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| File:COMSATS new logo.jpg - Wikimedia Commons  OBJECT ORIENTED PROGRAMMING  *Lab Task 07*  *INHERITANCE* | **submitted by:**  **Shahzaneer Ahmed**  **registration number:**  **sp21-bcs-087**  **submitted to:**  **mA’M sANEEHA aMIR**  **date of submission:**  **APRIL 7, 2022** |

Inheritance

**# Inheritance**

- It refers to `is a Relation`.

**## Single Level Inheritance**

- The phenomenon in which one class inherits other classs Attributes.

**# Important Points**

- Parent class - Child Class

- A Child can have only one Parent (Multilevel Inheritance is not allowed).

- Siblings are not Related.

- Parents have no information about child classes.

- Child has info of parents and its ancestors.

**## Super keyword**

- It refers to the super class' Object.

- Its must to call the parent class constructor in the child contrcutor.

- nhi likhayingay tou syntax error milega!

- `super();` is the way to call parent constructor.

- super can be default as well as parameterized Constructor.

**# Overridden Methods**

- Methods with same name and same return type in child and parent classes with different definitions.

- A method is to be overridden if the child needs to change/tailor the overidden Method.

- Overridden method is not like overloaded Method.

# Question 1

## CommEmployee

public class CommEmployee {

    protected String firstName;

    protected String lastName;

    protected double grossSale;

    protected double commRate;

    protected double SSN;

    public CommEmployee(){

*// super constructor*

    }

    public CommEmployee(String firstName , String lastName , double grossSale, double commRate , double SNN){

*this*.firstName = firstName;

*this*.lastName = lastName;

*this*.grossSale = grossSale;

*this*.commRate = commRate;

*this*.SSN = SNN;

    }

    public double earnings(){

        return grossSale\*commRate;

    }

    public void display(){

        System.out.println(*this*.firstName);

        System.out.println(*this*.lastName);

        System.out.println(*this*.grossSale);

        System.out.println(*this*.commRate);

        System.out.println(*this*.SSN);

    }

}

## BasePlusCommClass

public class BasePlusCommEmployee extends CommEmployee{

    private double basicSalary;

    public BasePlusCommEmployee(){

*super*();

    }

    public BasePlusCommEmployee(String firstName , String lastName,double grossSale,double commRate,double SNN, double basicSalary){

*super*(firstName, lastName, grossSale, commRate,SNN);

*this*.basicSalary = basicSalary;

    }

    @Override

    public double earnings(){

        return basicSalary + *super*.earnings();

    }

    public void display(){

*super*.display();

        System.out.println(*this*.basicSalary);

    }

}

## Runner

public class Runner {

    public static void main(String[] args) {

        BasePlusCommEmployee emp1 = new BasePlusCommEmployee("Shahzaneer","Ahmed",450.0,300,3456,9000);

        emp1.display(); *//emp1 ki body main jo earnings hain wo return hua hai!*

        System.out.println(emp1.earnings());

    }

}

# Question 2

## Computer:

public class Computer{

*// Data Members*

    private int wordSize;

    private int memorySize;

    private int storageSize;

    private double speed;

*// Constructors*

    public Computer(){}

    public Computer(int wordSize,int memorySize,int storageSize,double speed){

*this*.wordSize = wordSize;

*this*.memorySize = memorySize;

*this*.storageSize = storageSize;

*this*.speed = speed;

    }

*// setters*

    public void setWordSize(int wordSize){

*this*.wordSize = wordSize;

    }

    public void setMemorySize(int memorySize){

*this*.memorySize = memorySize;

    }

    public void setStorageMemory(int storageSize){

*this*.storageSize = storageSize;

    }

    public void setSpeed(double speed){

*this*.speed = speed;

    }

*// getters*

    public int getWordSize(){

        return *this*.wordSize;

    }

    public int getMemorySize(){

        return *this*.memorySize;

    }

    public int getStorageSize(){

        return *this*.storageSize;

    }

    public double getSpeed(){

        return *this*.speed;

    }

    public void display(){

        System.out.println(*this*.getWordSize());

        System.out.println(*this*.getMemorySize());

        System.out.println(*this*.getStorageSize());

        System.out.println(*this*.getSpeed());

    }

}

## Laptop

import javax.management.ConstructorParameters;

public class Laptop extends Computer{

    private double  length;

    private double width;

    private double height;

    private double weight;

    public Laptop(){

*super*(); *// yeh na bhi den tou by default compiler daal deta hai*

    }

    public Laptop(int ws, int ms , int ss, double sp, double l , double w, double h, double weight ){

*super*(ws,ms,ss,sp);

*// super first line main hi hona chahiay werna yeh error dega*

*this*.length = l;

*this*.width = w;

*this*.height = h;

*this*.weight = weight;

    }

    @Override *//annotations -> it describes how a function is going to behave*

    public void display(){

*super*.display();

        System.out.println(*this*.height);

        System.out.println(*this*.length);

        System.out.println(*this*.width);

        System.out.println(*this*.weight);

    }

}

## Runner

public class Runner {

    public static void main(String[] args) {

        Laptop l1 = new Laptop(2, 4, 7, 4.9, 2.4, 3.0, 7.0, 70);

        l1.display(); *// laptop wala display call hua hai q k object laptop wala tha aur method overridden tha!*

    }

}

# Question 3

## Person

public class Person {

    private String name;

    private int age;

    public Person(){}

    public Person(String name , int age){

*this*.name = name;

*this*.age = age;

    }

    public void setName(String name){

*this*.name = name;

    }

    public void setAge(int age){

*this*.age = age;

    }

    public String getName(){

        return *this*.name;

    }

    public int getAge(){

        return *this*.age;

    }

    public void display(){

        System.out.println(*this*.name);

        System.out.println(*this*.age);

    }

}

## Vehicle

public class Vehicle {

    private String manufacturerName;

    private int cylindersInEngine;

    private Person person;

    public Vehicle(){

        person = new Person(); *// takay null na jaye wahan!*

*// has a relationship ki example !*

    }

    public Vehicle(String manufacturerName , int cylindersInEngine, Person person){

*this*.manufacturerName = manufacturerName;

*this*.cylindersInEngine = cylindersInEngine;

*this*.person = person;

    }

    public void setManufacturerName(String manufacturerName){

*this*.manufacturerName = manufacturerName;

    }

    public void setCylindersInEngine(int cylindersInEngine){

*this*.cylindersInEngine = cylindersInEngine;

    }

    public void setPerson(Person p){

*this*.person = p;

    }

    public String getManufacturerName(){

        return *this*.manufacturerName;

    }

    public int getCylindersInEngine(){

        return *this*.cylindersInEngine;

    }

    public Person getPerson(){

        return *this*.person;

    }

    public void display(){

*this*.getPerson().display();

        System.out.println(*this*.manufacturerName);

        System.out.println(*this*.cylindersInEngine);

    }

}

## Truck

public class Truck extends Vehicle{

    private double loadCapacity;

    private int towingCapacity;

    public Truck(){

*super*();

    }

    public Truck(String manufacturerName , int cylindersInEngine , Person person , double loadCapacity , int towingCapacity){

*super*(manufacturerName, cylindersInEngine, person);

*this*.loadCapacity = loadCapacity;

*this*.towingCapacity = towingCapacity;

    }

    public void setLoadCapacity(double loadCapacity){

*this*.loadCapacity = loadCapacity;

    }

    public void setTowingCapacity(int towingCapacity){

*this*.towingCapacity = towingCapacity;

    }

    public double getLoadCapacity(){

        return *this*.loadCapacity;

    }

    public int getTowingCapacity(){

        return *this*.towingCapacity;

    }

    @Override

    public void display(){

*super*.display();

*// this.display(); this will be wrong as it will point to its own display function*

*// as usually happens in recursion !*

        System.out.println("The loading capacity is "+loadCapacity);

        System.out.println("The towing capacity is "+towingCapacity);

    }

}

## Runner

public class Runner {

    public static void main(String[] args) {

        Person p1 = new Person("Muhammad Iqbal", 56); *//Subpart*

        Truck t = new Truck("Toyota", 4, p1, 3, 1); *//whole + single level inheritance*

        t.display();

*// has a relationship + is a relationship --> in a nutshell!*

    }

}

# Question 4

## Publication

public class Publication {

    private String title;

    private double price;

*// Constructors*

*// 1 . Default*

    public Publication(){

    }

*// 2. Parameterized*

    public Publication(String title , double price){

*this*. title = title;

*this*.price = price;

    }

*// setters*

    public void setTitle(String title){

*this*.title = title;

    }

    public void setPrice(double price){

*this*.price = price;

    }

*// getters*

    public String getTitle(){

        return *this*.title;

    }

    public double getPrice(){

        return *this*.price;

    }

    public void display(){

        System.out.println(*this*.title);

        System.out.println(*this*.price);

    }

}

## Book

public class Book extends Publication {

    private int pageCount;

    public Book(){

*super*();

    }

    public Book(String title, double price , int pageCount){

*super*(title, price);

*this*.pageCount = pageCount;

    }

    public void setPageCount(int pageCount){

*this*.pageCount = pageCount;

    }

    public int getPageCount(){

        return *this*.pageCount;

    }

    @Override

    public void display(){

*super*.display();

        System.out.println("The Page Count is "+pageCount);

    }

}

## Tape:

public class Tape extends Publication{

    private int playingTime;

    public Tape(){

*super*();

    }

    public Tape(String title , double price ,int playingTime){

*super*(title, price);

*this*.playingTime = playingTime;

    }

    public void setPlayingTime(int playingTime){

*this*.playingTime = playingTime;

    }

    @Override

    public void display(){

*super*.display();

        System.out.println("The playing time in minutes is "+playingTime);

    }

}

# Question 5

## Person

public class Person {

    private String name;

    private String address;

    private String phoneNumber;

    private String emailAddress;

    public Person(){

    }

    public Person(String name, String address, String phoneNumber , String emailAddress){

*this*.name = name;

*this*.address = address;

*this*.phoneNumber = phoneNumber;

*this*.emailAddress = emailAddress;

    }

*// setters*

    public void setName(String name){

*this*.name = name;

    }

    public void setAddress(String address){

*this*.address = address;

    }

    public void setPhoneNumber(String phoneNumber){

*this*.phoneNumber = phoneNumber;

    }

    public void setEmailAddress(String emailAdrress){

*this*.emailAddress = emailAdrress;

    }

*// getters*

    public String getName(){

        return *this*.name;

    }

    public String getAddress(){

        return *this*.address;

    }

    public String getPhoneNumber(){

        return *this*.phoneNumber;

    }

    public String getEmailAddress(){

        return *this*.emailAddress;

    }

*// display*

    public void display(){

        System.out.println(*this*.name);

        System.out.println(*this*.address);

        System.out.println(*this*.phoneNumber);

        System.out.println(*this*.emailAddress);

    }

}

## Date

public class My\_Date {

    private int day;

    private int month;

    private int year;

    public My\_Date(int day, int month, int year) {

*this*.day = day;

*this*.month = month;

*this*.year = year;

    }

    public My\_Date() {

    }

    public int getDay() {

        return day;

    }

    public void setDay(int day) {

*this*.day = day;

    }

    public int getMonth() {

        return month;

    }

    public void setMonth(int month) {

*this*.month = month;

    }

    public int getYear() {

        return year;

    }

    public void setYear(int year) {

*this*.year = year;

    }

    public void display() {

        System.out.println(day + "  " + month + "  " + year);

    }

}

## Employee

public class Employee extends Person {

    private String office;

    private double salary;

    private My\_Date hiredDate;

    public Employee(){

*super*();

    }

    public Employee(String name , String address , String phoneNumber , String emailAddress, String office , double salary , My\_Date hiredDate){

*super*(name, address, phoneNumber, emailAddress);

*this*.office = office;

*this*.salary = salary;

*this*.hiredDate = hiredDate;

    }

    public void setOffice(String office){

*this*.office = office;

    }

    public void setSalary(double salary){

*this*.salary = salary;

    }

    public void setHiredDate(My\_Date hiredDate){

*this*.hiredDate = hiredDate;

    }

    public String getOffice(){

        return *this*.office;

    }

    public double getSalary(){

        return *this*.salary;

    }

    public My\_Date getHiredDate(){

        return *this*.hiredDate;

    }

    @Override

    public void display(){

*super*.display();

        System.out.println(*this*.office);

        System.out.println(*this*.salary);

*this*.hiredDate.display();

    }

}

## Faculty

public class Faculty extends Employee {

    private double officeHours;

    private String rank;

    public Faculty(){

*super*();

    }

    public Faculty(String name , String address , String phoneNumber , String emailAddress,String office, double salary , My\_Date hiredDate,double officeHours, String rank){

*super*(name, address, phoneNumber, emailAddress, office, salary, hiredDate);

*this*.officeHours = officeHours;

*this*.rank = rank;

    }

    public void setOfficeHours(double officeHours){

*this*.officeHours = officeHours;

    }

    public void setRank(String rank){

*this*.rank = rank;

    }

    public double getOfficeHours(){

        return *this*.officeHours;

    }

    public String getRank(){

        return *this*.rank;

    }

    @Override

    public void display(){

*super*.display();

        System.out.println("Office Hours "+*this*.officeHours);

        System.out.println("Rank "+*this*.rank);

    }

}

## Staff

public class Staff extends Employee {

    private String title;

    public Staff(){

*super*();

    }

    public Staff(String name , String address , String phoneNumber , String emailAddress,String office, double salary , My\_Date hiredDate,  String title){

*super*(name, address, phoneNumber, emailAddress, office, salary, hiredDate);

*this*.title = title;

    }

    public void setTitle(String title){

*this*.title = title;

    }

    public String getTitle(){

        return *this*.title;

    }

    @Override

    public void display(){

*super*.display();

        System.out.println("The title is : "+*this*.title);

    }

}

## Student

public class Student extends Person {

    private String status;

    public Student(){

*super*();

    }

    public Student(String name , String address , String phoneNumber , String emailAddress, String status){

*super*(name, address, phoneNumber, emailAddress);

*this*.status = status;

    }

    public void setStatus(String status){

*this*.status = status;

    }

    public String getStatus(){

        return *this*.status;

    }

    @Override

    public void display(){

*super*.display();

        System.out.println(*this*.status);

    }

}

## Runner

public class Runner {

    public static void main(String[] args) {

*// Person p = new Person("Shahzaneer Ahmed", "24 Bahawal sher road Mozang janazgah Lahore", 0316-4606490, "shahzaneer.dev@gmail.com");*

        Student shah = new Student("Shahzaneer Ahmed", "24 Bahawal Sher Road Lahore", "0316-4606490", "shahzaneer.dev@gmail.com", "Cs Sophomore");

        My\_Date d1 = new My\_Date(25, 11, 1999);

        Faculty tra = new Faculty("Tehseen Riaz Abbasi ", "CUI Islamabad", "0321-5679321", "trasays.gmail.com", "CS 1st floor Room 34", 400000, d1, 7,"Professor");

        tra.display();

        shah.display();

    }

}

# Question 6

## Simple

public class Simple {

    private int num1;

    private int num2;

    public Simple(){}

    public Simple(int num1 , int num2){

*this*.num1 = num1;

*this*.num2 = num2;

    }

    public void setNum1(int num1){

*this*.num1 = num1;

    }

    public void setNum2(int num2){

*this*.num2 = num2;

    }

    public int getNum1(){

        return *this*.num1;

    }

    public int getNum2(){

        return *this*.num2;

    }

    public double sum(){

        return num1+num2;

    }

    public double div(){

        return num1/num2;

    }

    public double mul(){

        return num1\*num2;

    }

    public double subtract(){

        return num1-num2;

    }

}

## VerifiedSimple

public class VerifiedSimple extends Simple {

    private int num1;

    private int num2;

    public VerifiedSimple(int num1 , int num2){

*super*.setNum1(num1);

*super*.setNum2(num2);

    }

    @Override

    public double sum(){

        if(*super*.getNum1()>0 && *super*.getNum2()>0){

            return *super*.sum();

        }

        return -1;

    }

    @Override

    public double subtract(){

        if(*super*.getNum1()>0 && *super*.getNum2()>0){

            return *super*.subtract();

        }

        return -1;

    }

    @Override

    public double mul(){

        if(*super*.getNum1()>0 && *super*.getNum2()>0){

            return *super*.mul();

        }

        return -1;

    }

    @Override

    public double div(){

        if(*super*.getNum1()>0 && *super*.getNum2()>0){

            return *super*.div();

        }

        return -1;

    }

*//! current class kay object ka reference --> this keyword*

*//! inherited class kay object ka reference --> super keyword*

}

# Runner

public class Runner {

    public static void main(String[] args) {

        Simple obj = new Simple(5,0);

        VerifiedSimple obj1 = new VerifiedSimple(5,0);

        System.out.println(obj.mul());

        System.out.println(obj1.mul());

*//! It will return -1 in case of zero*

*//! it will return answer in case of non zero values*

    }

}

# Question 5 updated

## Faculty

public class Faculty extends Employee {

    private double officeHours;

    private String rank;

    public Faculty(){

*super*();

    }

    public Faculty(String name , String address , String phoneNumber , String emailAddress,String office, double salary , My\_Date hiredDate,double officeHours, String rank){

*super*(name, address, phoneNumber, emailAddress, office, salary, hiredDate);

*this*.officeHours = officeHours;

*this*.rank = rank;

    }

    public void setOfficeHours(double officeHours){

*this*.officeHours = officeHours;

    }

    public void setRank(String rank){

*this*.rank = rank;

    }

    public double getOfficeHours(){

        return *this*.officeHours;

    }

    public String getRank(){

        return *this*.rank;

    }

    public void display(){

        System.out.println(*this*.getName());

        System.out.println(*this*.getAddress());

        System.out.println(*this*.getEmailAddress());

        System.out.println(*this*.getPhoneNumber());

        System.out.println(*this*.getSalary());

        System.out.println(*this*.getOffice());

*// System.out.println(this.getHiredDate());*

*this*.getHiredDate().display(); *// we cannot object print rather we will display its content!*

        System.out.println("Office Hours "+*this*.officeHours);

        System.out.println("Rank "+*this*.rank);

    }

}

## Staff

public class Staff extends Employee {

    private String title;

    public Staff(){

*super*();

    }

    public Staff(String name , String address , String phoneNumber , String emailAddress,String office, double salary , My\_Date hiredDate,  String title){

*super*(name, address, phoneNumber, emailAddress, office, salary, hiredDate);

*this*.title = title;

    }

    public void setTitle(String title){

*this*.title = title;

    }

    public String getTitle(){

        return *this*.title;

    }

*// Display is only made within the Staff and faculty function*

*// as attributes are mostly private therefore we have used the getters to get the value*

    public void display(){

        System.out.println(*this*.getName());

        System.out.println(*this*.getAddress());

        System.out.println(*this*.getEmailAddress());

        System.out.println(*this*.getPhoneNumber());

        System.out.println(*this*.getSalary());

        System.out.println(*this*.getOffice());

        System.out.println(*this*.getHiredDate());

        System.out.println("The title is : "+*this*.title);

    }

}