(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 discriminate $b^2 - 4ac$ is negative, display a message stating that there are no real solutions.

Lab - 1

```
import java.util.*;
class lab1 {
    public static void main(String args[]){
        Scanner in = new Scanner(System.in);
        float a, b, c, d;
        System.out.println("For ax^2 + bx + c = 0 \n
                                Enter values of a, b, c");
        a = in.nextInt();
        b = in.nextInt();
        c = in.nextInt();
        d = (float) Math.pow(b, 2) - 4*a*c;
        if (d > 0)
            System.out.println("The roots of
                                equation are real
                                and distinct: "+((-1*b+Math.sqrt
                                (d))/(2*a)) +"&" +
                                ((-1*b - Math.sqrt(d))/(2*a)));
        else if (d == 0)
            System.out.println("The roots of the
                                equation are real and equal: "
                                + ((-1*b)/(2*a)));
        else
            system.out.println("No real roots");
    }
}
```

Algorithm :-

Step 1 : START

Step 2 : Input a, b, c

Step 3 : Calculate discriminant (d)
= b^2 - 4*a*c

Step 4 : Check condition d > 0
then print the two real roots $\frac{-b \pm \sqrt{d}}{2a}$

Step 5 : If ~~d = 0~~ d is equal to 0
print $-\frac{b}{2a}$, equal roots

Step 5 : If the above 2 conditions donot satisfy, print "no real roots"

Step 6 : END

PROBLEMS 8 OUTPUT DEBUG CONSOLE TERMINAL

```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\Prg data> cd "d:\Prg data\Java\OOJ Lab\Sample\" ; if ($?) { javac lab1.java } ; if ($?) { java lab1 }
For ax^2 + bx + c = 0
Enter the values of coefficients a, b and c
2
30
5
The roots of the equation are real and distinct : -0.1685608506924101 & -14.83143914930759
PS D:\Prg data\Java\OOJ Lab\Sample>
```

(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.

Lab - 2

```
import java.util.*;
class student {
    String name, USN;
    int n, credits[], marks[];
  void inputs() {
  System.out.println("Enter name, USN and subjects no.");
  name = in.nextLine();
  USN = in.nextLine();
  n = in.nextInt();
  credits = new int [n];
  marks = new int [n];
  for (int i=0; i<n; i++) {
      System.out.println("Enter marks & credits
                          of subject "+(i+1));
    marks[i] = in.nextInt();
    Credits[i] = in.nextInt();
  }
}
int grade (int x) {
    if (x>=90 && x<=100)
     return 10;
    else if (x>=80 && x<90)
     return 9;
    else if (x>=70 && x<80)
     return 8;
    else if (x>=60 && x<70)
     return 7;
```

```
else if (x>=50 && x<60)
    return 6;
else if (x>=40 && x<50)
  return 5;
  else
   return 0;
 }
void disp(float m){
    System.out.println("SGPA:"+m);
   }
 }

  public class Student{
      public static void main(String args[]){
        {
        tstudent ob= new tstudent();
        float sumc =0,sum=0;
        for(int i=0; i<ob.n; i++) {
            sumc += ob.credits[i];
            sum += ob.grade(ob.marks[i])*
                        ob.credits[i];
            }
        ob.disp(sum/sumc);
      }
    }
```

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Algorithm :-

Step 1 : START

Step 2 : Input Name, USN, number of subjects and accordingly input marks & credits of each subject.

Step 3 : Return grade ~~for the sm~~ based on marks scored by student

100 >= marks >= 90	grade : 10
90 > marks >= 80	grade : 9
80 > marks >= 70	grade : 8
70 > marks >= 60	grade : 7
60 > marks >= 50	grade : 6
50 > marks >= 40	grade : 5
40 > marks	grade : 0

Step 4 : evaluate sum of all credits scored by: ~~multiplying~~ credits * grade and adding

Step 5 : find total credits per subject

Step 6 : for SGPA divide sum of grades / sum of credits

Step 7 : END

PROBLEMS 7 OUTPUT DEBUG CONSOLE TERMINAL

```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms

PS D:\Prg data> cd "d:\Prg data\Java\OOJ Lab\Sample"
Enter name, USN and number of subjects
Nishant
1BM21FG088
5
Enter marks and credits in subject 1
78
5
Enter marks and credits in subject 2
88
4
Enter marks and credits in subject 3
94
4
Enter marks and credits in subject 4
67
3
Enter marks and credits in subject 5
70
2
SGPA: 8.5
```

Lab Program-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 details of the object. Include toString() method that could display the complete details of the book. Develop a java program to create n book objects.

Info about toString() method:

```
class Test
{
 int a =10;

  public String toString() //when an object is
   {                        printed gets called
    return ("a=" + a); //return statement
      }                       with string
class TestMain
  {

  public static void main (String args[])
   {
     Test t1 = new Test()
       System.out.println(t1);
   }
}
```

Lab - 3 :-

```
import java.util.*;
class Book {
    String b_name1;
    String author1;
    int num_pages;
    int price1;
Book (String b_name, String author, int price,
                                int pages) {
    b_name1 = b_name;
    author1 = author;
    price1 = price;
    num_pages = pages;
  }
public String toString() {
    return ("Book name: " + b_name1 +
            " Author: " + author1 +
            " Price: " + price1 +
            " Number of pages: " + num_pages);
  }
}

public class testMain {
    public static void main(String args[]) {
      String b_name, author;
      int pages, price;
      Scanner in = new Scanner(System.in);
      System.out.println(" Enter number of books: ");
      int n = in.nextInt();
      in.nextLine();
```

```
Book ob[]= new Book[n];
 for (int i=0; i<n; i++) {
      System.out.println("Enter book name, author,
                                price and pages");
      b_name = in.nextLine();
      author = in.nextLine();
      price = in.nextInt();
      pages = in.nextInt();
        in.nextLine();
      ob[i] = new Book(b_name, author, price,
                                pages);
    }
   for (int i=0; i<n; i++){
        System.out.println(ob[i]);
    }
  }
}
```

Algorithm :-

Step 1 : Start

Step 2 : Constructor define to initialize member methods book name, author, price pages

Step 3 : A function defined to ~~overload~~ overwrite print function of an object to given string.

Step 4 : An array of object is made, i.e, various number of books by input or size.

Step 5 : values initialized per array instantiated

Step 6 : Details printed

Step 7 : END.

```
PS D:\Prg data\Java\OOJ Lab\Sample> cd "d:\Prg data\Java\OOJ Lab\Sampl
Enter number of books:
3
Enter book name, author's name, price of book and number of pages
Gulliver's Travels
Jonnathan Swift
180
430
Enter book name, author's name, price of book and number of pages
Percy Jackson
Rick Riordan
200
260
Enter book name, author's name, price of book and number of pages
Audacity of Hope
Barrack Obama
150
200
Book name: Gulliver's Travels
Author: Jonnathan Swift
Price: 180
Number of pages: 430

Book name: Percy Jackson
Author: Rick Riordan
Price: 200
Number of pages: 260

Book name: Audacity of Hope
Author: Barrack Obama
Price: 150
Number of pages: 200

PS D:\Prg data\Java\OOJ Lab\Sample>
```

(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 Rectangle, Triangle and Circle such that each one of the classes extends the class shape. Each of one of the classes containing the method printArea() that prints the area of the given shape.

Lab - 4

```
import java.util.*;
abstract class Shape {
    abstract void printArea();
    int x, y;
    Shape (int m, int n) {
        x=m;
        y=n;
    }
}
class Rectangle extends Shape {
    Rectangle (int p, int q) {
        super (p, q);
    }
    void printArea () {
        System.out.println ("Area = "+(x*y));
    }
}
Class Triangle extends Shape {
    Triangle (int p, int q) {
        Super (p, q);
    }
    void printArea () {
        System.out.println ("Area = "+ (x*y/2))
    }
}
```

```
class Circle extends Shape{
    Circle (int p) {
     Super (p, 0);
    }
    void printArea () {
      System.out.println ("Area = "+(((float)x*x
                                    * 3.142)));
    }
}
class Test {
    public static void main (String args []) {
      Scanner in = new Scanner (System.in);
      Shape sp;
        System.out.println ("Enter length &
                                  breadth");
      int m = in.nextInt();
      int n = in.nextInt();
  Rectangle System ~~Triangle~~ t = new ~~Triangle~~ Rectangle (m, n);
      ~~Sys~~ sp = t;
            sp.printArea();
      System.out.println ("Enter height & base");
      ~~int~~ m = in.nextInt ();
            n = in.nextInt ();
      Triangle r = new Triangle (m, n);
        sp = r;
          sp.printArea ();
```

```
System.out.println("Enter radius");
m = in.nextInt();
Circle c = ~~in.next~~ new Circle(m);
sp = c;
sp.printArea();
}
}
```

```
Windows PowerShell
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Try the new cross-platform PowerShell https://aka.ms/pscore6

PS D:\Prg data> cd "d:\Prg data\Java\OOJ Lab\Sample\" ; if ($?) { javac Test.java } ;
Enter length and breadth:
10
20
Area=200
Enter height and base:
5
10
Area=25
Enter radius:
4
Area=50.272
PS D:\Prg data\Java\OOJ Lab\Sample>
```

Date
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Lab 5 - Ques

Develop a Java program to create a class Bank that maintains two kind 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 but no interest.

Current account holders should also maintain a minimum balance and if 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 2 subclasses cur-act & sav acct. Include necessary methods in order to achieve following tasks:

Accept deposit from customer & update balance.
Display balance
Compute & deposit interest
Permit withdrawal & update balance.
Check for min balance & impose penalty if necessary.

Lab 5 :-

```
import java.util.*;

abstract class Account {
    Scanner in = new Scanner(System.in);
    String name, accnum, type;
    Account (String n, String a, String t) {
        name = n;
        accnum = a;
        type = t;
    }
    abstract void display();
    abstract void withdraw();
    abstract void deposit();
}
class Savacct extends Account {
    double r, amt, t;
    Savacct (String N, String A, String T, ~~St~~
            double AMT, double R,
            double y) {
        Super (N, A, T)
        amt = AMT;
        r = R;
        t = y;
    }
void withdraw(){
    System.out.println("Enter amount to withdraw");
    double z = in.nextFloat();
```

```
if (z>amt)
  System.out.println("Insufficient
                        Account Balance");
 else
 amt = amt-z;
 }
void deposit () {
  System.out.println("Enter amount to
                        deposit");
  double z = in.next~~Float~~Double();
  amt = amt +z;
 }
void display () {
    System.out.println("Amount="+amt);
  }
}
class Current extends Account {
    double th, tax, amt;
    Current (String N, String A, String T,
              double AMT, double R,
                double thres) {
     Super (N, A, T);
       amt = AMT;
       tax = R;
       th = thres;
    }
  void withdraw () {
     System.out.println("Enter amount to withdraw");
```

```
double z= in.nextDouble();
  if (z>amt)
     ~~amt = amt - z~~
  System.out.println("Insufficient amount");
  else
   amt= amt -z;
 }
void deposit () {
  System.out.println("Enter amount to
                        deposit");
   double z= in.nextDouble ();
   amt= amt +z;
  }
 void sertax () {
    if (amt<th)
      amt= amt - (amt * tax/100) ;
  }
void display {
      System.out.println("Amount="+amt);
 }

class Bank {

public static void main (String args[]){

Scanner in = new Scanner(System.in);
String name, accnum, type;
System.out.println("Enter name, acc number,
                        type");
```

```
name = in.nextLine();
accnum = in.nextLine();
typ = in.nextLine();
Account ac;
if ("saving".equalsIgnoreCase(typ)){
    System.out.println("enter initial
                        amount, rate &
                        time");
    double amt = in.nextDouble();
    double rate = in.nextDouble();
    int t = in.nextInt();
    Savacct sav = new Savacct(name,
                        accnum, typ,
                        amt, rate, t);
    ac = sav;
    ac.deposit();
    ac.withdraw();
    Sav.interest
    ac.display();
}
else if ("current".equalsIgnoreCase(typ)){

    System.out.println("enter initial amount
                        threshold & service tax");

    double amt = in.nextDouble();
    double t = in.nextDouble();
    int r = in.nextInt();
```

```
Curract cur = new Curract (name, accnum,
                           typ, amt);

ac = cur;
ac.deposit();
ac.withdraw();
ac.display();
}

else
System.out.println("Invalid account type");
}

}
```

```
PS D:\Prg data\Java\OOJ Lab\Sample> cd "d:\Prg data\Java\OOJ Lab\Sample\" ; if ($?) { javac Bank.java } ; if ($?) { java Bank }
Enter Name, account number, account type
Piyush
123X123
savings
Enter initial Amount (principal), rate and time period in years
10000
10
2
Enter amount to deposit
500
Enter amount to withdraw
100
Interest=1248000.0
Amount=1258400.0
PS D:\Prg data\Java\OOJ Lab\Sample> cd "d:\Prg data\Java\OOJ Lab\Sample\" ; if ($?) { javac Bank.java } ; if ($?) { java Bank }
Enter Name, account number, account type
Raghav
4323
current
Enter initial Amount (principal), threshold and service tax
10000
200
2
Enter amount to deposit
1000
Enter amount to withdraw
10
Amount=10990.0
PS D:\Prg data\Java\OOJ Lab\Sample> cd "d:\Prg data\Java\OOJ Lab\Sample\" ; if ($?) { javac Bank.java } ; if ($?) { java Bank }
Enter Name, account number, account type
Pinto
90ed
Recurring
Invalid account type
PS D:\Prg data\Java\OOJ Lab\Sample>
```