

RAJALAKSHMI ENGINEERING COLLEGE

[AUTONOMOUS]

RAJALAKSHMI NAGAR, THANDALAM – 602 105



RAJALAKSHMI
ENGINEERING COLLEGE

CS23333 OBJECT ORIENTED PROGRAMING USING JAVA

Laboratory Record Note Book

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College Roll No. : 2116231001206

Semester : III.

Academic Year : 2024-2025

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BONAFIDE CERTIFICATE

Name : . Smurithi.R.

Academic Year : 2024-2025 Semester:. III

Branch : IT-D

Register No.

2116231001206

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

Internal Examiner

External Examiner

1.

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

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

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

For example:

Input	Result
123	2
456	1

SOLUTION :

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

OUTPUT :

	Input	Expected	Got	
✓	123	2	2	✓
✓	456	1	1	✓

Passed all tests! ✓

2.

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

The last digit should be returned as a positive number.

For example,

if the given number is 197, the last digit is 7

if the given number is -197, the last digit is 7

For example:

Input	Result
197	7
-197	7

SOLUTION :

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

OUTPUT :

	Input	Expected	Got	
✓	197	7	7	✓
✓	-197	7	7	✓

Passed all tests! ✓

3.

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

For example,

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

Below is the explanation:

Last digit of the 267 is 7

Last digit of the 154 is 4

Sum of 7 and 4 = 11

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

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

0th index - pick up the units value of the number (in this case is 1).

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

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

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

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

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

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

Step 2:

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

{1, 25, 16, 49, 16}

Step 3:

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

Note:

- 1) While picking up a number in Step1, if you observe that the number is smaller than the required position then use 0.
- 2) In the given function, input1[] is the array of numbers and input2 represents the number of elements in input1.

Example 2:

input1: 5 and 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 = 62.

Example 2:
 input1 = 11
 input2 = [-22, -24, 16, -1, -17, -19, -37, -25, -19, -93, -61]
 Expected output = -1
 Explanation:
 There are NO positive numbers in the input array. Therefore, the expected output for such cases = -1.

Example 3:
 input1 = 16
 input2 = [-58, 32, 26, 92, -10, -4, 12, 0, 12, -2, 4, 32, -9, -7, 78, -79]
 Expected output = 174
 Explanation:
 The input array contains four sequences of POSITIVE numbers, i.e. "32, 26, 92", "12, 0, 12", "4, 32", and "78". The first and second sequences "32, 26, 92" and "12, 0, 12" are the longest of the four as they contain 4 elements each. Therefore, the expected output = sum of the longest sequence of POSITIVE numbers = (32 + 26 + 92) + (12 + 0 + 12) = 174.

For example:

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

SOLUTION :

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

}

OUTPUT :

	Input	Expected	Got	
✓	16 -12 -16 12 18 18 14 -4 -12 -13 32 34 -5 66 78 78 -79	62	62	✓
✓	11 -22 -24 -16 -1 -17 -19 -37 -25 -19 -93 -61	-1	-1	✓
✓	16 -58 32 26 92 -10 -4 12 8 12 -2 4 32 -9 -7 78 -79	174	174	✓

Passed all tests! ✓

3.

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

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	
<div>✓</div> 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	<div>✓</div>

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! ✓

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:il:pp:rr:oo

output = WIPRO

Explanation:

word1 is ww, both are same hence take w

word2 is il, 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:il: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! ✓

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);  
        setVisitingTeam(String name);  
}
```

```
interface Football extends Sports {  
    void homeTeamScored(int points);  
    void visitingTeamScored(int points);  
}
```

```
class College implements Football {  
    private String homeTeam; private  
    String visitingTeam; private int  
    homeTeamPoints = 0; private int  
    visitingTeamPoints = 0;
```

```
    public void setHomeTeam(String name) {  
        this.homeTeam = name;  
    }
```

```
    public void setVisitingTeam(String name) {  
        this.visitingTeam = name;  
    }  
    public void homeTeamScored(int points)  
    {
```



```

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

    public void visitingTeamScored(int points) {
        visitingTeamPoints += points;
        System.out.println(visitingTeam + " " + points + " scored");
    }

    public void winningTeam() { if
        (homeTeamPoints > visitingTeamPoints) {
            System.out.println(homeTeam + " is the winner!");
        } else if (homeTeamPoints < visitingTeamPoints) {
            System.out.println(visitingTeam + " is the winner!");
        } else {
            System.out.println("It's a tie match.");
        }
    }
}

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

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

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

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

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

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

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

        sc.close();
    }
}

```

}

OUTPUT :

	Test	Input	Expected	Got	
✓	1	Rajalakshmi Saveetha 22 21	Rajalakshmi 22 scored Saveetha 21 scored Rajalakshmi is the winner!	Rajalakshmi 22 scored Saveetha 21 scored Rajalakshmi is the winner!	✓
✓	2	Anna Balaji 21 21	Anna 21 scored Balaji 21 scored It's a tie match.	Anna 21 scored Balaji 21 scored It's a tie match.	✓
✓	3	SRM VIT 20 21	SRM 20 scored VIT 21 scored VIT is the winner!	SRM 20 scored VIT 21 scored VIT is the winner!	✓

Passed all tests! ✓

3.

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

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

Similarly, create Volleyball and Basketball classes.

Sample output:

```
sadhvin is Playing football  
sanjay is Playing volleyball  
sruthi is Playing basketball
```

For example:

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

SOLUTION :

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



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

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

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

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

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

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

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

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

    // Input for Football player

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

    // Input for Volleyball player
```

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



```
// Input for Basketball player

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

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

scanner.close();
}
}
```

OUTPUT :

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

Passed all tests! ✓

Lab-08 - Polymorphism, Abstract Classes, final Keyword
1.

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

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

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

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

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

input2: String array.

Example 1:

input1: 3

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

output: oreoapple

Example 2:

input1: 2

input2: {"Mango", "banana"}

output: no matches found

Explanation:

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

Hence the output is no matches found.

Example 3:

input1: 3

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

output: ateace

For example:

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

SOLUTION :

```
import java.util.Scanner; public

class VowelStringExtractor {

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

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

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

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

    // Input for the number of strings

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

    // Input for the strings in one line

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

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

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

OUTPUT :

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

Passed all tests! ✓

1. Final Variable:

- Once a variable is declared `final`, its value cannot be changed after it is initialized.
- It must be initialized when it is declared or in the constructor if it's not initialized at declaration.
- It can be used to define constants

```
final int MAX_SPEED = 120; // Constant value, cannot be changed
```

2. Final Method:

- A method declared `final` cannot be overridden by subclasses.
- It is used to prevent modification of the method's behavior in derived classes.

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

3. Final Class:

- A class declared as `final` cannot be subclassed (i.e., no other class can inherit from it).
 - It is used to prevent a class from being extended and modified.
- ```
public final class Vehicle {
 // class code
}
```

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

For example:

| Test | Result                                                                |
|------|-----------------------------------------------------------------------|
| 1    | The maximum speed is: 120 km/h<br>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.");
}
}
```

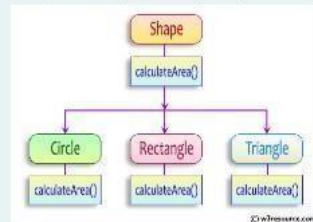
## OUTPUT :

|   | Test | Expected                                                              | Got                                                                   |   |
|---|------|-----------------------------------------------------------------------|-----------------------------------------------------------------------|---|
| ✓ | 1    | The maximum speed is: 120 km/h<br>This is a subclass of FinalExample. | The maximum speed is: 120 km/h<br>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<br>5<br>6<br>4<br>3         | Area of a circle: 50.27<br>Area of a Rectangle: 30.00<br>Area of a Triangle: 6.00  |
| 2    | 7<br>4.5<br>6.5<br>2.4<br>3.6 | Area of a circle: 153.94<br>Area of a Rectangle: 29.25<br>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: πr^2 }
}

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

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

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

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

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

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

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

 // Input for Circle

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

 // Input for Rectangle

```

```
double length = scanner.nextDouble();

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

// Input for Triangle double base =

scanner.nextDouble();

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

scanner.close();
}
}
```

**OUTPUT :**

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

|                                  |
|----------------------------------|
| <b>Result</b>                    |
| 82 is even.<br>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.<br>Error: 37 is odd. | 82 is even.<br>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<br>5 2 1 | 8                     |
| 2<br>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<br>5 2 1 | 8                     | 8                     | ✓ |
| ✓ | 2<br>1 g   | You entered bad data. | You entered bad data. | ✓ |

Passed all tests! ✓

Write a Java program to handle `ArithmeticException` and `ArrayIndexOutOfBoundsException`.  
Create an array, read the input from the user, and store it in the array.  
Divide the 0th index element by the 1st index element and store it.  
if the 1st element is zero, it will throw an exception.  
if you try to access an element beyond the array limit 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<br>1 0 4 1 2 8 | java.lang.ArithmeticException: / by zero<br>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<br>1 0 4 1 2 8 | java.lang.ArithmeticException: / by zero<br>I am always executed                                     | java.lang.ArithmeticException: / by zero<br>I am always executed                                     | ✓ |
| ✓ | 2    | 3<br>10 20 30    | java.lang.ArrayIndexOutOfBoundsException: Index 3 out of bounds for length 3<br>I am always executed | java.lang.ArrayIndexOutOfBoundsException: Index 3 out of bounds for length 3<br>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<br>30<br>20<br>40<br>50<br>10<br>80 | ArrayList: [30, 20, 40, 50, 10, 80]<br>First : 30, Last : 80 | ArrayList: [30, 20, 40, 50, 10, 80]<br>First : 30, Last : 80 | ✓ |
| ✓ | 2    | 4<br>5<br>15<br>25<br>35              | ArrayList: [5, 15, 25, 35]<br>First : 5, Last : 35           | ArrayList: [5, 15, 25, 35]<br>First : 5, Last : 35           | ✓ |

Passed all tests! ✓

**2.**

The given Java program is based on the ArrayList methods and its usage. The Java program is partially filled. Your task is to fill in the incomplete statements to get the desired output.

```
list.set();
list.indexOf();
list.lastIndexOf()
list.contains()
list.size();
list.add();
list.remove();
```

The above methods are used for the below Java program.

**SOLUTION :**

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

public class Prog {

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

```

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

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

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

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

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

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

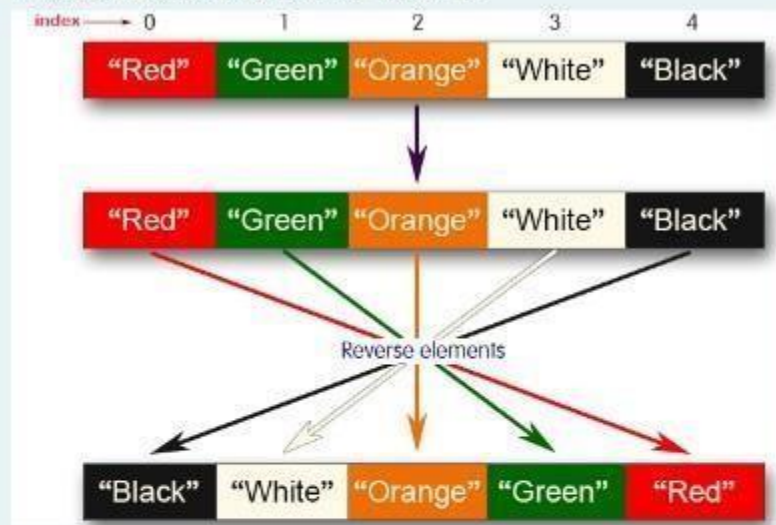
//Getting the index of last occurrence of 100
System.out.println("LastIndex of 100 = "+ list.lastIndexOf(100));
// Check whether 200 is in the list or not
System.out.println(list.contains(200)); //Output : false
// Print ArrayList size
System.out.println("Size Of ArrayList = "+list.size());
//Inserting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

```

### OUTPUT :

|                     | Test | Input | Expected                         | Got                              |   |
|---------------------|------|-------|----------------------------------|----------------------------------|---|
| ✓                   | 1    | 5     | ArrayList: [1, 2, 3, 100, 5]     | ArrayList: [1, 2, 3, 100, 5]     | ✓ |
|                     |      | 1     | Index of 100 = 1                 | Index of 100 = 1                 |   |
|                     |      | 2     | LastIndex of 100 = 3             | LastIndex of 100 = 3             |   |
|                     |      | 3     | false                            | false                            |   |
|                     |      | 100   | Size Of ArrayList = 5            | Size Of ArrayList = 5            |   |
|                     |      | 5     | ArrayList: [1, 500, 100, 100, 5] | ArrayList: [1, 500, 100, 100, 5] |   |
| Passed all tests! ✓ |      |       |                                  |                                  |   |

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



Sample input and Output:

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

## SOLUTION :

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

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

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

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

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

 Collections.reverse(list);

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

```
}
}
```

## OUTPUT :

|   | Test | Input                                         | Expected                                                                                                                      | Got                                                                                                                           |   |
|---|------|-----------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|---|
| ✓ | 1    | 5<br>Red<br>Green<br>Orange<br>White<br>Black | List before reversing :<br>[Red, Green, Orange, White, Black]<br>List after reversing :<br>[Black, White, Orange, Green, Red] | List before reversing :<br>[Red, Green, Orange, White, Black]<br>List after reversing :<br>[Black, White, Orange, Green, Red] | ✓ |
| ✓ | 2    | 4<br>CSE<br>AIML<br>AIDS<br>CYBER             | List before reversing :<br>[CSE, AIML, AIDS, CYBER]<br>List after reversing :<br>[CYBER, AIDS, AIML, CSE]                     | List before reversing :<br>[CSE, AIML, AIDS, CYBER]<br>List after reversing :<br>[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<br>90<br>56<br>45<br>78<br>25<br>78 | 78 was found in the set.    | 78 was found in the set.    | ✓ |
| ✓ | 2    | 3<br>-1<br>2<br>4<br>5                | 5 was not found in the set. | 5 was not found in the set. | ✓ |

Passed all tests! ✓

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

**Sample Input and Output:**

5

Football

Hockey

Cricket

Volleyball

Basketball

7 // **HashSet 2:**

Golf

Cricket

Badminton

Football

Hockey

Volleyball

Handball

**SAMPLE OUTPUT:**

Football

Hockey

Cricket

Volleyball

Basketball

**SOLUTION :**

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

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

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

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

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

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

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

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

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

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

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

scanner.close();
}
```

**OUTPUT :**

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

Passed all tests! ✓

### Java HashMap Methods

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

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

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

`remove()` Remove an entry from the map

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

`size()` Return the number of entries in the map

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

### SOLUTION :

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

 public static void main(String[] args) {
 // Creating HashMap with default initial capacity and load factor
 HashMap<String, Integer> map = new HashMap<String, Integer>();

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

 for (int i = 0; i < n; i++) {
 name = sc.next(); num
 = sc.nextInt();
 map.put(name, num);
 }

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

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

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

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

```

anotherMap.put("SEVEN", 7);

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

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

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

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

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

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

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

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

```

## OUTPUT :

|   | Test | Input                                   | Expected                                                                                                                      | Got                                                                                                                           |   |
|---|------|-----------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------|---|
| ✓ | 1    | 3<br>ONE<br>1<br>TWO<br>2<br>THREE<br>3 | ONE : 1<br>TWO : 2<br>THREE : 3<br>-----<br>SIX : 6<br>ONE : 1<br>TWO : 2<br>SEVEN : 7<br>THREE : 3<br>2<br>true<br>true<br>4 | ONE : 1<br>TWO : 2<br>THREE : 3<br>-----<br>SIX : 6<br>ONE : 1<br>TWO : 2<br>SEVEN : 7<br>THREE : 3<br>2<br>true<br>true<br>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: 000010000000000000000000100000000000100000000001000000000001
```

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 :**

Passed all tests! ✓

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.

```
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<br>b c | 8      |

```
import java.util.HashSet; import
java.util.Set; public class
CommonAlphabetSum {
 public static int singleDigitSum(int num) {
 int sum = 0;
 while (num > 0) {
 sum += num % 10;
 num /= 10;
 }
 if (sum > 9) { return
 singleDigitSum(sum); }
```



```

 return sum;
}

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

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

 return singleDigitSum(sum);
}

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

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

```

**OUTPUT :**

|   | Input        | Expected | Got |   |
|---|--------------|----------|-----|---|
| ✓ | a b c<br>b c | 8        | 8   | ✓ |

Passed all tests! ✓

3.

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

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

If case\_option = 0, normal reversal of words i.e., if the original sentence is "Wipro TechNologies BangaLore", the new reversed sentence should be "orpiW seigolonhceT erolagnaB".

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

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

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

NOTE:

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

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

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

Examples:

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

For example:

| Input                              | Result                        |
|------------------------------------|-------------------------------|
| Wipro Technologies Bangalore<br>0  | orpiW seigolonhceT erolagnaB  |
| Wipro Technologies, Bangalore<br>0 | orpiW ,seigolonhceT erolagnaB |
| Wipro Technologies Bangalore<br>1  | Orpiw Seigolonhcet Erolagnab  |
| Wipro Technologies, Bangalore<br>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<br>0  | orpiW seigolonhceT erolagnaB  | orpiW seigolonhceT erolagnaB  | ✓ |
| ✓ | Wipro Technologies, Bangalore<br>0 | orpiW ,seigolonhceT erolagnaB | orpiW ,seigolonhceT erolagnaB | ✓ |
| ✓ | Wipro Technologies Bangalore<br>1  | Orpiw SeigolonhceT Erolagnab  | Orpiw SeigolonhceT Erolagnab  | ✓ |
| ✓ | Wipro Technologies, Bangalore<br>1 | Orpiw ,seigolonhceT Erolagnab | Orpiw ,seigolonhceT Erolagnab | ✓ |

Passed all tests! ✓



# **RAJALAKSHMI ENGINEERING COLLEGE**

**An AUTONOMOUS Institution  
Affiliated to ANNA UNIVERSITY, Chennai**

## **ONLINE TENDER MANAGEMENT SYSTEM**

### **A MINI PROJECT REPORT**

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**THANDALAM**

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**2024 - 2025**

## BONAFIDE CERTIFICATE

Certified that this project report “**Online Tender Management System**” is the bonafide work of “**Smurithi R (231001206), Varnika S (231001236), Varshini S (231001238)**” who carried out the project work under my supervision.

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## **ABSTRACT**

The “Online Tender Management System” is an innovative and comprehensive software solution designed to streamline and enhance the efficiency of the tendering process. This project is developed using the Java programming language and utilizes MySQL as the backend database. The system addresses the challenges faced by organizations during the traditional tendering process by digitizing and automating various stages, ensuring transparency, accuracy, and accessibility. In this system, registered organizations can publish tender notices, while registered suppliers can submit bids electronically. The system provides a user-friendly web-based interface for both organizations and suppliers to interact with the tendering process. Organizations can create, manage, and publish tender announcements, along with necessary documents and specifications. Suppliers can access these announcements, submit bids online, and track the status of their submissions. The core functionalities of the system include user authentication, tender creation, bid submission, evaluation, and awarding of contracts. User authentication ensures secure access to the system, allowing only authorized users to participate. Tender creation involves specifying detailed information about the project, requirements, submission deadlines, and relevant documents. Suppliers can then submit their bids electronically, eliminating the need for physical submissions. The evaluation process ensures fairness and transparency while assisting organizations in selecting the most suitable bid. Upon evaluation, the system facilitates the contract awarding process to the winning supplier. MySQL, a robust relational database management system, is utilized to store and manage tender-related data, including organization profiles, tender announcements, bid submissions, evaluation criteria, and contract details. The database provides a structured and organized approach to data storage, retrieval, and manipulation, contributing to the system’s overall efficiency. The “Online Tender Management System” offers numerous benefits, including reduced paperwork, increased accessibility, minimized processing time, enhanced transparency, and improved vendor management. The project demonstrates the integration of Java and MySQL to create a sophisticated yet user-friendly platform for organizations and suppliers involved in the tendering process. This project showcases the potential of technology to simplify complex processes and foster efficiency and transparency in procurement activities.

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# INTRODUCTION

## 1.1 Introduction

The Online Tender Management System (OTMS) is an advanced software platform designed to digitize and streamline the entire tendering process. Traditionally, the process of managing tenders has been paper-intensive, manual, and prone to inefficiencies such as delays, errors, and lack of transparency. OTMS addresses these challenges by providing a centralized, web-based system for creating, submitting, and evaluating tenders in a secure and automated environment. This system is developed using the Java programming language for the application logic and MySQL as the relational database management system (RDBMS) to store and manage tender-related data.

The system benefits both organizations (those issuing tenders) and suppliers (those submitting bids). Registered organizations can create, manage, and publish tender notices, while suppliers can easily access these notices, submit bids electronically, and track the status of their submissions. The OTMS improves the procurement process by reducing paperwork, minimizing human error, ensuring fairness, increasing accessibility, and improving the overall transparency of tender management. By automating key stages such as tender creation, bid submission, evaluation, and awarding contracts, the system contributes to greater efficiency, accuracy, and accountability.

This system is not only beneficial for private sector companies but also serves as a valuable tool for public sector procurement, where transparency and compliance with legal standards are crucial. It demonstrates the potential of leveraging technology to simplify complex procurement procedures and foster better vendor management practices.

## **1.2 Objectives**

The main objectives of the Online Tender Management System (OTMS) are:

1. **Digitization of the Tendering Process:** To transition from a manual, paper-based process to a fully automated, online system that simplifies and accelerates the tendering process.
2. **Streamlining Tender Creation and Management:** To provide organizations with an easy-to-use platform for creating, managing, and publishing tender notices along with all the necessary documentation and specifications.
3. **Facilitation of Electronic Bidding:** To allow suppliers to submit their bids electronically, reducing the time and cost associated with physical submissions.
4. **Ensuring Transparency and Fairness:** To implement a system that guarantees transparency in the tender evaluation process and ensures that suppliers are evaluated based on predefined, objective criteria.
5. **Secure User Authentication and Access Control:** To ensure that only authorized users (organizations and registered suppliers) can access and participate in the system, maintaining the integrity of the tendering process.
6. **Improved Vendor Management:** To enable organizations to track supplier submissions, assess bids effectively, and select the most suitable vendor based on clear and transparent evaluation procedures.
7. **Data Integrity and Management:** To leverage MySQL as the backend database for secure and efficient management of tender-related data, including user profiles, tender documents, bids, and evaluation results.
8. **Efficiency and Time Reduction:** To reduce the time spent on manual tasks and paperwork, ultimately speeding up the tendering cycle and improving operational efficiency.

## **1.3 Modules**

The Online Tender Management System (OTMS) consists of several key modules that work together to provide a complete solution for organizations and suppliers. These modules are designed to manage different aspects of the tendering process:

1. User Authentication and Registration:

- This module handles user login, registration, and management of user profiles. It ensures secure access to the system and differentiates between different types of users (e.g., organizations, suppliers, and administrators).
- Features include password management, role-based access control, and multi-level security.

2. Tender Creation and Management:

- This module allows organizations to create and manage tenders, including entering detailed project requirements, specifications, deadlines, and uploading necessary documents.
- It also provides functionality for editing, updating, and publishing tenders online.

3. Bid Submission:

- Suppliers can access published tenders, view tender details, and submit their bids electronically through this module. The module ensures that bids are submitted in the correct format and before the specified deadline.
- It also provides functionality for suppliers to track the status of their submissions, including whether their bids are under evaluation, accepted, or rejected.

4. Tender Evaluation:

- This module helps organizations evaluate the received bids based on predefined criteria, such as price, experience, technical specifications, and compliance with tender requirements.
- It includes features for scoring bids, comparing suppliers, and generating evaluation reports that guide the selection process.

5. Contract Awarding:

- After evaluating bids, the system facilitates the process of awarding the contract to the winning supplier.
- The module generates award letters, sends notifications to suppliers, and updates the system with the contract details.

This module enables administrators and organizations to generate reports for performance analysis, compliance.

## **2. SURVEY OF TECHNOLOGIES**

### **2.1 SOFTWARE DESCRIPTION**

#### **ECLIPSE**

Eclipse is written mostly in Java and its primary use is for developing Java applications. Eclipse is an integrated development environment (IDE) used in computer programming. It contains a base workspace and an extensible plug-in system for customizing the environment. It is the second most-popular IDE for Java development, and, until 2016, was the most popular. Eclipse is written mostly in Java and its primary use is for developing Java applications.

Eclipse Enterprise Edition (EE) is a package for developers who work with Java and web applications. It includes tools for:

- Java
- JavaScript
- TypeScript
- JavaServer Pages and Faces
- Tomcat server
- Apache Maven

Eclipse EE is a version of Eclipse that comes with tools to make it easier to write server code. For example, you can compile and run a server by pressing the play button.

### **2.2 LANGUAGES**

#### **2.2.1 MySQL**

MySQL is an open-source relational database management system (RDBMS). A relational

database organizes data into one or more data tables in which data may be related to each other; these relations help structure the data. SQL is a language that programmers use to create, modify and extract data from the relational database, as well as control user access to the database. In addition to relational databases and SQL, an RDBMS like MySQL works with an operating system to implement a relational database in a computer's storage system, manages users, allows for network access and facilitates testing database integrity and creation of backups.

### **2.2.2 JAVA**

Java is a set of computer software and specifications that provides a software platform for developing application software and deploying it in a cross-platform computing environment. Java is used in a wide variety of computing platforms from embedded devices and mobile phones to enterprise servers and supercomputers. Java applets, which are less common than standalone Java applications, were commonly run in secure, sandboxed environments to provide many features of native applications through in HTML pages.

### **2.2.3 HTML**

HTML, or Hypertext Markup Language, is the standard language used to create web pages. It defines the structure and content of web documents using tags and attributes to format text, embed images, create links, and build interactive elements. HTML facilitates communication between web browsers and servers, making it a crucial skill for web goal was to create a simple way to share and access documents over the Internet. Since its inception, HTML has evolved significantly, becoming the foundation of web development. When working with HTML, you use a simple code structure that includes

attributes to build the layout of a webpage.

#### **2.2.4 CSS**

CSS, which stands for Cascading Style Sheets, is a language in web development that enhances the presentation of HTML elements. By applying styles like color, layout, and spacing, CSS makes web pages visually appealing and responsive to various screen sizes.

CSS is designed to enable the separation of content and presentation, including layout

#### **2.2.5 JAVASCRIPT**

JavaScript, often abbreviated as JS, is a programming language and core technology of the Web, alongside HTML and CSS. 99% of websites use JavaScript on the client side for webpage behavior. JavaScript is a high-level, often just-in-time compiled language that conforms to the ECMAScript standard.

How the Technologies Work Together:

- **Front-End Interaction:** The user interacts with the HTML/CSS/JavaScript frontend to browse tenders, submit bids, and view their status. The interface is responsive, ensuring a consistent experience across devices, and JavaScript enhances interactivity (e.g., form validation, real-time updates).
- **Back-End Logic:** Once the user submits a form or interacts with the system, the request is sent to the Java-based back-end via Servlets. The back-end processes the request, performs business logic (such as bid evaluation or tender creation), and communicates with the MySQL database to store or retrieve relevant data.
- **Database Communication:** The JDBC technology facilitates communication between the Java back-end and the MySQL database. It allows for operations such as retrieving the list of tenders, submitting new bids, and storing evaluation results.

**Dynamic Content Rendering:** After the business logic is processed, the system uses JSP to render dynamic web pages with the results (e.g., bid status, tender details). The pages are sent back to the user through the browser

### **3. REQUIREMENTS AND ANALYSIS**

The Online Tender Management System (OTMS) requires a well-defined set of functional and non-functional specifications, along with hardware and software prerequisites, to ensure the system meets performance, security, and usability goals. This section outlines the requirements, the system architecture, data modeling (ER Diagram), and database normalization, which are key elements in the design and implementation of the system.

#### **3.1 Requirement Specification**

The requirement specification defines the essential features and functionalities that the Online Tender Management System (OTMS) must have. These requirements are categorized into functional requirements and non-functional requirements.

##### **Functional Requirements:**

1. User Authentication & Authorization:
  - The system must provide secure login functionality for users (organizations and suppliers) using credentials such as a username and password.
  - Different user roles (admin, organization, supplier) should have role-based access control (RBAC) to ensure that users can only access the features pertinent to their roles.
2. Tender Creation & Management:
  - Organizations should be able to create and manage tender notices, including uploading documents, specifying tender details (e.g., project scope, deadlines, requirements), and publishing them for suppliers to access.
3. Bid Submission:
  - Suppliers must be able to view tender details and submit their bids electronically, including uploading required documentation (e.g., bid proposals, technical specifications, financial bids).
  - The system must allow suppliers to track the status of their bids (e.g., submitted, under review, accepted, rejected).

4. Bid Evaluation:

- Organizations should be able to evaluate bids based on predefined criteria such as price, experience, quality, and compliance with tender specifications.
- The evaluation process should include scoring, comparison of bids, and the ability to generate reports to aid in decision-making.

5. Contract Awarding:

- Once a bid is evaluated, the system should facilitate awarding the contract to the winning supplier and notify all involved parties.

6. Notification System:

- The system should send email or in-system notifications to users at various stages (e.g., when a tender is published, when a bid is received, when the contract is awarded).

7. Reporting & Analytics:

- Administrators and organizations should have access to real-time reporting tools to view tender statistics, supplier performance, and bid trends.

**Non-Functional Requirements:**

1. Performance:

- The system must handle multiple users simultaneously without performance degradation, ensuring a fast and responsive user experience.

2. Scalability:

- The system must be able to scale to accommodate more users, tenders, and bids as the system grows over time.

3. Security:

- Data security must be ensured by implementing secure protocols (e.g., HTTPS), data encryption, and secure user authentication.
- Only authorized users should have access to sensitive data (e.g., bids, evaluation criteria).

4. Usability:

- The user interface should be intuitive, with clear navigation and an easy-to-use interface for both organizations and suppliers.



## 3.2 Hardware and Software Requirements

The hardware and software requirements define the technical infrastructure needed to support the Online Tender Management System (OTMS).

### Hardware Requirements:

1. Server Requirements:
  - Processor: Intel Core i5 or higher (multi-core).
  - RAM: Minimum 8 GB (16 GB recommended for better performance).
  - Storage: 500 GB HDD or SSD (depending on data volume, SSD is preferred for faster access).
  - Network: 100 Mbps internet connection (for cloud-based systems).
  - Backup Server: A secondary server for data backup and disaster recovery (optional for high availability).
2. Client Requirements (for users accessing the system):
  - Processor: Intel Core i3 or higher.
  - RAM: Minimum 4 GB.
  - Storage: 50 GB free space.
  - Network: Stable internet connection (minimum 2 Mbps).
  - Browser: Google Chrome, Mozilla Firefox, or any modern browser with JavaScript support.

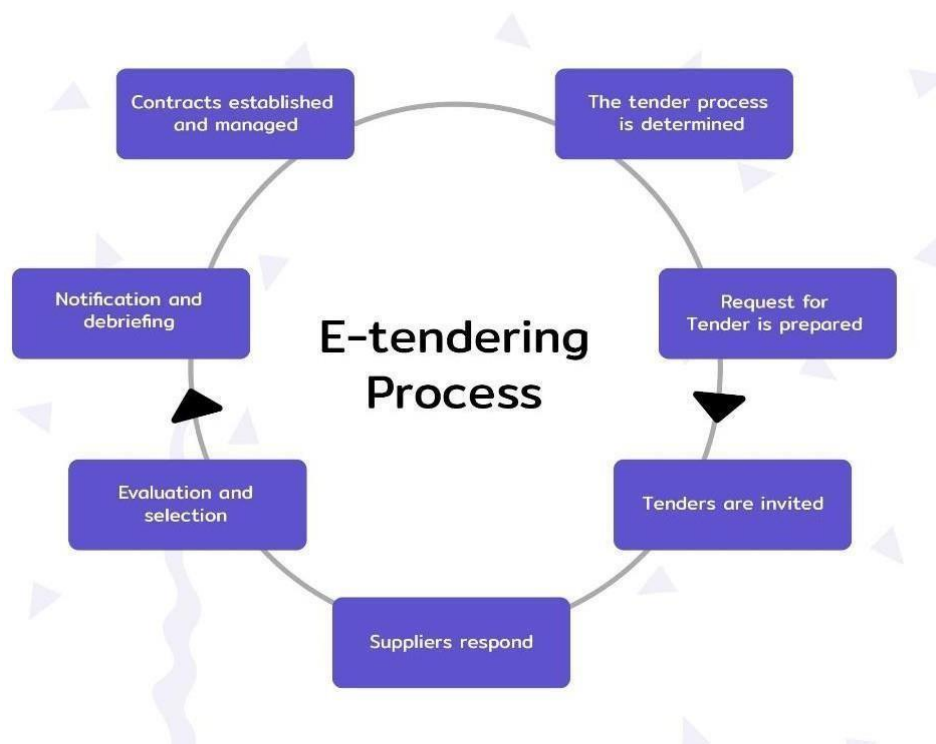
### Software Requirements:

1. Operating System:
  - Server: Linux (Ubuntu, CentOS) or Windows Server.
  - Client: Windows, macOS, or Linux (with a modern web browser).
2. Web Server:
  - Apache Tomcat or Jetty for serving Java-based web applications.
3. Programming Languages:

- Java (for backend business logic and servlets).
- JavaScript (for frontend interactivity).
- 4. Database:
  - MySQL (for storing tender data, bid submissions, evaluation records, etc.).
- 5. Frameworks & Libraries:
  - Spring Boot (for backend development).
  - Hibernate (optional, for simplifying database interaction).
  - Bootstrap (for responsive frontend design).
  - jQuery or React (optional for advanced UI features).
- 6. Development Tools:
  - IDE: IntelliJ IDEA or Eclipse (for Java development).
  - Version Control: Git (for code versioning and collaboration).
  - Build Tool: Maven or Gradle (for project dependency management).
- 7. Security Tools:
  - SSL Certificates (for secure HTTPS communication).
  - OAuth2 or JWT (for secure user authentication).
- 8. Backup Tools:
  - Backup software or cloud services for scheduled database and file backups.

### **3.3 Architecture Diagram**

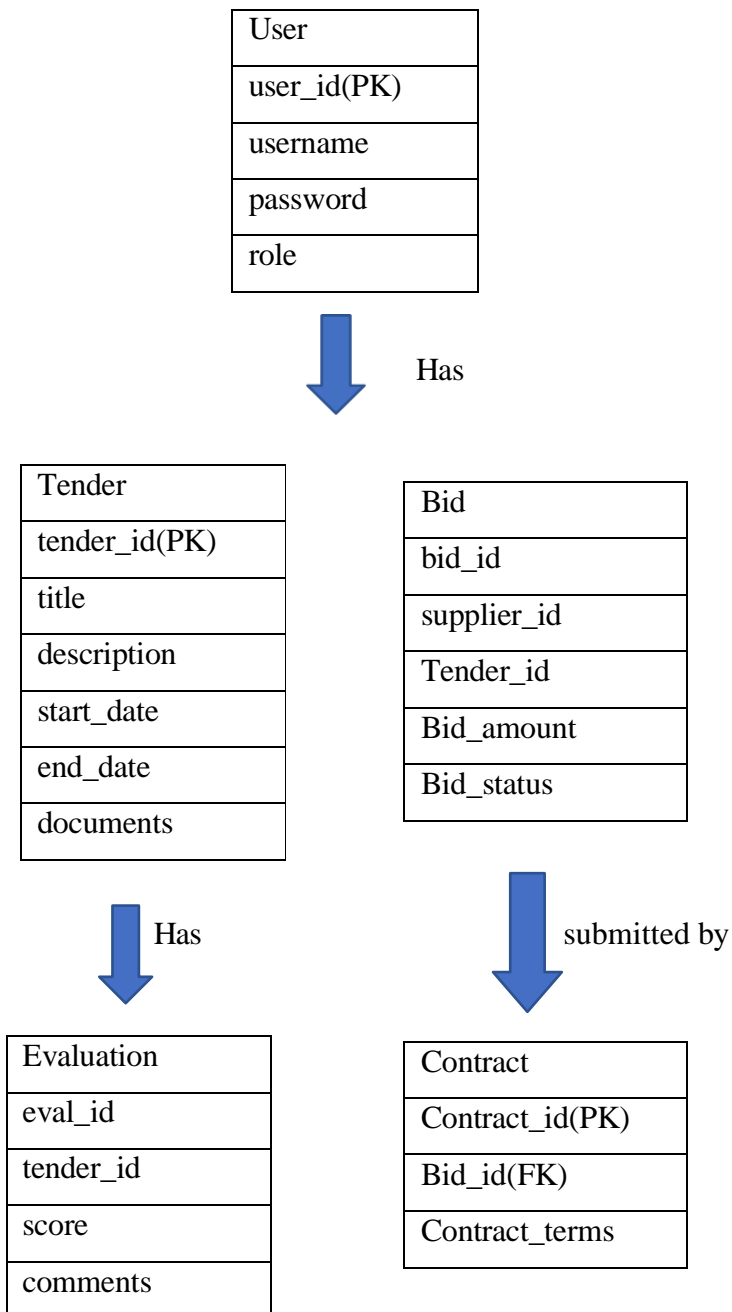
The architecture of the Online Tender Management System (OTMS) follows a 3-tier architecture, consisting of Presentation Layer, Business Logic Layer, and Data Access Layer.



- Frontend: The User Interface (UI) is the layer through which the end-users (organizations and suppliers) interact with the system. It sends requests to the back-end and displays data received from the server.
- Backend: The Application Server processes business logic, validates user inputs, and handles the communication between the UI and the database. It uses Java servlets, JSP, Spring Boot, and JDBC to interact with the MySQL database.
- Database Layer: The MySQL database stores all system data, such as user accounts, tender details, bids, and evaluations.

### 3.4 ER Diagram

The Entity-Relationship (ER) Diagram represents the data model of the Online Tender Management System (OTMS), showing the key entities, their attributes, and relationships. Below is a simplified version of the ER diagram:



- User: Represents the users of the system (organization, supplier, and admin).
- Tender: Represents the tender notices created by organizations.
- Bid: Represents the bids submitted by suppliers in response to a tender.
- Evaluation: Represents the evaluation results for each bid.
- Contract: Represents the contract awarded to the winning supplier.

## 4.PROGRAM CODE

### ADMIN HOME

```
<% @ page language="java" contentType="text/html; charset=ISO-8859-1"
pageEncoding="ISO-8859-1"%>

<% @page import="java.sql.*, com.hit.utility.DBUtil, javax.servlet.annotation.WebServlet"
errorPage="errorpage.jsp"%>

<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">

<html lang="en">

<head>

<link rel="shortcut icon" type="image/png" href="images/Banner_Hit.png">

<!--link rel="shortcut icon" type="image/ico" href="images/hit_favicon.ico"-->

<meta charset="utf-8">

<meta http-equiv="X-UA-Compatible" content="IE=edge">

<meta name="viewport" content="width=device-width, initial-scale=1.0">

<title>Tender Management System</title>

<link rel="stylesheet" href="css/bootstrap.min.css">

<link rel="stylesheet" href="css/animate.css">

<link href="css/font-awesome.min.css" type="text/css" rel="stylesheet">

<link href="css/SpryTabbedPanels.css" type="text/css" rel="stylesheet">

<!--link rel="stylesheet" href="css/styles.css"-->
```

```

<link href="css/bootstrap-dropdownhover.min.css">

<link rel="stylesheet" href="css/style2.css">

</head>

<body>

 <%

 String user = (String)session.getAttribute("user");

 String uname = (String)session.getAttribute("username");

 String pword = (String)session.getAttribute("password");

 if(!user.equalsIgnoreCase("admin") || uname.equals("") || pword.equals("")){

 response.sendRedirect("loginFailed.jsp");

 }

 %>

 <!-- Including the header of the page -->

 <jsp:include page="header.jsp"></jsp:include>

 <jsp:include page="adminMenu.jsp"></jsp:include>

 <div class="clearfix hidden-sm hidden-xs" style="color:white;background-color:
 green; margin-top:-15px; margin-bottom: 12px"><marquee>Welcome to Tender
 Management Site</marquee>

</div> <!--A green color line between header and body part-->

<div class="container-fluid">

<div class="notice">

<div class="col-md-3"style="margin-left:2%">

<% Connection con = DBUtil.provideConnection(); %>

<jsp:include page="notice.jsp"></jsp:include>


```

```

<!-- Next marquee starting-->

<jsp:include page="approved.jsp"></jsp:include>

</div> <!-- End of col-md-3-->

</div> <!-- End of notice class-->

<div class="col-md-8">

<div class="marquee" style="border:2px black hidden; background-color:white">

 <h4 style="background-color:black; margin-top:-1.8px; margin-bottom:1px;padding:
 5px; text-align: center;color:red;font-weight:bold">

 Admin Account</h4>

 <div class="marquee-content" style="align:center; padding-top:200px;min-
 height:750px;background-color:cyan">

 <h1><center>Hey Admin! Welcome to Our Tender Management
 system</center></h1>

 <h2><center>Here You can manage your vendors, add tenders and assign it to
 vendors according to their high bids</center></h2>

 <h3><center>You can also add notice,update it and delete the notice board from the
 database!</center></h3>

 </div>

<!-- Now from here the footer section starts-->

<!-- Including the footer of the page -->

<jsp:include page="footer.jsp"></jsp:include>

```

## TENDER FORM

```
<% @ page language="java" contentType="text/html; charset=ISO-8859-1"
pageEncoding="ISO-8859-1"%>

<% @page import="java.sql.*,com.hit.dao_VENDORDao,com.hit.dao_VENDORDaoImpl,
java.util.Date,com.hit.beans.TenderBean,com.hit.dao.TenderDao,com.hit.dao.TenderDaoImpl,
com.hit.utility.DBUtil, javax.servlet.annotation.WebServlet, com.hit.beans.VendorBean"
errorPage="errorpage.jsp"%>

<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">

<html lang="en">

<head>

 <link rel="shortcut icon" type="image/png" href="images/Banner_Hit.png">

 <!--link rel="shortcut icon" type="image/ico" href="images/hit_favicon.ico"-->

 <meta charset="utf-8">

 <meta http-equiv="X-UA-Compatible" content="IE=edge">

 <meta name="viewport" content="width=device-width, initial-scale=1.0">

 <title>Tender Management System</title>

 <link rel="stylesheet" href="css/bootstrap.min.css">

 <link rel="stylesheet" href="css/animate.css">

 <link href="css/font-awesome.min.css" type="text/css" rel="stylesheet">

 <link href="css/SpryTabbedPanels.css" type="text/css" rel="stylesheet">

 <!--link rel="stylesheet" href="css/styles.css"-->

 <link href="https://fonts.googleapis.com/css?family=Black+Ops+One" rel="stylesheet">
```



```

height:750px;background-color:cyan">

-->

<table style="border-radius:10px" >

<tr >

<td id="show" style="min-width:632px;min-height:0px;color:blue">Enter Bid Amount

And Deadline To Bid</td>

</tr>

</table>

<%

```

```

 String vendorId = request.getParameter("vid");

 String tenderId = request.getParameter("tid");

 TenderDao dao = new TenderDaoImpl();

 VendorDao daov = new VendorDaoImpl();

 TenderBean tender = dao.getTenderDataById(tenderId);

 VendorBean vendor = daov.getVendorDataById(vendorId);

```

```

%>

```

```

<form action="BidTenderSrv" method="post">

<table style="background-color:white">

<th colspan="2">Bid For The Tendor<input type="hidden" name="vid" value="<%=
vendorId%>"></th>

<tr><td style="color:red"> Tendor Id : </td><td><input type="hidden" name="tid"
value="<%= tender.getId()%>"><%= tender.getId()%></td></tr>

```

```

<tr><td style="color:red"> Tender Type:</td><td> <%=
tender.getType()%></td></tr>

<tr><td style="color:red"> Deadline Reqd:</td><td><%=
tender.getDeadline()%></td></tr>

<tr><td style="color:red"> Base Price :</td><td> <%=
tender.getPrice()%></td></tr>

<tr><td style="color:red"> Location :</td><td> <%=
tender.getLocation()%></td></tr>

<tr><td style="color:red"> Description: </td><td><textarea rows="2" cols="40"
readonly><%=tender.getDesc() %> </textarea></td></tr>

<tr><td style="color:red"> Bid Amount :</td><td> <input type="number"
name="bidamount" required="required" min="<%= tender.getPrice()%>"
value="<%=tender.getPrice()%>"></td></tr>

<input type="hidden" name="biddeadline" required="required" value="<%=
tender.getDeadline()%>">

<tr><td colspan="2" align="center" value="Launch"><input type="submit"
value="Bid Now" style="background-color:green;color:white;"></td></tr>

</table>

</form>

</div> <!-- End of container-fluid-->

<!-- <div class="container" style="height:300px">

uncomment this if you want to add some space in the lower part of page

</div> -->

```

```

 <!-- Now from here the footer section starts-->

 <!-- Including the footer of the page -->

 <jsp:include page="footer.jsp"></jsp:include>

</body>

<style>

 input,textarea,select{

 min-width:450px;

 font-size:16px;

 background-color:#f8f8f8;

 }

 input:hover,textarea:hover,select:hover{

 min-width:450px;

 background-color:white;

 }

 table, th, td {

 margin-bottom:10px;

 margin-left:20%;

 font-size:20px;

 border: 2px solid green;

 text-align:center;

 background-color:white;

 color:#003399;

 }

 td {

```

```

padding: 12px;

background-color:none;

}

th{

padding:12px;

background-color:#660033;

color:white;

font-weight:bold;

}

```

```
</style>
```

```
</html>
```

## LOGIN

```

<% @ page language="java" contentType="text/html; charset=ISO-8859-1"
pageEncoding="ISO-8859-1"%>

<% @page import="java.sql.*, com.hit.utility.DBUtil, javax.servlet.annotation.WebServlet"
errorPage="errorpage.jsp"%>

<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">

<html lang="en">

<head>

 <link rel="shortcut icon" type="image/png" href="images/Banner_Hit.png">

 <!--link rel="shortcut icon" type="image/ico"

```

```

 margin-bottom:10px;

 padding:20px;

 }

</style>

</head>

<body>

 <!-- Including the header of the page -->

 <jsp:include page="loginHeader.jsp"></jsp:include>

 <jsp:include page="menu.jsp"></jsp:include>

 <div class="clearfix hidden-sm hidden-xs" style="color:white;background-color:
 green; margin-top:-15px; margin-bottom: 12px"><marquee>Welcome to Tender
 Management Site</marquee>

 </div> <!--A green color line between header and body part-->

 <div class="container-fluid">

 <div class="notice">

 <div class="col-md-3" style="margin-left:2% ">

 <% Connection con = DBUtil.provideConnection(); %>

 jsp:include page="notice.jsp"></jsp:include>

 <!-- Next marquee starting-->

 <jsp:include page="approved.jsp"></jsp:include>

 </div> <!-- End of col-md-3-->

 </div> <!-- End of notice class-->

```

```
<% @ page language="java" contentType="text/html; charset=ISO-8859-1"
pageEncoding="ISO-8859-1"%>

<% @page import="java.sql.*, com.hit.utility.DBUtil, javax.servlet.annotation.WebServlet"
errorPage="errorpage.jsp"%>

<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">

<html lang="en">

<head>

 <link rel="shortcut icon" type="image/png" href="images/Banner_Hit.png">

 <!--link rel="shortcut icon" type="image/ico" href="images/hit_favicon.ico"-->

 <meta charset="utf-8">

 <meta http-equiv="X-UA-Compatible" content="IE=edge">

 <meta name="viewport" content="width=device-width, initial-scale=1.0">

 <title>Tender Management System</title>

 <link rel="stylesheet" href="css/bootstrap.min.css">

 <link rel="stylesheet" href="css/animate.css">

 <link href="css/font-awesome.min.css" type="text/css" rel="stylesheet">

 <link href="css/SpryTabbedPanels.css" type="text/css" rel="stylesheet">

 <!--link rel="stylesheet" href="css/styles.css"-->

 <link href="https://fonts.googleapis.com/css?family=Black+Ops+One" rel="stylesheet">

 <link href="css/bootstrap-dropdownhover.min.css">

 <link rel="stylesheet" href="css/style2.css">
```

```
<style>

.tab{

border-radius:10px;

border:1px black solid;

background-color: #FFE5CC;

margin-left: 25%;

width:450px;

color:green;

font-weight: bold;

font-style:normal;

text-align:center;

font-size: 20px;

margin-bottom:10px;

padding:20px;

}

</style>

</head>

<body>

<!-- Including the header of the page -->

<jsp:include page="loginHeader.jsp"></jsp:include>

<jsp:include page="menu.jsp"></jsp:include>

<div class="clearfix hidden-sm hidden-xs" style="color:white;background-color:
```

Management Site</marquee>

</div>

<div class="container-fluid">

<div class="notice">

<div class="col-md-3" style="margin-left:2%">

<% Connection con = DBUtil.provideConnection(); %>

<jsp:include page="notice.jsp"></jsp:include><br>

<jsp:include page="approved.jsp"></jsp:include><br>

</div>

</div>

<%-- <jsp:include page="login.jsp"></jsp:include> --%>

<div class="col-md-8">

<div class="marquee" style="border:2px black hidden; background-color:white">

<h4 style="background-color:black; margin-top:-1.8px; margin-top:1px;padding:5px; text-align: center;color:red;font-weight:bold">

&nbsp; <span id="pagetitle">Vendor Registration</span></h4><!-- pagetitle id is given here -->

<div class="marquee-content" style="align:center; padding-top:5px;min-height:750px;background-color:cyan">

<table class="tab hd " style="color:blue;margin-bottom:50px;background-color:white; ">



```

Vendor Name: <input type="text" name="vname" required="required">

Email Id : <input type="email" name="vemail"

required="required">

Mobile No. : <input type="phone" name="vmob"

required="required">

Address: <input type="text" name="vaddr"

required="required">

Company : <input type="text" name="cname"

required="required">

Password: <input type="password" name="vpass"

required="required">

<input type="submit" value="Register" name="user">

</form>

</td>

</tr>

</table>

</div>

</div> <!-- End of container-fluid-->

<!-- Now from here the footer section starts-->

<!-- Including the footer of the page -->

<jsp:include page="footer.jsp"></jsp:include>

</body>

</html>

```

## VIEW PROFILE

```
<% @ page language="java" contentType="text/html; charset=ISO-8859-1"
 pageEncoding="ISO-8859-1"%>

<% @page import="java.sql.*, com.hit.utility.DBUtil, javax.servlet.annotation.WebServlet,
com.hit.beans.VendorBean" errorPage="errorpage.jsp"%>

<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">

<html lang="en">

<head>

 <link rel="shortcut icon" type="image/png" href="images/Banner_Hit.png">

 <!--link rel="shortcut icon" type="image/ico" href="images/hit_favicon.ico"-->

 <meta charset="utf-8">

 <meta http-equiv="X-UA-Compatible" content="IE=edge">

 <meta name="viewport" content="width=device-width, initial-scale=1.0">

 <title>Tender Management System</title>

 <link rel="stylesheet" href="css/bootstrap.min.css">

 <link rel="stylesheet" href="css/animate.css">

 <link href="css/font-awesome.min.css" type="text/css" rel="stylesheet">

 <link href="css/SpryTabbedPanels.css" type="text/css" rel="stylesheet">

 <!--link rel="stylesheet" href="css/styles.css"-->

 <link href="https://fonts.googleapis.com/css?family=Black+Ops+One" rel="stylesheet">

</head>

<body>
```

```

<%

String user = (String)session.getAttribute("user");

String uname = (String)session.getAttribute("username");

String pword = (String)session.getAttribute("password");

if(!user.equalsIgnoreCase("user") || uname.equals("") || pword.equals("")){

 response.sendRedirect("loginFailed.jsp");

}

```

```

%>

```

```

<jsp:include page="header.jsp"></jsp:include>

```

```

<jsp:include page="vendorMenu.jsp"></jsp:include>

```

```

<div class="clearfix hidden-sm hidden-xs" style="color:white;background-color:
green; margin-top:-15px; margin-bottom: 12px"><marquee>Welcome to Tender
Management Site</marquee>

```

```

</div> <!--A green color line between header and body part-->

```

```

<div class="container-fluid">

```

```

<div class="notice">

```

```

<div class="col-md-3" style="margin-left:2%">

```

```

 <% Connection con = DBUtil.provideConnection(); %>

```

```

 <jsp:include page="notice.jsp"></jsp:include>


```

```

 <jsp:include page="approved.jsp"></jsp:include>


```

```

<!-- Now from here the footer section starts-->

<!-- Including the footer of the page -->

<jsp:include page="footer.jsp"></jsp:include>

</body>

<style>

 input,textarea,select{

 min-width:450px;

 font-size:16px;

 background-color:#f8f8f8;

 }

 input:hover,textarea:hover,select:hover{

 min-width:450px;

 background-color:white;

 }

 table, th, td {

 margin-bottom:10px;

 margin-left:20%;

 font-size:20px;

 border: 2px solid green;

 background-color:white;

 color:#003399;

 }

```

```

 td {

 padding: 12px;

 background-color:none;

 }

 th{

 padding:12px;

 background-color:#660033;

 color:white;

 font-weight:bold;

 }

 </style>

</html>

```

## **VIEW TENDER**

```

<% @ page language="java" contentType="text/html; charset=ISO-8859-1"
pageEncoding="ISO-8859-1"%>

<% @page

import="java.sql.*,java.lang.Integer,java.lang.String,
com.hit.beans.TenderBean,com.hit.utility.DBUtil,java.util.List,com.hit.dao.TenderDaoImpl,c
om.hit.dao.TenderDao, javax.servlet.annotation.WebServlet"

errorPage="errorpage.jsp"%>

<!DOCTYPE html PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/loose.dtd">

<html lang="en">

```

```

<link rel="shortcut icon" type="image/png" href="images/Banner_Hit.png">

<!--link rel="shortcut icon" type="image/ico" href="images/hit_favicon.ico"-->

<meta charset="utf-8">

<meta http-equiv="X-UA-Compatible" content="IE=edge">

<meta name="viewport" content="width=device-width, initial-scale=1.0">

<title>Tender Management System</title>

<link rel="stylesheet" href="css/bootstrap.min.css">

<link rel="stylesheet" href="css/animate.css">

<link href="css/font-awesome.min.css" type="text/css" rel="stylesheet">

<link href="css/SpryTabbedPanels.css" type="text/css" rel="stylesheet">

<!--link rel="stylesheet" href="css/styles.css"-->

<link href="https://fonts.googleapis.com/css?family=Black+Ops+One"

 rel="stylesheet">

<link href="css/bootstrap-dropdownhover.min.css">

<link rel="stylesheet" href="css/style2.css">

<style>

th, tr {

 height: 50px;

 border: 2px black solid;

}

td {

 min-width: 115px;

```

```

String uname = (String) session.getAttribute("username");

String pword = (String) session.getAttribute("password");

if (!user.equalsIgnoreCase("admin") || uname.equals("") || pword.equals("")) {

 response.sendRedirect("loginFailed.jsp");

}

%>

<!-- Including the header of the page -->

<jsp:include page="header.jsp"></jsp:include>

<jsp:include page="adminMenu.jsp"></jsp:include>

<div class="clearfix hidden-sm hidden-xs"

 style="color: white; background-color: green; margin-top: -15px; margin-

 bottom: 12px">

 <marquee>Welcome to Tender Management Site</marquee>

</div>

<!--A green color line between header and body part-->

<div class="container-fluid">

<div class="notice">

<div class="col-md-3" style="margin-left: 2%">

<%

 Connection con = DBUtil.provideConnection();

 %>

 <jsp:include page="notice.jsp"></jsp:include>

 <!-- Next marquee starting-->

 <jsp:include page="approved.jsp"></jsp:include>


```

```

 </div>

 <!-- End of col-md-3-->

</div>

<!-- End of notice class-->

<!-- Next part of same container-fluid in which galary or other information
will be shown-->

<div class="col-md-8">

<!-- <div class="marquee" style="border:2px black hidden;
background-color:white">

<div class="marquee-content" style="align:center; padding-top:200px;min-
height:750px;background-color:cyan">

-->

<table style="background-color: white">

<tr

 style="color: white; font-size: 18px; font-weight: bold;
 background-color: green">

 <td>Tender Id</td>

 <td>Name</td>

 <td>Type</td>

 <td>Budget</td>

 <td>Location</td>

 TenderDao dao = new TenderDaoImpl();

 List<TenderBean> tenderList = dao.getAllTenders();

```



```

 String tid = tender.getId();

 String tname = tender.getName();

 String ttype = tender.getType();

 int tprice = tender.getPrice();

 String tloc = tender.getLocation();

 java.util.Date udeadline = tender.getDeadline();

 java.sql.Date tdeadline = new
 java.sql.Date(udeadline.getTime());

 String tdesc = tender.getDesc();

 %>

<tr>

<td><a

href="viewTenderBidsForm.jsp?tid=<%=tid%>"><%=tid%></td>

 <td><%=tname%></td>

 <td><%=ttype%></td>

 <td>₹ <%=tprice%></td>

 <td><%=tloc%></td>

 <td><%=tdeadline%></td>

 <td><textarea rows="3" disabled><%=tdesc%></textarea></td>

</tr>

<!-- Including the footer of the page -->

<jsp:include page="footer.jsp"></jsp:include>

</body>

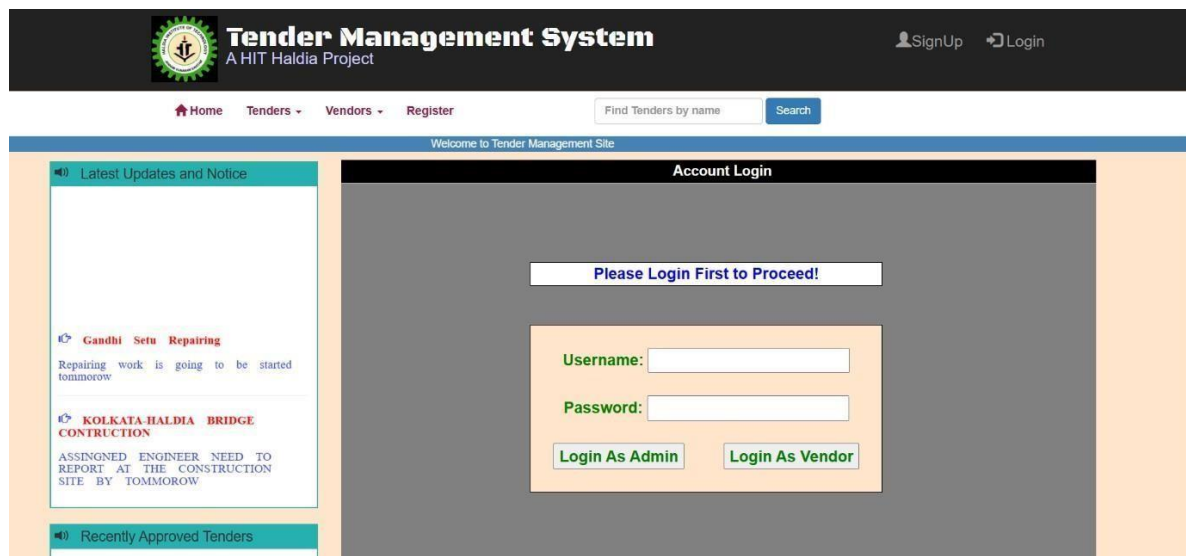
```

## 5.RESULT AND DISCUSSION


### Home Page



### Login Page



## Vendor Details


**Tender Management System**  
 A HIT Haldia Project
 Profile Logout


[Home](#)
[About Us](#)
[Tenders](#)
[Account](#)

Welcome to Tender Management Site

Tender Id	Tender Name	Type	Budget	Location	Deadline	Description	Status	Action
T20190725022124	Gandhi Setu Highway	maintenance	50000	Patna, Bihar	2019-07-19	lkjhgf	Assigned	Expired
T20190725022416	MEGA CITY CONNECTING ROAD CONSTRUCTION	construction	100000	Delhi	2019-09-14	mega city road construction	Assigned	Expired
T20190725022601	KOKATA HALDIA BRIDGE CONSTRUCTION	construction	5000000	KOLATA-HALDIA	2019-07-28	bridge construction from kolikata to haldia	Assigned	Expired
T20190725101239	Game Development	software	150000	Banglore, India	2019-07-19	We are going to start a project on game development using GPS specification.	Not Assigned	BID NOW
T20190725101322	Game Development	software	150000	Banglore, India	2019-07-19	We are going to start a project on game development using GPS specification.	Assigned	Expired

Our Amazing Team Members

## Vendor History


**Tender Management System**  
 A HIT Haldia Project
 Profile Logout

[Home](#)
[About Us](#)
[Tenders](#)
[Account](#)

Welcome to Tender Management Site

**Latest Updates and Notice**  
 SITE BY TOMMOROW

Tender Name	Type	Budget	Location	Deadline	Description
Gandhi Setu Highway	maintenance	₹ 50000	Patna, Bihar	2019-07-19	lkjhgf
MEGA CITY CONNECTING ROAD CONSTRUCTION	construction	₹ 100000	Delhi	2019-09-14	mega city road construction
KOKATA HALDIA BRIDGE CONSTRUCTION	construction	₹ 5000000	KOLATA-HALDIA	2019-07-28	bridge construction from kolikata to haldia
Game Development	software	₹ 150000	Banglore, India	2019-07-19	We are going to start a project on game development using GPS specification. Interested
Game Development	software	₹ 150000	Banglore, India	2019-07-19	We are going to start a project on game development using GPS specification. Interested

Recently Approved Tenders

# RESULT

## **1.User Features:**

Registration & Login: Successfully implemented with email confirmation upon registration, ensuring secure access for tender participants.

Tender Browsing: Users could easily view, search, and filter available tenders, allowing efficient navigation and selection.

Bid Submission: Bid submission functionality worked smoothly, with real-time validation of bid requirements and notifications for successful submissions.

## **2.Admin Functionality:**

Tender Management: Admins could effectively create, update, or remove tenders, including setting tender details, requirements, and submission deadlines.

User Management: Admins could monitor user registrations, authorize participant accounts, and address user queries efficiently.

## **3. Email Notifications:**

Successfully sent automated emails for registration, tender openings, bid submission confirmations, bid status updates, and tender award notifications.

## **4. Performance & Security:**

The platform was responsive and performed well under standard testing conditions, though it would require integration with a secure document handling system and enhanced security features for sensitive data in a live environment.

# DISCUSSIONS

## 1. User Experience:

Strengths: The user interface was intuitive and easy to navigate. Features like tender browsing, filtering, and bid tracking made the tender process straightforward and accessible for users.

## 2. Email Integration:

Strengths: The email notification system was effective, ensuring users stayed informed on key tender updates, submission deadlines, and bid status.

Areas for Improvement: Exploring a more robust email service could help manage larger volumes and improve delivery speeds, especially important for time-sensitive notifications.

## 3. Admin Efficiency:

Strengths: The admin panel was well-designed for tender and bid management, enabling efficient organization and monitoring of submissions.

## 4. Security Concerns:

Discussion: Given that tender management involves sensitive information, implementing secure document handling, encryption for bid data, and two-factor authentication (2FA) for user accounts would be essential for production use. Integration of secure digital signatures for bid submissions could further enhance data integrity.

## 5. Performance:

Observation: The platform's performance was satisfactory, managing concurrent user access effectively. However, stress testing should be performed to verify scalability and response times under high submission volumes and peak usage.

## **6. CONCLUSION**

The development of this tender management system has successfully demonstrated the essential functionalities required for a streamlined and effective tendering process. The project provides a solid foundation by implementing features that cater to both users and administrators, ensuring efficient operation and management of tenders.

From a user perspective, the system offers a straightforward and engaging experience. The registration and login system functions seamlessly, allowing new users to join securely with confirmation via automated email notifications. The bid submission and tracking features further enhance user satisfaction, providing participants with real-time updates and transparency throughout the bidding process—key factors for building trust and encouraging participation.

From an administrative standpoint, the platform provides a comprehensive interface for managing tenders and bids. The admin dashboard simplifies tasks like creating new tenders, reviewing bids, and managing submission deadlines, allowing administrators to operate the platform efficiently and maintain organized records.

The email integration feature significantly enhances the overall user experience. By automating critical notifications, the system minimizes manual tasks and keeps users informed about tender openings, submission deadlines, and bid status updates. This functionality also strengthens user engagement and retention, as it ensures timely communication throughout the tendering process.

In summary, this tender management system meets its objectives by providing a user-friendly, functional, and efficient solution for managing tenders and bids. With further enhancements in security, analytics, and performance, the platform can become a comprehensive solution for a wide range of tendering needs.

## 7. REFERENCES

### **Web Development Resources:**

W3Schools: Useful for learning and implementing HTML, CSS, and JavaScript fundamentals used in the front-end development of tender management systems. Available at:

<https://www.w3schools.com>

### **Java and Backend Development:**

Oracle Java Documentation: Comprehensive resource for understanding Java programming and Java Standard Edition (JDK 8+), often used in backend development for handling tender submissions and user management. Available at: <https://docs.oracle.com/javase>

### **Database Management:**

MySQL Documentation: Detailed explanations and best practices for creating and managing relational databases, essential for storing tender data and user information securely. Available at: <https://dev.mysql.com/doc>

### **Project Management and Development Tools:**

GitHub: For version control and project collaboration, allowing teams to track changes and manage code effectively. Documentation available at: <https://docs.github.com>

## **RESEARCH PAPERS:**

Database Management Systems for Tender Platforms: A Survey: Provides insights into the structure and management of databases for platforms handling tenders.

A Survey on Tender Management Systems: Design, Issues, and Challenges: Discusses the architectural considerations and key challenges of developing tender management systems. Available on Google Scholar.