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RAJALAKSHMI ENGINEERING COLLEGE

[AUTONOMOUS]

RAJALAKSHMI NAGAR, THANDALAM - 602 105



RAJALAKSHMI
ENGINEERING COLLEGE

CS23333 OBJECT ORIENTED PROGRAMING USING JAVA
Laboratory Record Note Book

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Year / Branch / Section : . . II/IT/D.....

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Semester : III.....

Academic Year : 2024-2025

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BONAFIDE CERTIFICATE

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Academic Year : 2024-2025 Semester:. III Branch : IT-D

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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.

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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

SOLUTION :

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

OUTPUT :

	Input	Expected	Got	
✓	123	2	2	✓
✓	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

•

SOLUTION :

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

OUTPUT :

	Input	Expected	Got	
✓	197	7	7	✓
✓	-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: The 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 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

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
-267 154	11
-267 -154	11

SOLUTION :

```

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

```

OUTPUT:

	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

1.

-

Consider the following sequence:

1st term: 1

2nd term: 1 2 1

3rd term: 1 2 1 3 1 2 1

4th term: 1 2 1 3 1 2 1 4 1 2 1 3 1 2 1

And so on. Write a program that takes as parameter an integer n and prints the nth terms of this sequence.

Example Input:

1

Output:

1

Example Input:

4

Output:

1 2 1 3 1 2 1 4 1 2 1 3 1 2 1

For example:

Input	Result
1	1
2	1 2 1
3	1 2 1 3 1 2 1
4	1 2 1 3 1 2 1 4 1 2 1 3 1 2 1

SOLUTION :

```
import java.util.Scanner; public class
SequenceGenerator{ public static void
main(String[]args){ Scanner S = new
Scanner(System.in);
    int n = S.nextInt();
    String term = generateTerm(n);
    System.out.print(term);
}
private static String generateTerm(int n){
    if (n==1){ return "1";
    }
    String prevTerm = generateTerm (n-1);
    StringBuilder currentTerm = new StringBuilder(prevTerm);
```

•

```

currentTerm.append(" " + n + " ");
currentTerm.append(prevTerm);
return currentTerm.toString();
}
}

```

OUTPUT :

	Input	Expected	Got	
✓	1	1	1	✓
✓	2	1 2 1	1 2 1	✓
✓	3	1 2 1 3 1 2 1	1 2 1 3 1 2 1	✓
✓	4	1 2 1 3 1 2 1 4 1 2 1 3 1 2 1	1 2 1 3 1 2 1 4 1 2 1 3 1 2 1	✓

Passed all tests! ✓

2.

Write a program that takes as parameter an integer n.
 You have to print the number of zeros at the end of the factorial of n.
 For example, 3! = 6. The number of zeros are 0. 5! = 120. The number of zeros at the end are 1.
 Note: n! < 10^5

Example Input:
 3
 Output:
 0

Example Input:
 60
 Output:
 14

Example Input:
 100
 Output:
 24

Example Input:
 1024
 Output:
 253

For example:

Input	Result
3	0
60	14
100	24
1024	253

SOLUTION :

```

// Java program to count trailing 0s in n!
import java.io.*; import
java.util.Scanner;
class prog {
    // Function to return trailing
    // 0s in factorial of n
    static int findTrailingZeros(int n)
    { if (n < 0) // Negative Number Edge Case
        return -1;

```


•

```
// Initialize result

int count=0;
// Keep dividing n by powers //
of 5 and update count for (int i =
5; n / i >= 1; i*=5      ){ count
+= n / i;
} return count;
}

// Driver Code
public static void main(String[] args)
{
    Scanner sc= new Scanner(System.in);
    int n=sc.nextInt();
    int res=findTrailingZeros(n);
    System.out.println(res);
}
}
```

OUTPUT :

	Input	Expected	Got	
✓	3	0	0	✓
✓	60	14	14	✓
✓	100	24	24	✓
✓	1024	253	253	✓

Passed all tests! ✓

3.

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.

Example Input:

5

Output:

4

Example Input:

8

Output:

24

Example Input:

11

Output:

149

For example:

Input	Result
5	4
8	24
11	149

SOLUTION :

```

import java.util.Scanner;
class fibo3{ int a; int b;
int c;
    fibo3(int a,int b,int c){
        this.a = a; this.b =
        b; this.c = c;
    }
    int nth(int x){
        if (x == 1){
            return 0;
        }
        else if(x == 2 && x == 3)
            return 1;
        else{ int temp1,temp2,temp; int
            count = 4; while(x >=
            count){ temp =
            this.a+this.b+this.c;
            temp1 = this.c;
            this.c = temp;
            temp2 = this.b;
            this.b = temp1;
            this.a = temp2;
            count++;
        }
        return this.c;
    }
}
}
public class Main{ public static void
main(String[] args){ Scanner s = new
Scanner(System.in);
    int t = s.nextInt(); fibo3 r
    = new fibo3(0,1,1);
    System.out.print(r.nth(t));
}
}

```

OUTPUT :

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

Passed all tests! ✓

Lab-03-Arrays

1.

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 input1.

Example 2:

input1: 5 and input2: {1, 5, 423, 310, 61540}

Step 1:

Generating the new array based on position, we get the below array:

{1, 0, 4, 0, 6}

In this case, the value in input2 at index 1 and 3 is less than the value required to be picked up based on position, so we use a 0.

Step 2:

{1, 0, 16, 0, 36}

Step 3:

The final result = 53.

For example:

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

SOLUTION :

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

•

```
int size =scanner.nextInt();
int[]inpar=new int[size];
for(int i=0;i<size;i++){
inpar[i]=scanner.nextInt();
}
int[]dig=new int[size];
for(int i=0;i<size;i++){
int num=inpar[i];
if(i==0){
dig[i]=num% 10;
}
else if (i==1){
dig[i]=(num/10)% 10;
}
else if(i==2){
dig[i]=(num/100)% 10;
}
else if(i==3){
dig[i]=(num/1000)% 10;
}
else if(i==4){
dig[i]=(num/10000)% 10;
} else{
dig[i]=0;
}
} int fin=0;
for(int digi:dig){
fin+=digi*digi;
}
System.out.print(fin);
}
}
```

OUTPUT :

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

Passed all tests! ✓

2.

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 = 62.

Example 2:

input1 = 11

input2 = {-22, -24, 16, -1, -17, -19, -37, -25, -19, -93, -61}

Expected output = -1

Explanation:

There are NO positive numbers in the input array. Therefore, the expected output for such cases = -1.

Example 3:

input1 = 16

input2 = {-58, 32, 26, 92, -10, -4, 12, 0, 12, -2, 4, 32, -9, -7, 78, -79}

Expected output = 174

Explanation:

The input array contains four sequences of POSITIVE numbers, i.e. "32, 26, 92", "12, 0, 12", "4, 32", and "78". The first and second sequences "32, 26, 92" and "12, 0, 12" are the longest of the four as they contain 4 elements each. Therefore, the expected output = sum of the longest sequence of POSITIVE numbers = (32 + 26 + 92) + (12 + 0 + 12) = 174.

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

SOLUTION :

```
import java.util.Scanner; public class
longdig{ public static void
main(String[]args){ Scanner sc=new
Scanner(System.in);
    int n=sc.nextInt();
    int c = 1,v,seqtemp = 0,seq = 0,countmax = 0;
    int count = 0; while(c <= n){ v = sc.nextInt();
    if(v >= 0){ countmax= countmax + v;
        seqtemp++;
    }
    else{
        seqtemp = 0;
        countmax = 0;
    }
    if(seqtemp > seq ){
        seq = seqtemp;
        count = countmax;
    }
    else if (seq == seqtemp){
        count = count + countmax;
    }
    c++; }
    if (count == 0)
        System.out.print(-1);
    else
        System.out.print(count);
```

```
}
```

•

}

OUTPUT :

	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 8 12 -2 4 32 -9 -7 78 -79	174	174	✓

Passed all tests! ✓

3.

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

- Find the maximum number in the array.
- Subtract the maximum number from each element of the array.
- 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}.

Example 2:

input1 = 5 (represents the number of elements in the input1 array)

input2 = {10, 87, 63, 42, 2}

Expected Output = {-6699, 0, -2088, -3915, -7395}

Explanation:

Step 1: The maximum number in the given array is 87.

Step 2: Subtracting the maximum number 87 from each element of the array:

{{10 - 87}, {87 - 87}, {63 - 87}, {42 - 87}, {2 - 87}} = {-77, 0, -24, -45, -85}

Step 3: Multiplying the maximum number 87 to each of the resultant array:

{{-77 x 87}, {0 x 87}, {-24 x 87}, {-45 x 87}, {-85 x 87}} = {-6699, 0, -2088, -3915, -7395}

So, the expected output is the resultant array {-6699, 0, -2088, -3915, -7395}.

Example 3:

input1 = 2 (represents the number of elements in the input1 array)

input2 = {-9, 9}

Expected Output = {-162, 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:

{{-9 - 9}, {9 - 9}} = {-18, 0}

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

{{-18 x 9}, {0 x 9}} = {-162, 0}

So, the expected output is the resultant array {-162, 0}.

Note: The input array will contain not more than 100 elements

For example:

Input	Result
4 1 5 6 9	-72 -36 -27 0
5 10 87 63 42 2	-6699 0 -2088 -3915 -7395

SOLUTION :

```

import java.util.Scanner; public
class res{ public static
int[]pa(int[]arr){
    int maxs=Integer.MIN_VALUE;
    for (int num:arr){
        if(num>maxs){
            maxs=num;
        }
    }
    for(int i=0;i<arr.length;i++){ arr[i]=(arr[i]-
        maxs)*maxs;
    }
    return arr;
}
public static void main(String[]args){
    Scanner scanner =new Scanner (System.in);
    int n=scanner.nextInt();
    int[]arr=new int[n]; for(int
    i=0;i<n;i++){
        arr[i]=scanner.nextInt();
    }
    int[]res=pa(arr);
    for(int i=0;i<n;i++){
        System.out.print(res[i]+" ");
    }
    scanner.close();
}
}

```

OUTPUT :

	Input	Expected	Got	
✓	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

1.

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 = $2\pi r$

Input:

2

Output:

Area = 12.57

Circumference = 12.57

For example:

Test	Input	Result
1	4	Area = 50.27 Circumference = 25.13

•

SOLUTION :

```
import java.io.*; import
java.util.Scanner; class
Circle
{ private double radius; public
  Circle(double radius){
    // set the instance variable radius
    this.radius =radius;
    } public void setRadius(double
radius){
    // set the radius
    this.radius=radius;

  }
public double getRadius()    {
    // return the radius
    return radius;

  }
public double calculateArea() { // complete the below statement
    return Math.PI*radius*radius;

  }
public double calculateCircumference()    {
    // complete the statement 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()));
    // invoke the calculatecircumference method
    System.out.println("Circumference = "+String.format("%.2f" ,
c.calculateCircumference()));

    sc.close();
  }
}
```

OUTPUT :

	Test	Input	Expected	Got	
✓	1	4	Area = 50.27 Circumference = 25.13	Area = 50.27 Circumference = 25.13	✓
✓	2	6	Area = 113.10 Circumference = 37.70	Area = 113.10 Circumference = 37.70	✓
✓	3	2	Area = 12.57 Circumference = 12.57	Area = 12.57 Circumference = 12.57	✓

Passed all tests! ✓

2.

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

SOLUTION :

```
public class mobile{
    private String man;
    private String os;
    public String clr;
    private int cost;
    public mobile(String man,String os,String clr,int cost){
        this.man=man; this.os=os; this.clr=clr;
        this.cost=cost;
    }
    public String toString(){ return "manufacturer = "+man+"\n"+"operating_system = "+os+"\n"+"color = "+ clr+"\n"+"cost = "+cost;
    }
    public static void main(String[]args){
```

•

```
mobile mobile=new mobile("Redmi","Andriod","Blue",34000);
System.out.println(mobile);
}
}
```

OUTPUT :

	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! ✓				

3.

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)

Input:
No input

Output:
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

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

SOLUTION :

```
public class stud{ private String name; private int roll;
public stud(){
    System.out.println("No-arg constructor is invoked"); name=null; roll=0;
}
public stud(String name){
    System.out.println("1 arg constructor is invoked"); this.name=name; roll=0;
}
```

-

```

}
public stud(String name,int roll){
    System.out.println("2 arg constructor is invoked"); this.name=name;
    this.roll=roll;

}

public static void main (String[]args){
    stud s1=new stud(); stud s2=new
    stud("Rajalakshmi"); stud s3=new
    stud("Lakshmi",101);
    System.out.println("Name =" +s1.name+" , Roll no = "+s2.roll);
    System.out.println("Name =" +s2.name+" , Roll no = "+s2.roll);
    System.out.println("Name =" +s3.name+" , Roll no = "+s3.roll);
}
}

```

OUTPUT :

	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! ✓				

Lab-05-Inheritance

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

```

SOLUTION :

```

class BankAccount {
    // Private field to store the account number
    private String accountNumber;

```

-

```
// Private field to store the balance
```

```

private double balance;

// Constructor to initialize account number and balance
public BankAccount(String accountNumber,double balance){
    this.accountNumber=accountNumber;
    this.balance=balance;
}

// Method to deposit an amount into the account
public void deposit(double amount) {
    // Increase the balance by the deposit amount
    balance+=amount;
}

// Method to withdraw an amount from the account
public void withdraw(double amount) {
    // Check if the balance is sufficient for the withdrawal
    if (balance >= amount) {
        // Decrease the balance by the withdrawal amount
        balance -= amount;
    } else {
        // Print a message if the balance is
        insufficient System.out.println("Insufficient
        balance"); }
}

// Method to get the current balance
public double getBalance() { //
    Return the current balance
    return balance;
}
public String getAccountNumber(){
    return accountNumber;
}
}
class SavingsAccount extends BankAccount {
    // Constructor to initialize account number and balance
    public SavingsAccount(String accountNumber, double balance) {
        // Call the parent class constructor
        super(accountNumber,balance);
    }

    // Override the withdraw method from the parent class
    @Override

```

-

```
public void withdraw(double amount) {  
    // Check if the withdrawal would cause the balance to drop below $100
```

```

        if (getBalance() - amount < 100) {
            // Print a message if the minimum balance requirement is not met
            System.out.println("Minimum balance of $100 required!");
        } else {
            // Call the parent class withdraw method
            super.withdraw(amount);
        }
    }
}
} public class Main {

    public static void main(String[] args) {
        // Print message to indicate creation of a BankAccount object
        System.out.println("Create a Bank Account object (A/c No. BA1234) with initial
balance of $500:");
        // Create a BankAccount object (A/c No. "BA1234") with initial balance of $500
        BankAccount BA1234 = new BankAccount("BA1234", 500);
        // Print message to indicate deposit action
        System.out.println("Deposit $1000 into account BA1234:");
        // Deposit $1000 into account BA1234
        BA1234.deposit(1000);
        // Print the new balance after deposit
        System.out.println("New balance after depositing $1000: $" + BA1234.getBalance());

        // Print message to indicate withdrawal action
        System.out.println("Withdraw $600 from account BA1234:");
        // Withdraw $600 from account BA1234
        BA1234.withdraw(600);
        // Print the new balance after withdrawal
        System.out.println("New balance after withdrawing $600: $" +
BA1234.getBalance());

        // Print message to indicate creation of another SavingsAccount object
        System.out.println("Create a SavingsAccount object (A/c No. SA1000) with initial
balance of $300:");
        // Create a SavingsAccount object (A/c No. "SA1000") with initial balance of $300
        SavingsAccount SA1000 = new SavingsAccount("SA1000", 300);

        // Print message to indicate withdrawal action
        System.out.println("Try to withdraw $250 from SA1000!");
        // Withdraw $250 from SA1000 (balance falls below $100)
        SA1000.withdraw(250);
        // Print the balance after attempting to withdraw $250
        System.out.println("Balance after trying to withdraw $250: $" +
SA1000.getBalance()); }
    }
}

```

OUTPUT :

•

Expected	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	✓
Passed all tests! ✓		

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()
```

Expected Output:

```
A student admitted in REC
```

```
CollegeName : REC
```

```
StudentName : Venkatesh
```

```
Department : CSE
```

For example:

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

SOLUTION :

```
class College
{
    public String collegeName;

    public College(String collegeName)
    { // initialize the instance variables
        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 department) {
        // initialize the instance variables
        super(collegeName);
        this.studentName=studentName;
        this.department=department;
```


•

```
}

public String toString(){
    // return the details of the student return "CollegeName :
"+collegeName+"\n"+"StudentName :
"+studentName+"\n"+"Department : "+department;
}
}

public class Main {
public static void main (String[] args) {
    Student s1 = new Student("REC","Venkatesh","CSE");
    s1.admitted();           // invoke the admitted() method
    System.out.println(s1.toString());
}
}
```

OUTPUT :

	Expected	Got	
✓	A student admitted in REC CollegeName : REC StudentName : Venkatesh Department : CSE	A student admitted in REC CollegeName : REC StudentName : Venkatesh Department : CSE	✓

Passed all tests! ✓

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 {
}
```

expected output:

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

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

SOLUTION :

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

•

```
}
void basmob(){
    System.out.println("Basic Mobile is Manufactured");
}
}
class cam extends
mob{ cam(){
    super();
    System.out.println("Camera Mobile is Manufactured");
}
void newm(){
    System.out.println("Camera Mobile with 5MG px");
}
}
class and extends
cam{ and(){
    super();
    System.out.println("Android Mobile is Manufactured");
}
void andmob(){
    System.out.println("Touch Screen Mobile is Manufactured");
}
} public class Main{ public static
void main(String[]args){ and
andmob=new and(); andmob.newm();
andmob.andmob();
}
}
```

OUTPUT :

	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, StringBuffer

1.

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"

Example 1:

input1 = "Today is a Nice Day"

input2 = 41

output = "iNce doTday"

Example 2:

input1 = "Fruits like Mango and Apple are common but Grapes are rare"

input2 = 39

output = "naMngo arGpes"

Note: The input string input1 will contain only alphabets and a single space character separating each word in the string.

Note: The input string input1 will NOT contain any other special characters.

Note: The input number input2 will always be a 2-digit number ($>=11$ and $<=99$). One of its digits will never be 0. Both the digits of the number will always point to a valid word in the input1 string.

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

SOLUTION :

```
import java.util.*; public class mix{
public static void main(String[] args){
    Scanner scan = new Scanner(System.in);
    String g = scan.nextLine(); int n =
    scan.nextInt(),ones,flag = 0; StringBuffer
    temp = new StringBuffer(); StringBuffer
    temp1 = new StringBuffer(); int space =
    0; while (n > 0){ ones = (n % 10) - 1;
        for(int i = 0; i < g.length();i++){
            if (g.charAt(i) == ' '){ space
            = space + 1;
            }
            else if(space == ones && flag == 0){
                temp.append(Character.toString(g.charAt(i)));
            }
            else if(space == ones && flag == 1){
                temp1.append(Character.toString(g.charAt(i)));
            }
        }
    }
}
```

•

```
        } space =
        0 ; flag =
        1; n = n
        /10;
    }
    rew m = new rew();
    System.out.println(m.r(temp1.toString()) + " " + m.r(temp.toString()));
}
}
class rew{
    String r(String a){ int le
        = a.length(),n,q;
    StringBuffer temp3 = new StringBuffer();
    if(le % 2 == 1){
        n = ((int)(le/2));
        q = ((int)(le/2));
    } else{ n =
        ((int)(le/2)) - 1;
        q = ((int)(le/2));
    }
    for(int i = n;i >= 0;i--){ temp3.append(Character.toString(a.charAt(i)));
        } for(int i = q;i < le;i++){
        temp3.append(Character.toString(a.charAt(i)));
        }
    return temp3.toString();
    }
}
```

OUTPUT :

	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! ✓

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.

Case 1:

Check whether the two alphabets are same.

If yes, then take one alphabet from it and add it to the output.

Example 1:

input1 = ww:li:pp:xr:oo

output = WIPRO

Explanation:

word1 is ww, both are same hence take w

word2 is li, both are same hence take i

word3 is pp, both are same hence take p

word4 is rr, both are same hence take r

word5 is oo, both are same hence take o

Hence the output is WIPRO

Case 2:

If the two alphabets are not same, then find the position value of them and find maximum value - minimum value.

Take the alphabet which comes at this (maximum value - minimum value) position in the alphabet series.

Example 2:

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:li:pp:xr:oo	WIPRO
zx:za:ee	BYE

SOLUTION :

```
import java.util.*; class diff{ char different(char
a, char b){ if ((int)a != (int)b) return
(char)((int)'a' + ((int)a-(int)b) - 1);
    return a;
}
}
public class Main{ public static void
main(String[] args){ Scanner scan = new
Scanner(System.in);
    diff z = new diff();
    String q = scan.nextLine();
    StringBuffer ans = new StringBuffer();
    StringBuffer temp = new
StringBuffer(); for(int i = 0;i <
q.length();i++){ if(q.charAt(i) == ':'){
temp.append(" ");
    } else{
temp.append(Character.toString(q.charAt(i))); }
```

•

```
}
String h = temp.toString(); for(int i
= 0;i < temp.length();i++){ if(i%3
== 0){
    ans.append(Character.toString(z.different(h.charAt(i),h.charAt(i+1))));
}
}
System.out.print(ans.toString().toUpperCase());
}
}
```

OUTPUT :

	Input	Expected	Got	
✓	wm:ii:pp:rr:oo	WIPRO	WIPRO	✓
✓	zx:za:ee	BYE	BYE	✓

Passed all tests! ✓

3.

Given 2 strings input1 & input2.

- Concatenate both the strings.
- Remove duplicate alphabets & white spaces.
- Arrange the alphabets in descending order.

Assumption 1:
There will either be alphabets, white spaces or null in both the inputs.

Assumption 2:
Both inputs will be in lower case.

Example 1:
Input 1: apple
Input 2: orange
Output: rponlgea

Example 2:
Input 1: fruits
Input 2: are good
Output: utsroigfeda

Example 3:
Input 1: ""
Input 2: ""
Output: null

For example:

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

SOLUTION :

•

```
import java.util.*;

public class HelloWorld { public static
    void main(String[] args) {
        Scanner scan = new Scanner(System.in);
        String a = scan.nextLine();
        String b = scan.nextLine();
        StringBuffer ab = new StringBuffer();
        if(a.trim().isEmpty() && b.trim().isEmpty()){
            System.out.print("null");
        }
        else{
            for(int i = 0;i < a.length();i++){ if (a.charAt(i)
                != ' ') {
                    ab.append(Character.toString(a.charAt(i))); }
            }
            for(int i = 0;i < b.length();i++){ if (b.charAt(i)
                != ' '){
                    ab.append(Character.toString(b.charAt(i))); }
            }
            char[] d = ab.toString().toCharArray();
            Arrays.sort(d);
            for(int i = d.length - 1;i >= 1;i--){
                if(d[i] != d[i-1])
                    System.out.print(d[i]);
            }
            System.out.print(d[0]);
        }
    }
}
```

OUTPUT :

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

Passed all tests! ✓

Lab-07-Interfaces

1.

•

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.
Sample Input/Output:
 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.
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.

SOLUTION :

```
// Define the RBI interface
interface RBI {
    // Variable declaration
    String parentBank = "RBI";

    // Abstract method
    double rateOfInterest();

    // Default method
    default void policyNote() {
        System.out.println("RBI has a new Policy issued in 2023");
    }

    // Static method
    static void regulations() {
        System.out.println("RBI has updated new regulations in 2024.");
    }
}

// SBI class implementing RBI interface
class SBI implements RBI {
    // Implementing the abstract method
    public double rateOfInterest() {
```


•

```
        return 7.6;
    }
}

// Karur class implementing RBI
interface class Karur implements RBI { //
Implementing the abstract method public
double rateOfInterest() { return 7.4;
    }
}

// Main class to test the functionality
public class Main { public static void
main(String[] args) {
    // RBI policies and regulations
    RBI rbi = new SBI(); // Can be any class implementing RBI
    rbi.policyNote(); // Default method RBI.regulations();
    // Static method

    // SBI bank details
    SBI sbi = new SBI();
    System.out.println("SBI rate of interest: " + sbi.rateOfInterest() + " per annum.");

    // Karur bank details
    Karur karur = new Karur();
    System.out.println("Karur rate of interest: " + karur.rateOfInterest() + " per annum.");
}
}
```

OUTPUT :

	Test	Expected	Got	
✓	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.	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.	✓
Passed all tests! ✓				

•

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.

sample Input:

```
Rajalakshmi  
Saveetha  
22  
21
```

Output:

```
Rajalakshmi 22 scored  
Saveetha 21 scored  
Rajalakshmi is the Winner!
```

For example:

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

SOLUTION :

```
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 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);

    // Get home team name
    String hname = sc.nextLine();

    // Get visiting team name
    String vteam = sc.nextLine();

    // Create College object College
    match = new College();
    match.setHomeTeam(hname);
    match.setVisitingTeam(vteam);

    // Get points scored by home team
    int htpoints = sc.nextInt();
    match.homeTeamScored(htpoints);

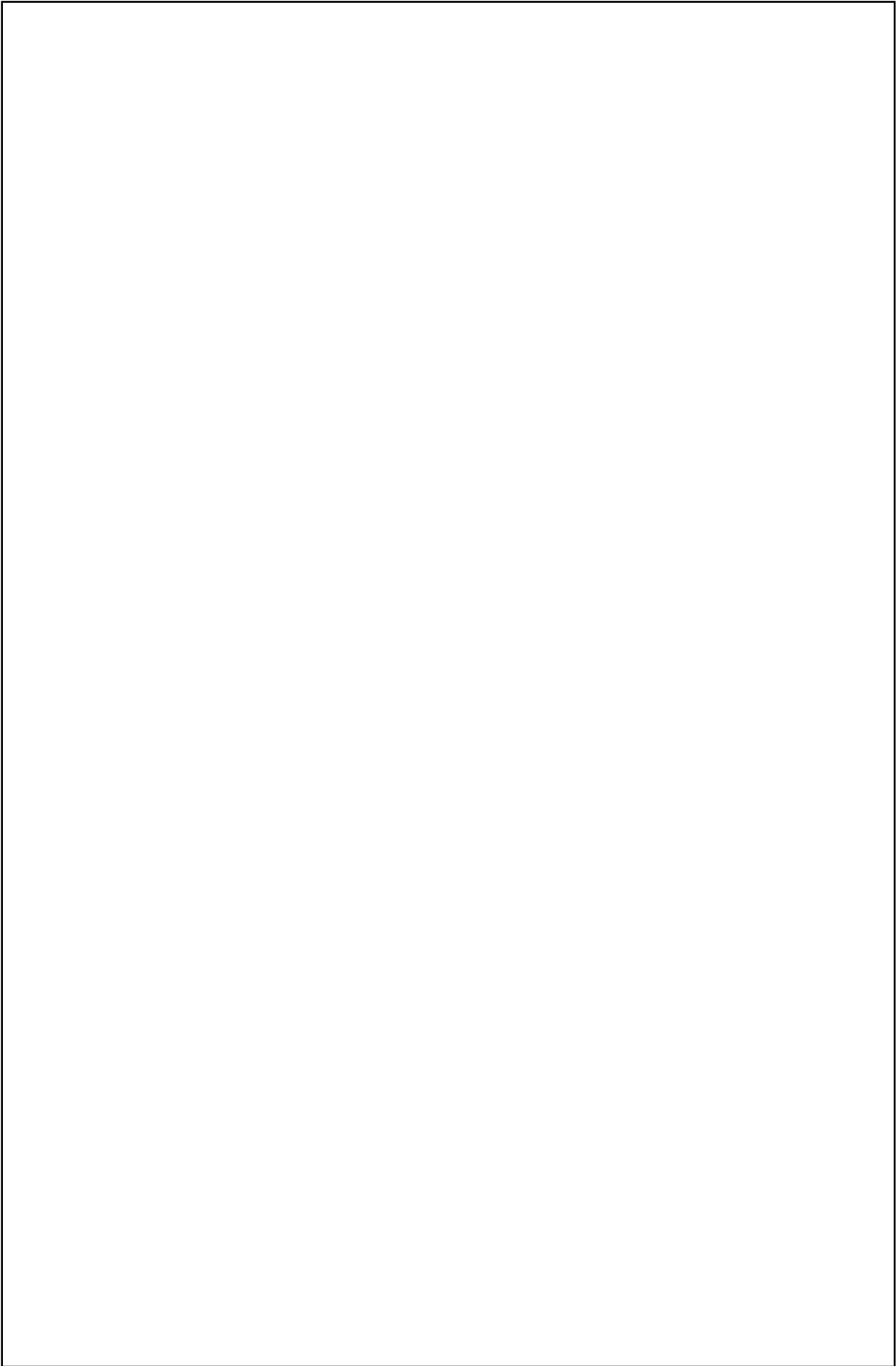
    // Get points scored by visiting team
    int vtpoints = sc.nextInt();
    match.visitingTeamScored(vtpoints);

    // Determine and print the winning team
    match.winningTeam();

    sc.close();
}
}

```

•



OUTPUT :

	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!	✓
✓	2	Anna Balaji 21 21	Anna 21 scored Balaji 21 scored It's a tie match.	Anna 21 scored Balaji 21 scored It's a tie match.	✓
✓	3	SRM VIT 20 21	SRM 20 scored VIT 21 scored VIT is the winner!	SRM 20 scored VIT 21 scored VIT is the winner!	✓

Passed all tests! ✓

3.

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.

Sample output:

```
Sadhvin is Playing football  
Sanjay is Playing volleyball  
Sruthi is Playing basketball
```

For example:

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

SOLUTION :

```
import java.util.Scanner;  
  
// Define the Playable interface  
interface Playable {  
    // Abstract method to play the respective sport  
    void play();  
}  
  
// Football class implementing Playable interface  
class Football implements Playable {  
    String name;  
  
    // Constructor  
    public Football(String name) {  
        this.name = name;  
    }  
  
    // Override the play method
```

-

```

    public void play() {
        System.out.println(name + " is Playing football");
    }
}

// Volleyball class implementing Playable interface
class Volleyball implements Playable {
    String name;

    // Constructor
    public Volleyball(String name) {
        this.name = name;
    }

    // Override the play method
    public void play() {
        System.out.println(name + " is Playing volleyball");
    }
}

// Basketball class implementing Playable interface
class Basketball implements Playable {
    String name;

    // Constructor
    public Basketball(String name) {
        this.name = name;
    }

    // Override the play method
    public void play() {
        System.out.println(name + " is Playing basketball");
    }
}

// Main class to test the functionality
public class Main { public static void
main(String[] args) {
    Scanner scanner = new Scanner(System.in);

    // Input for Football player

    String footballPlayerName = scanner.nextLine();
    Football footballPlayer = new Football(footballPlayerName);

    // Input for Volleyball player

```

-

```
String volleyballPlayerName = scanner.nextLine();  
Volleyball volleyballPlayer = new Volleyball(volleyballPlayerName);
```


•

```
// Input for Basketball player
```

```
String basketballPlayerName = scanner.nextLine();  
Basketball basketballPlayer = new Basketball(basketballPlayerName);
```

```
// Call the play method for each player  
footballPlayer.play();  
volleyballPlayer.play();  
basketballPlayer.play();
```

```
scanner.close();
```

```
}
```

```
}
```

OUTPUT :

	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! ✓

Lab-08 - Polymorphism, Abstract Classes, final Keyword

1.

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

input1: an integer representing the number of elements in the array.

input2: String array.

Example 1:

input1: 3

input2: {"oreo", "sirish", "apple"}

output: oreoapple

Example 2:

input1: 2

input2: {"Mango", "banana"}

output: no matches found

Explanation:

None of the strings has first and last character as vowel.

Hence the output is no matches found.

Example 3:

input1: 3

input2: {"Ate", "Ace", "Girl"}

output: ateace

For example:

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

SOLUTION :

```
import java.util.Scanner; public

class VowelStringExtractor {

    // Method to extract strings with vowels as first and last characters
    public static String extractVowelStrings(String[] stringArray) {
        StringBuilder result = new StringBuilder();
        String vowels = "aeiouAEIOU"; // String containing all vowels

        // Iterate through the array of strings
        for (String s : stringArray) {
            // Check if the string is not empty and if both the first and last characters are vowels
            if (s.length() > 0 && vowels.indexOf(s.charAt(0)) != -1 &&
                vowels.indexOf(s.charAt(s.length() - 1)) != -1) { result.append(s); // Append matching
                string to the result }
            }

        // Return the concatenated string in lowercase or "no matches found"
        return result.length() > 0 ? result.toString().toLowerCase() : "no matches found"; }
```

```

public static void main(String[] args) {
    Scanner scanner = new Scanner(System.in);

    // Input for the number of strings

    int n = scanner.nextInt();
    scanner.nextLine(); // Consume the newline character

    // Input for the strings in one line

    String input = scanner.nextLine();
    String[] strings = input.split(" "); // Split input into an array

    // Process and output the result
    String result = extractVowelStrings(strings);
    System.out.println(result);

    scanner.close(); // Close the scanner
}
}

```

OUTPUT :

	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! ✓

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
}

Given a Java Program that contains the bug in it, your task is to clear the bug to the output, you should delete any piece of code.

For example:

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

SOLUTION :

```
// Final class definition  
final class FinalExample {  
    // Final variable  
    final int MAX_SPEED = 120; // Constant value  
  
    // Final method  
    public final void display() {  
        System.out.println("The maximum speed is: " + MAX_SPEED + " km/h");  
    }  
}  
  
// Main class to test the final class public  
class Test { public static void  
main(String[] args) {  
    // Create an instance of FinalExample  
    FinalExample example = new FinalExample();  
    example.display();  
  
    // Uncommenting the following line will result in a compile-time error  
    // because FinalExample is a final class and cannot be subclassed. //  
    class SubclassExample extends FinalExample { }  
  
    System.out.println("This is a subclass of FinalExample.");  
}  
}
```

OUTPUT :

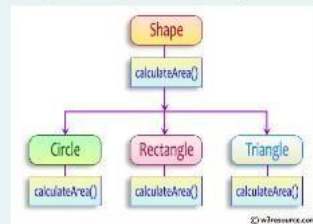
•

	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! ✓

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:



```

abstract class Shape {
    public abstract double calculateArea();
}

```

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

sample Input :

```

4 // radius of the circle to calculate area PI*r*r
5 // length of the rectangle
6 // breadth of the rectangle to calculate the area of a rectangle
4 // base of the triangle
3 // height of the triangle

```

OUTPUT:

```

Area of a circle :50.27
Area of a Rectangle :30.00
Area of a Triangle :6.00

```

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

SOLUTION :

```

import java.util.Scanner;

// Abstract class Shape abstract class
Shape { public abstract double
calculateArea();
}

// Circle class
class Circle extends Shape {
    private double radius;

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

    @Override

```



```

    public double calculateArea() { return Math.PI * radius
    * radius; // Area of circle:  $\pi r^2$  }
}

// Rectangle class
class Rectangle extends Shape {
    private double length; private
    double breadth;

    public Rectangle(double length, double breadth) {
        this.length = length; this.breadth = breadth;
    }

    @Override
    public double calculateArea() { return length * breadth; // Area
    of rectangle: length * breadth
    }
}

// Triangle class
class Triangle extends Shape {
    private double base; private
    double height;

    public Triangle(double base, double height) {
        this.base = base; this.height = height;
    }

    @Override
    public double calculateArea() { return 0.5 * base * height; // Area
    of triangle: 0.5 * base * height
    }
}

// Main class to test the shapes public
class ShapeTest { public static void
main(String[] args) {
    Scanner scanner = new Scanner(System.in);

    // Input for Circle

    double radius = scanner.nextDouble();
    Circle circle = new Circle(radius);
    System.out.printf("Area of a circle: %.2f%n", circle.calculateArea());

    // Input for Rectangle

```

```

double length = scanner.nextDouble();

double breadth = scanner.nextDouble();
Rectangle rectangle = new Rectangle(length, breadth);
System.out.printf("Area of a Rectangle: %.2f%n", rectangle.calculateArea());

// Input for Triangle double base =

scanner.nextDouble();

double height = scanner.nextDouble();
Triangle triangle = new Triangle(base, height);
System.out.printf("Area of a Triangle: %.2f%n", triangle.calculateArea());

scanner.close();
}
}

```

OUTPUT :

	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

1.

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

Sample input and Output:

82 is even.
Error: 37 is odd.

Fill the preloaded answer to get the expected output.

For example:

Result
82 is even. Error: 37 is odd.

SOLUTION :

```

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

```



```

int n = 82;
trynumber(n);
n = 37;
trynumber(n); // Call the trynumber(n);
}

public static void trynumber(int n) { try {
    checkEvenNumber(n); // Call the checkEvenNumber()
    System.out.println(n + " is even.");
} catch (Exception e) { // Catch the exception
    System.out.println("Error: " + e.getMessage());
}
}

public static void checkEvenNumber(int number) { if (number % 2 != 0) { throw new
    RuntimeException(number + " is odd."); // Throw a RuntimeException }
}
}

```

OUTPUT :

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

Passed all tests! ✓

2.

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.*/

Sample Input:

3
5 2 1

Sample Output:

8

Sample Input:

2
1 g

Sample Output:

You entered bad data.

For example:

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

SOLUTION :

```

import java.util.Scanner;
import java.util.InputMismatchException;

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 sum = 0; // save
        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. */
        try { for (int i = 0; i < length; i++) { name[i] =
            sc.nextInt(); // save user input in the array
            }

            // Calculate the total sum
            for (int num : name) {
                sum += num;
            }

            // Print the total sum
            System.out.println(sum);
        } catch (InputMismatchException e) {
            System.out.println("You entered bad data.");
        }

        sc.close(); // Close the scanner
    }
}

```

OUTPUT :

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

Passed all tests! ✓

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, it throws an exception.

Input:

5

10 0 20 30 40

Output:

`java.lang.ArithmeticException: / by zero`

I am always executed

Input:

3

10 20 30

Output

`java.lang.ArrayIndexOutOfBoundsException: Index 3 out of bounds for length 3`

I am always executed

For example:

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

SOLUTION :

```
import java.util.Scanner;

public class ExceptionHandlingExample {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);

        // Read the size of the array
        int size = scanner.nextInt();

        // Initialize the array int[]
        numbers = new int[size];

        // Read the elements into the array
        for (int i = 0; i < size; i++) {
            numbers[i] = scanner.nextInt();
        }

        try {
            // Attempt to perform division
            int result = numbers[0] / numbers[1]; // This may cause an ArithmeticException
        } catch (ArithmeticException e) {
            System.out.println(e); // Catch division by zero
        } catch (ArrayIndexOutOfBoundsException e) {
            System.out.println(e); // Catch accessing out of bounds
        } catch (Exception e) {
            System.out.println(e); // Catch any other exceptions
        }
    }
}
```

```

    } finally {
        // This block is always executed
    }

    try {
        // Attempt to access an out-of-bounds index
        int outOfBoundsValue = numbers[3]; // This will trigger
        // ArrayIndexOutOfBoundsException if size < 4
    } catch (ArrayIndexOutOfBoundsException e) {
        System.out.println(e);
    } finally {
        // This block is always executed for the second try
        System.out.println("I am always executed");
    }

    scanner.close();
}
}

```

OUTPUT :

	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	✓
✓	2	3 10 20 30	java.lang.ArrayIndexOutOfBoundsException: Index 3 out of bounds for length 3 I am always executed	java.lang.ArrayIndexOutOfBoundsException: Index 3 out of bounds for length 3 I am always executed	✓

Passed all tests! ✓

Lab-10- Collection- List

1.

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

Input: ArrayList = [1, 2, 3, 4]
Output: First = 1, Last = 4

Input: ArrayList = [12, 23, 34, 45, 57, 67, 89]
Output: First = 12, Last = 89

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.

SOLUTION :

```

import java.util.ArrayList;
import java.util.Scanner;

public class FirstAndLastElement {
    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);

        // Create an ArrayList
        ArrayList<Integer> numbers = new ArrayList<>();
    }
}

```

```
int numElements = scanner.nextInt();

for (int i = 0; i < numElements; i++) {
    int number = scanner.nextInt();
    numbers.add(number);
}
System.out.println("ArrayList: " + numbers);

// Get the first element int
firstElement = numbers.get(0);

// Get the last element
int lastElement = numbers.get(numbers.size() - 1);

// Print the results
System.out.print("First : " + firstElement);
System.out.println(", Last : " + lastElement);
}
}
```

OUTPUT :

	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! ✓

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.

SOLUTION :

```
import java.util.ArrayList;

import java.util.Scanner;

public class Prog {

    public static void main(String[] args)
    {
```

```

Scanner sc= new Scanner(System.in);
int n = sc.nextInt();

ArrayList<Integer> list = new ArrayList<Integer>();

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

// printing initial value ArrayList
System.out.println("ArrayList: " + list);

//Replacing the element at index 1 with 100
list.set(1,100);

//Getting the index of first occurrence of 100
System.out.println("Index of 100 = "+ list.indexOf(100) );

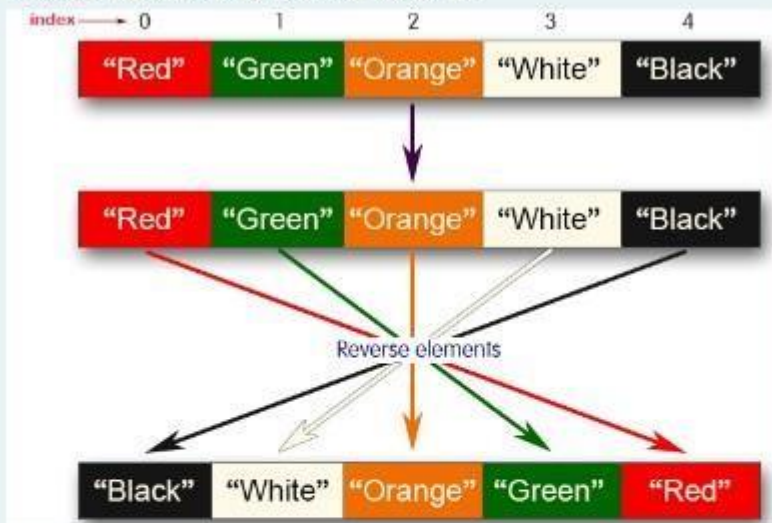
//Getting the index of last occurrence of 100
System.out.println("LastIndex of 100 = "+ list.lastIndexOf(100));
// Check whether 200 is in the list or not
System.out.println(list.contains(200)); //Output : false
// Print ArrayList size
System.out.println("Size Of ArrayList = "+list.size() );
//Inserting 500 at index 1
list.add(1,500); // code here
//Removing an element from position 3
list.remove(3); // code here
System.out.print("ArrayList: " + list);
}
}

```

OUTPUT :

	Test	Input	Expected	Got	
✓	1	5	ArrayList: [1, 2, 3, 100, 5]	ArrayList: [1, 2, 3, 100, 5]	✓
		1	Index of 100 = 1	Index of 100 = 1	
		2	LastIndex of 100 = 3	LastIndex of 100 = 3	
		3	false	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! ✓					

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



Sample input and Output:

Red
Green
Orange
White
Black

Sample output

List before reversing :
[Red, Green, Orange, White, Black]
List after reversing :
[Black, White, Orange, Green, Red]

SOLUTION :

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

public class ReverseArrayList { public
    static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);

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

        for (int i = 0; i < n; i++) {
            String element = scanner.next();
            list.add(element);
        }

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

        Collections.reverse(list);

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

```
}
}
```

OUTPUT :

	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]	✓
✓	2	4 CSE AIML AIDS CYBER	List before reversing : [CSE, AIML, AIDS, CYBER] List after reversing : [CYBER, AIDS, AIML, CSE]	List before reversing : [CSE, AIML, AIDS, CYBER] List after reversing : [CYBER, AIDS, AIML, CSE]	✓

Passed all tests! ✓

Lab-11-Set, Map

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
```

Sample Input and Output:

```
5
```

```
90
```

```
56
```

```
45
```

```
78
```

```
25
```

```
78
```

Sample Output:

```
78 was found in the set.
```

Sample Input and output:

```
3
```

```
2
```

```
7
```

```
9
```

```
5
```

Sample Input and output:

```
5 was not found in the set.
```

SOLUTION :

```
import java.util.HashSet;
import java.util.Scanner;

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

        // Read the number of elements
        int n = sc.nextInt();
```



```

// Create a HashSet object to store numbers
HashSet<Integer> numbers = new HashSet<>();

// Add numbers to the HashSet
for (int i = 0; i < n; i++) {
    numbers.add(sc.nextInt());
}

// Read the search key
int skey = sc.nextInt();

// Check if skey is present in the HashSet
if (numbers.contains(skey)) {
    System.out.println(skey + " was found in the set.");
} else {
    System.out.println(skey + " was not found in the set.");
}

// Close the scanner
sc.close();
}
}

```

OUTPUT :

	Test	Input	Expected	Got	
✓	1	5 90 56 45 78 25 78	78 was found in the set.	78 was found in the set.	✓
✓	2	3 -1 2 4 5	5 was not found in the set.	5 was not found in the set.	✓

Passed all tests! ✓

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

Sample Input and Output:

5

Football

Hockey

Cricket

Volleyball

Basketball

7 **// HashSet 2:**

Golf

Cricket

Badminton

Football

Hockey

Volleyball

Handball

SAMPLE OUTPUT:

Football

Hockey

Cricket

Volleyball

Basketball

SOLUTION :

```
import java.util.HashSet;
import java.util.Scanner;
import java.util.Set;

public class CompareSets { public static
    void main(String[] args) {
        Scanner scanner = new Scanner(System.in);

        // Read the size of the first set
        int size1 = Integer.parseInt(scanner.nextLine());

        // Create a HashSet to store the first set of elements
        Set<String> set1 = new HashSet<>();

        // Read elements for the first set
        for (int i = 0; i < size1; i++) {
            set1.add(scanner.nextLine());
        }

        // Read the size of the second set
```

```
int size2 = Integer.parseInt(scanner.nextLine());

// Create a HashSet to store the second set of elements
Set<String> set2 = new HashSet<>();

// Read elements for the second set
for (int i = 0; i < size2; i++) {
    set2.add(scanner.nextLine());
}

// Retain common elements using the retainAll() method
set1.retainAll(set2);

// Print the common elements
for (String element : set1) {
    System.out.println(element);
}

scanner.close();
}
```

OUTPUT :

	Test	Input	Expected	Got	
✓	1	5 Football Hockey Cricket Volleyball Basketball 7 Golf Cricket Badminton Football Hockey Volleyball Throwball	Cricket Hockey Volleyball Football	Cricket Hockey Volleyball Football	✓
✓	2	4 Toy Bus Car Auto 3 Car Bus Lorry	Bus Car	Bus Car	✓

Passed all tests! ✓

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

SOLUTION :

```
import java.util.HashMap;
import
java.util.Map.Entry;
import java.util.Scanner;
import java.util.Set; public
class Prog {

    public static void main(String[] args) {
        // Creating HashMap with default initial capacity and load factor
        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);
        }

        // Printing key-value pairs
        Set<Entry<String, Integer>> entrySet = map.entrySet();

        for (Entry<String, Integer> entry : entrySet) {
            System.out.println(entry.getKey() + " : " + entry.getValue());
        }
        System.out.println(" ----- ");

        // Creating another HashMap
        HashMap<String, Integer> anotherMap = new HashMap<String, Integer>();
```

•

```
// Inserting key-value pairs to anotherMap using put() method  
anotherMap.put("SIX", 6);
```

```

anotherMap.put("SEVEN", 7);

// Inserting key-value pairs of map to anotherMap using putAll() method
anotherMap.putAll(map); // This line fills in the missing code

// Printing key-value pairs of anotherMap entrySet
= anotherMap.entrySet();

for (Entry<String, Integer> entry : entrySet) {
    System.out.println(entry.getKey() + " : " + entry.getValue());
}

// Adds key-value pair 'FIVE-5' only if it is not present in map
map.putIfAbsent("FIVE", 5);

// Retrieving a value associated with key 'TWO'
int value = map.get("TWO");
System.out.println(value); // Prints the value associated with key "TWO" (if it
exists)

// Checking whether key 'ONE' exists in map
System.out.println(map.containsKey("ONE")); // Prints true if "ONE" is a key,
false otherwise

// Checking whether value '3' exists in map
boolean valueExists = map.containsValue(3); // You can use a variable to store
the result
System.out.println(valueExists); // Prints true if value 3 exists in the map, false
otherwise

// Retrieving the number of key-value pairs present in map
System.out.println(map.size()); // Prints the number of entries in the map
}
}

```

OUTPUT :

	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 2 true true 4	ONE : 1 TWO : 2 THREE : 3 ----- SIX : 6 ONE : 1 TWO : 2 SEVEN : 7 THREE : 3 2 true true 4	✓

Passed all tests! ✓

Lab-12-Introduction to I/O, I/O Operations, Object Serialization

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: 00000000

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.

Example 1:

input1: 010010001

The decoded string (original word) will be: ZYX

Example 2:

```
input1: 00001000000000000000000000001000000000001000000000010000000000001
```

The decoded string (original word) will be: WIPRO

Note: The decoded string must always be in UPPER case.

SOLUTION :

```
import java.util.Scanner;

public class DecodeString { public static
    void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        String encodedString = scanner.nextLine();

        StringBuilder decodedString = new StringBuilder();
        int count = 0;

        for (int i = 0; i < encodedString.length(); i++) {
            if (encodedString.charAt(i) == '0') {
                count++;
            } else { char decodedChar = (char) ('Z' - count
                + 1); decodedString.append(decodedChar);
                count = 0;
            }
        }

        System.out.println(decodedString.toString());
    }
}
```

OUTPUT :

	Input	Expected	Got	
✓	010010001	ZYX	ZYX	✓
✓	00001000000000000000000001000000000001000000000010000000000001	WIPRO	WIPRO	✓

Passed all tests! ✓

2.

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.

Example 1:

input1: {'a', 'b', 'c'}

input2: {'b', 'c'}

output: 8

Explanation:

'b' and 'c' are present in both the arrays.

ASCII value of 'b' is 98 and 'c' is 99.

$98 + 99 = 197$

$1 + 9 + 7 = 17$

$1 + 7 = 8$

For example:

Input	Result
a b c	8
b c	

SOLUTION :

```
import java.util.HashSet; import
java.util.Set; public class
CommonAlphabetSum {

    public static int singleDigitSum(int num) {
        int sum = 0;
        while (num > 0) {
            sum += num % 10;
            num /= 10;
        }
        if (sum > 9) { return
            singleDigitSum(sum); }
```



```

    return sum;
}

public static int calculateCommonAlphabetSum(char[] input1, char[] input2) {
    Set<Character> set1 = new HashSet<>(); for (char c : input1) { set1.add(c);
    }

    int sum = 0; for
    (char c : input2) {
        if (set1.contains(c)) {
            sum += c;
        }
    }

    return singleDigitSum(sum);
}

public static void main(String[] args)
{ char[] input1 = {'a', 'b', 'c'};
  char[] input2 = {'b', 'c', 'd'};

  int result = calculateCommonAlphabetSum(input1, input2);
  System.out.println(result); }
}

```

OUTPUT :

	Input	Expected	Got	
✓	a b c b c	8	8	✓

Passed all tests! ✓

3.

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.

Examples:

S. No.	input1	input2	output
1	Wipro Technologies Bangalore	0	orpiW seigolonhceT erolagnaB
2	Wipro Technologies, Bangalore	0	orpiW ,seigolonhceT erolagnaB
3	Wipro Technologies Bangalore	1	Orpiw SeigolonhceT Erolagnab
4	Wipro Technologies, Bangalore	1	Orpiw ,seigolonhceT Erolagnab

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

SOLUTION :

```
import java.util.Scanner;
```

```
public class WordReverser {
```

```
    public static String reverseWordsWithCase(String sentence, int caseOption) {
```

```
        // Split the sentence into words based on spaces
```

```
        String[] words = sentence.split(" ");
```

```
        // StringBuilder to store the result
```

```
        StringBuilder result = new StringBuilder();
```

```
        // Process each word for
```

```
        (String word : words) {
```

```
            // Reverse the word
```

```
            String reversedWord = new StringBuilder(word).reverse().toString();
```

```
            if (caseOption == 0) {
```

```
                // If caseOption is 0, no case conversion, just reverse the word
```

```
                result.append(reversedWord).append(" ");
```

```
            } else if (caseOption == 1) {
```

```
                // If caseOption is 1, adjust the case while maintaining original letter
```

```
                positions
```

```

        result.append(applyCaseConversion(reversedWord, word)).append(" ");
    }
}

// Remove the trailing space and return the result return
result.toString().trim();
}

private static String applyCaseConversion(String reversedWord, String
originalWord) {
    // StringBuilder to store the adjusted word
    StringBuilder adjustedWord = new StringBuilder();

    // Iterate over each character in the reversed word
    for (int i = 0; i < reversedWord.length(); i++) { char
reversedChar = reversedWord.charAt(i); char
originalChar = originalWord.charAt(i);

        if (Character.isLowerCase(originalChar)) {
            // If the original character was lowercase, the reversed character should be
uppercase adjustedWord.append(Character.toLowerCase(reversedChar));
        } else if (Character.isUpperCase(originalChar)) {
            // If the original character was uppercase, the reversed character should be
lowercase adjustedWord.append(Character.toUpperCase(reversedChar));
        } else {
            // Non-alphabetic characters remain unchanged
            adjustedWord.append(reversedChar); }
    }

    return adjustedWord.toString();
}

public static void main(String[] args) {
    // Create a Scanner object to get input from the user Scanner
    scanner = new Scanner(System.in);

    // Get sentence input from the user

    String sentence = scanner.nextLine(); //

    Get case option input from the user int

    caseOption = scanner.nextInt();

    // Validate the case option
    if (caseOption != 0 && caseOption != 1) {

```

```
        System.out.println("Invalid case option. Please enter 0 or 1.");
    } else {
        // Call the function and print the result
        String result = reverseWordsWithCase(sentence, caseOption);
        System.out.println(result);
    }

    // Close the scanner
    scanner.close();
}
}
```

OUTPUT :

	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! ✓



RAJALAKSHMI
ENGINEERING COLLEGE
An AUTONOMOUS Institution
Affiliated to ANNA UNIVERSITY, Chennai

STUDENT MANAGEMENT SYSTEM

A MINI PROJECT REPORT

Submitted by

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In partial fulfillment for the award of the degree of

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RAJALAKSHMI ENGINEERING COLLEGE (AUTONOMOUS)

THANDALAM

CHENNAI-602105

2024-2025

BONAFIDE CERTIFICATE

Certified that this project report “Student Management System” is the bonafide work of “Sritharanika G K (231001215),Thenmozhi S(231001232)” who carried out the project work under my supervision.

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ABSTRACT

The Student Management System is a comprehensive framework designed to streamline the administration and management of student-related information in educational institutions. This system automates essential tasks such as student enrollment, attendance tracking, academic performance monitoring, fee management, and communication between stakeholders. By offering a centralized database, it ensures the accuracy, accessibility, and security of student records.

The system aims to minimize manual work, reduce errors, and enhance efficiency for administrators, teachers, students, and parents. Additionally, it supports real-time data access, simplifies reporting, and facilitates better decision-making.

The implementation of a Student Management System fosters a collaborative educational environment, improves resource allocation, and ensures smooth functioning of academic and administrative processes, ultimately contributing to the institution's overall effectiveness and success.

1.INTRODUCTION

1.1 INTRODUCTION:

A Student Management System is a vital framework used in educational institutions to organize and manage student-related data efficiently. It serves as a centralized platform to handle various academic and administrative tasks, such as student enrollment, attendance monitoring, grade tracking, timetable scheduling, and performance evaluation.

This system helps in maintaining accurate records, reducing paperwork, and ensuring data accessibility for administrators, teachers, and students. It facilitates communication between stakeholders by providing updates about events, progress, and important notices. Teachers can easily manage class activities and assessments, while students and parents can stay informed about academic progress.

By streamlining these processes, institutions can enhance productivity, foster collaboration, and make informed decisions based on organized data. This approach also supports better resource allocation and promotes a structured educational environment that benefits everyone involved.

1.2 OBJECTIVES:

Centralized Information Storage: To develop a system that consolidates all student-related data in one secure platform.

Automation of Administrative Tasks: To automate processes like student enrollment, attendance, fee management, and grade tracking.

Efficient Communication: To enable seamless communication between students, teachers, administrators, and parents through integrated notification systems.

Real-Time Data Accessibility: To provide instant access to information for stakeholders, ensuring transparency and timely decision-making.

Performance Tracking: To facilitate monitoring and evaluation of student academic progress and attendance.

Resource Optimization: To efficiently manage institutional resources such as staff, classrooms, and materials.

Error Reduction: To minimize human errors in data entry, record maintenance, and reporting.

Data Security: To ensure the safety and confidentiality of sensitive student information using robust security measures.

Custom Reporting: To generate detailed reports and analytics for academic and administrative planning.

1.3 MODULES:

User Management Module:Manages user roles and access levels for administrators, teachers, students, and parents.

Student Information Management Module:Stores and manages student details such as personal information, academic history, and contact details.

Admission and Enrollment Module:Handles the admission process, including application submission, document verification, and student enrollment.

Attendance Management Module:Tracks student attendance and generates reports for analysis.

Fee Management Module:Manages fee collection, payment tracking, and generation of receipts.

Academic Performance Module:Records and evaluates student grades, exam results, and progress reports.

Timetable Management Module:Creates and manages class schedules, exams, and other events.

Communication Module:Facilitates notifications, announcements, and communication between students, parents, and staff.

Examination Management Module:Schedules exams, manages results, and provides detailed performance analysis.

Security and Authentication Module:Ensures data security through user authentication and role-based access control.

2.SURVEY OF TECHNOLOGIES

2.1 SOFTWARE DESCRIPTION:

The Student Management System (SMS) is a robust and scalable software solution designed to efficiently manage the academic and administrative tasks of educational institutions. The system is developed using modern programming languages and database technologies to ensure seamless functionality, reliability, and data security.

The software provides a centralized platform for storing and retrieving student-related information, including personal details, academic records, attendance, fee payments, and more. It automates repetitive tasks such as enrollment, grade calculation, and timetable scheduling, reducing the workload for administrators and teachers.

The system includes user-friendly interfaces for various stakeholders like students, teachers, parents, and administrators. Role-based access control ensures that users can access only the data relevant to their responsibilities. Real-time notifications and communication tools foster collaboration and keep all parties informed of important updates.

Key features include attendance tracking, fee management, academic performance monitoring, timetable creation, and customizable reporting. Advanced modules like library management, transport scheduling, and hostel allocation enhance its functionality further.

Built with a secure architecture, the SMS ensures data confidentiality and integrity, using encryption and secure authentication mechanisms. It is also designed to be scalable, adaptable to the growing needs of institutions, and compatible with various operating systems and devices.

2.2 LANGUAGES:

The development of the Student Management System. Primarily relies on MYSQL DBMS, JSWINGS, NETBEANS 8.2 to achieve frontend and backend functionally.

2.2.1 MYSQL:

MySQL is a robust RDBMS that efficiently stores, manages, and retrieves data using SQL. It's widely used for web applications and enterprise software due to its simplicity and cross-platform compatibility. Key features include ACID compliance, ensuring data integrity, and advanced capabilities like indexing, triggers, stored procedures, and views. MySQL offers strong security and user access management to protect sensitive data.

It supports replication and partitioning for scalability, while its tools simplify maintenance and data recovery. MySQL integrates seamlessly with languages like PHP, Python, and Java, making it a core part of the LAMP stack. Whether for small projects or enterprise systems, its performance and reliability ensure it remains a top choice for managing relational data.

2.2.2. JSWINGS:

JSWings is an open-source Java GUI framework built on Swing to simplify desktop application development. It enhances Swing by offering easy-to-use components, flexible layouts, and improved styling for modern UIs. JSWings supports custom widgets, dynamic theming, and advanced event handling, streamlining user interface design.

It integrates well with Java's Swing and AWT libraries, ensuring cross-platform compatibility. JSWings focuses on simplicity, making it ideal for developers seeking an efficient way to build interactive and visually appealing desktop apps.

2.2.3 NETBEANS:

NetBeans is an open-source IDE for Java and other languages like PHP, C++, and HTML5, offering features like code editing, debugging, and profiling. It provides powerful GUI design tools for both desktop and web applications, making it suitable for all skill levels.

NetBeans supports version control integration (e.g., Git) and includes tools for refactoring and project management. Its modular architecture allows easy extension through plugins.

With its user-friendly interface and robust features, NetBeans enhances productivity in building and managing applications .

3.REQUIREMENTS AND ANALYSIS

3.1 REQUIREMENTS SPECIFICATION:

1. Functional Requirements:

User Management:Allow role-based access for administrators, teachers, students, and parents.

Provide user authentication with login credentials.

Student Information Management:Enable adding, updating, and deleting student details.Maintain a searchable database for student records.

Enrollment and Admission:Facilitate online admission and registration processes. Manage application approvals and enrollment status.

Academic Performance Management:Input and track grades and examination results.Generate report cards and performance analytics.

Fee Management:Track fee payments and dues.Generate receipts and fee reports.

Reporting and Analytics:Generate detailed reports on attendance, performance, and fee collections.

Provide data visualization tools for decision-making.

2.Non-Functional Requirements:

Performance:The system should handle up to 1000 simultaneous users.All actions should execute within 2-3 seconds under normal load.

Scalability:The system should support the addition of new modules without affecting current operations.

Security:Implement role-based access control (RBAC).
Encrypt sensitive data such as passwords and financial transactions.

Usability:Provide an intuitive, user-friendly interface.
Ensure compatibility with desktop and laptop devices.
Ensure compatibility with desktop and laptop devices.
Maintainability:

Portability:Compatible with Windows, Linux, and macOS operating systems.Deployable on local servers or cloud platforms.

3.2 SOFTWARE AND HARDWARE REQUIREMENTS:

3.2.1 SOFTWARE REQUIREMENTS:

- ➔ Programming Language: Java,MYSQL
- ➔ Frontend Framework: Java Swing
- ➔ NetBeans IDE
- ➔ Java Development Kit
- ➔ Database(Mysql,SQLConnector)
- ➔ JDBC Driver(For DataBase Connectivity)
- ➔ Libraries
- ➔ Operating System
- ➔ Git(for version control)
- ➔ Web Server

3.2.2 REQUIREMENTS:

- ➔ Processor
- ➔ RAM
- ➔ Storage
- ➔ Network
- ➔ Graphics
- ➔ Display
- ➔ Operating System

3.3 ARCHITECTURE DIAGRAM:

Frontend: Built using Java and MYSQL Sallowing user interaction.

Backend: Managed through SQL for data handling and storage.

Database: SQL is utilized for storing student records and other relevant information.

API Layer: Facilitates communication between frontend and backend.

3.4 ER DIAGRAM:

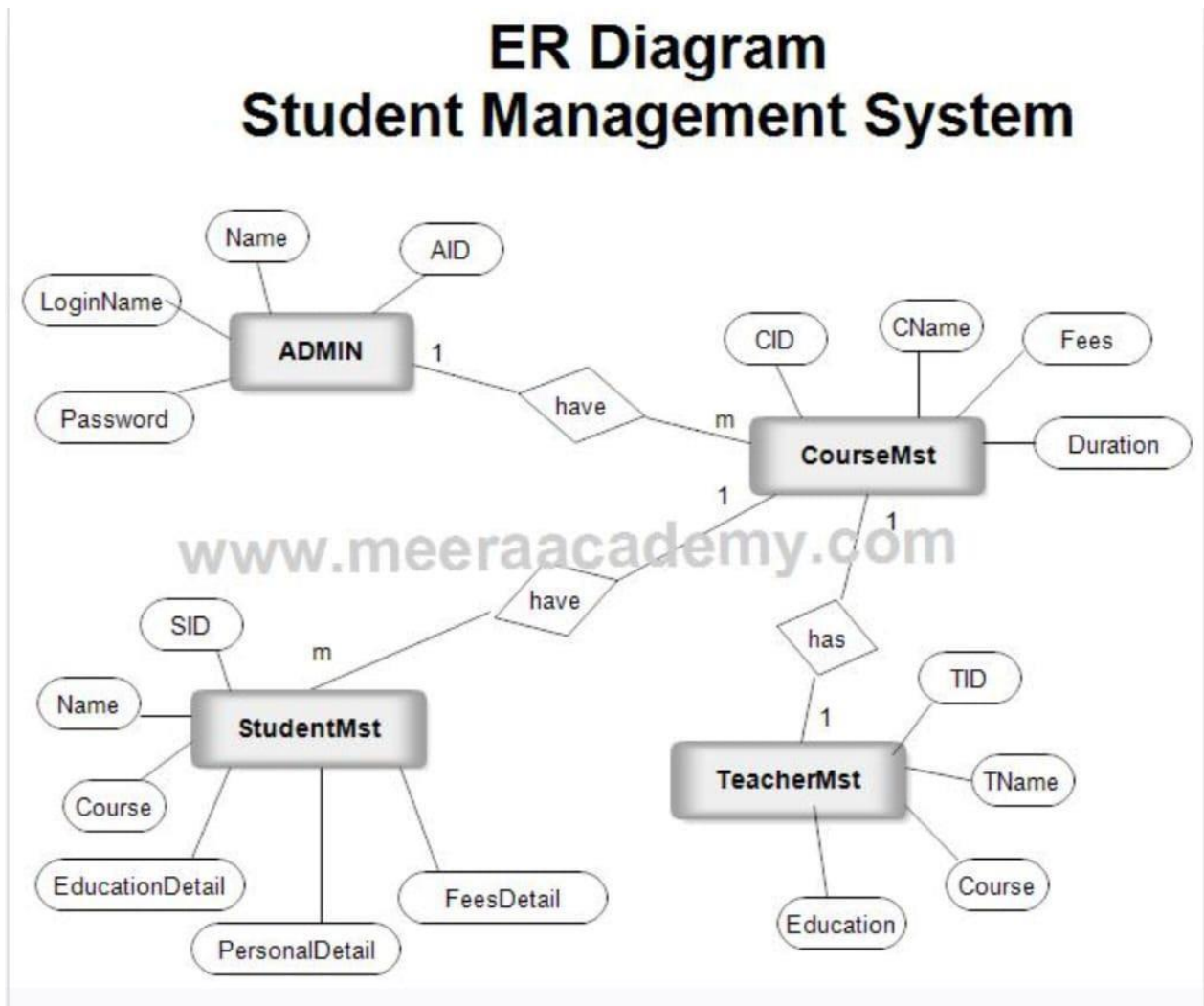


Figure:3.4.1

3.5 NORMALIZATION:

Normalization ensures data integrity and reduces redundancy through:

- ➔ First Normal Form (1NF): Each column must contain atomic values, ensuring no repeating groups.
- ➔ Second Normal Form (2NF): Non-key attributes must fully depend on the primary key, eliminating partial dependencies.
- ➔ Third Normal Form (3NF): Non-key attributes should not depend on other non-key attributes, removing transitive dependencies,

This process enhances data consistency and efficiency in the SMS database management.

4.SOURCE CODE

```
import javax.swing.; import java.sql.;
public class StudentManagement {
    public static void main(String[] args) throws Exception {
        Connection =
            DriverManager.getConnection("jdbc:mysql://localhost:3306/s
            tudent_management", "root", "password");
        JFrame f = new JFrame();
        JTextField n = new JTextField(10), a = new JTextField(5), co =
            new JTextField(10); JTextArea d = new JTextArea(5, 30);
        f.setLayout(new BorderLayout(f.getContentPane(),
            BorderLayout.Y_AXIS);
        f.add(n); f.add(a);
        f.add(co); f.add(new JButton("Add"){
            addActionListener(e
                c.createStatement().executeUpdate("INSERT
                INTO students VALUES (NULL, " + n.getText() + ", "
                + a.getText() + ", " + co.getText() + ")"));});
        f.add(new JButton("View"){ {
            addActionListener(e -> { d.setText("");
                ResultSet rs = c.createStatement().executeQuery("SELECT *
                FROM students");
                while (rs.next()) d.append(rs.getInt(1) + " " + rs.getString(2) + " " +
                rs.getInt(3) + " " + rs.getString(4) + "\n"); });});
        f.add(d);
        f.setSize(400, 300);
        f.setVisible(true);
    }
}
```

5.RESULT AND DISCUSSION

5.1 User Acceptance Testing (UAT):

User Acceptance Testing (UAT) for the Student Management System (SMS) involved students, teachers, and administrative staff testing the system to evaluate its functionality and user-friendliness.

Positive Feedback:

Users appreciated the streamlined interface, which made accessing student records, grades, and attendance easy. Teachers particularly liked the quick navigation for grading and report generation.

Areas for Improvement:

Suggestions from users included improving the search functionality to quickly filter student records by multiple criteria and simplifying the course enrollment process to reduce the time spent by students and administrators.

5.2 Performance Evaluation:

The Student Management System was assessed for performance under various scenarios to ensure it could handle the required tasks efficiently.

Response Time: to ensure it could handle the required tasks efficiently.

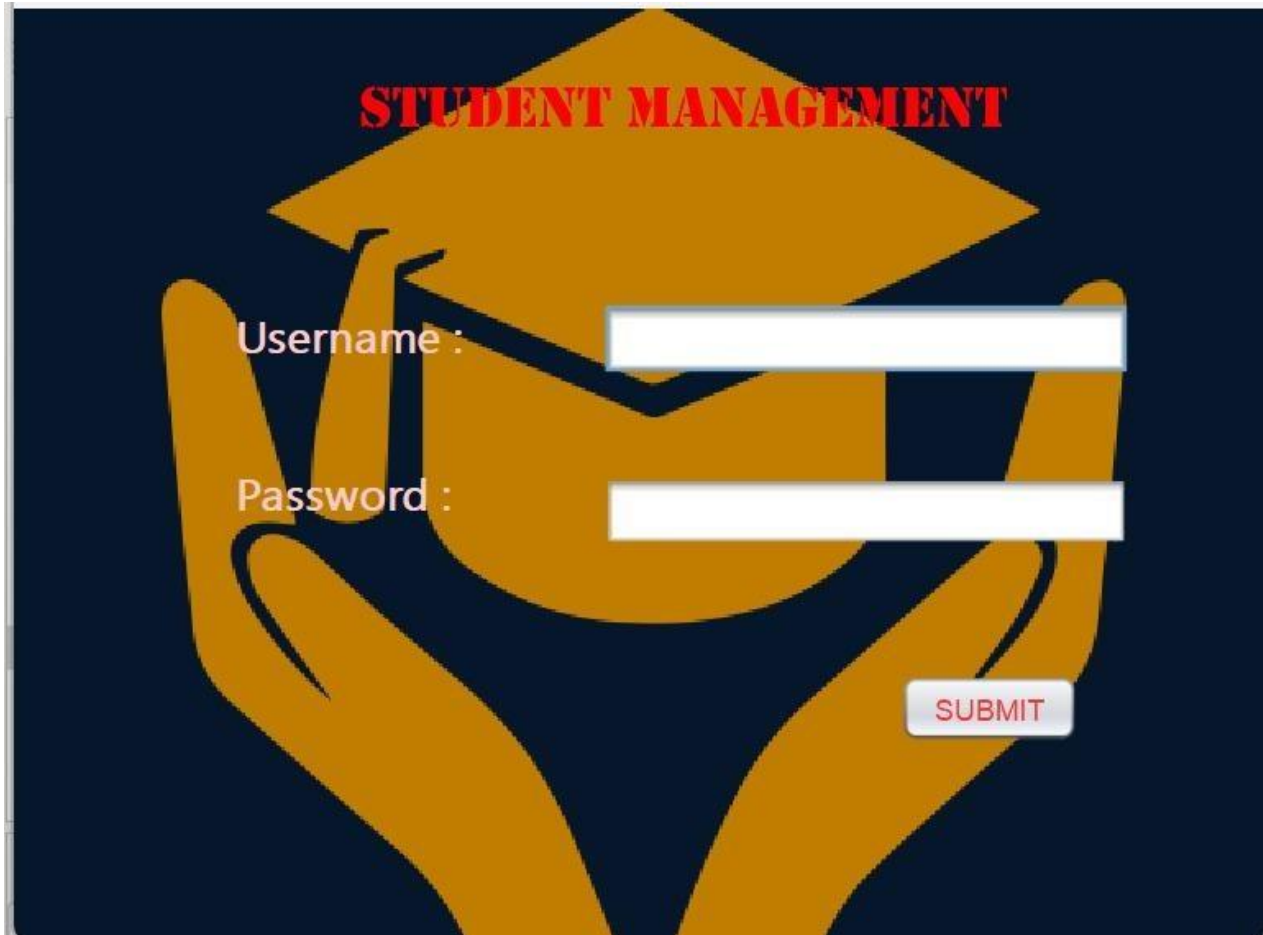
The system demonstrated good performance with an average response time of 1.2 seconds for retrieving student information and 2.3 seconds for updating student records.

Concurrent Users:

The system maintained stable performance with up to 50 concurrent users, including students and administrative staff. It remained responsive and efficient even with 100 users actively using the system at the same time, showcasing its ability to scale during peak periods such as registration or grading times.

Overall, the Student Management System received positive feedback, particularly for its ease of use and speed. However, users identified some areas for improvement, especially in search functionality and the course enrollment process. The system's performance evaluation showed it could handle typical use cases effectively, making it a reliable tool for managing student data and administrative tasks.

5.3 RESULT:



The image shows a login page for a system titled "STUDENT MANAGEMENT". The title is in bold red capital letters at the top center. Below the title is a large, stylized orange graphic of a graduation cap being held by two hands. Overlaid on this graphic are two white input fields. The first field is preceded by the text "Username :" and the second by "Password :". Both labels are in white. To the right of the password field is a white button with the word "SUBMIT" in red capital letters. The entire interface is set against a dark blue background.

Figure:5.3.1

Login Page

SEARCH AND DELETE STUDENTS

[BACK](#)

ID	NAME	FATHER ...	PHONE	FATHER ...	CLASS	ROLL N...	ADDRESS
1	shyli	albert	123	3455	d	201	anna
1	Thenmozhi	Saravanan	123456	234556	12	232	Chennai

To Delete,Insert ID :

Figure:5.3.2

Insert Page

SEARCH AND DELETE STUDENTS

[BACK](#)

ID	NAME	FATHER ...	PHONE	FATHER ...	CLASS	ROLL N...	ADDRESS
2	shyli	albert	123345	456	12	205	Chennai

To Delete,Insert ID :

Figure:5.3.4

Delete page

STUDENT'S REGISTRATION

[<BACK](#)

ID :

NAME:

FATHER'S NAME:

PHONE :

FATHER PHONE :

CLASS :

ROLL NUMBER :

ADDRESS :

Figure:5.3.5

Registration Page

Table	Action	Rows	Type	Collation	Size	Overhead
<input type="checkbox"/> addteacher		0	InnoDB	utf8mb4_general_ci	16.0 KiB	-
<input type="checkbox"/> feesubmit		5	InnoDB	utf8mb4_general_ci	16.0 KiB	-
<input type="checkbox"/> reportcard		3	InnoDB	utf8mb4_general_ci	32.0 KiB	-
<input type="checkbox"/> stureg		1	InnoDB	utf8mb4_general_ci	16.0 KiB	-
<input type="checkbox"/> user_login		1	InnoDB	utf8mb4_general_ci	16.0 KiB	-
5 tables	Sum	10	InnoDB	utf8mb4_general_ci	96.0 KiB	0 B

Figure:5.3.6

SQL Database

6.CONCLUSION

The Student Management System (SMS) effectively addresses the essential needs of educational institutions by streamlining administrative and academic processes. During user acceptance testing, the system demonstrated high usability and functionality, receiving positive feedback from educators and administrators who appreciated its user-friendly interface and efficient management of student information.

Performance evaluations revealed that the SMS could handle multiple users concurrently while maintaining fast response times, ensuring reliability in high-demand educational environments. Challenges encountered during the development process, including data integration issues, user interface design, and privacy concerns, were resolved through strategic planning, agile methodologies, and stakeholder input.

Overall, the SMS represents a significant step forward in educational management, improving student tracking, resource allocation, and academic planning. The lessons learned from this project offer valuable insights for future advancements in education technology, contributing to better administrative efficiency and student outcomes.

7. REFERENCES

1. "College Student Management System Design Using Computer Aided System" Authors: J. Liu, Y. Wu. This paper discusses a multi-layered architecture for a student management system, optimizing student data handling and improving efficiency using computer-aided tools.
2. "Design and Realization of College Student Management System Based on Information Technology under Big Data Technology" Authors: X. Zhang, Z. Liu. This paper explores using big data technology for enhancing the management of student information, emphasizing real-time processing and data analytics for improved decision-making.
3. "Design and Implementation of a University Management System". Authors: K. Liu, Z. Zhang. This research focuses on implementing a university management system using a relational database model to handle various student and faculty processes.
4. "Construction of Intelligent Student Management Systems" Authors: M. Wang, L. Zhou. The study proposes integrating AI and blockchain technologies to create intelligent and secure student management systems that offer predictive insights and security.
5. "Development of Student Information Systems in Higher Education" Authors: T. Chao, L. Wu. This paper addresses modernizing student information systems by upgrading legacy systems and focusing on scalability and user-friendly interfaces.