VISVESVARAYA TECHNOLOGICAL UNIVERSITY

"JnanaSangama", Belgaum -590014, Karnataka.

LAB REPORT
on

Object Oriented Java Programming
(22CS3PCOOJ)

Submitted by

ARVIND ASHOK (1BM21CS032)

in partial fulfillment for the award of the degree of
BACHELOR OF ENGINEERING
in
COMPUTER SCIENCE AND ENGINEERING

B.M.S. COLLEGE OF ENGINEERING
(Autonomous Institution under VTU)
BENGALURU-560019

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B. M. S. College of Engineering,

Bull Temple Road, Bangalore 560019

(Affiliated To Visvesvaraya Technological University, Belgaum)

Department of Computer Science and Engineering

CERTIFICATE

This is to certify that the Lab work entitled “Object Oriented Java Programming (22CS3PCOOJ)” carried out by **Arvind Ashok (1BM21CS032),** who is a bonafide student of **B. M. S. College of Engineering.** It is in partial fulfillment for the award of **Bachelor of Engineering in Computer Science and Engineering** of the Visvesvaraya Technological University, Belgaum during the year 2022. The Lab report has been approved as it satisfies the academic requirements in respect of an Object Oriented Java Programming (22CS3PCOOJ) work prescribed for the said degree.

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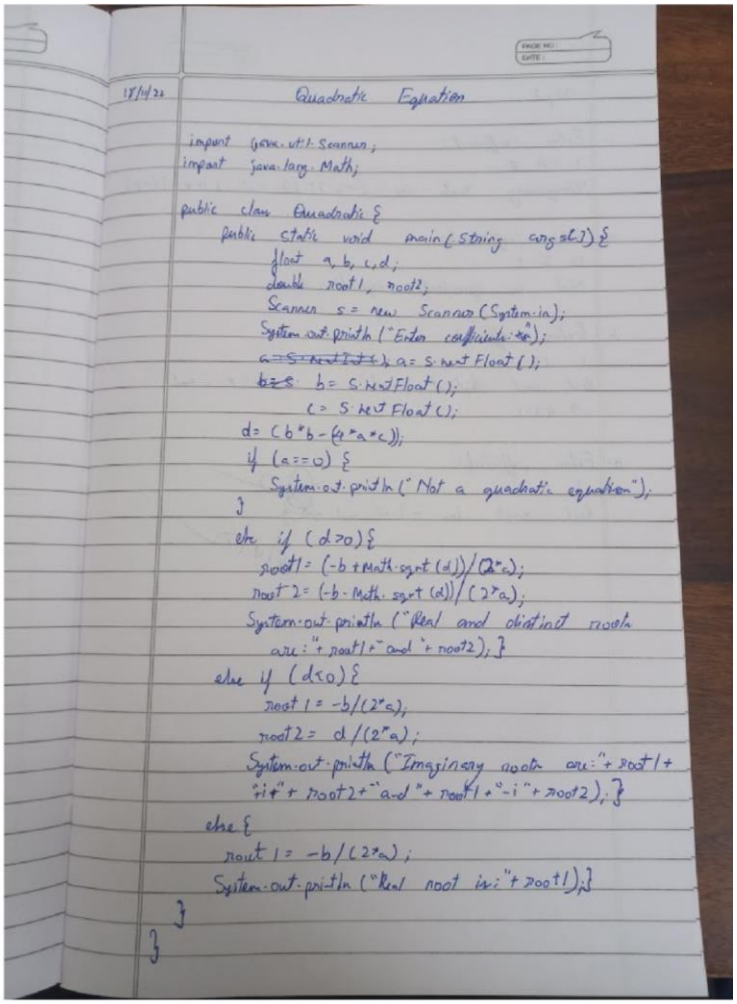
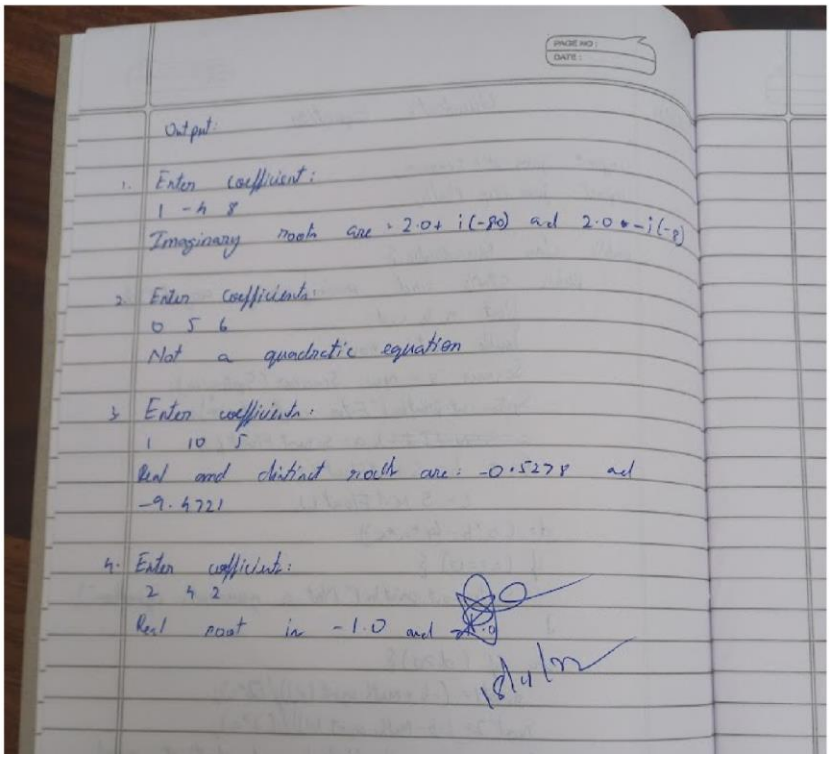
1. Develop a Java program that prints all real solutions to the quadratic equation $ax^2+bx+c = 0$. Read in a, b, c and use the quadratic formula. If the discriminant b^2-4ac is negative, display a message stating that there are no real solutions.

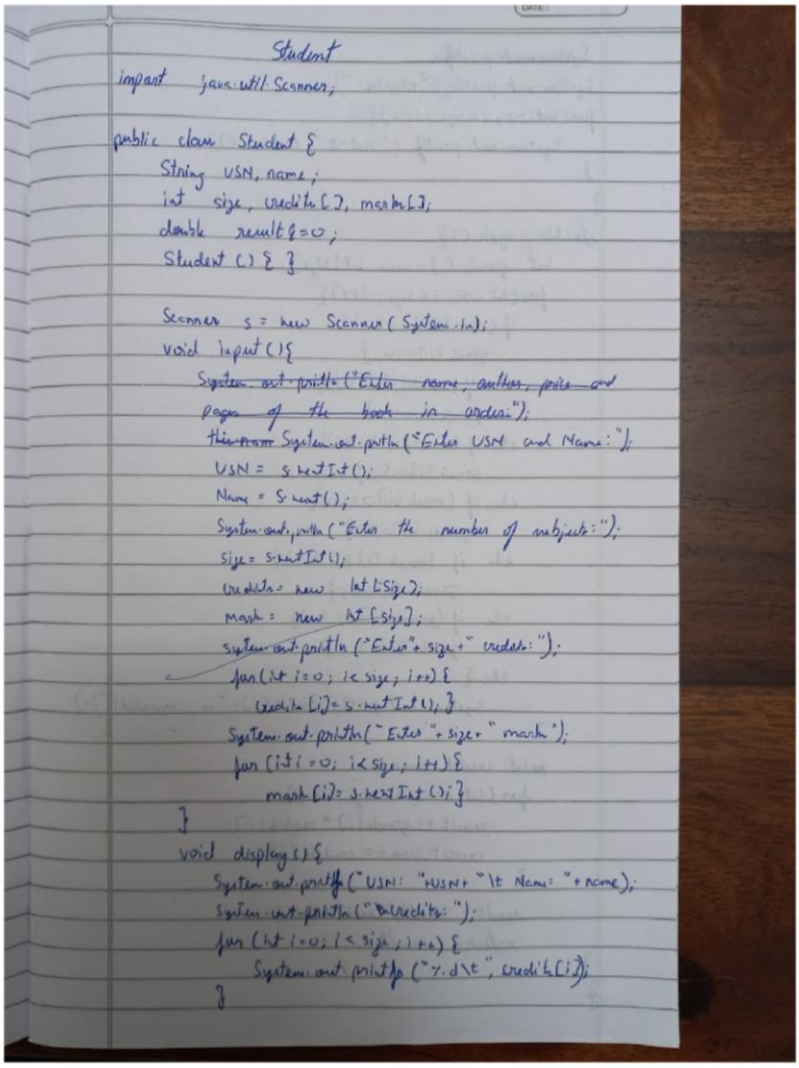


```
18/11/21                Quadratic Equation

import java.util.Scanner;
import java.lang.Math;

public class Quadratic {
    public static void main(String args[]) {
        float a, b, c, d;
        double root1, root2;
        Scanner s = new Scanner(System.in);
        System.out.println("Enter coefficients:");
        a = s.nextFloat();
        b = s.nextFloat();
        c = s.nextFloat();
        d = (b*b - (4*a*c));
        if (a==0) {
            System.out.println("Not a quadratic equation");
        }
        else if (d>0) {
            root1 = (-b + Math.sqrt(d))/(2*a);
            root2 = (-b - Math.sqrt(d))/(2*a);
            System.out.println("Real and distinct roots
            are:" + root1 + " and " + root2); }
        else if (d<0) {
            root1 = -b/(2*a);
            root2 = d/(2*a);
            System.out.println("Imaginary roots are:" + root1 +
            "i+" + root2 + "a-d " + root1 + "-i " + root2); }
        else {
            root1 = -b/(2*a);
            System.out.println("Real root is:" + root1); }
    }
}
```

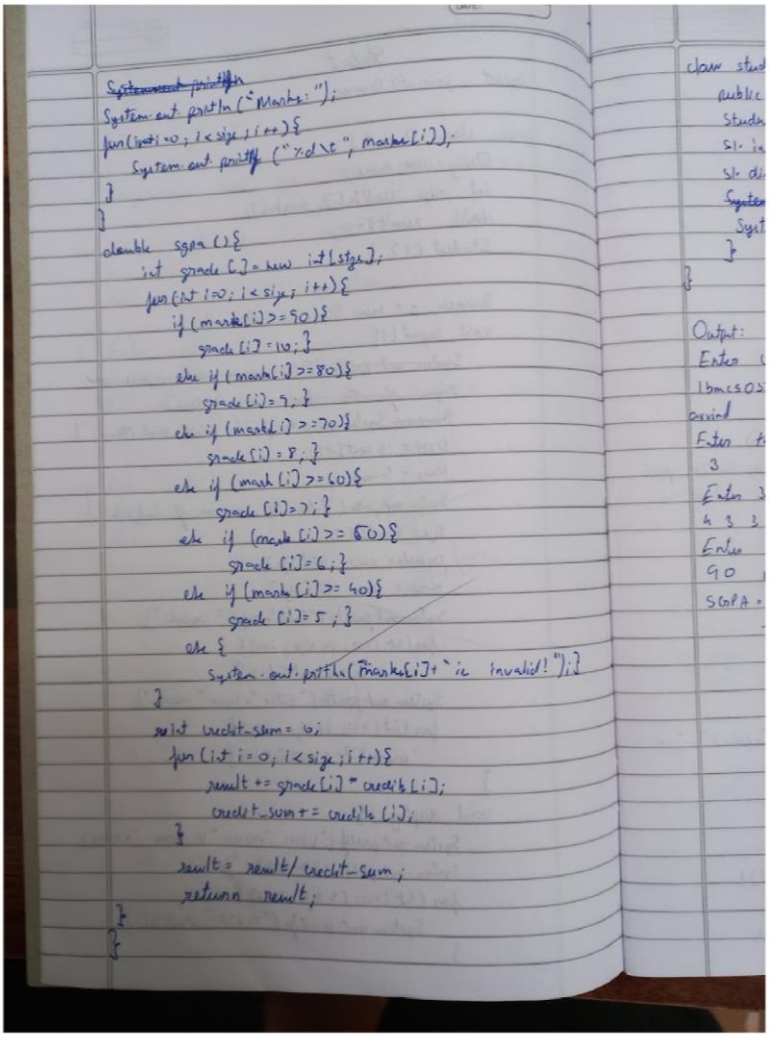



```
C:\Users\bmsce\Desktop\1BM21CS032\OOJ>java Quadratic
Enter coefficients:
1 -4 8
Imaginary roots and distinct are:2.0+i-8.0 and 2.0-i-8.0

C:\Users\bmsce\Desktop\1BM21CS032\OOJ>java Quadratic
Enter coefficients:
0 5 6
Not a quadratic equation

C:\Users\bmsce\Desktop\1BM21CS032\OOJ>java Quadratic
Enter coefficients:
1 10 5
Real and distinct roots are:-0.5278640450004204 and -9.47213595499958

C:\Users\bmsce\Desktop\1BM21CS032\OOJ>java Quadratic
Enter coefficients:
2 4 2
Real roots are:-1.0and-1.0
```

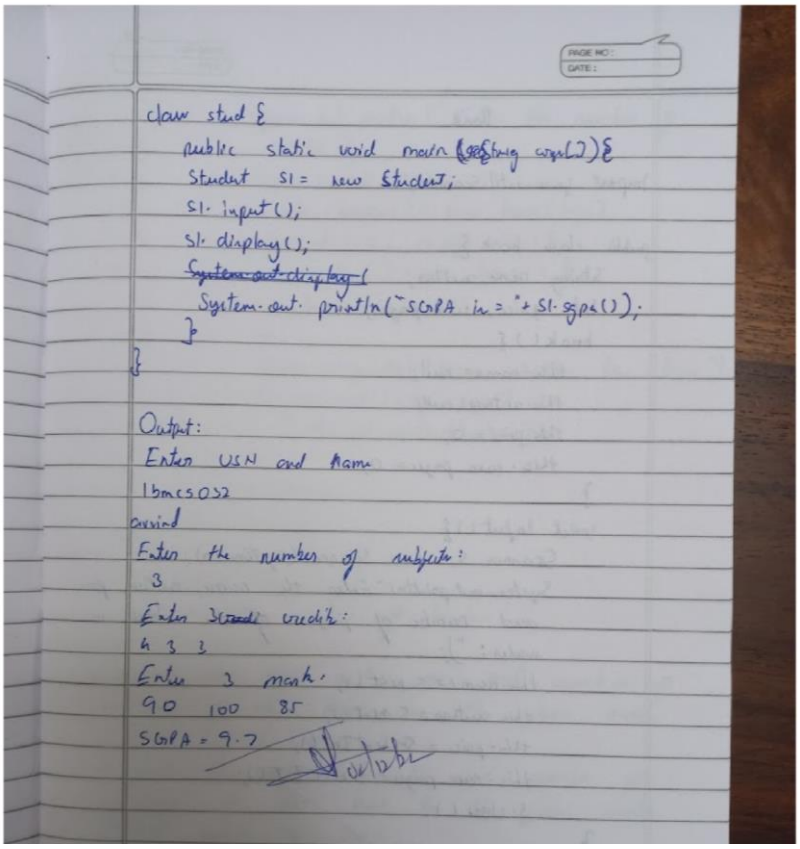
2. Develop a Java program to create a class Student with members USN, name, an array credits and an array marks. Include methods to accept and display details and a method to calculate SGPA of a student.



```
Student
import java.util.Scanner;

public class Student {
    String USN, name;
    int size, credits[], marks[];
    double result[]=0;
    Student () { }

    Scanner s = new Scanner ( System.in);
    void input (){
        System.out.println("Enter name, author, price and
        Page of the book in order:");
        this.name System.out.println("Enter USN and Name:");
        USN = s.nextInt();
        Name = s.next();
        System.out.println("Enter the number of subjects:");
        size = s.nextInt();
        credits = new int[size];
        mark = new int[size];
        System.out.println("Enter"+ size+" credits:");
        for(int i=0; i<size; i++) {
            credits[i]= s.nextInt(); }
        System.out.println("Enter "+ size+" mark");
        for (int i=0; i<size; i++) {
            mark[i]= s.nextInt(); }
    }
    void display(){
        System.out.printf("USN: "+USN+"\t Name: "+name);
        System.out.println("\nCredits:");
        for (int i=0; i<size; i++) {
            System.out.printf("%d\t", credits[i]);
        }
```



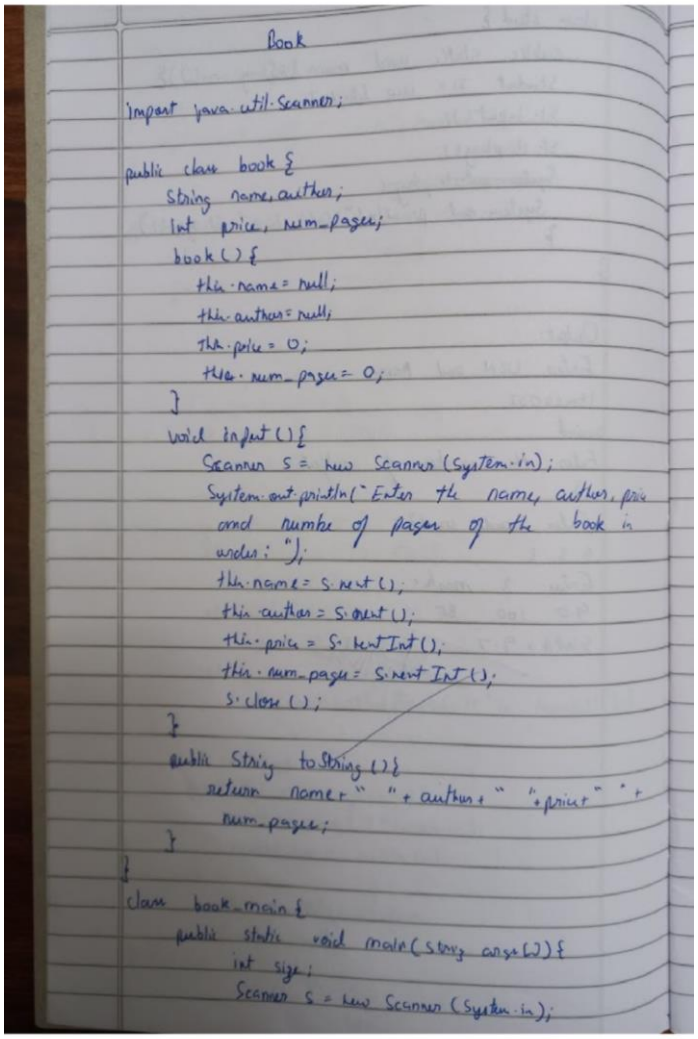
```
System.out.println("Marks:");
for(int i=0; i<size; i++){
    System.out.printf("%d\t", marks[i]);
}
}
double sgpa(){
    int grade[] = new int[size];
    for(int i=0; i<size; i++){
        if(marks[i]>=90){
            grade[i]=10;}
        else if(marks[i]>=80){
            grade[i]=9;}
        else if(marks[i]>=70){
            grade[i]=8;}
        else if(marks[i]>=60){
            grade[i]=7;}
        else if(marks[i]>=50){
            grade[i]=6;}
        else if(marks[i]>=40){
            grade[i]=5;}
        else{
            System.out.printf("Marks[i]+" is invalid!");}
    }
    int credit_sum=0;
    for(int i=0; i<size; i++){
        result += grade[i]*credit[i];
        credit_sum+=credit[i];
    }
    result = result/credit_sum;
    return result;
}
}
```



```
class stud {
    public static void main (String args[]){
    Student S1 = new Student;
    S1. input();
    S1. display();
    System.out.println("SGPA is = "+ S1.sgpa());
    }
}

Output:
Enter USN and Name
1bmcs032
arvind
Enter the number of subjects:
3
Enter 3 credits:
4 3 3
Enter 3 mark.
90 100 85
SGPA = 9.7
```

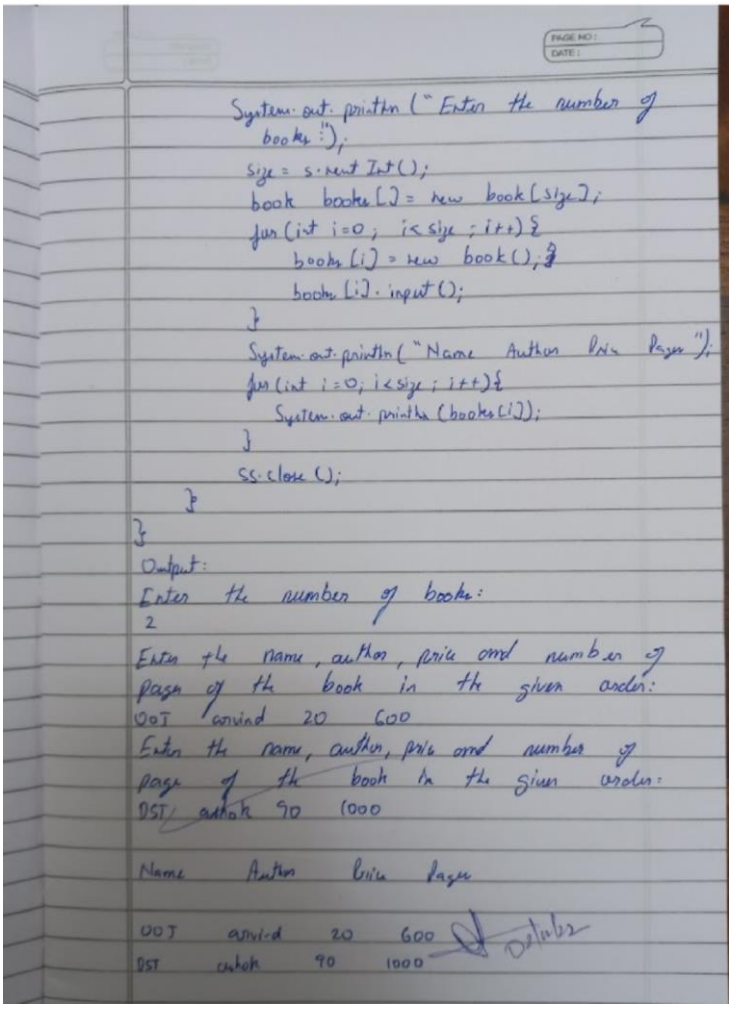
```
C:\Users\bmsce\Desktop\1BM21CS032\OOJ>javac student.java

C:\Users\bmsce\Desktop\1BM21CS032\OOJ>java stud
Enter USN and name
1bmcs032
arvind
Enter the number of subjects:
3
Enter 3 credits:
4 3 3
Enter 3 marks
90 100 85
USN: 1bmcs032    Name: arvind
Credits: 4       3        3
Marks: 90        100      85
SGPA = 9.7
C:\Users\bmsce\Desktop\1BM21CS032\OOJ>
```

3. Create a class Book which contains four members: name, author, price, num_pages. Include a constructor to set the values for the members. Include methods to set and get the details of the objects. Include a toString( ) method that could display the complete details of the book. Develop a Java program to create n book objects.



```
Book

import java.util.Scanner;

public class book {
    String name, author;
    int price, num_pages;
    book() {
        this.name = null;
        this.author = null;
        this.price = 0;
        this.num_pages = 0;
    }
    void input() {
        Scanner s = new Scanner(System.in);
        System.out.println("Enter the name, author, price
        and number of pages of the book in
        order: ");
        this.name = s.next();
        this.author = s.next();
        this.price = s.nextInt();
        this.num_page = s.nextInt();
        s.close();
    }
    public String toString() {
        return name+" "+author+" "+price+" "+
        num_pages;
    }
}
class book_main {
    public static void main(String args[]) {
        int size;
        Scanner s = new Scanner(System.in);
```

OBJ



```
System.out.println("Enter the number of books:");
size = s.nextInt();
book books[] = new book[size];
for(int i=0; i<size; i++){
    books[i] = new book();
    books[i].input();
}
System.out.println("Name Author Price Pages");
for(int i=0; i<size; i++){
    System.out.println(books[i]);
}
ss.close();
}
}
```

Output:

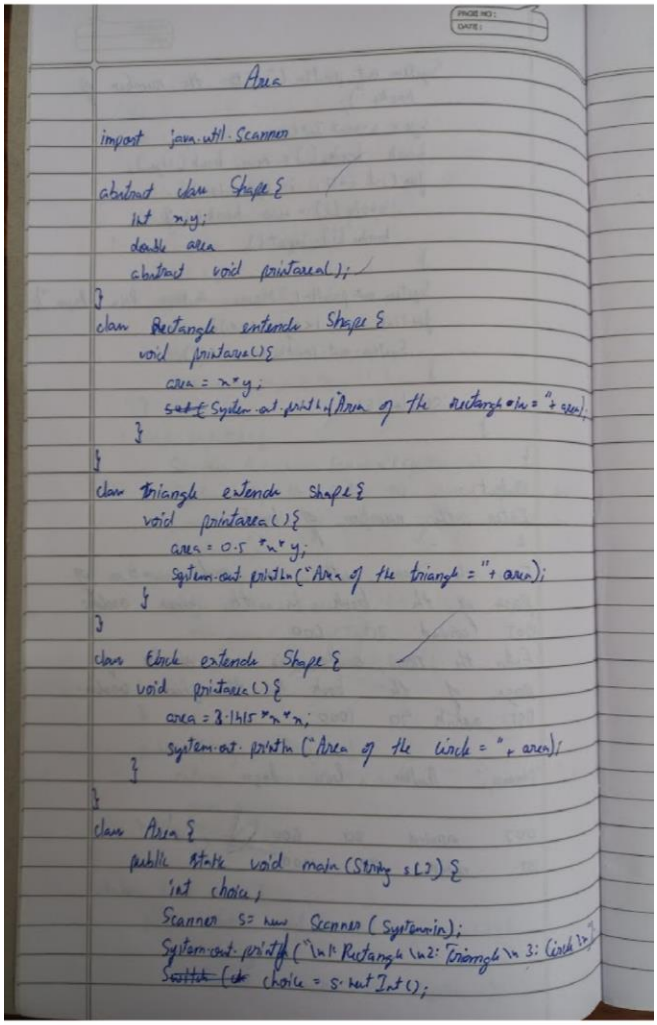
Enter the number of books:
2
Enter the name, author, price and number of pages of the book in the given order:
OOJ arvind 20 600
Enter the name, author, price and number of pages of the book in the given order:
DST ashok 90 1000

Name Author Price Pages

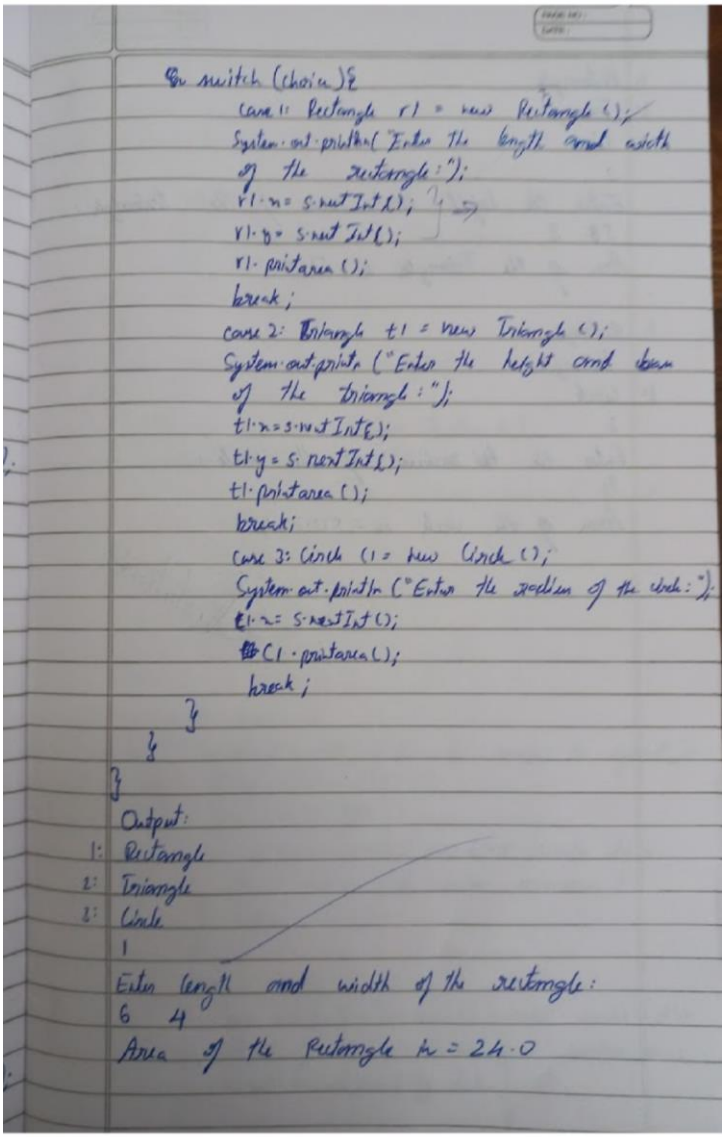
OOJ arvind 20 600
DST ashok 90 1000

```
C:\Users\bmsce\Desktop\1BM21CS032\OOJ>javac book.java

C:\Users\bmsce\Desktop\1BM21CS032\OOJ>java book_main
Enter the number of books:
2
Enter the name, author, price and number of pages of the book in the given order:
OOJ arvind 20 600
Enter the name, author, price and number of pages of the book in the given order:
DST ashok 90 1000

Name    Author    Price    Pages

OOJ     arvind     20      600
DST     ashok      90      1000

C:\Users\bmsce\Desktop\1BM21CS032\OOJ>
```

4. Develop a Java program to create an abstract class named Shape that contains two integers and an empty method named printArea( ). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contain only the method printArea( ) that prints the area of the given shape.



```
Area

import java.util.Scanner

abstract class Shape {
    int x,y;
    double area
    abstract void printarea();
}
class Rectangle extends Shape {
    void printarea(){
        area = x*y;
        System.out.println("Area of the rectangle is = " + area);
    }
}
class Triangle extends Shape {
    void printarea(){
        area = 0.5 *x*y;
        System.out.println("Area of the triangle = " + area);
    }
}
class Circle extends Shape {
    void printarea(){
        area = 3.1415 *x*x;
        System.out.println("Area of the circle = " + area);
    }
}
class Area {
    public static void main(String s[]) {
        int choice;
        Scanner s= new Scanner(System.in);
        System.out.printf("\n1: Rectangle \n2: Triangle \n3: Circle");
        choice = s.nextInt();
```



```
switch (choice){
    case 1: Rectangle r1 = new Rectangle ();
    System.out.println("Enter the length and width
    of the rectangle:");
    r1.x = S.nextInt();
    r1.y = S.nextInt();
    r1.printarea ();
    break;
    case 2: Triangle t1 = new Triangle ();
    System.out.println("Enter the height and base
    of the triangle:");
    t1.x = S.nextInt();
    t1.y = S.nextInt();
    t1.printarea ();
    break;
    case 3: Circle c1 = new Circle ();
    System.out.println("Enter the radius of the circle:");
    c1.z = S.nextInt();
    c1.printarea();
    break;
    }
  }
}
```

Output:

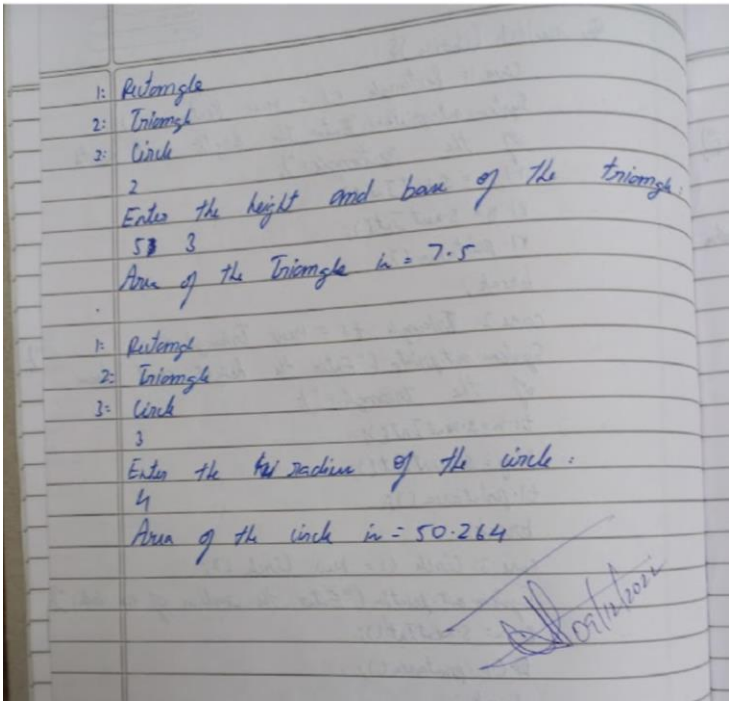
1: Rectangle
2: Triangle
3: Circle

1

Enter length and width of the rectangle:

6 4

Area of the Rectangle is = 24.0

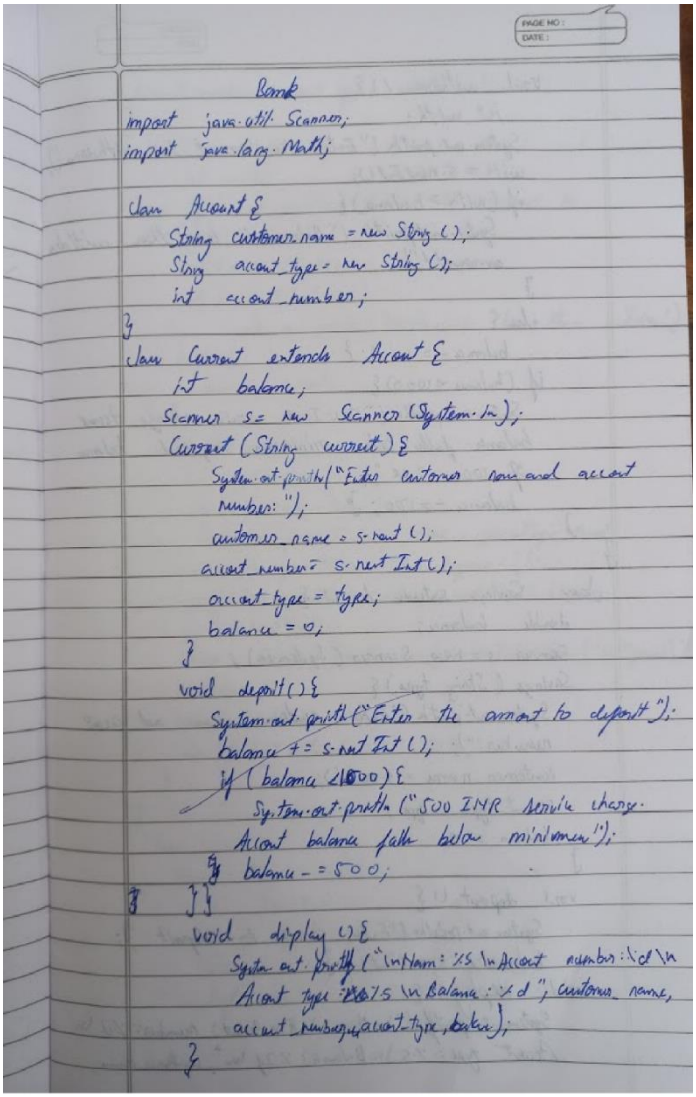



```
PS C:\Users\bmsce\Desktop\1BM21CS032\OOJ> java Area

1:Rectangle
2:Triangle
3:Circle
1
Enter the length and width of the rectangle:
6 4
Area of the Rectangle is= 24.0
```

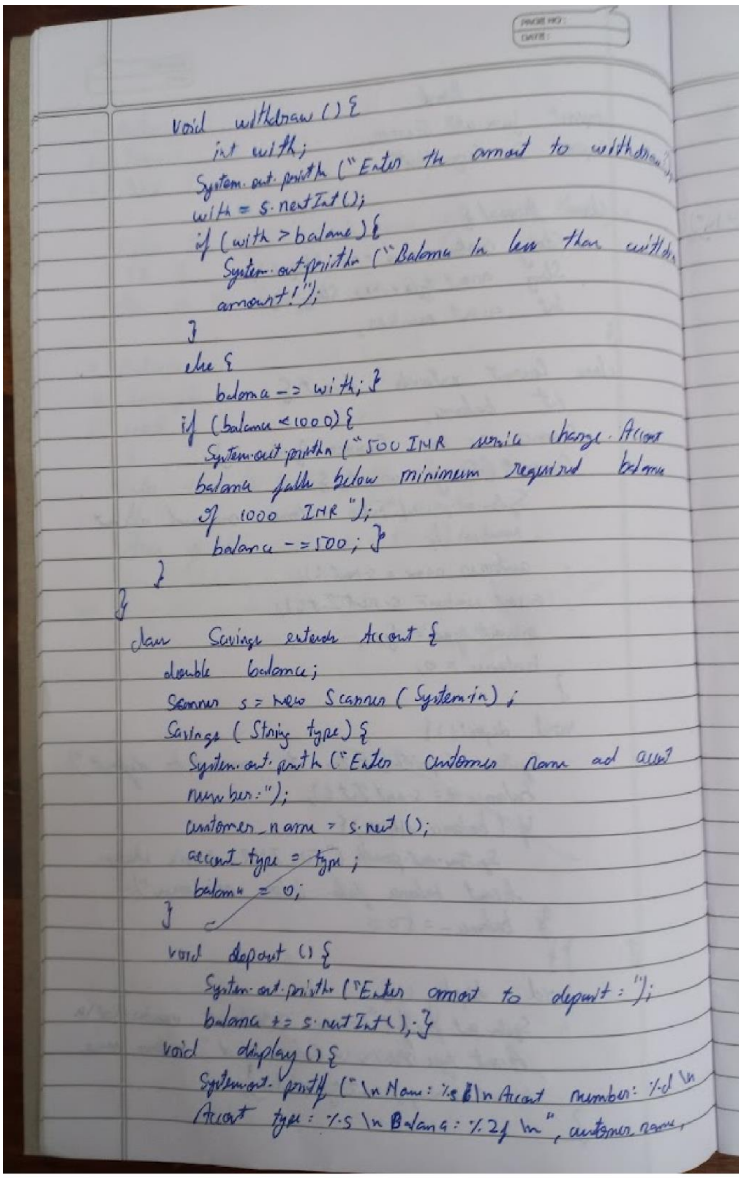
```
PS C:\Users\bmsce\Desktop\1BM21CS032\OOJ> java Area

1:Rectangle
2:Triangle
3:Circle
2
Enter the height and base of the triangle:
5 3
Area of the Triangle is= 7.5
```

```
PS C:\Users\bmsce\Desktop\1BM21CS032\OOJ> java Area

1:Rectangle
2:Triangle
3:Circle
3
Enter the radius of the Circle:
4
Area of the Circle is= 50.264
```

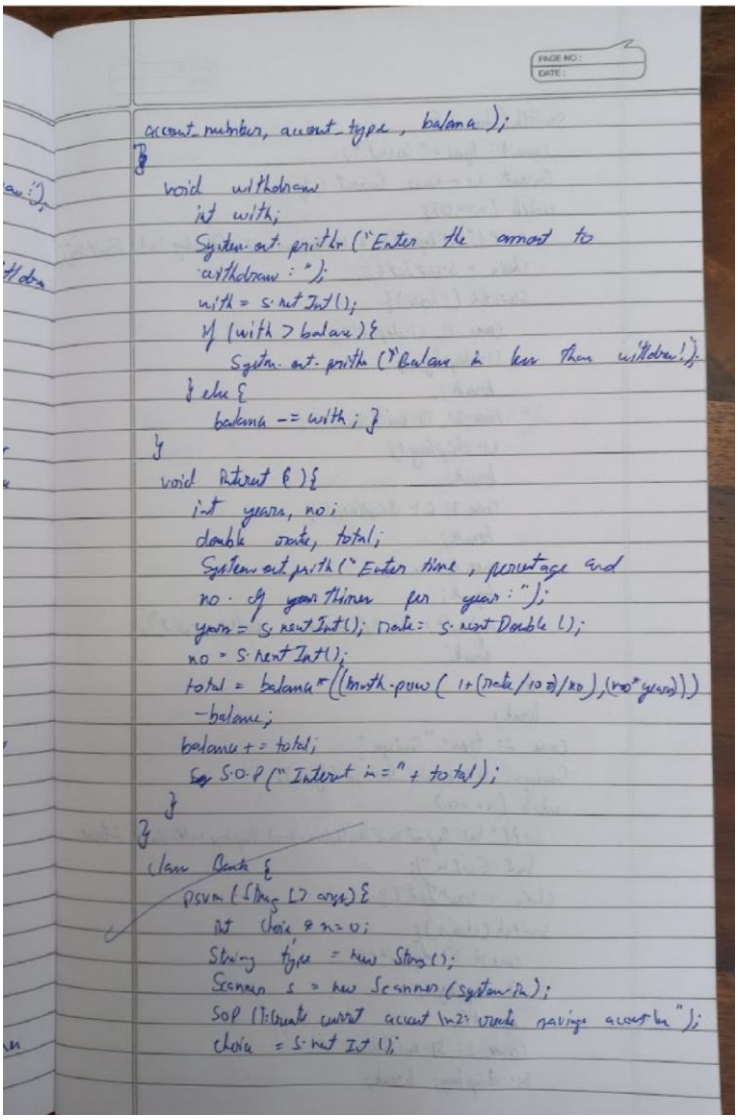
5. Develop a Java program to create a class Bank that maintains two kinds of account for its customers, one called savings account and the other current account. The savings account provides compound interest and withdrawal facilities but no cheque book facility. The current account provides cheque book facility but no interest. Current account holders should also maintain a minimum balance and if the balance falls below this level, a service charge is imposed.
   Create a class Account that stores customer name, account number and type of account. From this derive the classes Cur-acct and Sav-acct to make them more specific to their requirements. Include the necessary methods in order to achieve the following tasks:
   a) Accept deposits from customers and update the balance.
   b) Display the balance.
   c) Compute and deposit interest
   d) Permit withdrawal and update the balance
   Check for the minimum balance, impose penalty if necessary and update the Balance.



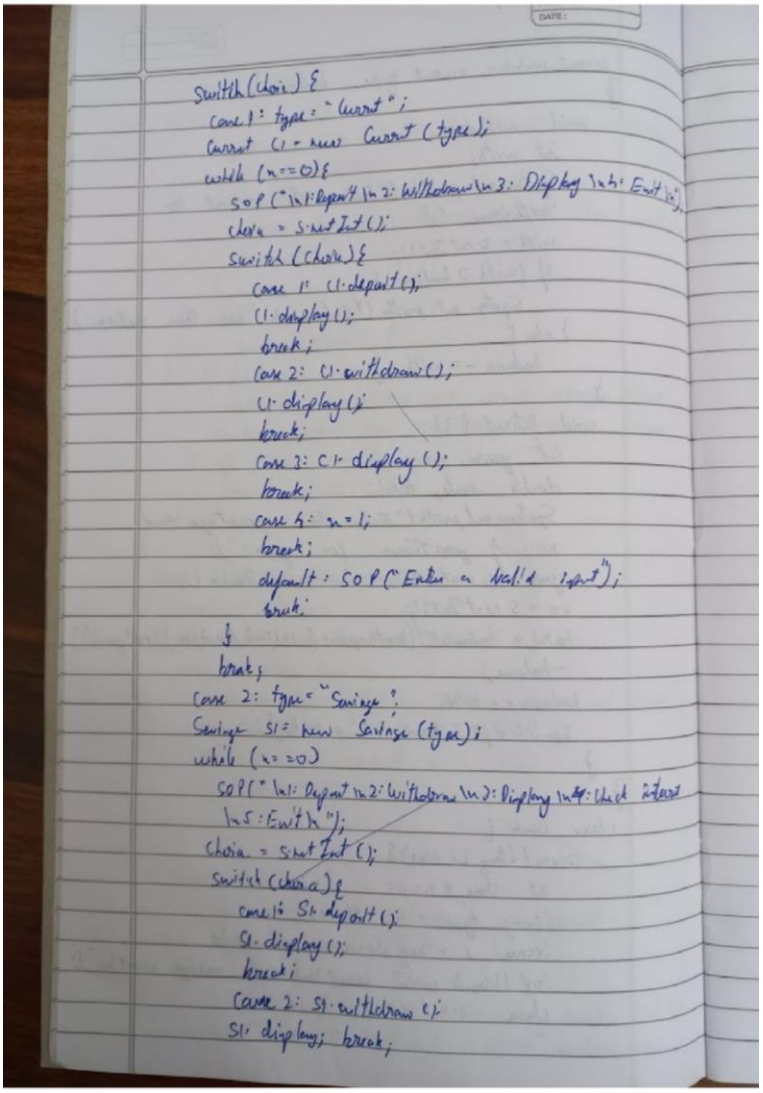
```
Bank
import java.util.Scanner;
import java.lang.Math;

class Account {
    String customer_name = new String();
    String account_type = new String();
    int account_number;
}
class Current extends Account {
    int balance;
    Scanner s = new Scanner(System.in);
    Current(String current) {
        System.out.println("Enter customer name and account
        number:");
        customer_name = s.next();
        account_number = s.nextInt();
        account_type = type;
        balance = 0;
    }
    void deposit() {
        System.out.println("Enter the amount to deposit");
        balance += s.nextInt();
        if (balance < 1000) {
            System.out.println("500 INR service charge.
            Account balance falls below minimum");
            balance -= 500;
    }}
    void display() {
        System.out.printf("\nName: %s \nAccount number: %d \n
        Acount type: %s \n Balance: %d", customer_name,
        account_number, account_type, balance);
    }
```



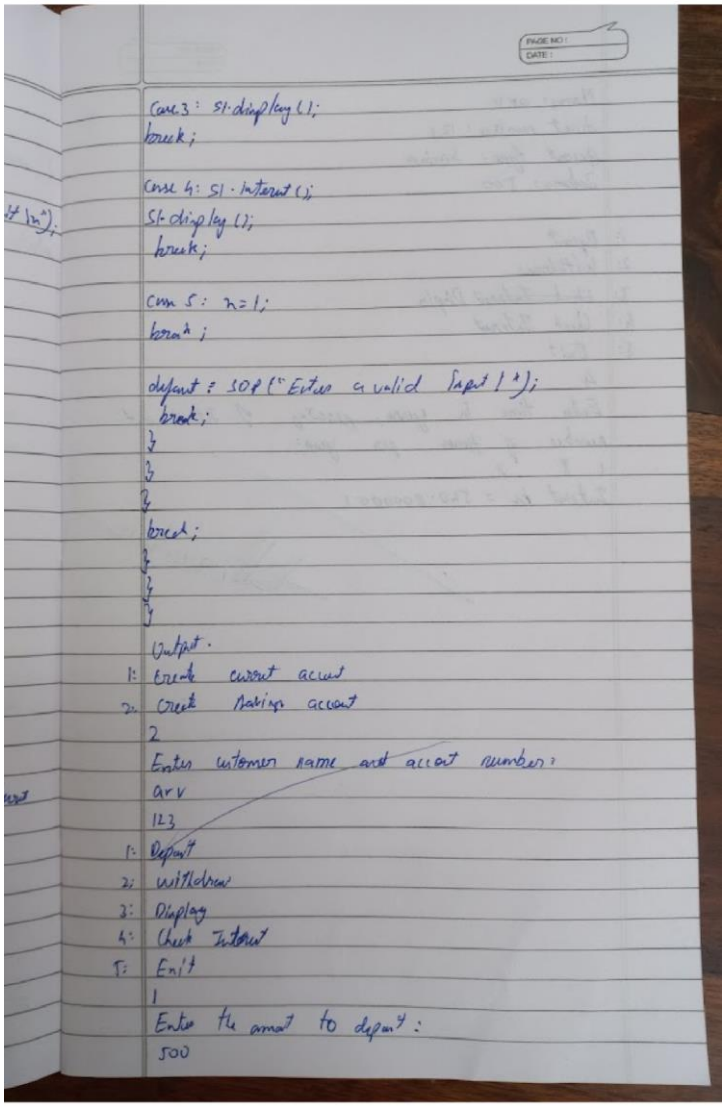
```
void withdraw () {
    int with;
    System.out.println ("Enter the amount to withdraw");
    with = s.nextInt();
    if (with > balance) {
      System.out.println ("Balance is less than withdraw
      amount!");
    }
    else {
      balance -= with; }
    if (balance < 1000) {
      System.out.println ("500 INR will charge. Account
      balance falls below minimum required balance
      of 1000 INR");
      balance -= 500; }
  }
}
class Savings extends Account {
  double balance;
  Scanner s = new Scanner (System.in);
  Savings (String type) {
    System.out.println ("Enter customer name and acct
    number:");
    customer_name = s.next ();
    account type = type;
    balance = 0;
  }
  void deposit () {
    System.out.println ("Enter amount to deposit:");
    balance += s.nextInt(); }
  void display () {
    System.out.printf ("\n Name: %s \n Account number: %d \n
    Account type: %s \n Balance: %.2f \n", customer_name,
```



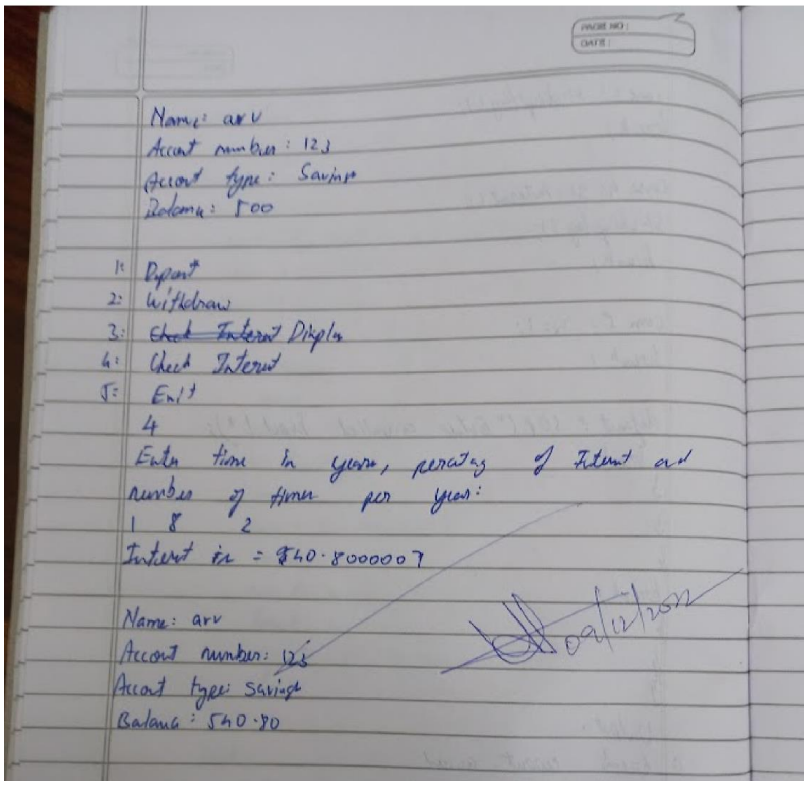
```
account_number, account_type, balance );
}
void withdraw
    int with;
    System.out.println("Enter the amount to
    withdraw : ");
    with = S.nextInt();
    if (with > balance){
        System.out.println("Balance is less than withdraw!");
    } else {
        balance -= with; }
}
void Interest (){
    int years, no;
    double rate, total;
    System.out.println("Enter time, percentage and
    no. of your times per year : ");
    years = S.nextInt(); rate = S.nextDouble();
    no = S.nextInt();
    total = balance*((Math.pow(1+(rate/100)/no),(no*years))
    -balance;
    balance += total;
    S.O.P("Interest is = " + total);
}
}
class Bank {
    psvm(String[] args){
        int choice, n=0;
        String type = new String();
        Scanner s = new Scanner(System.in);
        SOP("1:Create current account \n2: Create savings account");
        choice = S.nextInt();
```



```
switch(choice){
case 1: type = "Current";
Current C1 = new Current(type);
while(n==0){
  SOP("\n1: Deposit \n2: Withdraw \n3: Display \n4: Exit\n");
  choice = S.nextInt();
  switch(choice){
    case 1: C1.deposit();
    C1.display();
    break;
    case 2: C1.withdraw();
    C1.display();
    break;
    case 3: C1.display();
    break;
    case 4: n=1;
    break;
    default: SOP("Enter a valid input");
    break;
  }
  break;
case 2: type = "Savings";
Savings S1 = new Savings(type);
while(n==0)
  SOP("\n1: Deposit \n2: Withdraw \n3: Display \n4: Check interest
  \n5: Exit\n");
  choice = S.nextInt();
  switch(choice){
    case 1: S1.deposit();
    S1.display();
    break;
    case 2: S1.withdraw();
    S1.display; break;
```



```
case 3 : SI.display();
break;

case 4: SI.interest();
SI.display();
break;

case 5: n=1;
break;

default : SOP("Enter a valid input!");
break;
}
}
}
break;
}
}
}
Output.
1: Create current acount
2: Create Savings account
2
Enter customer name and account number:
arv
123
1: Deposit
2: Withdraw
3: Display
4: Check Interest
5: Exit
1
Enter the amount to deposit:
500
```



Name: arv
Accont number: 123
Accont type: Savings
Balance: 500

1: Deposit
2: Withdraw
3: ~~Check Interest~~ Display
4: Check Interest
5: Exit
4
Enter time in years, percentage of Interest and number of times per year:
1 8 2
Interest is = $40.8000007

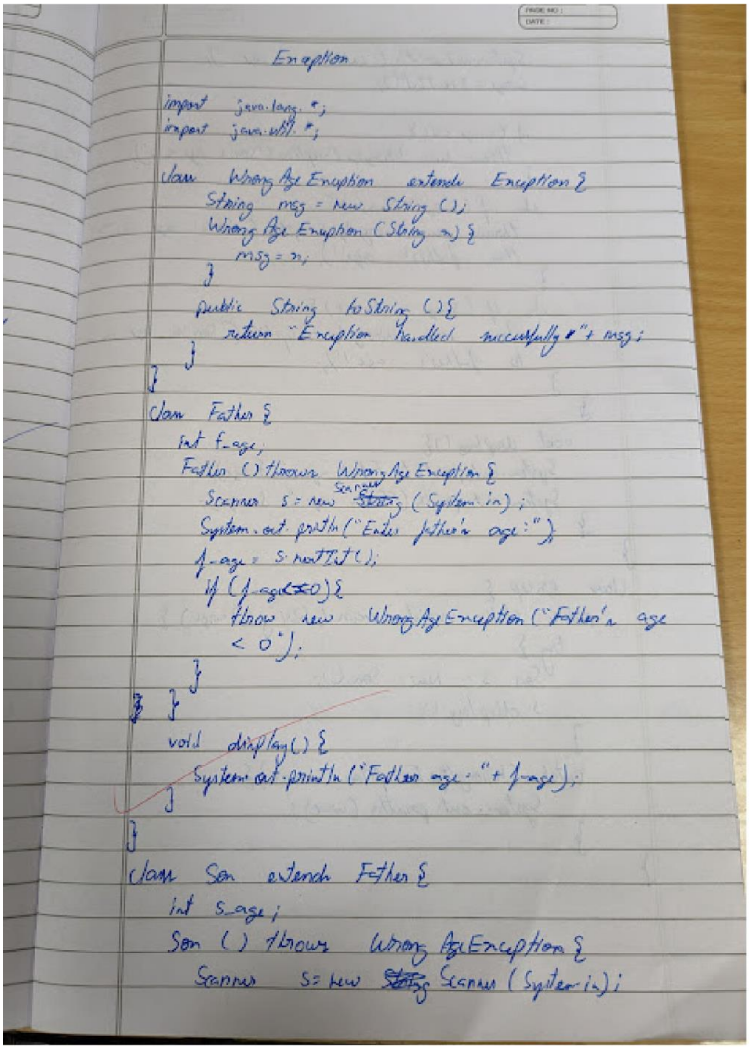
09/12/2022

Name: arv
Accont number: 123
Accont type: Savings
Balance: $40.80

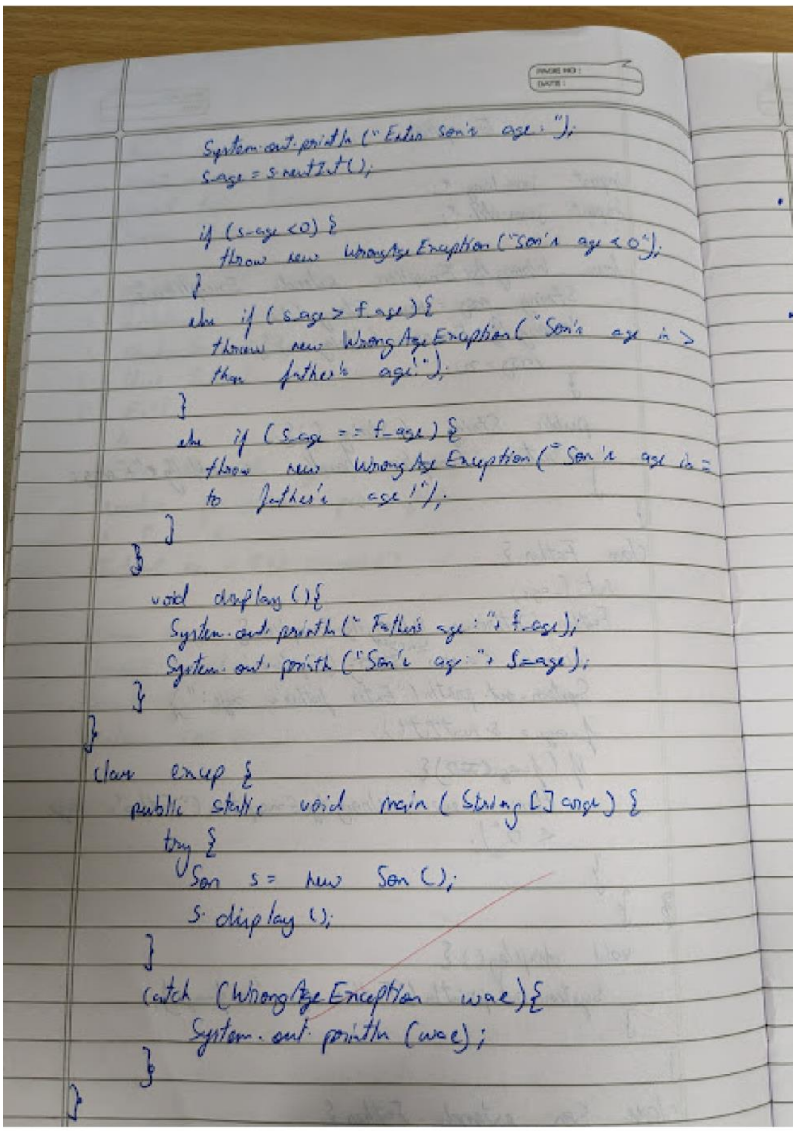
```
1:Create current account
2:Create savings account
2
Enter customer name and account number:
arv
123

1:Deposit
2:Withdraw
3:Display balance
4:Check interest
5:Exit
1
Enter the amount to deposit:
500

Name: arv
Account number: 123
Account type: Savings
Balance: 500.00

1:Deposit
2:Withdraw
3:Display balance
4:Check interest
5:Exit
4
Enter time in years, percentage of interest and number of times per year:
1 8 2
Interest is= 40.80000000000007
```

```
1
Enter the amount to deposit:
500

Name: arv
Account number: 123
Account type: Savings
Balance: 500.00

1:Deposit
2:Withdraw
3:Display balance
4:Check interest
5:Exit
4
Enter time in years, percentage of interest and number of times per year:
1 8 2
Interest is= 40.80000000000007

Name: arv
Account number: 123
Account type: Savings
Balance: 540.80
```

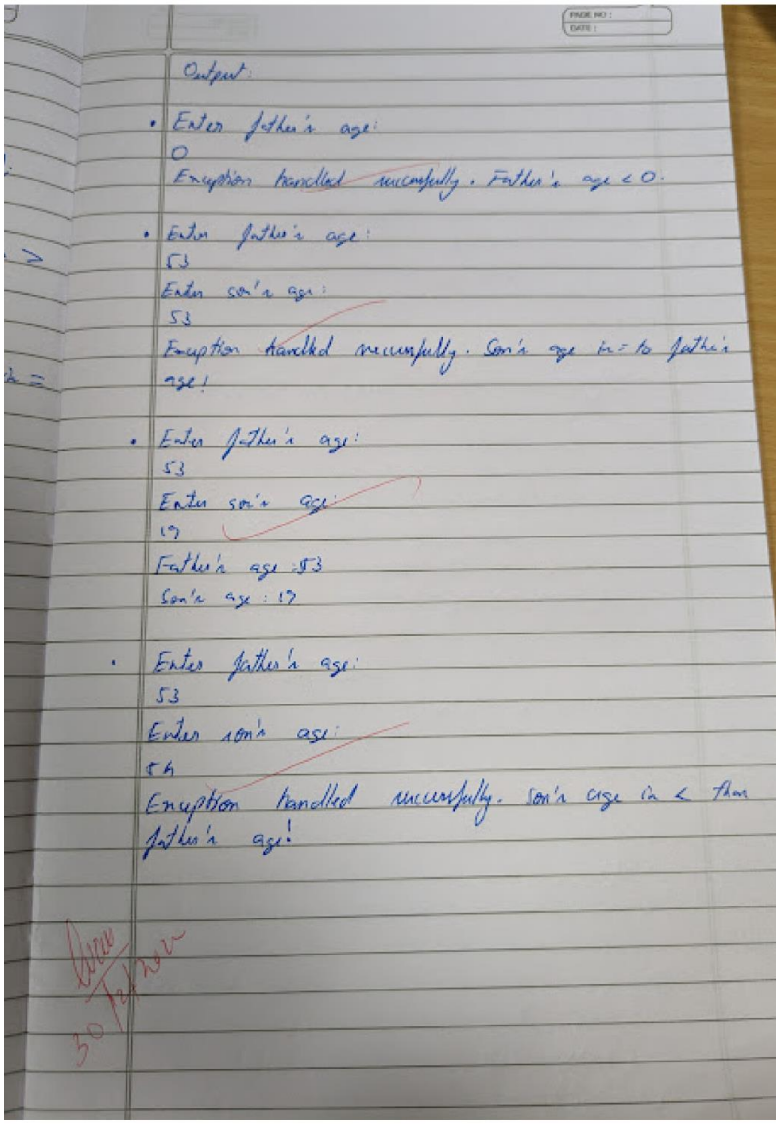
6. Write a program that demonstrates handling of exceptions in inheritance trees. Create a base class called “Father” and a derived class called “Son” which extends the base class. In Father class, implement a constructor which takes the age and throws the exception WrongAge( ) when the input age<0. In Son class, implement a constructor that causes both father and son’s age and throws an exception if son’s age is >=father’s age.



```
Exception

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

class WrongAgeException extends Exception {
    String msg = new String();
    WrongAgeException(String s) {
        msg = s;
    }
    public String toString() {
        return "Exception handled successfully" + msg;
    }
}
class Father {
    int f_age;
    Father() throws WrongAgeException {
        Scanner s = new Scanner(System.in);
        System.out.println("Enter father's age:");
        f_age = s.nextInt();
        if (f_age<0) {
            throw new WrongAgeException("Father's age
            < 0");
        }
    }
    void display() {
        System.out.println("Father age: " + f_age);
    }
}
class Son extends Father {
    int s_age;
    Son() throws WrongAgeException {
        Scanner s = new Scanner(System.in);
```



```
System.out.println("Enter son's age:");
s_age = s.nextInt();

if (s_age < 0) {
    throw new WrongAge Exception("Son's age < 0");
}
else if (s_age > f_age) {
    throw new WrongAge Exception("Son's age is >
    than father's age");
}
else if (s_age == f_age) {
    throw new WrongAge Exception("Son's age is =
    to father's age!");
}
}

void display() {
System.out.println("Father's age:" + f_age);
System.out.println("Son's age:" + s_age);
}
}

class excep {
public static void main(String[] args) {
try {
Son s = new Son();
s.display();
}
catch (WrongAge Exception wae) {
System.out.println(wae);
}
}
```



Output:

- Enter father's age:
  0
  Exception handled successfully. Father's age < 0.

- Enter father's age:
  53
  Enter son's age:
  53
  Exception handled successfully. Son's age is = to father's age!

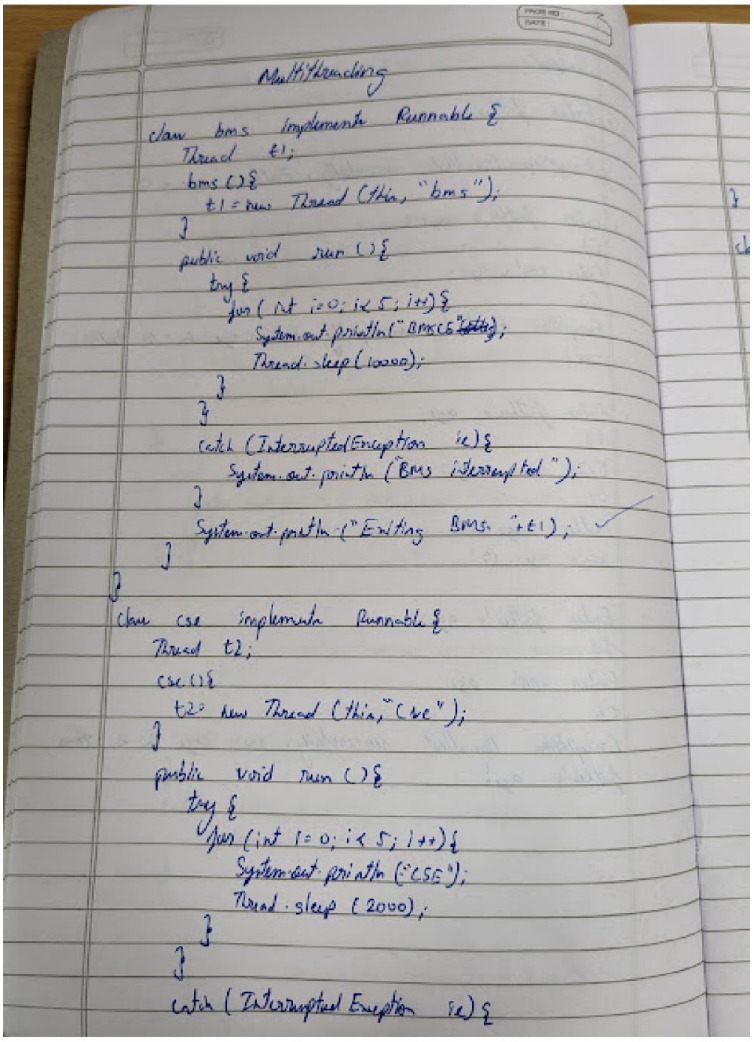
- Enter father's age:
  53
  Enter son's age:
  17
  Father's age :53
  Son's age : 17

- Enter father's age:
  53
  Enter son's age:
  54
  Exception handled successfully. Son's age is < than father's age!

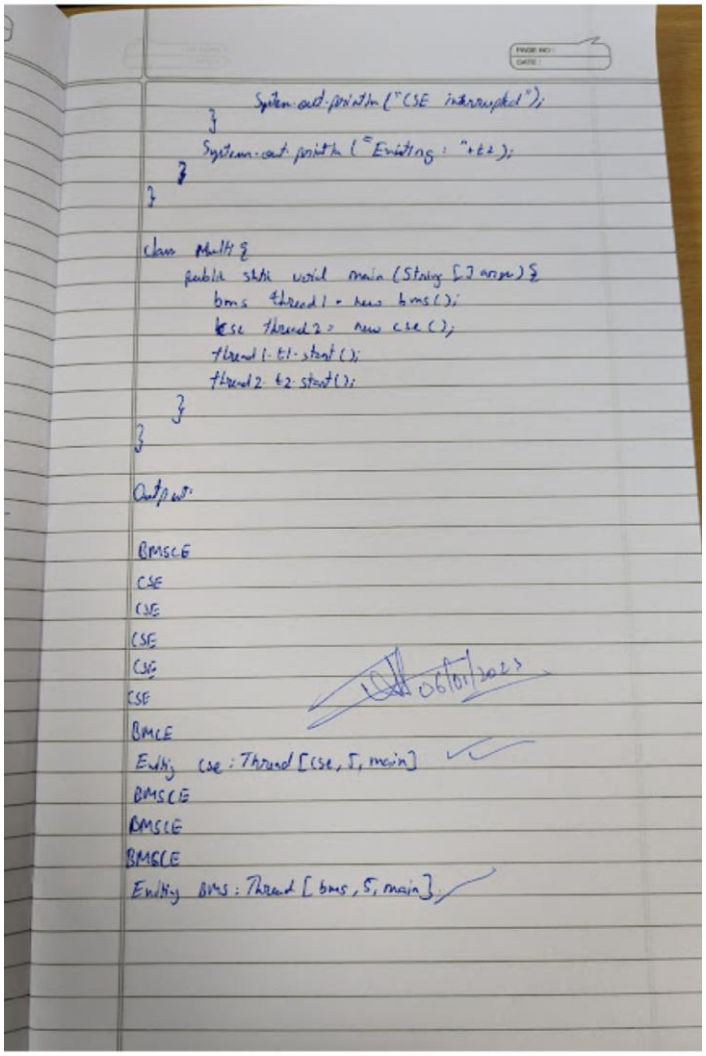
Done
30 Tak

```
PS C:\Users\bmsce\Desktop\1bm21cs032> java excep
Enter father's age:
0
Exception handled succcessfully. Father's age < 0
PS C:\Users\bmsce\Desktop\1bm21cs032> java excep
Enter father's age:
53
Enter son's age:
53
Exception handled succcessfully. Son's age is = to father's age!
PS C:\Users\bmsce\Desktop\1bm21cs032> java excep
Enter father's age:
53
Enter son's age:
19
Father's age: 53
Son's age: 19
PS C:\Users\bmsce\Desktop\1bm21cs032> java excep
Enter father's age:
53
Enter son's age:
54
Exception handled succcessfully. Son's age is > than father's age!
```

7. Write a program which creates two threads, one thread displaying “BMS College of Engineering” once every ten seconds and another displaying “CSE” once every two seconds.



```
Multithreading

class bms implements Runnable {
    Thread t1;
    bms(){
        t1 = new Thread(this, "bms");
    }
    public void run(){
        try{
            for(int i=0; i<5; i++){
                System.out.println("BMSCE");
                Thread.sleep(10000);
            }
        }
        catch(InterruptedException ie){
            System.out.println("BMS interrupted");
        }
        System.out.println("Exiting BMS. "+t1);
    }
}
class cse implements Runnable{
    Thread t2;
    cse(){
        t2= new Thread(this,"cse");
    }
    public void run(){
        try{
            for(int i=0; i<5; i++){
                System.out.println("CSE");
                Thread.sleep(2000);
            }
        }
        catch(InterruptedException ie){
```



```
System.out.println("CSE interrupted");
}
System.out.println("Exiting : "+t2);
}
}

class Multi{
    public static void main(String[] args){
        bms thread1 = new bms();
        cse thread2 = new cse();
        thread1.t1.start();
        thread2.t2.start();
    }
}

Output:

BMSCE
CSE
CSE
CSE
CSE
CSE
BMCE
Exiting cse : Thread[cse,5,main]
BMSCE
BMSCE
BMSCE
Exiting BMS: Thread[bms,5,main]
```

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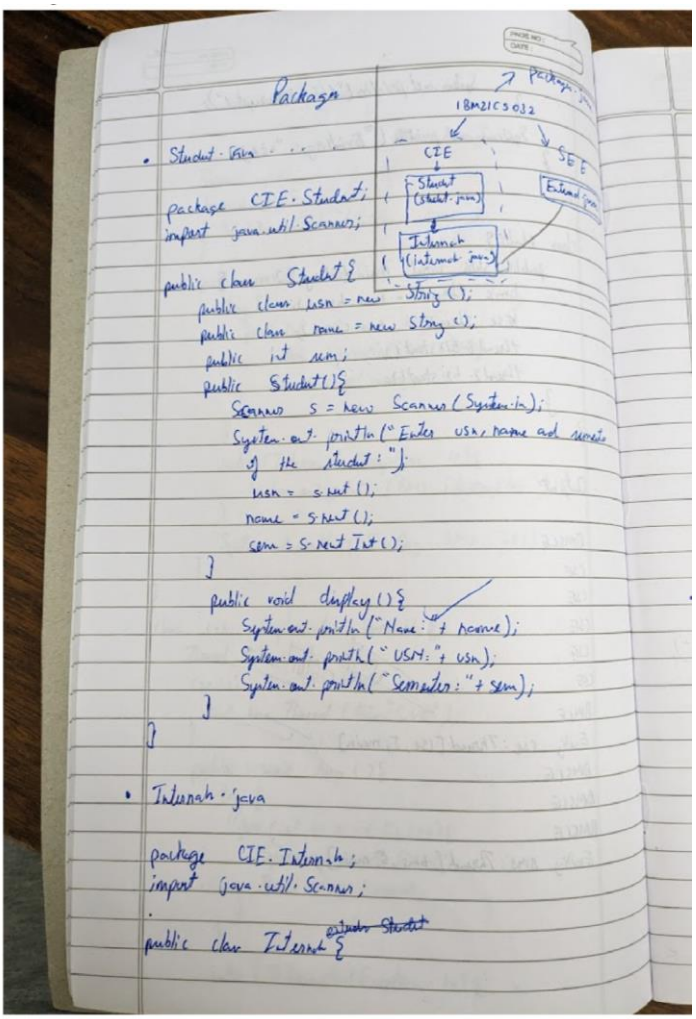
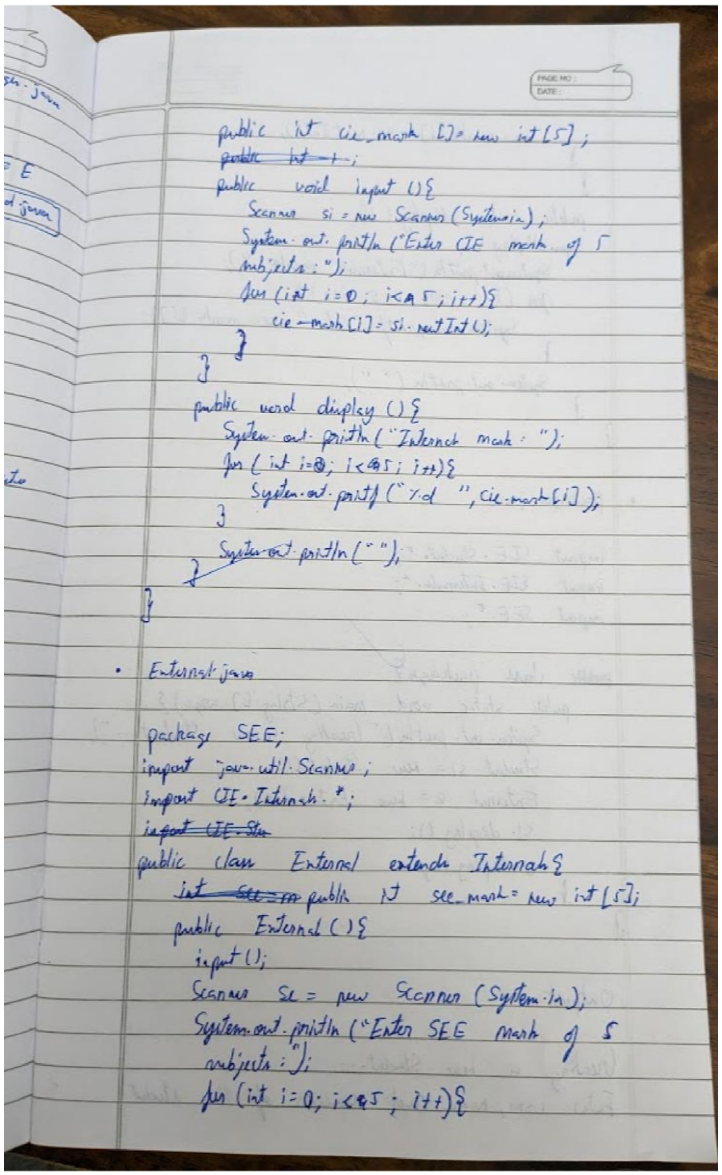
```
PS C:\Users\bmsce\Desktop\1bm21cs032> java multi
BMSCE
CSE
CSE
CSE
CSE
CSE
BMSCE
Exiting CSE: Thread[cse,5,main]
BMSCE
BMSCE
BMSCE
Exiting BMS: Thread[bms,5,main]
PS C:\Users\bmsce\Desktop\1bm21cs032>
```

8. Create a package CIE which has two classes- Student and Internals. The class Personal has members like USN, name, sem. The class internals has an array that stores the internal marks scored in five courses of the current semester of the student. Create another package SEE which has the class External which is a derived class of Student. This class has an array that stores the SEE marks scored in five courses of the current semester of the student. Import the two packages in a file that declares the final marks of n students in all five courses.

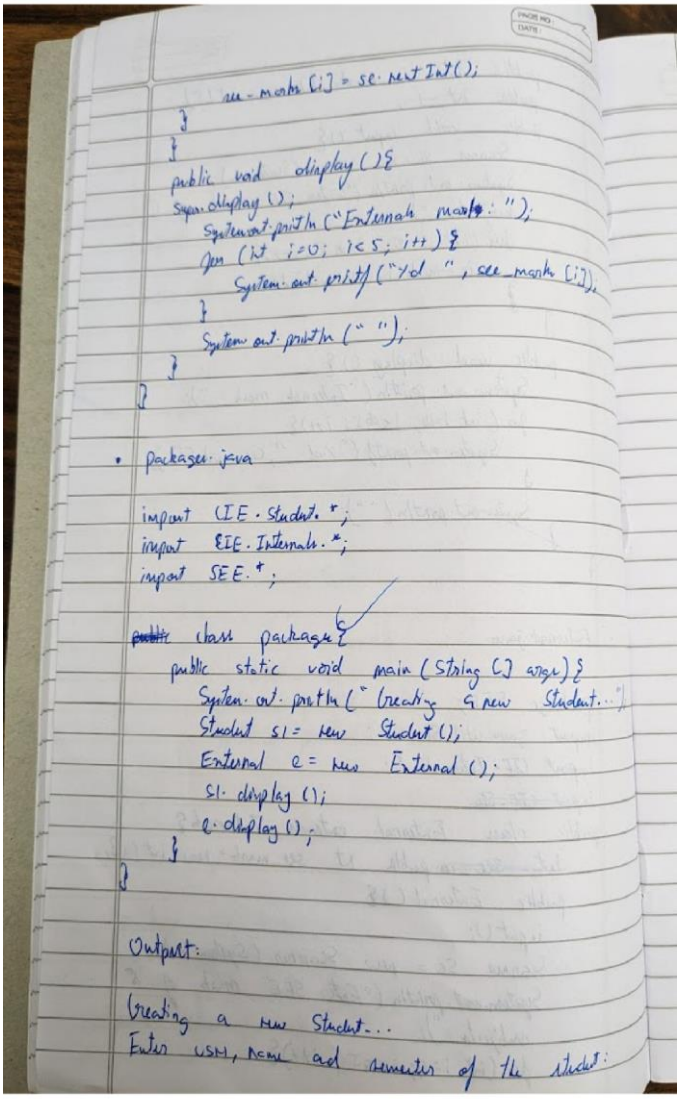




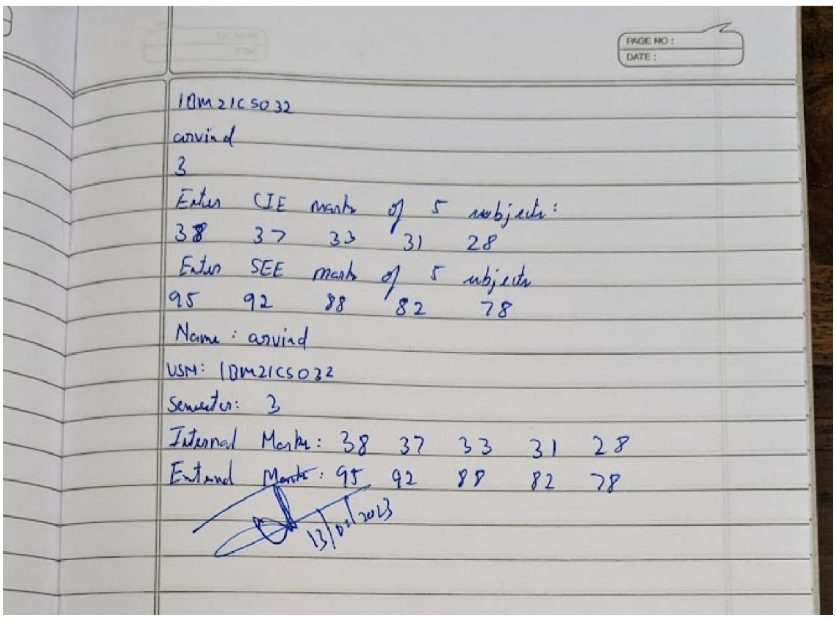
```
    public int cie_mark[] = new int[5];
    public int i;
    public void input(){
        Scanner si = new Scanner(System.in);
        System.out.println("Enter CIE mark of 5
        subjects:");
        for(int i=0; i<5; i++){
            cie_mark[i] = si.nextInt();
        }
    }
    public void display(){
        System.out.println("Internal mark:");
        for(int i=0; i<5; i++){
            System.out.printf("%d ", cie_mark[i]);
        }
        System.out.println("");
    }
}
```

- External.java

```
package SEE;
import java.util.Scanner;
import CIE.Internals.*;
public class External extends Internals{
    public int see_mark[] = new int[5];
    public External(){
        input();
        Scanner Se = new Scanner(System.in);
        System.out.println("Enter SEE mark of 5
        subjects:");
        for(int i=0; i<5; i++){
```



```
        se_marks[i] = se.nextInt();
    }
}
public void display(){
super.display();
    System.out.println("External marks: ");
    for (int i=0; i<5; i++){
        System.out.printf("%d ", see_marks[i]);
    }
    System.out.println(" ");
}
}

• package: java

import CIE.Student.*;
import EIE.Internals.*;
import SEE.*;

public class package{
    public static void main(String[] args){
        System.out.println("Creating a new Student...");
        Student s1 = new Student();
        External e = new External();
        s1.display();
        e.display();
    }
}

Output:

Creating a new Student...
Enter USN, name and semester of the student:
```




```
Creating a new Studet...
Enter usn, name and semester of the student:
1bm21cs032 arvind 3
Enter CIE marks of 5 subjects:
38 37 33 31 28
Enter SEE marks of 5 subjects:
95 92 88 82 78
Name: arvind
USN: 1bm21cs032
Semester: 3
Internals marks:
38  37  33  31  28
Externals marks:
95  92  88  82  78
```