Assignment 4

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1) Explain the following terms ((Definition and explanation how it is implemented in Java, rules and syntax, and a program to demonstrate the concept))
 a) Class
b) Object
c) Inheritance: Single Inheritance, Multilevel inheritance, hierarchical inheritance, hybrid inheritance
d) Polymorphism
e) Compile time polymorphism and method overloading
f) Runtime polymorphism and method overriding
g) Constructor
h) Constructor overloading
i) super
j) this
k) getters and setters
l) access modifiers
→
a) Class

A class is a blueprint or template that defines the properties and behavior of an object. It's essentially a design pattern or template that defines the characteristics and actions of an object.

Example:

```
class Car {

   private String color;
   private int speed;

   public Car(String color, int speed) {
       this.color = color;
       this.speed = speed;
   }

   public void accelerate() {
       speed++;
   }
   public String getColor() {
       return color;
   }

}
```

b) Object

An object is an instance of a class, and it has its own set of attributes (data) and methods (functions).

Example:

```
Car myCar = new Car("Red", 60);
```

c) Inheritance

Inheritance is a mechanism where one class can inherit the properties and behavior of another class.
Types of Inheritance:

- Single Inheritance: One child class inherits from one parent class.
- Multilevel Inheritance: A child class inherits from a parent class, which in turn inherits from another parent class.
- Hierarchical Inheritance: Multiple child classes inherit from one parent class.
- Hybrid Inheritance: Combination of multiple inheritance types.

Example:

```
class Inheritance{

// Single Inheritance
public class Animal {
   public void eat() {
       System.out.println("Eating...");
   }
}

public class Dog extends Animal {
   public void bark() {
       System.out.println("Barking...");
   }
```

```java
}

// Multilevel Inheritance
public class Mammal extends Animal {
   public void walk() {
       System.out.println("Walking...");
   }
}

public class Cat extends Mammal {
   public void meow() {
       System.out.println("Meowing...");

   }
}

// Hierarchical Inheritance
public class Vehicle {
   public void move() {
       System.out.println("Moving...");
   }
}

public class Car extends Vehicle {
   public void accelerate() {
       System.out.println("Accelerating...");
   }
}

public class Truck extends Vehicle {
   public void load() {
       System.out.println("Loading...");
   }
}

// Hybrid Inheritance
public class ElectricCar extends Car {
   public void charge() {
       System.out.println("Charging...");
   }
}


}
```

d) Polymorphism

Polymorphism is the ability of an object to take on multiple forms. This can be achieved through method overloading or method overriding.

```
// Method Overloading
public class Calculator {
   public int add(int a, int b) {
       return a + b;
   }

   public double add(double a, double b) {
       return a + b;
   }
}

// Method Overriding
public class Shape {
   public void draw() {
       System.out.println("Drawing a shape...");
   }
}

public class Circle extends Shape {
   @Override
   public void draw() {
       System.out.println("Drawing a circle...");
   }
}
//Example:

Calculator calculator = new Calculator();
System.out.println(calculator.add(2, 3)); // Output: 5
```

```java
System.out.println(calculator.add(2.5, 3.7)); // Output: 6.2

Shape shape = new Circle();
shape.draw(); // Output: Drawing a circle…
```

e) Compile-time Polymorphism and Method Overloading

Method overloading is a form of compile-time polymorphism where multiple methods with the same name can be defined, but with different parameter lists.

```java
public class Calculator {
   public int add(int a, int b) {
       return a + b;
   }

   public double add(double a, double b) {
       return a + b;
   }

   public int add(int a, int b, int c) {
       return a + b + c;
   }
}

//Example:

Calculator calculator = new Calculator();
System.out.println(calculator.add(2, 3)); // Output: 5
System.out.println(calculator.add(2.5, 3.7)); // Output: 6.2
System.out.println(calculator.add(2, 3, 4)); // Output: 9
```

f) Runtime Polymorphism and Method Overriding

Method overriding is a form of runtime polymorphism where a subclass provides a different implementation of a method that is already defined in its superclass.

```java
public class Shape {
   public void draw() {
       System.out.println("Drawing a shape...");
   }
}

public class Circle extends Shape {
   @Override
   public void draw() {
       System.out.println("Drawing a circle...");
   }
}

//Example:

Shape shape = new Circle();
shape.draw(); // Output: Drawing a circle…
```

g) Constructor

A constructor is a special method that is used to initialize objects when they are created.

Example:

```java
public class Car {
   private String color;
   private int speed;

   public Car(String color, int speed) {
       this.color = color;
       this.speed = speed;
   }
}
```

h) Constructor Overloading
Constructor overloading is a technique where multiple constructors with different parameter lists can be defined.

```
public class Car {
   private String color;
   private int speed;

   public Car() {
       this.color = "Red";
       this.speed = 60;
   }

   public Car(String color) {
       this.color = color;
       this.speed = 60;
   }

   public Car(String color, int speed) {
       this.color = color;
       this.speed = speed;
   }
}
```

i) super

The super keyword is used to access the members of a superclass.

```
public class Subclass extends Superclass {
   public void methodName() {
       super.methodName();
   }
}

//Example:

public class Animal {
   public void sound() {
       System.out.println("The animal makes a sound.");
   }
}

public class Dog extends Animal {
   public void sound() {
       super.sound();
       System.out.println("The dog barks.");
   }
}
```

j) this
The this keyword is used to refer to the current object.

```
public class ClassName {
    public void methodName() {
        this.memberName;
    }
}
//Example:

public class Car {
    private String color;
    private int speed;

    public Car(String color, int speed) {
        this.color = color;
        this.speed = speed;
    }
}
```

k) Getters and Setters

Getters and setters are methods used to access and modify the properties of an object.

```java
public class ClassName {
   private DataType propertyName;

   public DataType getPropertyName() {
       return propertyName;
   }

   public void setPropertyName(DataType propertyName) {
       this.propertyName = propertyName;
   }
}

//Example:

public class Car {
   private String color;
   private int speed;

   public String getColor() {
       return color;
   }

   public void setColor(String color) {
       this.color = color;
   }

   public int getSpeed() {
       return speed;
   }

   public void setSpeed(int speed) {
       this.speed = speed;
   }
}
```

l) Access Modifiers

Access modifiers are keywords used to specify the accessibility of a class, method, or variable.

- public: accessible from anywhere
- private: accessible only within the same class
- protected: accessible within the same class and subclasses
- default (no modifier): accessible within the same package

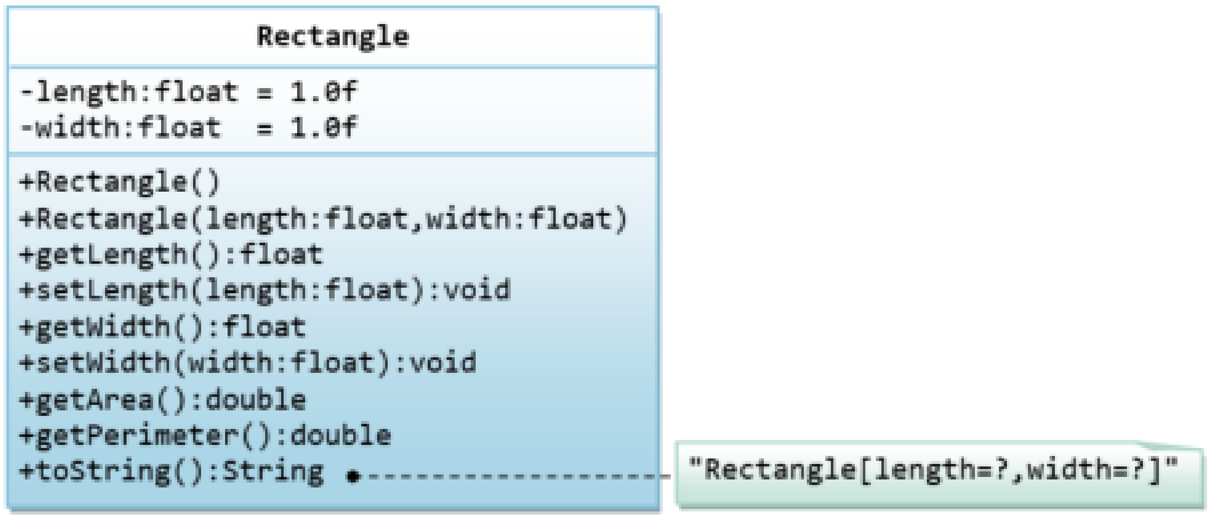
```
public class ClassName {
   // public members

   private DataType propertyName;
   // private members

   protected DataType propertyName;
   // protected members

   default DataType propertyName;
   // default members
}

//Example:

public class Car {
   public String color;
   private int speed;
   protected String brand;

   public void accelerate() {
       // public method
   }

   private void brake() {
       // private method
   }

   protected void turn() {
       // protected method
```

```
    }
}
```

Q1. WAP to create a class called Circle. It contains:
• private instance variable: radius (of the type double) with default value of 1.0.
• Two overloaded constructors - a default constructor with no argument, and a constructor which takes a double argument for radius.
• Two public methods: getRadius(), calculateArea(), calculateCircumference() which return the radius, calculate and return area, and circumference respectively.
Hint: Use Math.PI for calculating area and circumference
→

```
import java.util.Scanner;

public class Circle {
    private double radius;

    public Circle() {
        this.radius = 1.0;
    }

    public Circle(double radius) {
        this.radius = radius;
    }

    public double getRadius() {
        return this.radius;
    }

    public double calculateArea() {
        return Math.PI * this.radius * this.radius;
    }

    public double calculateCircumference() {
        return 2 * Math.PI * this.radius;
    }

    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.println("Enter the radius of the circle (default is 1.0): ");
        double radius = scanner.nextDouble();
        Circle circle = new Circle(radius);
        System.out.println("Radius: " + circle.getRadius());
        System.out.println("Area: " + circle.calculateArea());
        System.out.println("Circumference: " + circle.calculateCircumference());
        scanner.close();
    }
}
```

Q2. A class called Rectangle, which models a rectangle with a length and a width (in float), is designed as shown in the following class diagram. Write the Rectangle class as per UML diagram.

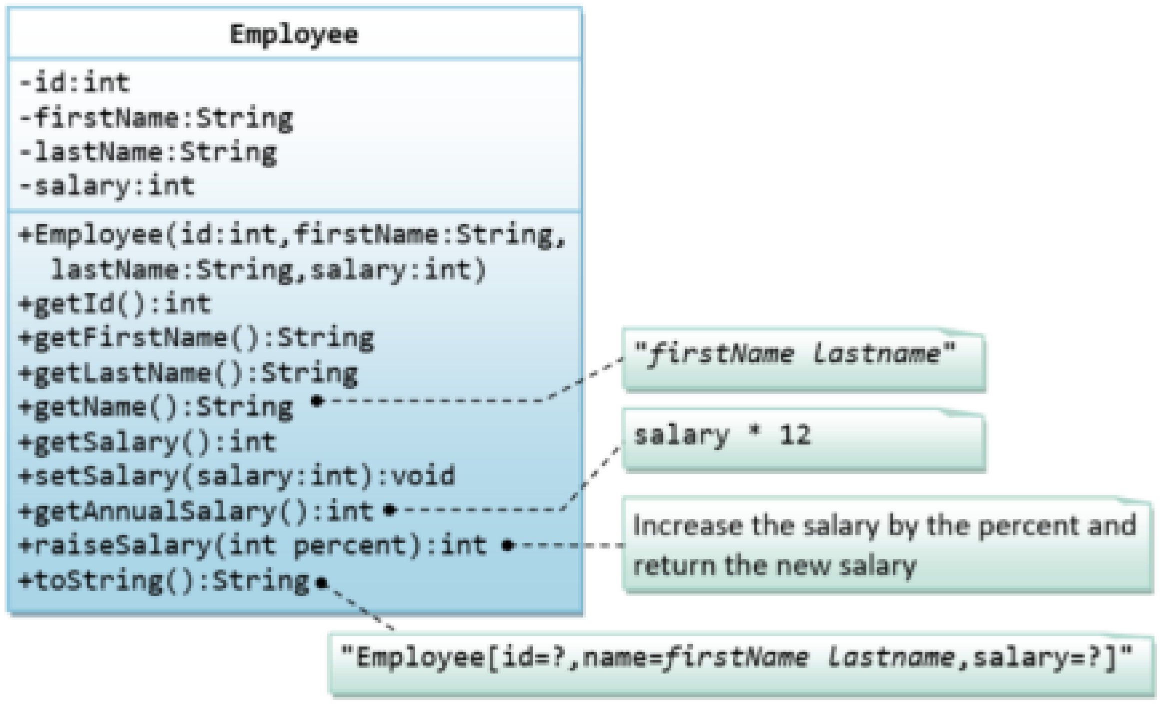


→

```
import java.util.Scanner;

public class Rectangle {
    private float length;
    private float width;

    public Rectangle() {
        this.length = 1.0f;
        this.width = 1.0f;
    }
```

```java
    public Rectangle(float length, float width) {
        this.length = length;
        this.width = width;
    }

    public float getLength() {
        return this.length;
    }

    public float getWidth() {
        return this.width;
    }

    public double calculateArea() {
        return this.length * this.width;
    }

    public double calculatePerimeter() {
        return 2 * (this.length + this.width);
    }

    public static void main(String[] args) {
        Scanner scanner = new Scanner(System.in);
        System.out.println("Enter the length of the rectangle (default is 1.0): ");
        float length = scanner.nextFloat();
        System.out.println("Enter the width of the rectangle (default is 1.0): ");
        float width = scanner.nextFloat();
        Rectangle rectangle = new Rectangle(length, width);
        System.out.println("Length: " + rectangle.getLength());
        System.out.println("Width: " + rectangle.getWidth());
        System.out.println("Area: " + rectangle.calculateArea());
        System.out.println("Perimeter: " + rectangle.calculatePerimeter());
        scanner.close();
    }
}
```

Q3. A class called Employee, which models an employee with an ID, name and salary, is designed as shown in the following class diagram. The method raiseSalary(percent) increases the salary by the given percentage. Write the Employee class and its driver class.


Employee
-id:int
-firstName:String
-lastName:String
-salary:int
+Employee(id:int,firstName:String, lastName:String,salary:int)
+getId():int
+getFirstName():String
+getLastName():String
+getName():String
+getSalary():int
+setSalary(salary:int):void
+getAnnualSalary():int
+raiseSalary(int percent):int
+toString():String
"firstName Lastname"
salary * 12
Increase the salary by the percent and return the new salary
"Employee[id=?,name=firstName Lastname,salary=?]"

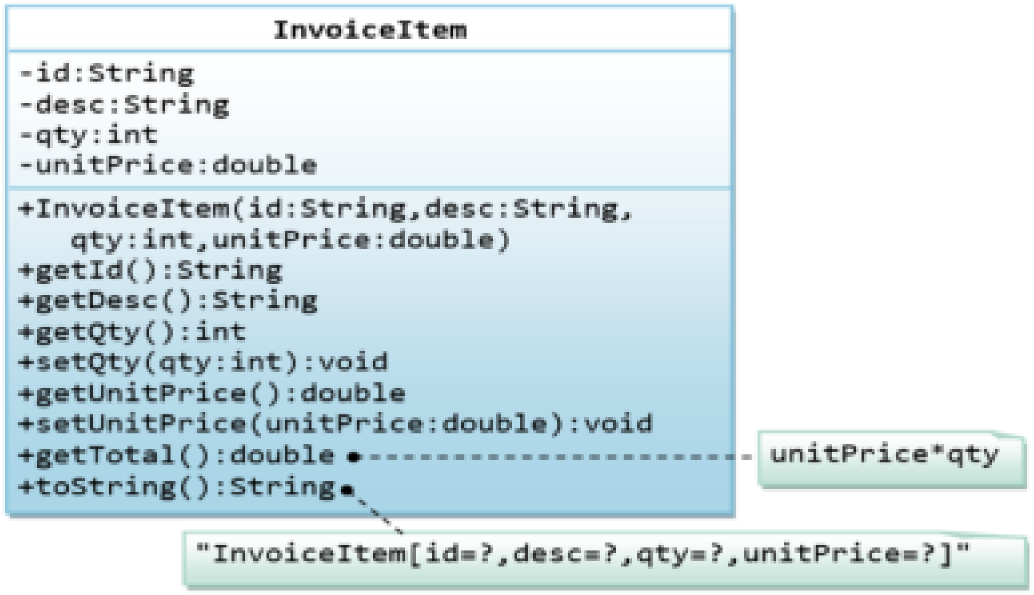
→

```
import java.util.Scanner;

public class Employee {
   private int id;
   private String firstName;
   private String lastName;
   private int salary;

   public Employee(int id, String firstName, String lastName, int salary) {
       this.id = id;
       this.firstName = firstName;
       this.lastName = lastName;
       this.salary = salary;
   }

   public Employee() {}
```

```java
public int getId() {
    return id;
}

public void setId(int id) {
    this.id = id;
}

public String getFirstName() {
    return firstName;
}

public void setFirstName(String firstName) {
    this.firstName = firstName;
}

public String getLastName() {
    return lastName;
}

public void setLastName(String lastName) {
    this.lastName = lastName;
}

public String getName() {
    return firstName + " " + lastName;
}

public int getSalary() {
    return salary;
}

public void setSalary(int salary) {
    this.salary = salary;
}

public int getAnnualSalary() {
    return salary * 12;
    }

    public void raiseSalary(double percent) {
        this.salary += this.salary * (percent / 100);
    }

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

        System.out.println("Enter Employee ID: ");
        employee.setId(scanner.nextInt());
        scanner.nextLine(); // Consume newline left-over

        System.out.println("Enter Employee First Name: ");
        employee.setFirstName(scanner.nextLine());

        System.out.println("Enter Employee Last Name: ");
        employee.setLastName(scanner.nextLine());

        System.out.println("Enter Employee Monthly Salary: ");
        employee.setSalary(scanner.nextInt());

        System.out.println("Employee ID: " + employee.getId());
        System.out.println("Employee Name: " + employee.getName());
        System.out.println("Employee Monthly Salary: " + employee.getSalary());
        System.out.println("Employee Annual Salary: " + employee.getAnnualSalary());

        System.out.println("Enter percentage to raise salary: ");
        double percent = scanner.nextDouble();
        employee.raiseSalary(percent);

        System.out.println("Employee Monthly Salary after raise: " +
employee.getSalary());
        System.out.println("Employee Annual Salary after raise: " +
employee.getAnnualSalary());

        scanner.close();
    }
```

```
}
```

Q4. A class called InvoiceItem, which models an item of an invoice, with ID, description, quantity and unit price, is designed as shown in the following class diagram. It has a method getTotal which calculates total value (total=quantity*unit price). Write the InvoiceItem class and it's driver class.



→

```
import java.util.Scanner;

public class InvoiceItem {
   private String id;
   private String description;
   private int quantity;
   private double unitPrice;

   public InvoiceItem(String id, String description, int quantity, double unitPrice) {
       this.id = id;
       this.description = description;
       this.quantity = quantity;
       this.unitPrice = unitPrice;
   }

   public InvoiceItem() {}
   public String getId() {
       return id;
   }

   public void setId(String id) {
       this.id = id;
   }

   public String getDescription() {
       return description;
   }

   public void setDescription(String description) {
       this.description = description;
   }

   public int getQuantity() {
       return quantity;
   }

   public void setQuantity(int quantity) {
       this.quantity = quantity;
   }

   public double getUnitPrice() {
       return unitPrice;
   }

   public void setUnitPrice(double unitPrice) {
       this.unitPrice = unitPrice;
   }

   public double getTotal() {
       return quantity * unitPrice;
   }

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

```
        System.out.println("Enter Invoice Item ID: ");
        item.setId(scanner.nextLine());

        System.out.println("Enter Invoice Item Description: ");
        item.setDescription(scanner.nextLine());

        System.out.println("Enter Invoice Item Quantity: ");
        item.setQuantity(scanner.nextInt());
        scanner.nextLine(); // Consume newline left-over

        System.out.println("Enter Invoice Item Unit Price: ");
        item.setUnitPrice(scanner.nextDouble());
        scanner.nextLine(); // Consume newline left-over

        System.out.println("ID: " + item.getId());
        System.out.println("Description: " + item.getDescription());
        System.out.println("Quantity: " + item.getQuantity());
        System.out.println("Unit Price: " + item.getUnitPrice());
        System.out.println("Total: " + item.getTotal());

        scanner.close();
    }
}
```

Q5. A class called Author is designed to model a book's author. It contains:
1) Three private instance variables: name (String), email (String), and gender (char of either 'm' or 'f');
2) One constructor to initialize the name, email and gender with the given values; a) public Author (String name, String email, char gender) {......}(There is no default constructor for Author, as there are no defaults for name, email and gender.) 3) public getters/setters: getName(), getEmail(), setEmail(), and getGender(); (There are no setters for name and gender, as these attributes cannot be changed.)
4) A toString() method that returns "Author[name=?,email=?,gender=?]", e.g., “Author[name=Abc ,email=Abc@gmail.com, gender=m]".
→

```
import java.util.Scanner;

public class Author {
    private String name;
```

```java
    private String email;
    private char gender;

    public Author(String name, String email, char gender) {
        this.name = name;
        this.email = email;
        this.gender = gender;
    }

    public String getName() {
        return name;
    }

    public String getEmail() {
        return email;
    }

    public void setEmail(String email) {
        this.email = email;
    }

    public char getGender() {
        return gender;
    }

    public String toString() {
        return "Author[name=" + name + ",email=" + email + ",gender=" + gender + "]";
    }

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

        System.out.println("Enter Author's Name: ");
        String name = scanner.nextLine();

        System.out.println("Enter Author's Email: ");
        String email = scanner.nextLine();

        System.out.println("Enter Author's Gender (m/f): ");
        char gender = scanner.next().charAt(0);

        Author author = new Author(name, email, gender);

        System.out.println(author.toString());

        System.out.println("Enter new Email: ");
        String newEmail = scanner.next();
        author.setEmail(newEmail);

        System.out.println("Updated Author's Information: ");
        System.out.println(author.toString());

        scanner.close();
    }
}
```

Q6. WAP to create a class time having default constructor, parameterized constructor whose specifications are as follows:
1) Instance variable: hr, min, sec
2) Constructors:
i) default (with no parameters passed; should initialize the represented time to 12:0:0) ii) a constructor with three parameters: hours, minutes, and seconds.
iii) a constructor with one parameter: the value of time in seconds since midnight (it should be converted into the time value in hours, minutes, and seconds)
3) Instance methods:
i) setClock() with one parameter seconds since midnight (to be converted into the time value in hours, minutes, and seconds as above).
ii) tick() with no parameters that increments the time stored in a Clock object by one second.
iii) tickDown() which decrements the time stored in a Clock object by one second.
iv) displaytime() displays the time in the format hr: min:sec e.g: 05:45:23
→

```
public class Time {
    private int hr;
    private int min;
    private int sec;

    public Time() {
        this.hr = 12;
        this.min = 0;
        this.sec = 0;
    }

    public Time(int hr, int min, int sec) {
        this.hr = hr;
        this.min = min;
        this.sec = sec;
    }

    public Time(int seconds) {
        this.hr = seconds / 3600;
        this.min = (seconds % 3600) / 60;
        this.sec = seconds % 60;
    }

    public void setClock(int seconds) {
        this.hr = seconds / 3600;
        this.min = (seconds % 3600) / 60;
        this.sec = seconds % 60;
    }

    public void tick() {
        this.sec++;
        if (this.sec == 60) {
            this.sec = 0;
            this.min++;
            if (this.min == 60) {
                this.min = 0;
                this.hr = (this.hr + 1) % 24;
            }
        }
    }

    public void tickDown() {
        this.sec--;
        if (this.sec == -1) {
            this.sec = 59;
            this.min--;
            if (this.min == -1) {
                this.min = 59;
                this.hr = (this.hr - 1 + 24) % 24;
            }
        }
    }

    public void displayTime() {
        System.out.printf("%02d:%02d:%02d\n", hr, min, sec);
    }

    public static void main(String[] args) {
        Time time = new Time();
        time.displayTime();
        time.tick();
        time.displayTime();
        time.tickDown();
        time.displayTime();
    }
}
```

Q7. Write a Java class Complex for dealing with complex number. Your class must have the following features:
1) Instance variables :
a) real for the real part of type double
b) imag for imaginary part of type double.
2) Constructor:
a) public Complex (): A default constructor, it should initialize the number to 0, 0) b) public Complex (double real, double imag: A constructor with parameters, it creates the complex object by setting the two fields to the passed values.
3) Instance methods:
a) public Complex add (Complex n): This method will find the sum of the current complex number and the passed complex number. The methods returns a new Complex number which is the sum of the two.
b) public Complex subtract (Complex n): This method will find the difference of the current complex number and the passed complex number. The methods returns a new Complex number which is the difference of the two.
c) public void setReal(double real): Used to set the real part of this complex number. d) public void setImag(double image): Used to set the imaginary part of this complex number.

e) public double getReal(): This method returns the real part of the complex number f) public double getImag(): This method returns the imaginary part of the complex number
g) public String toString(): This method allows the complex number to be easily printed out to the screen
4) Write a separate class ComplexDemo with a main() method and test the Complex class methods.
→

```java
import java.util.Scanner;

public class Complex {
   private double real;
   private double imag;

   public Complex() {
       this.real = 0;
       this.imag = 0;
   }

   public Complex(double real, double imag) {
       this.real = real;
       this.imag = imag;
   }

   public Complex add(Complex n) {
       return new Complex(this.real + n.getReal(), this.imag + n.getImag());
   }

   public Complex subtract(Complex n) {
       return new Complex(this.real - n.getReal(), this.imag - n.getImag());
   }

   public void setReal(double real) {
       this.real = real;
   }

   public void setImag(double imag) {
       this.imag = imag;
   }

   public double getReal() {
       return this.real;
```

```
    }

    public double getImag() {
        return this.imag;
    }

    public String toString() {
        return this.real + " + " + this.imag + "i";
    }
}

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

        System.out.println("Enter real part of first complex number: ");
        double real1 = scanner.nextDouble();
        System.out.println("Enter imaginary part of first complex number: ");
        double imag1 = scanner.nextDouble();

        System.out.println("Enter real part of second complex number: ");
        double real2 = scanner.nextDouble();
        System.out.println("Enter imaginary part of second complex number: ");
        double imag2 = scanner.nextDouble();

        Complex c1 = new Complex(real1, imag1);
        Complex c2 = new Complex(real2, imag2);

        System.out.println("First complex number: " + c1.toString());
        System.out.println("Second complex number: " + c2.toString());

        Complex sum = c1.add(c2);
        System.out.println("Sum: " + sum.toString());

        Complex difference = c1.subtract(c2);
        System.out.println("Difference: " + difference.toString());

        scanner.close();
    }
```

```
}
```

Q8. Create a SumEx1class and overload sum() method for:
• two integers
• three integers
• two double
• three double
→

```
import java.util.Scanner;

public class SumEx1 {
   public int sum(int a, int b) {
       return a + b;
   }

   public int sum(int a, int b, int c) {
       return a + b + c;
   }

   public double sum(double a, double b) {
       return a + b;
   }

   public double sum(double a, double b, double c) {
       return a + b + c;
   }

   public static void main(String[] args) {
       SumEx1 sumEx1 = new SumEx1();
       Scanner scanner = new Scanner(System.in);

       System.out.println("Enter two integers: ");
       int a = scanner.nextInt();
       int b = scanner.nextInt();
       System.out.println("Sum of two integers: " + sumEx1.sum(a, b));

       System.out.println("Enter three integers: ");
       a = scanner.nextInt();
```

```
        b = scanner.nextInt();
        int c = scanner.nextInt();
        System.out.println("Sum of three integers: " + sumEx1.sum(a, b, c));

        System.out.println("Enter two doubles: ");
        double d = scanner.nextDouble();
        double e = scanner.nextDouble();
        System.out.println("Sum of two doubles: " + sumEx1.sum(d, e));

        System.out.println("Enter three doubles: ");
        d = scanner.nextDouble();
        e = scanner.nextDouble();
        double f = scanner.nextDouble();
        System.out.println("Sum of three doubles: " + sumEx1.sum(d, e, f));

        scanner.close();
    }
}
```

Q9. WAP to implement Box class.
• Inherit Box class in BoxWt whose
o instance variable is weight and
o method is print_BoxWt()
o constructors: default, parameterized and BoxWt(BoxWt ob)
o Use super() to invoke superclass constructors.
• WAP to demonstrate multilevel inheritance by creating a BoxColor class and inheriting BoxWt class. BoxColor class has an instance variable color of String type.
→

```
import java.util.Scanner;

class Box {
    protected double width;
    protected double height;
    protected double depth;

    public Box() {
        this.width = 0;
        this.height = 0;
        this.depth = 0;
```

```java
   }

   public Box(double width, double height, double depth) {
       this.width = width;
       this.height = height;
       this.depth = depth;
   }

   public double getWidth() {
       return width;
   }

   public double getHeight() {
       return height;
   }

   public double getDepth() {
       return depth;
   }
}

class BoxWt extends Box {
   protected double weight;

   public BoxWt() {
       super();
       this.weight = 0;
   }

   public BoxWt(double width, double height, double depth, double weight) {
       super(width, height, depth);
       this.weight = weight;
   }

   public BoxWt(BoxWt ob) {
       super(ob.getWidth(), ob.getHeight(), ob.getDepth());
       this.weight = ob.weight;
   }
```

```
    public void print_BoxWt() {
        System.out.println("Width: " + getWidth() + ", Height: " + getHeight() + ",
Depth: " + getDepth() + ", Weight: " + weight);
    }
}

class BoxColor extends BoxWt {
    private String color;

    public BoxColor(double width, double height, double depth, double weight, String
color) {
        super(width, height, depth, weight);
        this.color = color;
    }

    public void print_BoxColor() {
        System.out.println("Width: " + getWidth() + ", Height: " + getHeight() + ",
Depth: " + getDepth() + ", Weight: " + weight + ", Color: " + color);
    }
}

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

        System.out.println("Enter width for BoxWt: ");
        double widthWt = scanner.nextDouble();
        System.out.println("Enter height for BoxWt: ");
        double heightWt = scanner.nextDouble();
        System.out.println("Enter depth for BoxWt: ");
        double depthWt = scanner.nextDouble();
        System.out.println("Enter weight for BoxWt: ");
        double weightWt = scanner.nextDouble();

        BoxWt boxWt = new BoxWt(widthWt, heightWt, depthWt, weightWt);
        boxWt.print_BoxWt();

        System.out.println("Enter width for BoxColor: ");
        double widthColor = scanner.nextDouble();
        System.out.println("Enter height for BoxColor: ");
        double heightColor = scanner.nextDouble();
        System.out.println("Enter depth for BoxColor: ");
        double depthColor = scanner.nextDouble();
        System.out.println("Enter weight for BoxColor: ");
        double weightColor = scanner.nextDouble();
        System.out.println("Enter color for BoxColor: ");
        String color = scanner.next();

        BoxColor boxColor = new BoxColor(widthColor, heightColor, depthColor,
weightColor, color);
        boxColor.print_BoxColor();

        scanner.close();
    }
}
```

Q15. Create a class Animal with:
1) instance variables:
a) boolean vegetarian
b) String food
c) int numOfLegs
2) Create a no-argument constructor and parameterized constructor. (Use “this”) 3) Create getters and setters
4) Create a toString() method for animal class
5) Create a subclass Cat with instance variable:
a) String color
b) Create a no-argument constructor and parameterized constructor which has all four parameters (Use this and super)
c) Create a toString() method for Cat class
6) Create a subclass Cow with instance variable:
a) String breed
b) Create a no-argument constructor and parameterized constructor which has all four parameters. (Use this and super)
c) Create a toString() method for Cow class
→

```
import java.util.Scanner;

public class Animal {
    private boolean vegetarian;
```

```java
   private String food;
   private int numOfLegs;

   public Animal() {
       this.vegetarian = false;
       this.food = "Unknown";
       this.numOfLegs = 0;
   }

   public Animal(boolean vegetarian, String food, int numOfLegs) {
       this.vegetarian = vegetarian;
       this.food = food;
       this.numOfLegs = numOfLegs;
   }

   public boolean isVegetarian() {
       return vegetarian;
   }

   public void setVegetarian(boolean vegetarian) {
       this.vegetarian = vegetarian;
   }

   public String getFood() {
       return food;
   }

   public void setFood(String food) {
       this.food = food;
   }

   public int getNumOfLegs() {
       return numOfLegs;
   }

   public void setNumOfLegs(int numOfLegs) {
       this.numOfLegs = numOfLegs;
   }
   public String toString() {
       return "Animal{" +
               "vegetarian=" + vegetarian +
               ", food='" + food + '\'' +
               ", numOfLegs=" + numOfLegs +
               '}';
   }

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

       System.out.println("Is the animal vegetarian? (true/false): ");
       boolean vegetarian = scanner.nextBoolean();

       System.out.println("What does the animal eat? ");
       String food = scanner.next();

       System.out.println("How many legs does the animal have? ");
       int numOfLegs = scanner.nextInt();

       Animal animal = new Animal(vegetarian, food, numOfLegs);
       System.out.println(animal.toString());

       scanner.close();
   }
}

class Cat extends Animal {
   private String color;

   public Cat() {
       super();
       this.color = "Unknown";
   }

   public Cat(boolean vegetarian, String food, int numOfLegs, String color) {
       super(vegetarian, food, numOfLegs);
       this.color = color;
   }
```

```
    public String getColor() {
        return color;
    }

    public void setColor(String color) {
        this.color = color;
    }

    public String toString() {
        return "Cat{" +
                "color='" + color + '\'' +
                ", " + super.toString() +
                '}';
    }

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

        System.out.println("Is the cat vegetarian? (true/false): ");
        boolean vegetarian = scanner.nextBoolean();

        System.out.println("What does the cat eat? ");
        String food = scanner.next();

        System.out.println("How many legs does the cat have? ");
        int numOfLegs = scanner.nextInt();

        System.out.println("What color is the cat? ");
        String color = scanner.next();

        Cat cat = new Cat(vegetarian, food, numOfLegs, color);
        System.out.println(cat.toString());

        scanner.close();
    }
}

class Cow extends Animal {
```

```java
private String breed;

public Cow() {
    super();
    this.breed = "Unknown";
}

public Cow(boolean vegetarian, String food, int numOfLegs, String breed) {
    super(vegetarian, food, numOfLegs);
    this.breed = breed;
}

public String getBreed() {
    return breed;
}

public void setBreed(String breed) {
    this.breed = breed;
}

public String toString() {
    return "Cow{" +
            "breed='" + breed + '\'' +
            ", " + super.toString() +
            '}';
}

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

    System.out.println("Is the cow vegetarian? (true/false): ");
    boolean vegetarian = scanner.nextBoolean();

    System.out.println("What does the cow eat? ");
    String food = scanner.next();

    System.out.println("How many legs does the cow have? ");
    int numOfLegs = scanner.nextInt();
```

```
        System.out.println("What breed is the cow? ");
        String breed = scanner.next();

        Cow cow = new Cow(vegetarian, food, numOfLegs, breed);
        System.out.println(cow.toString());

        scanner.close();
    }
}
```