—Administrator and Employee—with features like real-time stock updates, product search, and transaction logging. Built with Object-Oriented Programming (OOP) principles and following Test-Driven Development (TDD), it offers a modular and scalable solution for efficient store operations, reducing manual errors and improving decision-making.

TABLE OF CONTENT

CHAPTER 1

INTRODUCTION

1.1 Motivation:

This Inventory Management System project is an excellent opportunity to showcase your skills in Java, database management, and user interface design. By building this application, you're not just creating a tool; you're providing a solution that can significantly improve how small to mid-sized businesses manage their inventory, transactions, and customer relations. The integration of MySQL, JDBC, and Swing demonstrates your ability to work with key technologies, while the user-friendly features you've incorporated will make it accessible for real-world users. This project will not only enhance your coding and problem-solving abilities but also give you a practical application that can be used by businesses to streamline operations. Stay focused, and remember that this project is a step towards becoming a proficient developer capable of tackling complex, real-world challenges! Keep up the great work!

1.2 Project Objectives:

The objective of this Inventory Management System project is to develop a user-friendly, efficient, and scalable solution for small to mid-sized businesses to manage their inventory, sales, purchases, suppliers, and customer records.

- **Streamline Inventory Management**: Allow users to easily add, edit, delete, and track products and stock levels.

- **Enhance User Experience**: Provide an intuitive GUI using Java Swing, ensuring that both administrators and employees can navigate the system with ease.

- **Improve Data Organization**: Maintain a detailed log of transactions, user activities, and stock updates, ensuring transparency and efficiency.

- **Ensure Reliability and Security**: Integrate MySQL for robust data storage and JDBC for secure database connectivity.

- **Facilitate Business Management**: Enable administrators to manage users, suppliers, and customers, providing full control over store operations.

1.3 Proposed System:

The proposed system for the Inventory Management System is designed to address the needs of small to mid-sized businesses by providing an efficient, user-friendly, and automated way to manage their inventory, transactions, and business operations.

BENEFITS OF PROPOSED SYSTEM:

1) **Improved Inventory Control**:
   - Real-time tracking of stock levels reduces the risk of stockouts or overstocking.
   - Automated stock updates after each transaction ensure accuracy and up-to-date inventory information.

2) **Enhanced Operational Efficiency**:
   - The system automates routine tasks such as sales and purchase transactions, reducing manual work and minimizing human error.
   - Quick and easy data entry via product and customer codes speeds up the sales and purchase processes, saving time.

3) **Time and Cost Savings**:
   - Automation reduces manual labor, allowing employees to focus on other critical tasks and increasing overall productivity.
   - Minimizes the risk of errors in inventory management and financial transactions, which can lead to cost savings in the long run.

4) **Data-Driven Insights**:
   - The system provides valuable insights through transaction histories, stock levels, and user activity logs, which can guide business planning and improve efficiency.
   - Real-time access to reports helps in monitoring business health and making quick decisions.

5) **Enhanced Customer and Supplier Relationship Management**:

- By managing customer and supplier information in one place, businesses can improve communication and maintain stronger relationships.
- The system enables businesses to track customer purchase history and supplier transactions, improving future interactions and negotiations.

CHAPTER 2

SYSTEM DESIGN

2.1 System Architecture:

The system architecture for the proposed Inventory Management System is designed to support multiple components and ensure seamless communication between the user interface, database, and the business logic. Below is a high-level overview of the system architecture
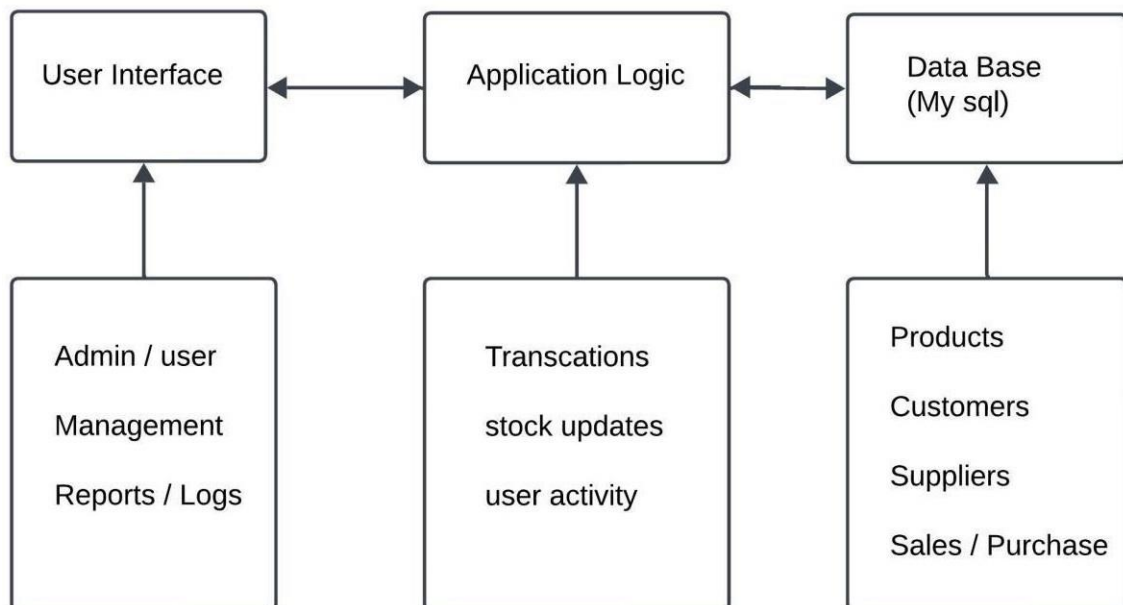
⭘ **User Interface Layer**:

• Responsible for displaying the system's interface and collecting user inputs (e.g., product codes, customer IDs, etc.).

Application Layer:

- Processes the data from the UI, applies business rules (e.g., stock updates, sales processing), and interacts with the database.

Data Access Layer:

- Manages database operations through JDBC, handling the retrieval and modification of data stored in the database.

Database Layer:

- The relational database (MySQL) stores all the essential data (products, customers, sales transactions, logs) and ensures data persistence.

2.2 Technologies Used :

JetBrains IntelliJ IDE:

- **Purpose:**

  JetBrains IntelliJ IDEA is used as the primary Integrated Development Environment (IDE) for writing and managing the Java code. It provides features like intelligent code completion, debugging, version control, and project management, making it easier and more efficient to develop Java applications. It also supports JDBC for database connectivity and allows seamless integration with external libraries.

Apache NetBeans IDE (for the GUI Designer):

- Purpose:

  Apache NetBeans is used specifically for designing the graphical user interface (GUI) of the application. Its drag-and-drop GUI designer simplifies the creation of Swing-based components like buttons, text fields, labels, and tables. NetBeans makes it easier to layout and structure the user interface, saving time in the development of the front-end of the application.

MySQL Server and Workbench:

- **Purpose**:

- **MySQL Server**: MySQL is used as the relational database management system (RDBMS) to store all the data for the inventory, sales, purchase transactions, customers, suppliers, and user logs. It ensures data integrity, security, and scalability. MySQL provides the backend storage and allows efficient data retrieval through SQL queries.

- **MySQL Workbench**: MySQL Workbench is used for database management and design. It provides a visual interface for creating and managing databases, tables, and queries. Developers use MySQL Workbench to set up and maintain the database schema, perform SQL operations, and troubleshoot database-related issues.

⭕ JDK 16 (Java Development Kit):

- **Purpose**:

The JDK 16 is used for compiling and running the Java code. It provides the necessary tools and libraries required to build and execute Java applications. JDK includes essential libraries, the Java compiler, and the Java Virtual Machine (JVM), enabling the development of the application in Java. It ensures that the code is compiled and executed efficiently, and allows the use of modern Java features (like lambda expressions, enhanced switch statements, etc.) that improve the readability and performance of the code.

2.3 ER Diagram
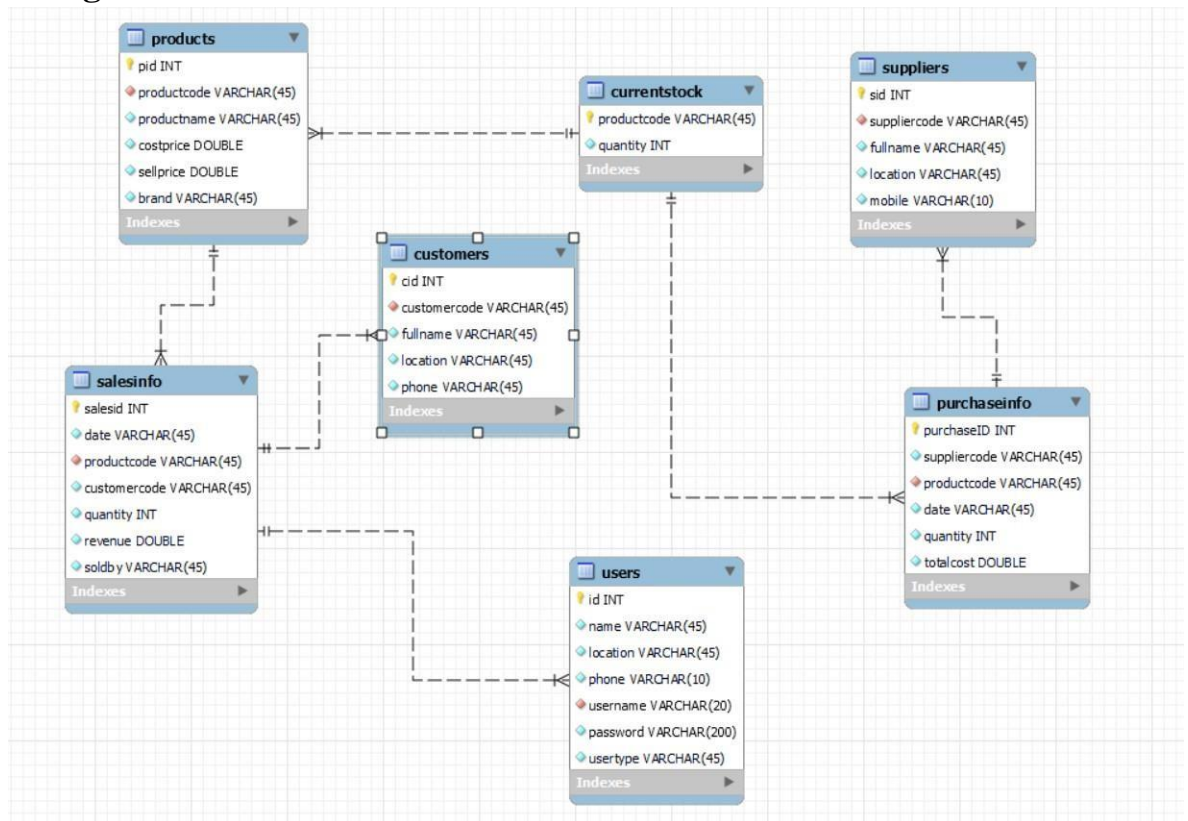
CHAPTER 3

IMPLEMENTATION

3.1 CODING:

```
/*
* To change this license header, choose License Headers in Project
  Properties.
* To change this template file, choose Tools | Templates
* and open the template in the editor.
*/

package com.inventory.DAO;
```

```java
import com.inventory.DTO.CustomerDTO; import
com.inventory.Database.ConnectionFactory;

import javax.swing.*;
import javax.swing.table.DefaultTableModel;
import java.sql.*; import java.util.Locale;
import java.util.Vector;

/**
 *
 * @author asjad
 */

// Data Access Object for Customers public
class CustomerDAO {
    Connection conn = null;
    PreparedStatement prepStatement= null;
    Statement statement = null;
    ResultSet resultSet = null;

    public CustomerDAO() {
        try {
            conn = new ConnectionFactory().getConn();
statement = conn.createStatement();        } catch
(SQLException e) {
```

```java
            e.printStackTrace();

        }

    }

    // Methods to add new custoemr    public void
addCustomerDAO(CustomerDTO customerDTO) {

        try {

            String query = "SELECT * FROM customers WHERE fullname='"

                    +customerDTO.getFullName()

                    + "' AND location='"

                    +customerDTO.getLocation()

                    + "' AND phone='"

                    +customerDTO.getPhone()

                    + "'";

            resultSet = statement.executeQuery(query);

            if (resultSet.next())

                JOptionPane.showMessageDialog(null, "Customer already
exists.");

            else

                addFunction(customerDTO);

} catch (SQLException e) {

            e.printStackTrace();

        }

    }

    public void addFunction(CustomerDTO customerDTO) {

        try {
```

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```java
        String query = "INSERT INTO customers VALUES(null,?,?,?,?)";

prepStatement = conn.prepareStatement(query);

prepStatement.setString(1, customerDTO.getCustCode());

prepStatement.setString(2, customerDTO.getFullName());

prepStatement.setString(3, customerDTO.getLocation());

prepStatement.setString(4, customerDTO.getPhone());

prepStatement.executeUpdate();

        JOptionPane.showMessageDialog(null, "New customer has been
added.");

    } catch (SQLException e) {

        e.printStackTrace();

    }


  }

  // Method to edit existing customer details     public  void

editCustomerDAO(CustomerDTO customerDTO) {        try {

        String query = "UPDATE customers SET
fullname=?,location=?,phone=? WHERE customercode=?";

prepStatement = conn.prepareStatement(query);

prepStatement.setString(1, customerDTO.getFullName());

prepStatement.setString(2, customerDTO.getLocation());

prepStatement.setString(3, customerDTO.getPhone());

prepStatement.setString(4, customerDTO.getCustCode());

prepStatement.executeUpdate();

        JOptionPane.showMessageDialog(null, "Customer details have been
updated.");
```

```java
        } catch (SQLException e) {
            e.printStackTrace();
        }
    }
    // Method to delete existing customer     public void
deleteCustomerDAO(String custCode) {
        try {
            String query = "DELETE FROM customers WHERE
customercode='" +custCode+ "'";
statement.executeUpdate(query);
            JOptionPane.showMessageDialog(null, "Customer removed.");
} catch (SQLException e) {
            e.printStackTrace();
        }
    }

    // Method to retrieve data set to be displayed
public ResultSet getQueryResult() {
        try {
            String query = "SELECT customercode,fullname,location,phone
FROM customers";
            resultSet = statement.executeQuery(query);
} catch (SQLException e) {
            e.printStackTrace();
        }
        return resultSet;
```

```java
    }

    // Method to retrieve search data    public
ResultSet getCustomerSearch(String text) {

        try {

            String query = "SELECT customercode,fullname,location,phone
FROM customers " +

                "WHERE customercode LIKE '%"+text+"%' OR fullname
LIKE '%"+text+"%' OR " +

                "location LIKE '%"+text+"%' OR phone LIKE
'%"+text+"%'";

            resultSet = statement.executeQuery(query);

} catch (SQLException e) {

            e.printStackTrace();

        }

        return resultSet;

    }


    public ResultSet getCustName(String custCode) {

        try {

            String query = "SELECT * FROM customers WHERE
customercode='" +custCode+ "'";            resultSet =
statement.executeQuery(query);        } catch (SQLException
e) {

            e.printStackTrace();

        }

        return resultSet;

    }
```

```java
    public ResultSet getProdName(String prodCode) {

        try {

            String query = "SELECT productname,currentstock.quantity FROM products " +
                "INNER JOIN currentstock ON products.productcode=currentstock.productcode " +
                "WHERE currentstock.productcode='" +prodCode+ "'";
resultSet = statement.executeQuery(query);         } catch (SQLException e) {

            e.printStackTrace();

        }

        return resultSet;

    }


    // Method to display data set in tabular form
    public DefaultTableModel buildTableModel(ResultSet resultSet) throws SQLException {

        ResultSetMetaData metaData = resultSet.getMetaData();

        Vector<String> columnNames = new Vector<String>();

        int colCount = metaData.getColumnCount();


        for (int col=1; col <= colCount; col++){

columnNames.add(metaData.getColumnName(col).toUpperCase(Locale.ROOT));

        }
```

```java
        Vector<Vector<Object>> data = new Vector<Vector<Object>>();

        while (resultSet.next()) {

            Vector<Object> vector = new Vector<Object>();

for (int col=1; col<=colCount; col++) {

vector.add(resultSet.getObject(col));

            }

            data.add(vector);

        }

        return new DefaultTableModel(data, columnNames);

    }
}
```

3.2 Result

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CHAPTER 4

CONCLUSION

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The Inventory Management System developed in Java using MySQL as the backend database provides a comprehensive solution for small to mid-sized stores to efficiently manage their inventory, sales, and purchase transactions. Through the application of structured methodologies like the Waterfall Model and Agile Development, the project ensures both disciplined planning and the flexibility to adapt to user feedback. The Object-Oriented Programming (OOP) approach enhances modularity and reusability, making the codebase easier to maintain and extend in the future.

The system's database-driven design, utilizing MySQL and JDBC, ensures data consistency and reliability while enabling efficient retrieval and management of large amounts of transactional data. The incorporation of Test-Driven Development (TDD) ensures high-quality code with minimal defects, while User-Centered Design (UCD) guarantees that the system is intuitive and meets the real-world needs of its users.

This system simplifies the inventory management process for store owners by automating routine tasks, improving stock accuracy, and providing easy access to vital information. By supporting multiple user roles (admin and employee) and ensuring security and efficiency, the system enhances the overall operational workflow of the store, ultimately driving better decision-making and improving business performance.

In conclusion, the Inventory Management System not only addresses the immediate needs of inventory tracking and transaction management but also provides a scalable and reliable solution for future growth. The combination of robust methodologies and technologies ensures that this system remains effective, efficient, and adaptable to changing business requirements.

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