



CSE 2001: Data Structure & Algorithms

Programming Assignment-II

(Object-Oriented Design)



Question-1:

A phone number can be thought of as having three parts: the area code, the exchange code and the number.

CODE:-

```
class Phone
{
    int area_code;
    int exchange;
    int number;

    void input(int a,int e,int n)
    {
        area_code =a;
        exchange = e;
        number =n;
    }

    void display()
    {
        System.out.printf("(03d) 03d-%04d", area_code, exchange,number);
    }
}
public class Q1
{
    public static void main(String[] args) {
        Phone phone1 = new Phone();
        phone1.area_code=212;
        phone1.exchange=767;
        phone1.number=8900;

        Phone phone2 = new Phone();
        phone2.input(415,555,1212);

        System.out.print("My number is ");
        phone1.display();

        System.out.print("\nYour number is ");
        phone2.display();
    }
}
```

OUTPUT:-

```
My number is (212) 767-8900
Your number is (415) 555-1212
```



Question-2:

Define a class called Complex with instance variables real, imag and instance methods setData(), display(), add(). Write a Java program to add two complex numbers.

The prototype of add method is:

public Complex add(Complex, Complex).

Code:-

```
import java.util.*;
class Complex
{
    double re;
    double im;
    void setData (double r, double i)
    {
        re = r;
        im= i;
    }

    void display()
    {
        System.out.printf("%.2f %s %.2f%s\n",re,(im <0?" - ":" + ") ,Math.abs(im),"i");
    }

    Complex add(Complex c1, Complex c2) {
        Complex result = new Complex();
        result.re = c1.re + c2.re;
        result.im = c1.im + c2.im;
        return result;
    }
}
public class Q2
{
    public static void main(String[] args)
    {
        Scanner obj=new Scanner(System.in);
        double r,i;
        Complex c1=new Complex();
        System.out.println("Enter real and imaginary part of 1st number separated by space :");
        r = obj.nextDouble();
        i = obj.nextDouble();
        c1.setData(r,i);
        Complex c2=new Complex();
        System.out.println("Enter real and imaginary part of 2nd number separated by space :");
        r = obj.nextDouble();
        i = obj.nextDouble();
        c2.setData(r,i);
        System.out.println("The 1st Complex number is : ");
        c1.display();
        System.out.println("The 2nd Complex number is : ");
        c2.display();
        Complex sum=new Complex();
        sum=sum.add(c1,c2);
        System.out.println("The sum is : ");
        sum.display();
        obj.close();
    }
}
```

OUTPUT:-

Enter real and imaginary part of 1st number separated by space :

4.9 -9.3

Enter real and imaginary part of 2nd number separated by space :

7.4 2.8

The 1st Complex number is :

4.90 - 9.30i

The 2nd Complex number is :

7.40 + 2.80i

The sum is :

12.30 - 6.50i



Question-3:

Define a class called Student with instance variables Roll, Name, DSA_Mark. Also, the class consists of instance methods getdata(), showdata() to provide input to the instance variable and to display the value of instance variable. Write a program to create the details of 5 students. Display the information of the students who has secured the highest DSA_Mark.

Code:-

```
class Student
{
    int Roll;
    String Name;
    int DSA_Mark;
    void getdata(int r,String s,int mark)
    {
        this.Roll =r;
        this.Name =s;
        this.DSA_Mark =mark;
    }
    public void showdata()
    {
        System.out.println( this.Roll+"\t"+ this.Name+"\t"+ this.DSA_Mark);
    }
}
public class Q3
{
    public static void main(String[] args)
    {
        Student[] students = new Student[5];
        double maxMark = -1;
        int maxIndex = -1;
        for (int i = 0; i < students.length; i++)
            students[i] = new Student();
        students[0].getdata(30, "Chiku",56);
        students[1].getdata(31, "Pran",55);
        students[2].getdata(32, "Ap",58);
        students[3].getdata(33, "AS",52);
        students[4].getdata(34, "Khusi",51);
        for (int i = 0; i < students.length; i++)
            if (students[i].DSA_Mark > maxMark)
        {
            maxMark = students[i].DSA_Mark;
            maxIndex = i;
        }
        System.out.println("\nDetails of all students:");
        System.out.println("Roll\tName\tDSA Mark");
        for (int i = 0; i < students.length; i++) {
            students[i].showdata();
        }
        System.out.printf(students[maxIndex].Name+" having roll no"+students[maxIndex].Roll+" has the
highest DSA Mark of "+ maxMark);
    }
}
```

OUTPUT:-

Details of all students:

Roll	Name	DSA Mark
30	Chiku	56
31	Pran	55
32	Ap	58
33	AS	52
34	Khusi	51



Question-4:

Define a class called product. Two instance variables of the class are pid (product-id) and price (product price). It consists of one static variable tot_price (total price). Initialize the value of instance variables through parameterized constructor. It consists of a display () method to display the value of instance variables. A person went to market and purchase 5 different products. Using the above mentioned class, display the details of products that the person has purchased. Also, determine how much total amount the person will pay for the purchase of 5 products.

code:-

```

class product
{
    int pid;
    double price;
    static double tot_price;
    product(int pid, double price)
    {
        this.pid = pid;
        this.price = price;
    }
    void display()
    {
        System.out.println(pid +"\t\t"+ price);
    }
    static double totalAmount(product[] prod)
    {
        for (int i = 0; i < prod.length; i++)
            tot_price += prod[i].price;
        return tot_price;
    }
}
public class Q4
{
    public static void main(String[] args)
    {
        product[] products = new product[5];
        products[0] = new product(785432, 199.99);
        products[1] = new product(845753, 79.99);
        products[2] = new product(264535, 999.49);
        products[3] = new product(454121, 749.99);
        products[4] = new product(121312, 149.99);
        System.out.println("slno\t"+ "Product-id\t" + "Product_price");
        for (int i = 0; i < products.length; i++)
        {
            System.out.print((i+1)+"\t");
            products[i].display();
        }
        double total_price = product.totalAmount(products);
        System.out.println("Total price is : " + total_price+" rupees only...");
    }
}

```

OUTPUT:-

slno	Product-id	Product_price
1	785432	199.99
2	845753	79.99
3	264535	999.49
4	454121	749.99
5	121312	149.99

Total price is : 2179.45 rupees only...



Question-5:

Initialize the instance variables Principal, Time, rate through constructors. Constructors are overloaded with the following prototypes.

```

Constructor1: Deposit ( )
Constructor2: Deposit (long, int, double)
Constructor3: Deposit (long, int)
Constructor4: Deposit (long, double)
Apart from constructor, the other instance methods are (i) display ( ): to display the value of
instance variables, (ii) calc_amt( ) to calculate the total amount.
Total_amt = Principal + (Principal*rate*Time)/100;
code:-
class Deposit
{
    long Principal;
    int Time;
    double rate;
    double Total_amt;
    Deposit()
    { }
    Deposit(long Principal, int Time, double rate)
    {
        this.Principal = Principal;
        this.Time = Time;
        this.rate = rate;
    }
    Deposit(long Principal, int Time)
    {
        this.Principal = Principal;
        this.Time = Time;
    }
    Deposit(long Principal, double rate)
    {
        this.Principal = Principal;
        this.rate = rate;
    }
    void display()
    {
        System.out.println(Principal+"\t"+Time+"\t"+rate+"\t"+Total_amt);
    }
    void calc_amt()
    {
        Total_amt = Principal + ((Principal * rate * Time) / 100.0);
    }
}
public class Q5
{
    public static void main(String[] args)
    {
        System.out.println("Principal\t"+ "Time\t" + "rate\t" + "Total_amt");
        Deposit d1 = new Deposit();
        d1.display();
        Deposit d2 = new Deposit(1000 , 2 , 5.0);
        d2.calc_amt();
        d2.display();
        Deposit d3 = new Deposit(2500 , 3 );
        d3.calc_amt();
        d3.display();
        Deposit d4 = new Deposit(4800 ,5.2 );
        d4.calc_amt();
        d4.display();
    }
}

```

OUTPUT:-

Principal	Time	rate	Total_amt
0	0	0.0	0.0
1000	2	5.0	1100.0
2500	3	0.0	2500.0
4800	0	5.2	4800.0



Question-6:

Create an abstract class Shape and the derived classes Square, Triangle and Circle. Write a java program to display area of different shapes.

code:-

```
abstract class Shape
{
    abstract double getArea();
}
class Square extends Shape
{
    double side;
    Square(double s)
    {
        side = s;
    }
    double getArea()
    {
        return side * side;
    }
}
class Triangle extends Shape
{
    double base;
    double height;
    Triangle(double b, double h)
    {
        base = b;
        height = h;
    }
    double getArea()
    {
        return 0.5 * base * height;
    }
}
class Circle extends Shape
{
    double radius;
    Circle(double r)
    {
        radius = r;
    }
    double getArea()
    {
        return Math.PI * radius * radius;
    }
}
public class Q6
{
    public static void main(String[] args)
    {
        Shape shapes1 = new Square(5);
        Shape shapes2 = new Triangle(4, 3);
        Shape shapes3 = new Circle(2.5);
        System.out.println("Area of shape1 is : " + shapes1.getArea());
        System.out.println("Area of shape2 is : " + shapes2.getArea());
        System.out.println("Area of shape3 is : " + shapes3.getArea());
    }
}
```

OUTPUT:-

```
Area of shape1 is : 25.0
Area of shape2 is : 6.0
Area of shape3 is : 19.634954084936208
```



Question-7:

Define a base class Person with instance variable name, age. The instance variables are initialized through constructors. The prototype of constructor is as below. Person (string, int)
Define a derived class Employee with instance variables Eid, salary. The instance variables are initialized through constructors.

The prototype of constructor is as below.

Employee (string, int, int, double). Another instance method of Employee class is empDisplay() to display the information of employee details.

CODE:-

```
class Person
{
    String name;
    int age;
    public Person(String name, int age)
    {
        this.name = name;
        this.age = age;
    }
}
class Employee extends Person
{
    int Eid;
    double salary;
    public Employee(String name, int age, int Eid, double salary)
    {
        super(name, age);
        this.Eid = Eid;
        this.salary = salary;
    }

    public void empDisplay()
    {
        System.out.println(  name+"\t"+ age+"\t"+Eid+"\t"+salary);
    }
}
public class Q7
{
    public static void main(String[] args)
    {
        Employee emp1 = new Employee("Ansuman", 24, 72563, 83623.34);
        Employee emp2 = new Employee("Chiku", 25, 85478, 63485.25);
        System.out.println("Emp_Name\t "+ "Age:\t" + "Emp_ID \t" + "Salary\t");
        emp1.empDisplay();
        emp2.empDisplay();
    }
}
```

OUTPUT:-

Emp_Name	Age:	Emp_ID	Salary
Ansuman	24	72563	83623.34
Chiku	25	85478	63485.25



Question-8:

Define an interface DetailInfo to declare methods display () & count (). Another class Person contains a static data member maxcount, instance member name & method display () to display name of a person, count the no. of characters present in the name of the person.

CODE:-

```
interface DetailInfo
{
    void display();
    int count();
}
class Person implements DetailInfo
{
    static int maxcount = 15;
    String name;
    public Person(String name)
    {
        this.name = name;
    }
    public void display()
    {
        System.out.println("Name: " + name);
    }
    public int count()
    {
        return name.length();
    }
}
class HelloWorld {
    public static void main(String[] args)
    {
        Person p = new Person("Ansuman");
        p.display();
        int count=p.count();
        System.out.println("Name length: " + count);
    }
}
```

OUTPUT:-

Name: Ansuman

Name length: 7

// By Ansuman Swain



Question-9:

Write a Java program to declare a Class named as Student which contains roll number, name and course as instance variables and input_Student () and display_Student () as instance methods. A derived class Exam is created from the class Student. The derived class contains mark1, mark2, mark3 as instance variables representing the marks of three subjects and input_Marks () and display_Result () as instance methods. Create an array of objects of the Exam class and display the result of 5 students.

CODE:-

```
package a;
import java.util.*;
class Student
{
    int rollNumber;
    String name;
    String course;
    void input_Student(int r, String n, String c)
    {
        rollNumber=r;
        name=n;
        course=c;
    }
    void display_Student()
    {
        System.out.print(rollNumber+"\t"+name+"\t"+course+"\t");
    }
}
class Exam extends Student
{
    int mark1;
    int mark2;
    int mark3;
    void input_Marks(int m1, int m2, int m3)
    {
        mark1 = m1;
        mark2 = m2;
        mark3 = m3;
    }
    void display_Result()
    {
        System.out.println(mark1+"\t"+mark2+"\t"+mark3);
    }
}

public class Q9
{
    public static void main(String[] args)
    {
        Exam[] exams = new Exam[5];
        for (int i = 0; i < exams.length; i++)
            exams[i] = new Exam();
        System.out.println("Rollno\tName\tBranch\tMark1\tMark2\tMark3");
        exams[0].input_Student(30, "Ansuman", "Btech");
        exams[0].input_Marks(70, 80, 50);
        exams[1].input_Student(31, "Chiku", "Btech");
        exams[1].input_Marks(50, 43, 55);
        exams[2].input_Student(32, "PS", "Btech");
        exams[2].input_Marks(78, 62, 58);
        exams[3].input_Student(33, "AP", "Btech");
        exams[3].input_Marks(90, 69, 59);
        exams[4].input_Student(34, "AS", "Btech");
        exams[4].input_Marks(35, 45, 55);
        for (int i = 0; i < exams.length; i++)
        {
            exams[i].display_Student();
            exams[i].display_Result();
        }
    }
}
```

OUTPUT:-

Rollno	Name	Branch	Mark1	Mark2	Mark3
30	Ansuman	Btech	70	80	50
31	Chiku	Btech	50	43	55
32	PS	Btech	78	62	58
33	AP	Btech	90	69	59
34	AS	Btech	35	45	55

// By Ansuman Swain

Question-10:

Design a package that contains two classes Student & Test. The Student class has data members as name, roll and instance methods input () & output (). Similarly the Test class has data members as mark1, mark2 and instance methods input (), output (), Student is extended by Test. Another package carry interface Sports with 2 attributes score1, score2. Find grand total mark & score in another class.

CODE:-

```
//Create a 2 package q10pack1 and q10pack2
//create a q10.java in q10pack1 and sport.java file under q10pack2....
//The first part in q10.java under q10pack1
package q10pack1;
import java.util.Scanner;
import q10pack2.sport.Sports;
import q10pack2.*;
class Student
{
    String name;
    int roll;
    public void input()
    {
        Scanner obj = new Scanner(System.in);
        System.out.print("Enter student name : ");
        name = obj.nextLine();
        System.out.print("Enter roll no : ");
        roll = obj.nextInt();
    }
    public void output()
    {
        System.out.print("Student Name is " + name+" having roll no " + roll);
    }
}
class Test extends Student {
    int mark1;
    int mark2;
    public void input()
    {
        super.input();
        Scanner obj = new Scanner(System.in);
        System.out.print("Enter mark1: ");
        mark1 = obj.nextInt();
        System.out.print("Enter mark2: ");
        mark2 = obj.nextInt();
    }
    public void output()
    {
        super.output();
        System.out.print(" secured Mark 1: " + mark1+ " & Mark 2 " + mark2);
    }
}
class GrandTotal extends Test implements Sports
{
    public void input()
    {
        super.input();
    }

    public void output() {
        super.output();
        System.out.println(" and having Score 1: " + score1+ " & Score 2: " + score2);
        System.out.println("Total mark " + (mark1 + mark2) + " and total Score " + (score1 + score2));
        System.out.println("Grand total is :" +(mark1+mark2+score1+score2));
    }
}
public class q10
{
    public static void main(String[] args) {
        GrandTotal g1=new GrandTotal();
        g1.input();
        g1.output();
    }
}

//Create sport.java under q10pack2 and create sport interface in that package
package q10pack2;
public class sport {
    public static void main(String[] args) {
    }
}
public interface Sports {
    int score1 = 40;
    int score2 = 30;
}
```

OUTPUT:-

```
Enter student name : Ansuman Swain
Enter roll no : 9588
Enter mark1: 95
Enter mark2: 45
Student Name is Ansuman Swain having roll no 9588 secured Mark 1: 95 & Mark 2 45 and having Score 1: 40
& Score 2: 30
Total mark 140 and total Score 70
Grand total is :210
```



Home Assignment

Question-1:

CODE:-

```
import java.util.*;
class Commission
{
    double sales;
    Commission(double sales)
    {
        this.sales = sales;
    }

    public double getCommission()
    {
        if (sales < 0)
        {
            System.out.println("Invalid Input");
            return 0;
        }
        else if (sales < 100)
            return 0.02 * sales;
        else if (sales < 5000)
            return 0.05 * sales;
        else
            return 0.08 * sales;
    }
}
class Demo
{
    public static void main(String[] args)
    {
        Scanner obj = new Scanner(System.in);
        System.out.print("Enter the sale: ");
        double sale = obj.nextDouble();

        Commission com = new Commission(sale);
        double com_amt = com.getCommission();

        if (com_amt > 0)
            System.out.println("The commission is Rs " + com_amt);
    }
}
```

OUTPUT:-
Enter the sale: 5400
The commission is Rs 432.0

[Home Assignment](#)

Question-2:

Define a class called Book with instance variables BName, BEdition, BPrice. Use constructor to initialize the instance variables of the class. Another instance method display() to display the book information. A person purchase 5 different books. Display the book details which has the maximum price.

CODE:-

```
class Book
{
    String BName;
    int BEdition;
    double BPrice;
    Book(String BName, int BEdition, double BPrice)
    {
        this.BName = BName;
        this.BEdition = BEdition;
        this.BPrice = BPrice;
    }
    void display()
    {
        System.out.println( this.BName + "\t" + this.BEdition + "\t" + this.BPrice);
    }
    public double getPrice()
    {
        return this.BPrice;
    }
    void displaymax()
    {
        System.out.println(this.BName + " Book having price " + this.BPrice + " has maximum price.");
    }
}
class BookDemo
{
    public static void main(String[] args)
    {
        Book[] books = new Book[5];
        books[0] = new Book("JAVA DSA", 5, 499.99);
        books[1] = new Book("Calculus II", 2, 799.99);
        books[2] = new Book("Economics", 8, 649.99);
        books[3] = new Book("University PHY", 9, 699.99);
        books[4] = new Book("Graph Theory", 5, 459.49);
        System.out.println("Book Name\tEdition\tBook price");
        Book max = books[0];
        for (int i = 1; i < books.length; i++)
        {
            books[i].display();
            if (books[i].getPrice() > max.getPrice())
                max = books[i];
        }
        max.displaymax();
    }
}
```

OUTPUT:-

Book Name	Edition	Book price
Calculus II	2	799.99
Economics	8	649.99
University PHY	9	699.99
Graph Theory	5	459.49

Calculus II Book having price 799.99 has maximum price.



Home Assignment

Question-3:

Write a Java code that would represent Distance object (meters, centimetres) using classes. The class definition include a parameterized constructor, display () to display the instance variables, sum (Distance, Distance) to add two distances. Now write a main function that creates a couple of Distance objects and demonstrates the addition of two distances

CODE:-

```
class Distance {  
    int meters;  
    int centimeters;  
    Distance(int meters, int centimeters)  
    {  
        if (centimeters >= 100)  
        {  
            meters += centimeters / 100;  
            centimeters = centimeters % 100;  
        }  
        this.meters = meters;  
        this.centimeters = centimeters;  
    }  
    public void display()  
    {  
        System.out.println(meters + " m " + centimeters + " cm ");  
    }  
    Distance sum(Distance d1, Distance d2)  
    {  
        int me = d1.meters + d2.meters;  
        int cm = d1.centimeters + d2.centimeters;  
        return new Distance(me, cm);  
    }  
}  
public class HW3{  
    public static void main(String[] args) {  
        Distance d1 = new Distance(5, 70);  
        Distance d2 = new Distance(3, 30);  
        System.out.println("Two distances are : ");  
        Distance d3 = d1.sum(d1, d2);  
        d1.display();  
        d2.display();  
        System.out.print("The sum is : ");  
        d3.display();  
    }  
}
```

OUTPUT:-

Two distances are :

5 m 70 cm

3 m 30 cm

The sum is : 9 m 0 cm



Home Assignment

Question-4:
CODE:-

```
class PointType
{
    double x;
    double y;
    PointType(double x, double y)
    {
        this.x = x;
        this.y = y;
    }
    void setCoordinates(double x, double y)
    {
        this.x = x;
        this.y = y;
    }
    void printCoordinates()
    {
        System.out.println("(" + this.x + ", " + this.y + ")");
    }
    double X()
    {
        return this.x;
    }
    double Y()
    {
        return this.y;
    }
}
class CircleType extends PointType
{
    double radius;
    public CircleType(double x, double y, double radius)
    {
        super(x, y);
        this.radius = radius;
    }
    void setRadius(double radius)
    {
        this.radius = radius;
    }
    void printRadius()
    {
        System.out.println("Radius is: " + this.radius);
    }
    void printCenter()
    {
        System.out.println("Center is : "+this.x+","+this.y);
    }
    double getArea()
    {
        return Math.PI * this.radius * this.radius;
    }
    double getCircumference()
    {
        return 2*Math.PI*this.radius;
    }
}
public class HW4
{
    public static void main(String[] args)
    {
        PointType point = new PointType(1, 2);
        System.out.print("Point: ");
        point.printCoordinates();
        point.setCoordinates(8, 9);
        System.out.print("Now the point is : ");
        System.out.println("(" + point.X() + ", " + point.Y() + ")");
        CircleType circle = new CircleType(1, 2, 5);
        circle.printRadius();
        circle.setRadius(10);
        System.out.print("Updated ");
        circle.printRadius();
        System.out.print("Circle area is : ");
        System.out.println(circle.getArea());
        System.out.print("Circle Circumference is : ");
        System.out.println(circle.getCircumference());
    }
}
```

OUTPUT:-

```
Point: (1.0, 2.0)
Now the point is : (8.0,9.0)
Radius is: 5.0
Updated Radius is: 10.0
Circle area is : 314.1592653589793
Circle Circumference is : 62.83185307179586
```

[Home Assignment](#)

Question-5:

CODE:-

```
class RestaurantMeal
{
    String name;
    double price;
    RestaurantMeal(String name, double price)
    {
        this.name = name;
        this.price = price;
    }
    void display()
    {
        System.out.printf("A \""+name+"\" costing Rs."+ price);
    }
}
interface HotelService
{
    String serviceName();
    double serviceFee();
    String RoomNo();
}
class RoomServiceMeal extends RestaurantMeal implements HotelService
{
    String room;
    double fee;
    public RoomServiceMeal(String name, double price, String room)
    {
        super(name, price);
        this.room = room;
        this.fee = 24.00;
    }

    public String serviceName()
    {
        return "room service";
    }

    public double serviceFee()
    {
        return fee;
    }
    public String RoomNo()
    {
        return room;
    }
    double getPrice()
    {
        return 600;
    }
    public void display()
    {
        super.display();
        System.out.print(" is a \""+ serviceName()+"\" "+ provided to room "+RoomNo()+" for a Rs
"+serviceFee());
    }
}
public class HW5
{
    public static void main(String[] args)
    {
        RoomServiceMeal meal = new RoomServiceMeal("steak dinner", 600.00, "1202");
        meal.display();
    }
}
```

OUTPUT:-

A "steak dinner" costing Rs.600.0 is a "room service" provided to room 1202 for a Rs 24.0