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E-10

ASSIGNMENT - 02

Title → Polymorphism

Aim → Identify commonilities and difference between publication, Book and magazine. Title, price, copies are cannon instance varibles and sellcopy is comman method. The difference are Book has author and ordercopies(). Magazine class has orderQty, current_issue, and receive_issue(). Write a program to find how many copies of the given books are ordered and display total sell of publications.

Objectives →

a) Identify relationship among object using inheritance and polymorphism.
b) Apply concepts of objects-oriented paradigm.

Theory →

① Definitions →

a) Inheritance →

It can be defined as the process where all class acquires the properties (methods and datamembers) of another with the use of inheritance, the info is made managable in a hierarchical order.

The types of inheritance are
1) Sihgle level 2) Multilevel 3) Hierarchical 4) Multiple

b) Polymorphism →

Polymorphism means "many forms", and it occurs when we have many classes that are related to each other by inheritance.

The types of polymorphism are →
1) Runtime Polymorphism.
2) Compile time Polymorphism.

Inheritance and polymorphism are one of the two main features of object oriented programming.

(2) Explanation →

a) Features →

Features of inheritance and same imp. definitions

1) Using inheritance we can create new classes that are built upon existing ones.
2) We can reuse methods and fields of parent classes.
3) 'extends' → it is the keyword that is used to inherit the properties of a class.

Syntax →

```
class parent {
}
class child extends parent {
}
```

iv) super → super keyword is similar to "this" keyword.

→ super keyword is used to call (invoke) the parent class constructors in child classes.

→ It is also used to differentiate the members of parent class from the child class, if they have same name.

Syntax →

```
super.variable_name;
super()    // for constructors.
```

→ Features of Polymorphism →

There are two types

① Static binding (compile time)

② Dynamic binding (runtime)

The most common use of polymorphism in OOP occurs when a parent class referance is used to refer to a child class object.

Syntax →

```
class Parent {
  public void method 1 {
  }
}
class child extends parent {
  public void method 1 {
}
}
```

(3) Example →

```
class vehicle
{
  int wheels;
  vehicle()
  {
    wheels = 4;
    System.out.println("Inside vehicle()");
  }
}

class Bike extends vehicle
{
  int wheels;
  Bike()
  {
    super();
    wheels = 2;
    System.out.println("Inside Bike");
    System.out.println("super x=" + super.wheels);
  }
public void start()
  {
    System.out.println("Bike started");
  }
}
```

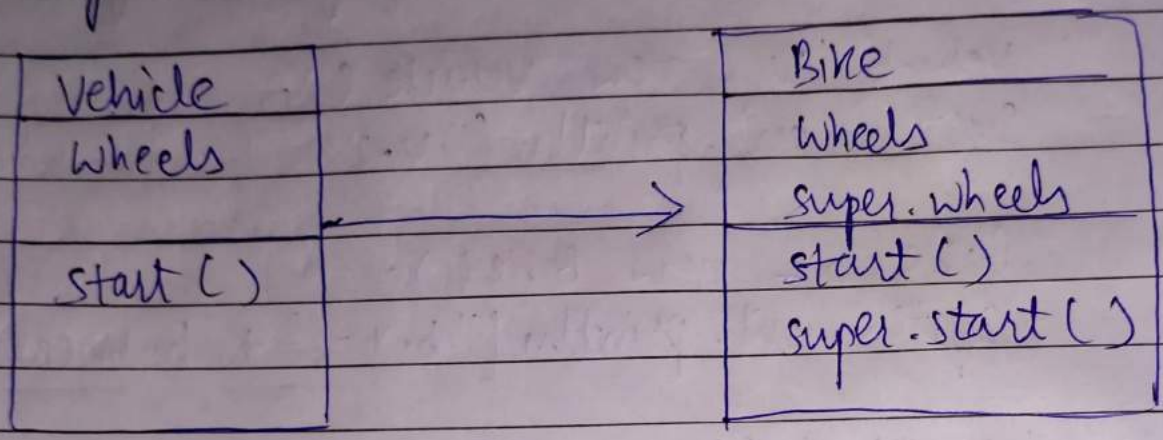
```
public class Main
{
    public static void main (String [] args)
    {
        Vehicle V = new Vehicle ();
        System. out. println ("V.x = " + V. wheels);

        Bike b = new Bike ();
        System. out. println ("b.x = " + b. wheels);

        V. start ();
        b. start ();
    }
}
```

O/P →

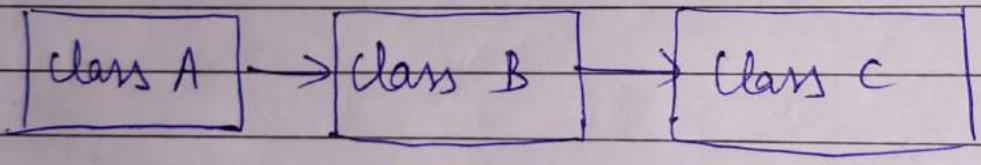
```
inside vehicle ()
V.x = 4
inside vehicle ()
inside Bike ()
super. x = 4
b. x = 2
Vehicle started
Bike started
```

4) Diagram →

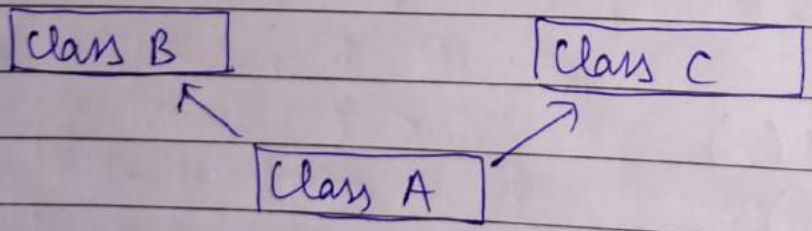
a) Sihgle Level Inheritance →



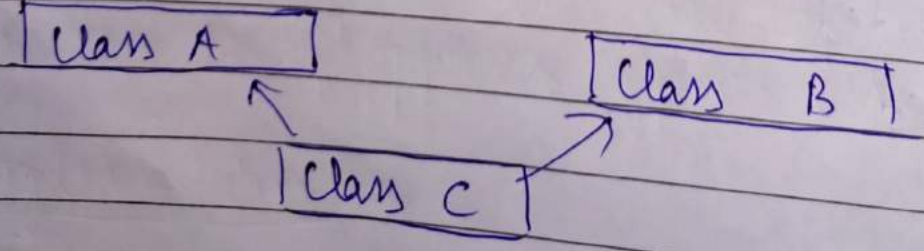
b) Multi - Level inheritance →



c) Multiple inheritance →



d) Hierarchical inheritance →



public class

(5) Working →

→ Publication class →

a) This class consists of 5 data members which are private. title, price, copies are non static data members of type string, float and int resp.

Total_sell_amount and Total_copies_sold are static data members of type double.

b) The methods are as follows :-

i) Constructor → Publication ( ) :
It is used to initialize the values of title, price & copies.

ii) setter method → set_copies (int c)
It is used to set the copies to c.

iii) Getter method → get copies (int c)
It is used to increment the demand and retur copies

v) read ( ) →
It is used to read the title, price and no. of copies available.

vi) display ( ) →
It is used to display title, price & copies.

vii) Static method total-sell() →
to display total no. of copies sold & total amt. from sell.

viii) sellcopy() →
to display the details and billing amt of book or magazine.

→ Book class →

a) This class is inherited from publication & along with no's of publications, Book consists
① private data member author of string type.
② Constructor : BOOK()
It is used to call publication class constructor and initialize author.
③ read_book() →
It is used to call read() method of publication and ~~display~~ read the author name
④ display_book() →
It is used to call display() method of publication and display the author name.
⑤ order_copies(int c) →
It is used to take the input of no_of_copies to be ordered for a particular book.

→ Magazine class →

a) This class is inherited from publications and along with members and publications, magazine consists:

(1) private data member orderQty and current_issue of type int and string resp.

(2) Constructor_Magazine() →
It is used to call publication class constructor and initialize orderQty and current_issue.

(3) read_mg() →
It is used to call read() of publication and to read current_issue date.

(4) display_mg() →
It is used to call display() of publication class and display the current_issue

(5) receive_issue() →
It is used to set current_issue and orderQty to new_issue and the quantities ordered resp. with one formal parameter & also to update copies.

→ Test class →

(1) In test class, first the scanner class object is created for scanning (s).

(2) Objects of Book and Magazine, book and Mdg resp. are created.

(3) While creation default constructors of Book & magzine and publications class constructor are called.

④ Then we read data for book and magazine respectively.

⑤ Then user is given choices as follows-
a) to work with Book.
b) to work with Magazine
c) to display total sell of publication.
d) Exit.

⑥ Suppose the details given for book are as follows.

Title : Wings of Fire
No of copies : 30
Price : 360
Author : Dr. APJ Abdul Kalam

and details of magazine are as follows:-
Title : Harry Potter
no. of copies : 20
price : 630
current_issue : 11-11-2019

⑦ Suppose you enter 1 (work with book) then options will be
1.) display
2.) order copies
3) sell copies
4) return to main menu.

- If user pass 1 then, details of Book, are displayed.
- If user pass 2 then, no. of copies to be ordered are taken as input and copies are updated.
- If user pass 3 then no. of copies to be sold are taken as input & following proper validations, copies are sold.
- If user pass 4 then return to main menu
- Similar execution is there for magazine the diff. is we don't order, we receive new issue for that magazine.
- If user enters 3 for main menu then total copies sold and total amt. of copies sold are displayed.
- If user enters 4, then program execution stops.

(6) Advantages & Disadvantages →

A) Advantages →

- It helps the programmer to reuse the codes.
- Simple variable can be used to store data of multiple & diff datatypes.
- Easy to debug the code.

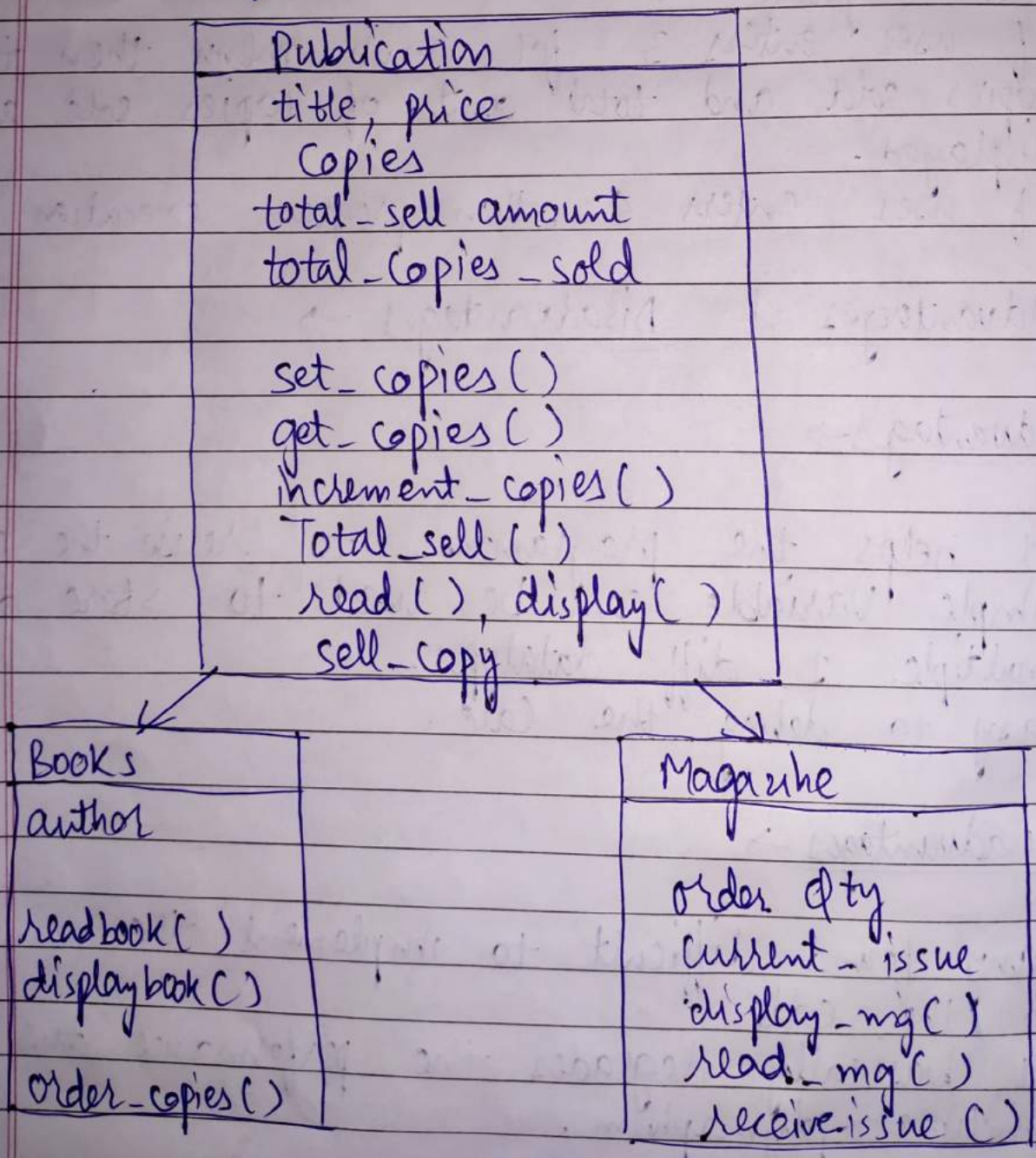
B) Disadvantages →

- Many found difficult to implement the concept in the code.
- It basically degrades the performance due to runtime polymorphism.

(7) Applications →

- There are many useful applications
- Inheritance and polymorphism reduces the code and makes it easier.
- Real life example are living things
  Animal → Dog

(8) Class Diagram →



→ Validations →

① Validations are done for sell_copy() →

→ If the no. of copies to sold are less than or equal to (Copies - 1) then directly billing is done

→ If the no. of copies to be ~~said~~ sold are greater than (Copies-1) then user gets a choice to purchase (Copies-1) no of copies or leave without purchasing.

→ If user purchase it then billing is done

else no updates.

* Test Cases →

S.No	Input	Expected output	Actual output	Result
1)	Book : Copies = 45 Order copies = 10 Sell copies = 30 price = 250	Copies sold = 30 Total amt = 7500	Copies sold = 30 Total amt = 7500	Success
2)	Magazine : Copies = 35 Sell copies = 20 price = 100	Copies sold = 20 Total amt = 2000	Copies sold = 20 Total amt = 2000	Success
		Total copies = 50 Total amt = 9500	Total copies = 50 Total amt = 9500	Success

Date
Page

→ Conclusion →

Thrugh this assignment we learned how to apply inheritance and polymorphism and how to use super and extends keyword.

We also learned more about static data membess and methods.