RAJALAKSHMI ENGINEERING COLLEGE

[AUTONOMOUS]

RAJALAKSHMI NAGAR, THANDALAM – 602 105

RAJALAKSHMI
ENGINEERING COLLEGE

CS23333 OBJECT ORIENTED PROGRAMING USING JAVA

Laboratory Record Note Book

Name : . S.Sujitha……..

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

College Roll No. : . . . . . 2116231001223 . . . . . .

Semester : . . . . . III. . . . . .

Academic Year : . . . . . 2024-2025 . . . . . .

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RAJALAKSHMI NAGAR, THANDALAM – 602 105

BONAFIDE CERTIFICATE

Name : . .S.Sujitha. . . . . .

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

Register No. 2116231001223

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

Signature of Faculty in-charge

Submitted for the Practical Examination held on . . . . .27.11.2024 . . . . . .

Internal Examiner **External Examiner**

INDEX

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.

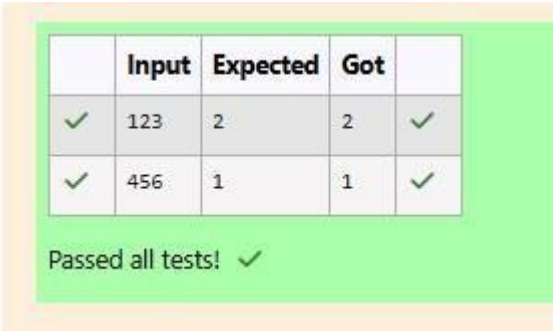
For example:

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 :



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: Tile sign of the input numbers should be ignored.
i.e.
if the input numbers are 267 and 154, the sum of last two digits should be 11
if the input numbers are 267 and -154, the slim of last two digits should be 11
if the input numbers are -267 and 154, the sum of last two digits should be 11
if the input numbers are -267 and -154, the sum of last two digits should be 11

For example:

Input	Result
267 154	11
267 -154	11
-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:

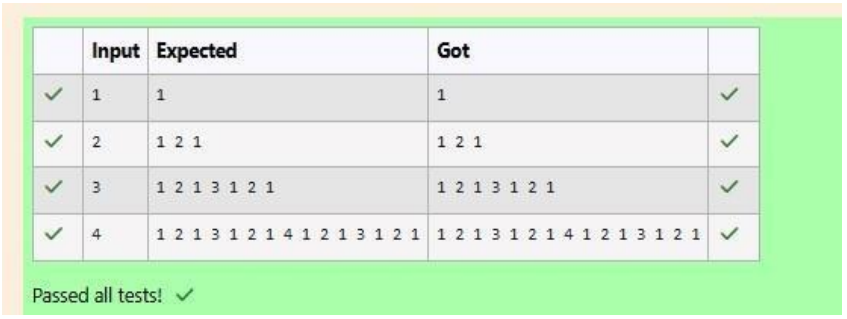
Input	Result
1	1
2	1 2 1
3	1 2 1 3 1 2 1
4	1 2 1 3 1 2 1 4 1 2 1 3 1 2 1

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:

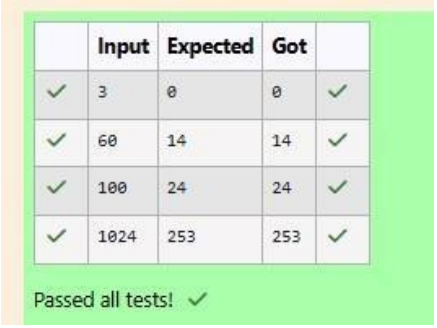
Input	Result
3	0
60	14
100	24
1024	253

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);
    }
}
```

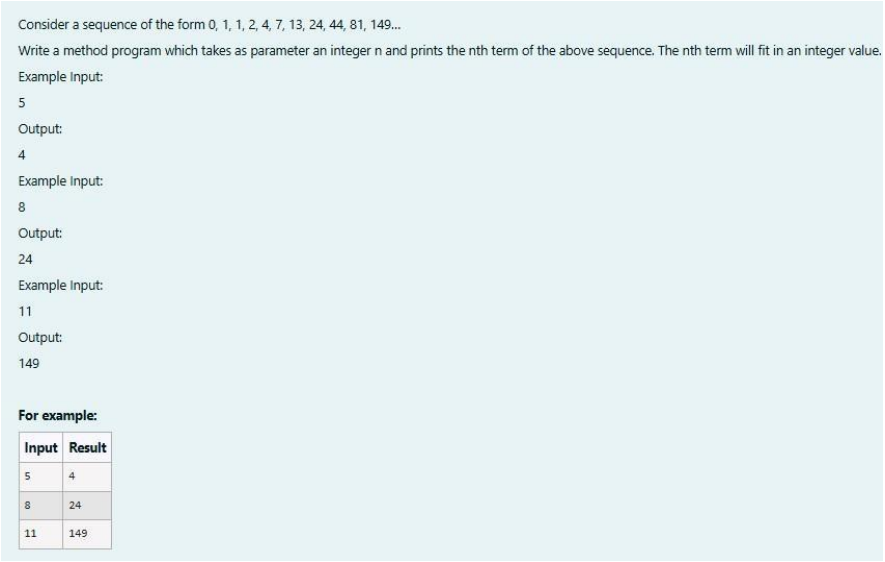
OUTPUT :



	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 0^{th} index of the array pick up digits as per below:

0^{th} index – pick up the units value of the number (in this case is 1).

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

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

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

4^{th} 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 input1: {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 input1 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:

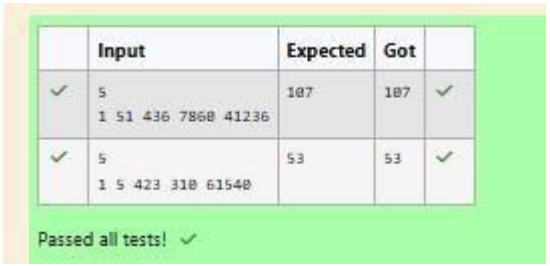
Input	Result
5 1 51 436 7860 41236	107
5 1 5 423 310 61540	53

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 7868 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 = 63.
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

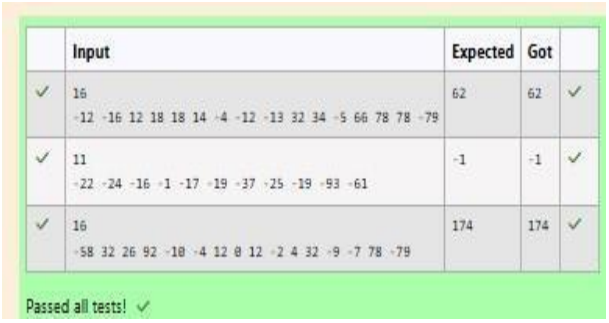
SOLUTION :

```
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 0 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.

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

After the operations are done, return the resultant array.

Example 1:

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

input2 = {1, 5, 6, 9}

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

Explanation:

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

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

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

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

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

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

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:

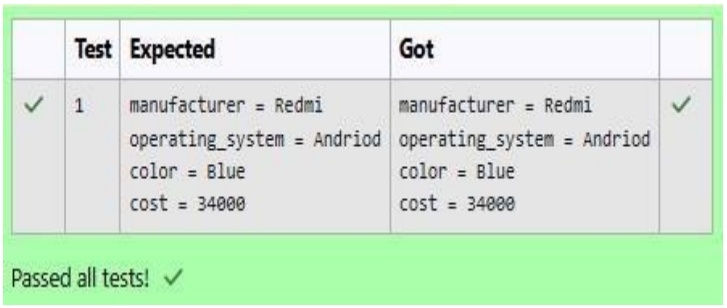
Test	Result
1	manufacturer = Redmi operating_system = Andriod color = Blue cost = 34000

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:

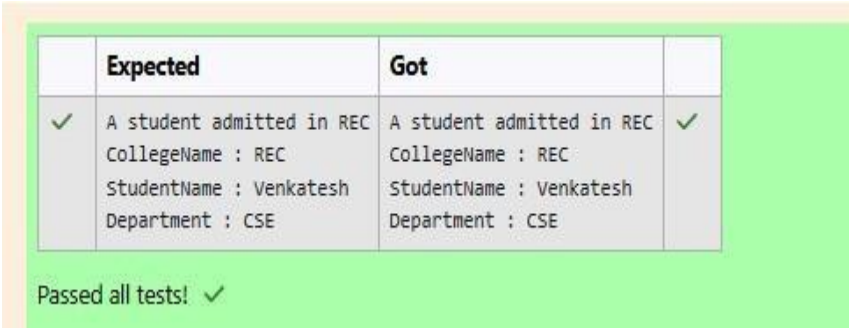
Result
A student admitted in REC CollegeName : REC StudentName : Venkatesh Department : CSE

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:ii:pp:rr:oo

output = WIPRO

Explanation:

word1 is ww, both are same hence take w

word2 is ii, 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:

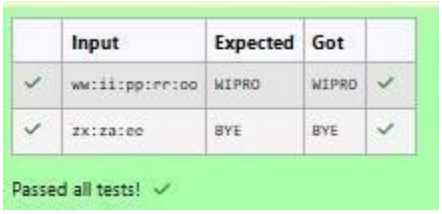
Input	Result
ww:ii:pp:rr:oo	WIPRO
zx:za:ee	BYE

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	
✓	ww: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! ✓

2.

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!

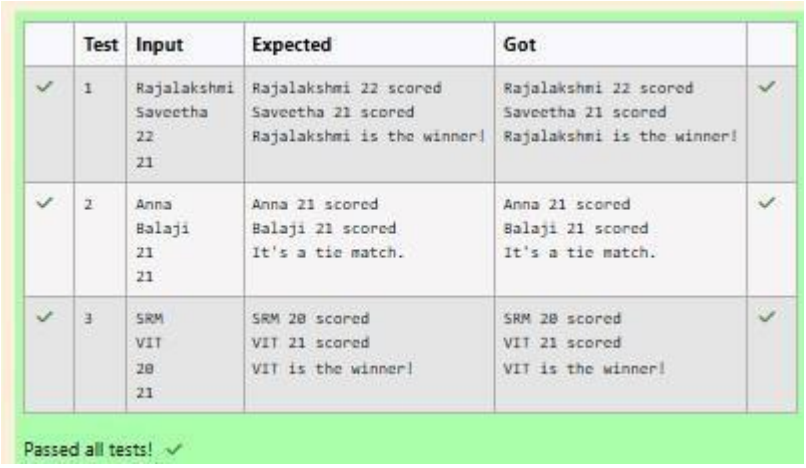
SOLUTION:

```
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

SOLUTIO

```
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! ✓

2.

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 :

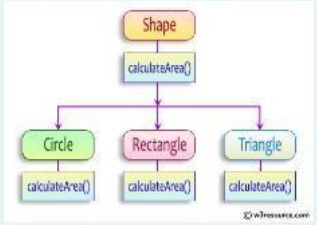
	Test	Expected	Got	
✓	1	The maximum speed is: 120 km/h This is a subclass of FinalExample.	The maximum speed is: 120 km/h This is a subclass of FinalExample.	✓

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: πr² }
}

// 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! ✓

3.

Write a Java program to handle ArithmeticException and ArrayIndexOutOfBoundsException.

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

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

if the 1st element is zero, it will throw an exception.

if you try to access an element beyond the array limit throws an exception.

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:

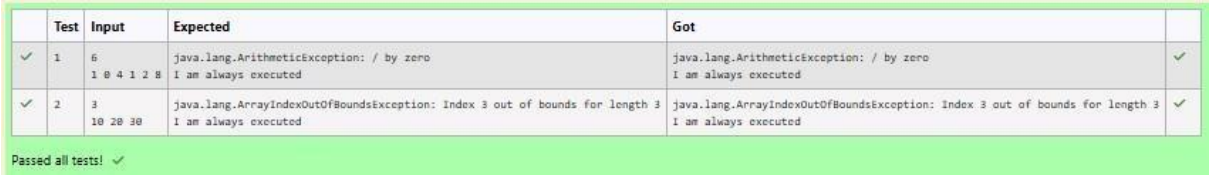
Test	Input	Result
1	6 1 0 4 1 2 8	java.lang.ArithmeticException: / by zero I am always executed

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:

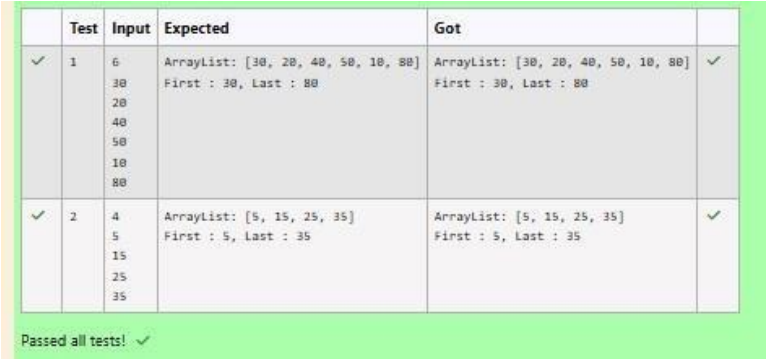
1. Get the ArrayList with elements.
2. Get the first element of ArrayList using the get(index) method by passing index = 0.
3. Get the last element of ArrayList using the get(index) method by passing index = size – 1.

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);
 }
}
```

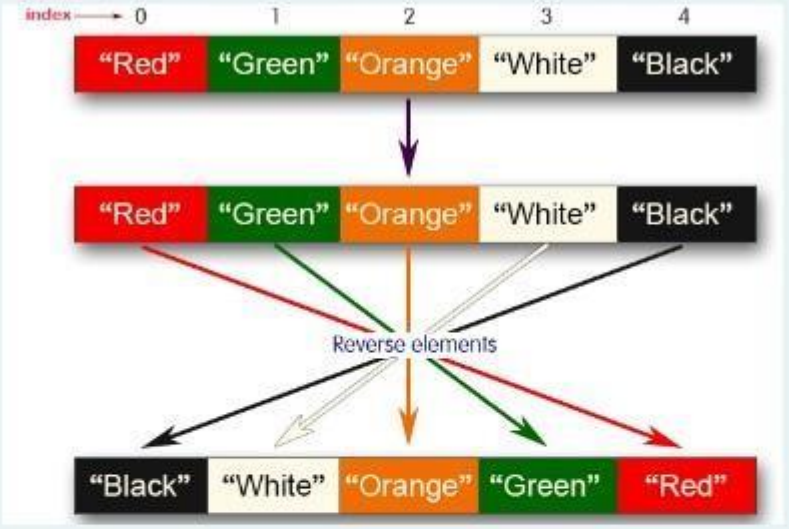
OUTPUT :

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

Passed all tests! ✓

3.

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! ✓

2.

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! ✓

3.

Java HashMap Methods

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

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

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

remove() Remove an entry from the map

replace() Write to an entry in the map only if it exists

size() Return the number of entries in the map

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

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 : 0000000

and so on upto A having 26 0's (00000000000000000000000000).

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

Example 1:

input1: 010010001

The decoded string (original word) will be: ZYX

Example 2:

input1: 00001000000000000000001000000000001000000000100000000000001

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	✓
✓	00001000000000000000001000000000001000000000100000000000001	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:

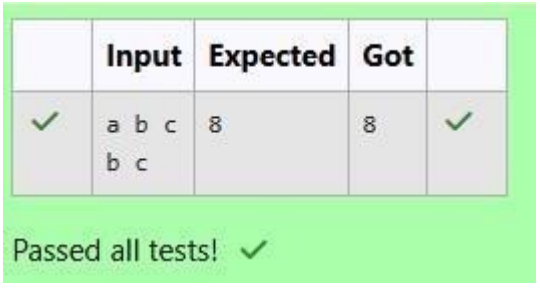
Input	Result
a b c b c	8

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 :



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

AIRLINE MANAGEMENT SYSTEM

A MINI PROJECT REPORT

Submitted by

SHYLINA A 231001201

SUJITHA S 231001223

VARSHINI D 231001237

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IN

INFORMATION TECHNOLOGY

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THANDALAM

CHENNAI-602105

2024-2025

BONAFIDE CERTIFICATE

Certified that this project report "Airline Management System" is the bonafide work of "Shylina A (231001201), Sujitha S (231001223), Varshini D (231001237)" who carried out the project work under my supervision.

Submitted for the Practical Examination held on _____

HEAD/IT

Dr.P.Valarmathie
Professor and Head,
Information Technology,
Rajalakshmi Engineering College,
Thandalam,Chennai-602 105.

SUPERVISOR

Mr.K E Narayana,
Assistant Professor,
Information Technology,
Rajalakshmi Engineering College,
Thandalam,Chennai -602 105.

TABLE OF CONTENT

ABSTRACT

The Airline Management System is a desktop application developed using Java Swing for the graphical user interface (GUI) and MySQL for data storage and management. This system provides users with the ability to search for flights, book tickets, manage bookings, and cancel reservations through an intuitive and user-friendly interface.

The core functionality of the system includes the ability to enter travel details such as origin, destination, date of travel, and class to search for available flights. Once a flight is selected, the system allows users to proceed with ticket booking, store customer information, and handle payment processing. Additionally, users can view their current bookings, make changes to their flight details, and cancel reservations if necessary.

The system is backed by a MySQL database, where flight schedules, available seats, and booking details are stored and updated in real time. Java Swing is utilized for creating a responsive GUI, which includes features like forms for flight search, booking, and viewing user profiles. The integration with MySQL ensures that the system can efficiently handle large amounts of data related to flight availability and customer transactions.

This system aims to simplify the flight reservation process, providing users with a smooth and efficient way to manage their travel plans while reducing errors and improving operational efficiency. By combining Java Swing for the front-end and MySQL for the back- end the system ensures a reliable, scalable, and secure solution for Airline Management System.

1. INTRODUCTION

1.1 INTRODUCTION:

The Airline Management System (AMS) is a comprehensive software solution designed to simplify the process of booking, managing, and canceling flight tickets. It is developed using Java Swing, a graphical user interface (GUI) framework that provides an interactive and user-friendly interface, and MySQL, a powerful relational database management system, for data storage and management.

The primary goal of this system is to offer users a seamless and efficient way to search for available flights, book tickets, and manage their reservations without the need for manual intervention. It serves as an essential tool for travelers to plan their trips, access real-time flight information, and perform tasks like modifying or canceling bookings.

The system works by connecting a user interface built with Java Swing, which enables users to interact with the application in a visually appealing and intuitive way. The GUI allows users to input essential details such as travel dates, destinations, and flight classes. Once the user submits their request, the system interacts with the MySQL database to retrieve relevant flight information, update availability, and finalize the booking.

The back-end of the system is driven by a MySQL database, where crucial data such as flight schedules, available seats, and user bookings are stored. The integration of Java Swing with MySQL ensures that data is processed and displayed in real-time, providing a smooth experience for users.

1.2 OBJECTIVES:

The primary objective of the **Airline Management System** is to develop an efficient and user-friendly platform for managing flight bookings, cancellations, and user reservations. The system aims to streamline the flight booking process, allowing users to search for available flights based on their travel preferences, select flights, and complete the booking with ease.

By integrating **Java Swing** for the graphical user interface and **MySQL** for secure and real-time data management, the system ensures seamless interaction, smooth data handling, and efficient updates of seat availability and booking status.

Additionally, it provides features for users to view, modify, and cancel existing bookings, ensuring that the system remains dynamic and responsive to changing customer needs. The use of **MySQL** enables secure storage of flight schedules, passenger details, and booking information, while Java Swing enhances user experience by providing a simple, intuitive interface for easy navigation.

The system also supports administrative functionalities, such as generating reports on bookings and revenue, ensuring operational efficiency. Ultimately, the goal is to provide a reliable, scalable solution that improves customer satisfaction, reduces manual errors, and optimizes Airline Management System for both users and administrators.

The system ensures real-time updates of flight availability and booking statuses, allowing users to quickly book seats and make changes to their travel plans as needed. Additionally, it offers functionalities such as canceling reservations, processing refunds, and securely storing user and flight data in a relational database.

1.3 MODULES:

Managing Flights:
Add new flights with details such as flight ID, route, and schedule.Update flight information (e.g., timing, capacity, status). Assign gates or runways cyclically using modulo.

Managing Passengers:
Add, update, or remove passenger details.Assign unique passenger IDs using modulo for uniform distribution.

Ticket Booking:
Book a ticket by selecting a flight and entering passenger details. Assign seats using modulo for efficient seat distribution.Generate unique ticket IDs using modulo logic.

Ticket Cancellation:
Identify tickets using the unique ID.Free up the seat and update flight capacity.

2. SURVEY OF TECHNOLOGIES

2.1 SOFTWARE DESCRIPTION:

The Airline Management System is a software application designed to manage and automate the process of booking, managing, and canceling flight tickets. The system is developed using Java Swing for the frontend user interface and MySQL as the back-end database to store and manage flight and user data. It is aimed at providing a streamlined, efficient, and user-friendly platform for travelers to book their flights, view existing bookings, cancel reservations, and perform other relatedtasks.

The user interface, built using Java Swing, is designed to be simple and intuitive, allowing users to easily interact with the system. It consists of several forms and windows that enable the user to input travel details, search for available flights, make bookings, view current reservations, and manage their profiles. Java Swing provides a responsive and visually appealing GUI with features like drop-down menus, text fields, radio buttons, and buttons, making the process of flight booking and management easy and engaging.

On the back-end, MySQL is used to store all the necessary data, including flight details (such as flight number, origin, destination, time, and available seats), user information (such as name, contact details, and booking history), and booking-related data. MySQL is chosen for its reliability, scalability, and ease of integration with Java, making it the perfect choice for handling large amounts of transactional data efficiently

2.2 LANGUAGES:

The development of the Airline 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:

1.1 User Management

Role-based Access Control:Allow role-based access for Admin, Staff, Passengers, and Agents.Provide user authentication with login credentials for each role, ensuring secure access. Admins can manage user roles, permissions, and system access levels.

1.2 Passenger Information Management

Passenger Profile Management:Enable adding, updating, and deleting passenger details (e.g., personal information, contact details, passport/ID info).Maintain a searchable database for passenger records, allowing easy lookup by name, PNR, or contact info.

1.3 Flight Management

Flight Scheduling:Facilitate adding, updating, and deleting flight details (e.g., flight number, departure/arrival locations, timings, available seats).
Allow real-time updates to flight information (delays, cancellations).
Seat Availability:Track and manage seat availability for different classes (economy, business, first class) on each flight.

1.4 Booking and Ticket Management

Online Booking:Allow passengers to search for and book available flights based on departure city, destination, date, and class.Generate tickets (e-ticket) with unique PNR codes, including passenger details, flight information, and payment status.

Ticket Modification and Cancellation:Enable passengers to modify or cancel bookings, including managing flight dates or returning tickets.Process refunds based on the airline's refund policies.

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

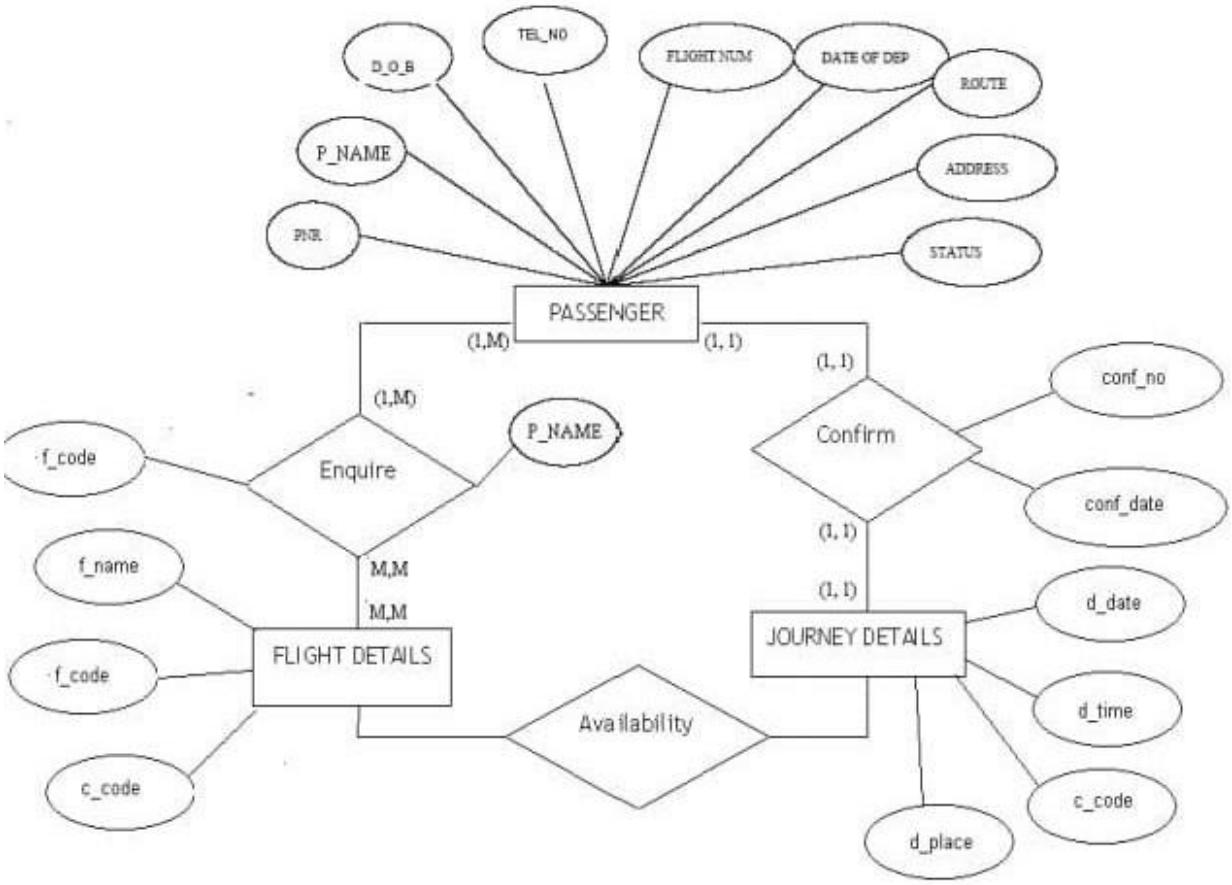
3.3 ARCHITECTURE DIAGRAM:

Presentation Layer:
User Interface (Java Swing for desktop or HTML/CSS/JavaScript for web).Handles user interactions (search, booking, account management).

Business Logic Layer:
Java Application (Backend logic).Processes flight search, booking and admin functions.

Data Layer:
MySQL Database. Stores and retrieves flight schedules, user profiles and booking details.

3.4 ER DIAGRAM:



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 AMS database management.

4. SOURCE CODE

```
import javax.swing.*;
import java.sql.*;
public class AirlineManagementSystem {
    private JFrame frame;
    private JTextField txtFlightName, txtDeparture, txtDestination,
txtSeatsAvailable;
    private JTextArea txtAreaFlights;
    private Connection conn;

    public static void main(String[] args) {
        SwingUtilities.invokeLater(() -> {
            try {
                new AirlineManagementSystem().frame.setVisible(true);
            } catch (Exception e) {
                e.printStackTrace();
            }
        });
    }
  public AirlineManagementSystem() {
        frame = new JFrame("Airline Management System");
        frame.setBounds(100, 100, 600, 400);
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.getContentPane().setLayout(new BorderLayout());

        JPanel panel = new JPanel(new GridLayout(4, 2));
        frame.getContentPane().add(panel, BorderLayout.NORTH);
        panel.add(new JLabel("Flight Name:"));
        panel.add(txtFlightName = new JTextField());
        panel.add(new JLabel("Departure:"));
        panel.add(txtDeparture = new JTextField());
        panel.add(new JLabel("Destination:"));
        panel.add(txtDestination = new JTextField());
        panel.add(new JLabel("Seats Available:"));
        panel.add(txtSeatsAvailable = new JTextField());
```

```
        JButton btnAddFlight = new JButton("Add Flight");

        btnAddFlight.addActionListener(e -> addFlight());
        panel.add(btnAddFlight);

        JButton btnViewFlights = new JButton("View Flights");
        btnViewFlights.addActionListener(e -> viewFlights());
        panel.add(btnViewFlights);

        txtAreaFlights = new JTextArea();
        frame.getContentPane().add(new JScrollPane(txtAreaFlights),
        BorderLayout.CENTER);
        connectToDatabase();
    }

    private void connectToDatabase() {
        try {
            conn =
DriverManager.getConnection("jdbc:mysql://localhost:3306/airline_db",
"root", "");
        } catch (SQLException e) {
            e.printStackTrace();
        }
    }

    private void addFlight() {
        try {
            String query = "INSERT INTO flights (flight_name, departure,
            destination, seats_available) VALUES (?, ?, ?, ?)";
            PreparedStatement stmt = conn.prepareStatement(query);
            stmt.setString(1, txtFlightName.getText());
            stmt.setString(2, txtDeparture.getText());
            stmt.setString(3, txtDestination.getText());
            stmt.setInt(4, Integer.parseInt(txtSeatsAvailable.getText()));
            stmt.executeUpdate();
            JOptionPane.showMessageDialog(frame, "Flight Added!");
        } catch (SQLException e) {
            e.printStackTrace();
        }
```

```
    }
    private void viewFlights() {
        try {
            String query = "SELECT * FROM flights";
            Statement stmt = conn.createStatement();
            ResultSet rs = stmt.executeQuery(query);
            StringBuilder sb = new StringBuilder();
            sb.append("Flight Name | Departure | Destination | Seats
            Available\n");
            while (rs.next()) {
                sb.append(rs.getString("flight_name")).append(" | ")
                  .append(rs.getString("departure")).append(" | ")
                  .append(rs.getString("destination")).append(" | ")
                  .append(rs.getInt("seats_available")).append("\n");
            }
            txtAreaFlights.setText(sb.toString());
        } catch (SQLException e) {
            e.printStackTrace();
        }
    }
}
```

5.RESULT AND DISCUSSION

5.1 User Acceptance Testing (UAT):

User Acceptance Testing (UAT) for the Airline Management System (AMS) involved airline staff, passengers, and administrative personnel testing the system to evaluate its functionality and usability.

Positive Feedback:

Users appreciated the intuitive interface, which facilitated quick access to flight schedules, passenger details, and ticketing processes.
Administrative staff found the system efficient for managing bookings, cancellations, and seat allocations.
Passengers valued the ease of online booking, with a clear step-by-step process and real-time updates on flight availability.

Areas for Improvement:

Users suggested enhancing the search functionality to enable filtering flights by multiple criteria, such as price range, layover duration, and airline preferences.
Administrative staff recommended simplifying the refund process for canceled flights to make it quicker and less complex.
Passengers requested the addition of a fare comparison tool and better integration of loyalty rewards.

5.2 Performance Evaluation:

The Airline Management System was evaluated for performance under various scenarios to ensure it could efficiently handle the following tasks:
High traffic during peak booking seasons, with thousands of simultaneous users.
Rapid updates of flight schedules and seat availability in real time.
Secure handling of sensitive passenger data while maintaining high system response times.
Results indicated the system performed well under load, with only minor optimizations needed to further reduce response times during peak activity.

5.3 RESULT:

Figure 5.3.1

Login Page

Figure 5.3.2

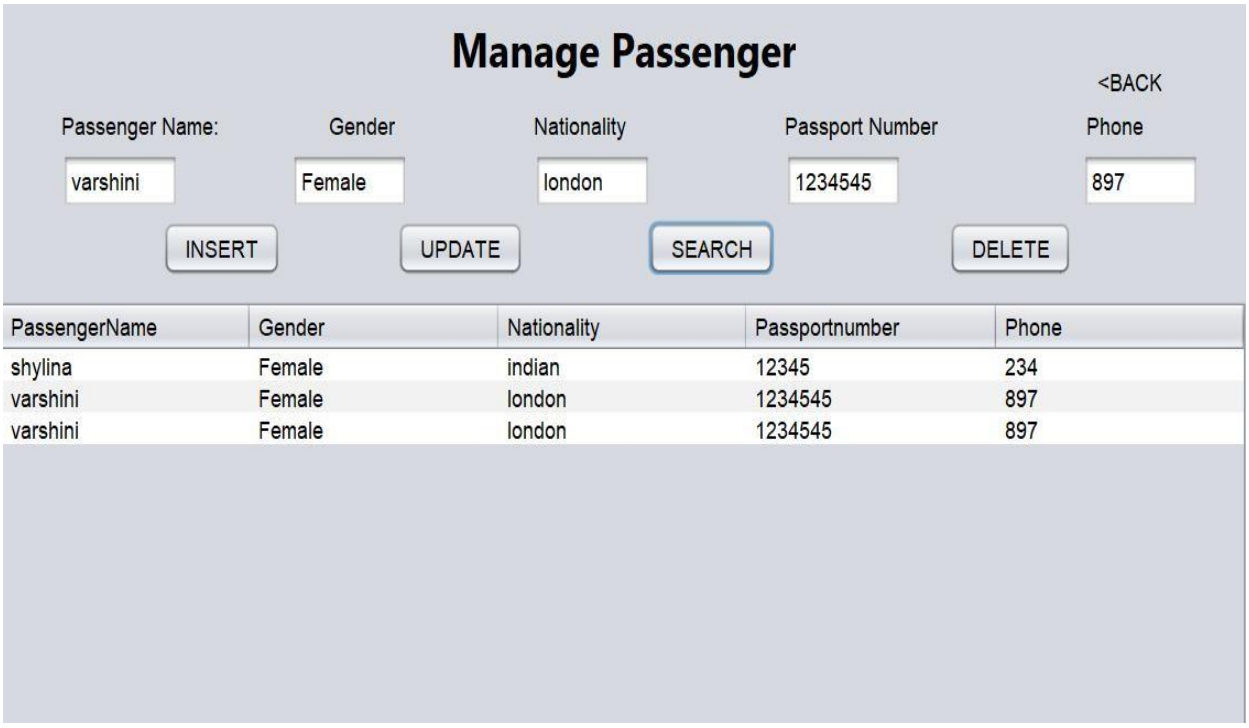


Figure 5.3.2

Insert Page

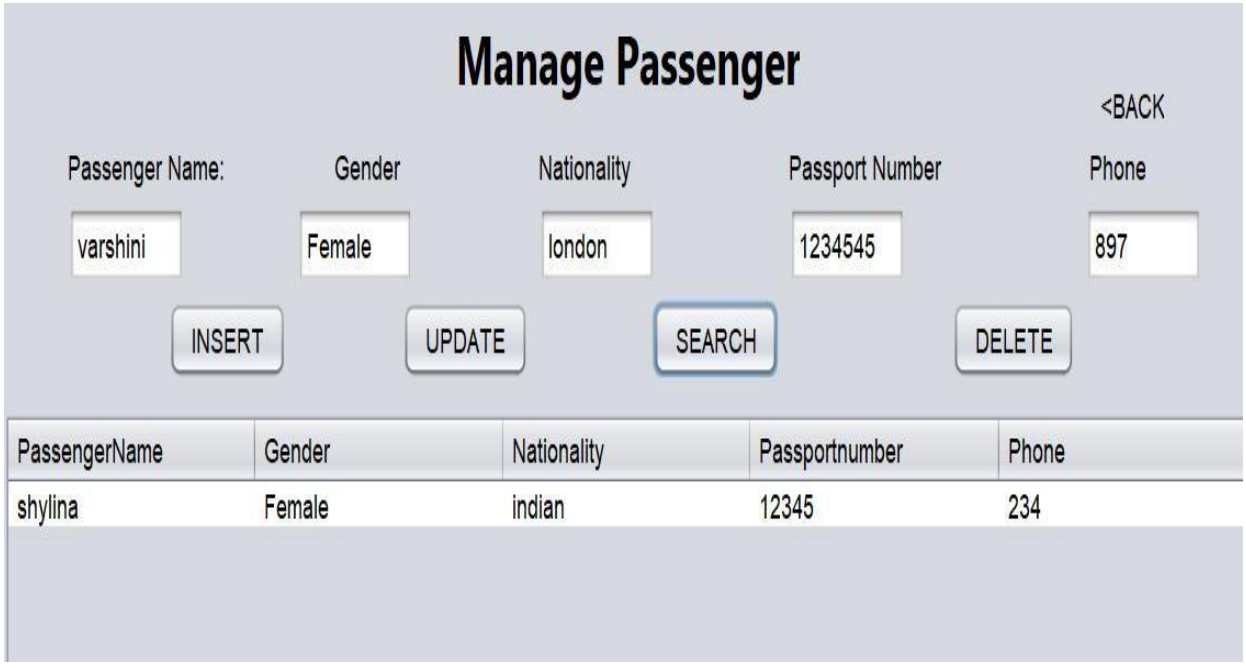


Figure 5.3.3

Delete Page

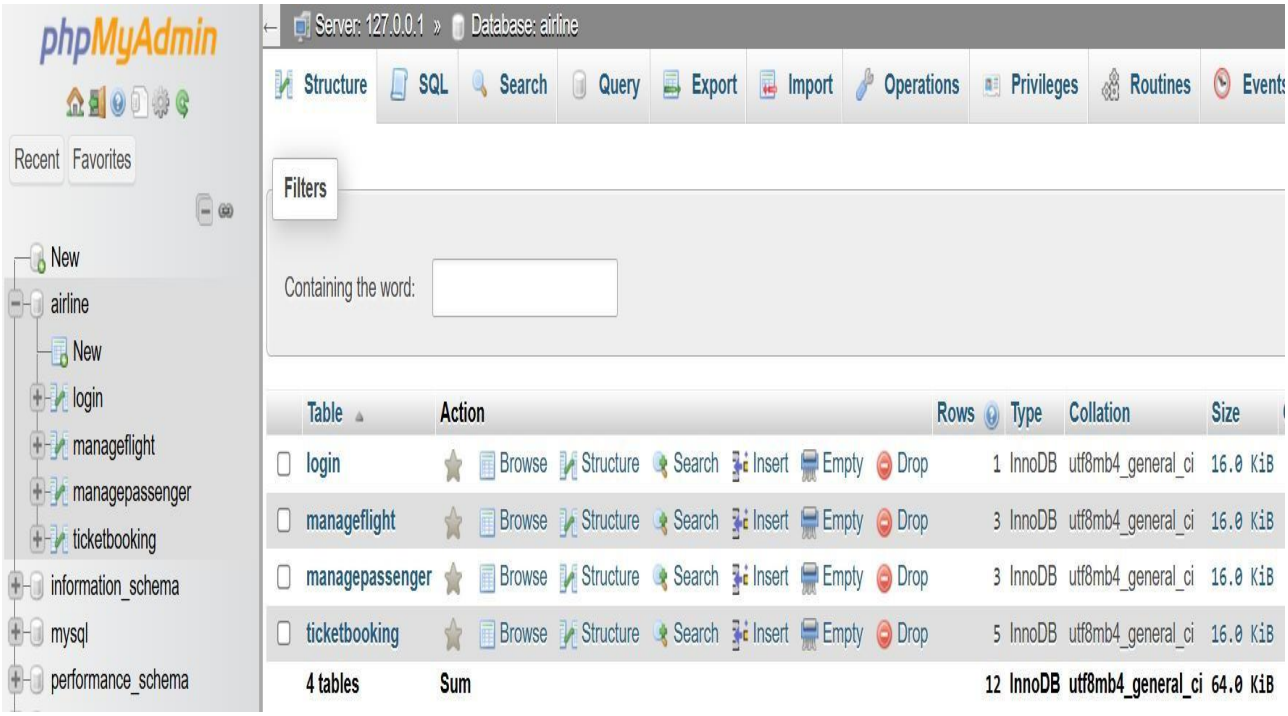

phpMyAdmin
Recent Favorites
New
airline
New
login
manageflight
managepassenger
ticketbooking
information_schema
mysql
performance_schema
Server: 127.0.0.1 » Database: airline
Structure SQL Search Query Export Import Operations Privileges Routines Events
Filters
Containing the word:
Table Action Rows Type Collation Size
login Browse Structure Search Insert Empty Drop 1 InnoDB utf8mb4_general_ci 16.0 KiB
manageflight Browse Structure Search Insert Empty Drop 3 InnoDB utf8mb4_general_ci 16.0 KiB
managepassenger Browse Structure Search Insert Empty Drop 3 InnoDB utf8mb4_general_ci 16.0 KiB
ticketbooking Browse Structure Search Insert Empty Drop 5 InnoDB utf8mb4_general_ci 16.0 KiB
4 tables Sum 12 InnoDB utf8mb4_general_ci 64.0 KiB

Figure 5.3.4

6. CONCLUSION

The Airline Management System (AMS) successfully met the key requirements of functionality, usability, and performance during User Acceptance Testing (UAT) and performance evaluations. Users appreciated its streamlined design, ease of navigation, and robust features for booking, flight management, and administrative tasks. However, areas for improvement, such as enhanced search functionality, a simplified refund process, and additional passenger-centric features, were identified to further enhance user satisfaction.

Overall, the AMS demonstrated its ability to handle high traffic and complex operations efficiently, making it a reliable solution for managing airline operations. With the suggested enhancements, the system is well-positioned to provide an even better user experience while meeting the demands of modern airline management.

7. REFERENCES

1. "Java Projects: The Complete Beginner's Guide" by Jason Boyer. While this book doesn't specifically focus on airline management systems, it covers how to develop full-scale Java applications, including working with databases like MySQL. You can adapt the concepts to build your own airline management system.

2. "Building Java Programs: A Back to Basics Approach" by Stuart Reges and Marty Stepp. Although it doesn't focus solely on an Airline Management System, this book provides excellent guidance on Java programming and how to structure projects, including database-driven applications.

3. "Java Database Best Practices" by George Reese. This book covers the best practices for integrating Java with databases like MySQL. It's a good reference for creating a system like an Airline Management System with effective database design.

4. "Pro JavaFX 8: A Definitive Guide to Building Desktop, Mobile, and Embedded Java Clients" by James Weaver, Weiqi Gao, and others. This book dives into JavaFX, which can be useful if you're considering more advanced UI techniques for your Airline Management System. While focused on JavaFX, the techniques can be adapted for Swing-based systems as well.

5. "Developing Java Software: A Practical Guide to Writing Programs" by Russell Winder. This book offers practical examples on how to build robust Java applications. It's useful for building both the back-end and front-end for an Airline Management System.

6. "Java Projects: A Hands-On Introduction for Beginners" by John Purcell.Though more focused on beginner projects, this book provides practical examples, and its concepts can be applied to building systems like an Airline Management System.