(DIGITAL ASSIGNMENT - 2) CLASSES AND OBJECTS

CSE1007(JAVA PROGRAMMING)LAB:L31-L32

FEBURARY 20, 2022

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20BCE2940

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(DIGITAL ASSIGNMENT - 2) CLASSES AND OBJECTS

Classes and Objects are basic concepts of Object Oriented Programming which revolve around the real life entities.

Class

A class is a user defined blueprint or prototype from which objects are created. It represents the set of properties or methods that are common to all objects of one type. In general, class declarations can include these components, in order:

1. **Modifiers**: A class can be public or has default access (Refer this for details).
2. **class keyword:** class keyword is used to create a class.
3. **Class name:** The name should begin with an initial letter (capitalized by convention).
4. **Superclass (if any):** The name of the class's parent (superclass), if any, preceded by the keyword extends. A class can only extend (subclass) one parent.
5. **Interfaces (if any):** A comma-separated list of interfaces implemented by the class, if any, preceded by the keyword implements. A class can implement more than one interface.
6. **Body:** The class body surrounded by braces, { }.

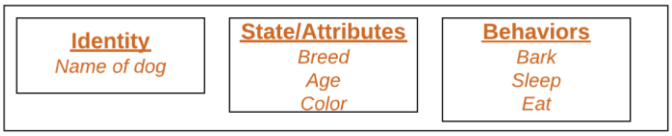
Constructors are used for initializing new objects. Fields are variables that provides the state of the class and its objects, and methods are used to implement the behaviour of the class and its objects.
There are various types of classes that are used in real time applications such as nested classes, anonymous classes, lambda expressions.

Object

It is a basic unit of Object-Oriented Programming and represents the real life entities. A typical Java program creates many objects, which as you know, interact by invoking methods. An object consists of:

1. **State**: It is represented by attributes of an object. It also reflects the properties of an object.
2. **Behavior**: It is represented by methods of an object. It also reflects the response of an object with other objects.
3. **Identity**: It gives a unique name to an object and enables one object to interact with other objects.

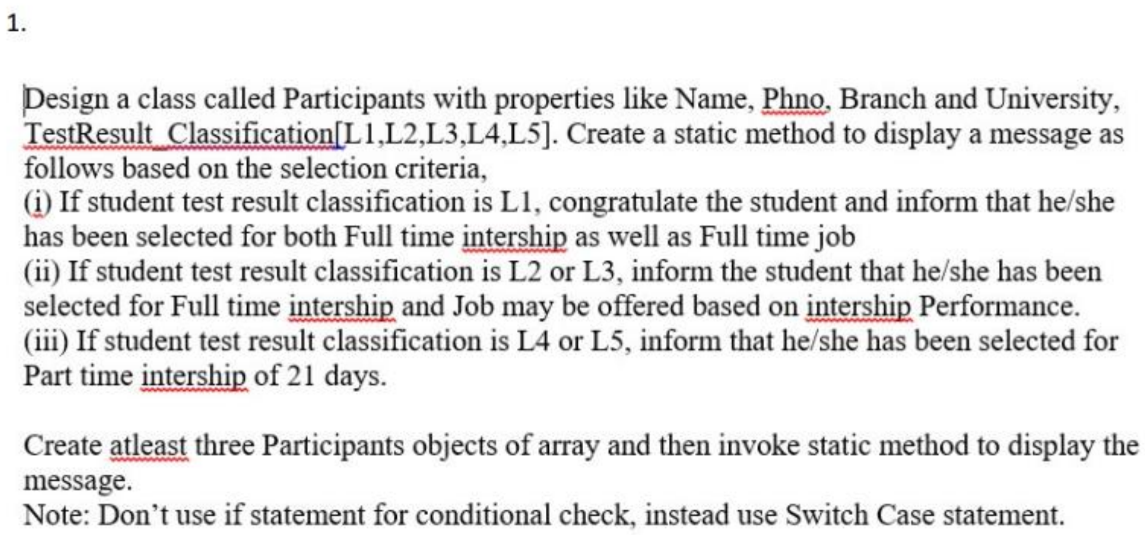
Example of an object: dog



Objects correspond to things found in the real world. For example, a graphics program may have objects such as "circle", "square", "menu". An online shopping system might have objects such as "shopping cart", "customer", and "product".

ACTIVITY – 4:

QUESTION 1:



1.

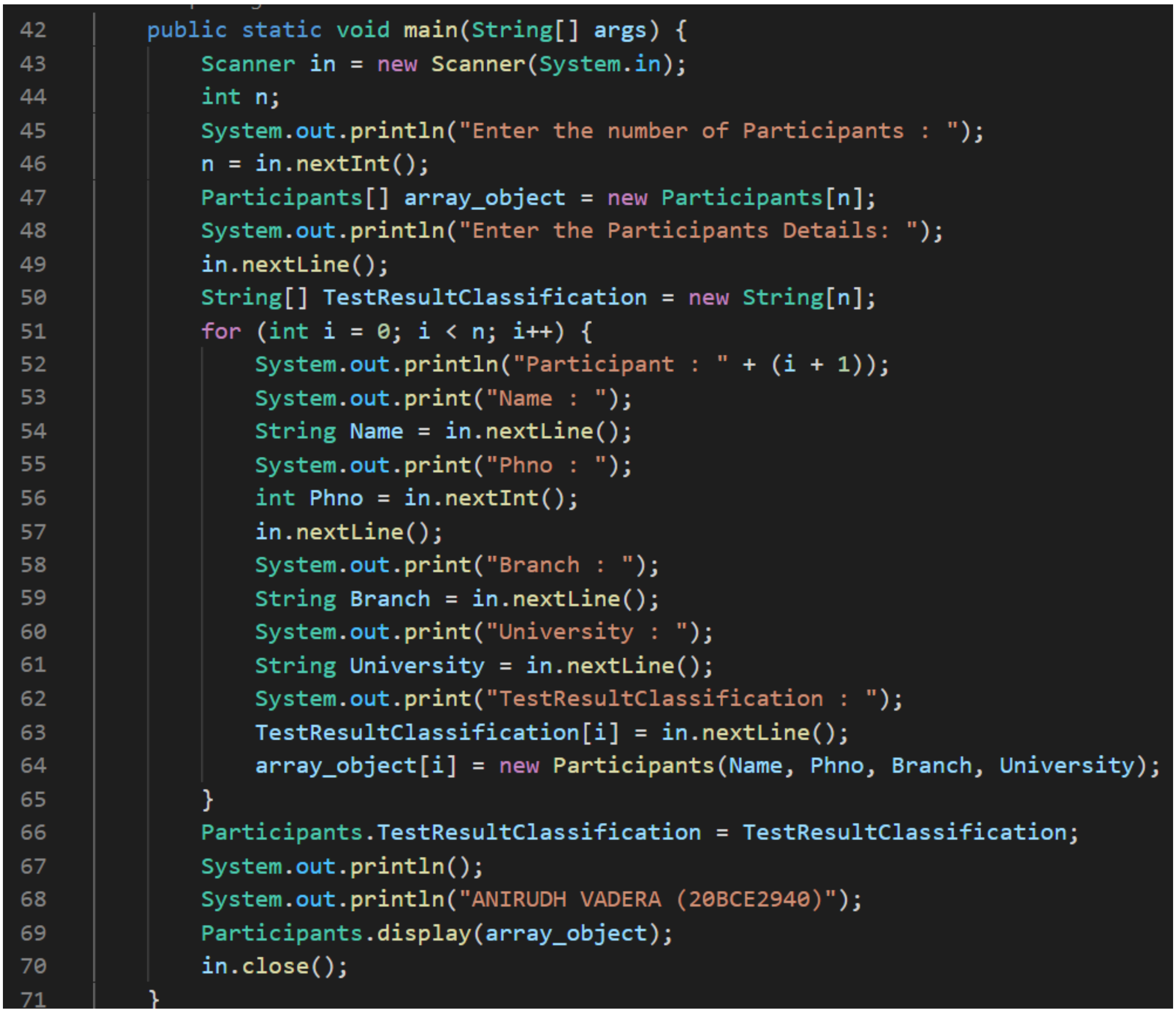
Design a class called Participants with properties like Name, Phno, Branch and University, TestResult_Classification[L1,L2,L3,L4,L5]. Create a static method to display a message as follows based on the selection criteria,
(i) If student test result classification is L1, congratulate the student and inform that he/she has been selected for both Full time intership as well as Full time job
(ii) If student test result classification is L2 or L3, inform the student that he/she has been selected for Full time intership and Job may be offered based on intership Performance.
(iii) If student test result classification is L4 or L5, inform that he/she has been selected for Part time intership of 21 days.

Create atleast three Participants objects of array and then invoke static method to display the message.
Note: Don't use if statement for conditional check, instead use Switch Case statement.

CODE:

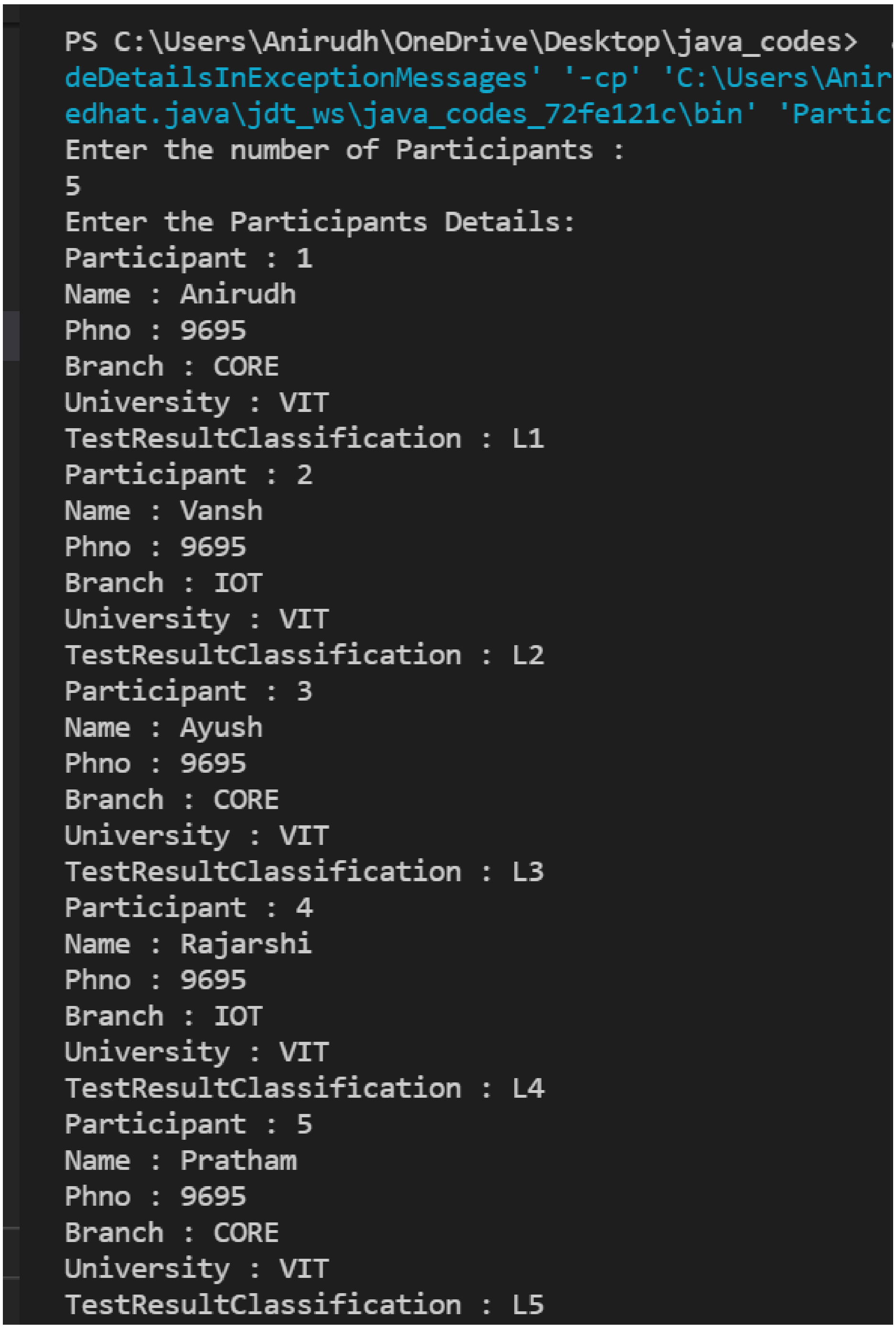
```
import java.util.Scanner;

public class Participants {
    String Name;
    int Phno;
    String Branch;
    String University;
    static String[] TestResultClassification;

    Participants(String Name, int Phno, String Branch, String University) {
        this.Name = Name;
        this.Phno = Phno;
        this.Branch = Branch;
        this.University = University;
    }

    static void display(Participants[] Participant_array) {
        for (int i = 0; i < TestResultClassification.length; i++) {
            System.out.println("The result of student " +
Participant_array[i].Name + " is : ");
            switch (TestResultClassification[i]) {
                case "L1":
                    System.out.println("Congratulations You have been selected
for both Internship and Full Time Job");
                    break;
                case "L2":
                    System.out.println(
                            "You have been selected for Internship and based 
on the performance in Internship program you will be offered Full Time Job");
                    break;
                case "L3":
                    System.out.println(
                            "You have been selected for Internship and based 
on the performance in Internship program you will be offered Full Time Job");
                    break;
                case "L4":
                    System.out.println("You have been selected for Part Time 
Internship for 21 days");
                    break;
                case "L5":
                    System.out.println("You have been selected for Part Time 
Internship for 21 days");
                    break;
            }
        }
    }

    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        int n;
        System.out.println("Enter the number of Participants : ");
        n = in.nextInt();
        Participants[] array_object = new Participants[n];
        System.out.println("Enter the Participants Details: ");
        in.nextLine();
        String[] TestResultClassification = new String[n];
        for (int i = 0; i < n; i++) {
            System.out.println("Participant : " + (i + 1));
            System.out.print("Name : ");
            String Name = in.nextLine();
            System.out.print("Phno : ");
            int Phno = in.nextInt();
            in.nextLine();
            System.out.print("Branch : ");
            String Branch = in.nextLine();
            System.out.print("University : ");
            String University = in.nextLine();
            System.out.print("TestResultClassification : ");
            TestResultClassification[i] = in.nextLine();
            array_object[i] = new Participants(Name, Phno, Branch, 
University);
        }
        Participants.TestResultClassification = TestResultClassification;
        System.out.println();
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        Participants.display(array_object);
        in.close();
    }

}
```

CODE SNAPSHOT:

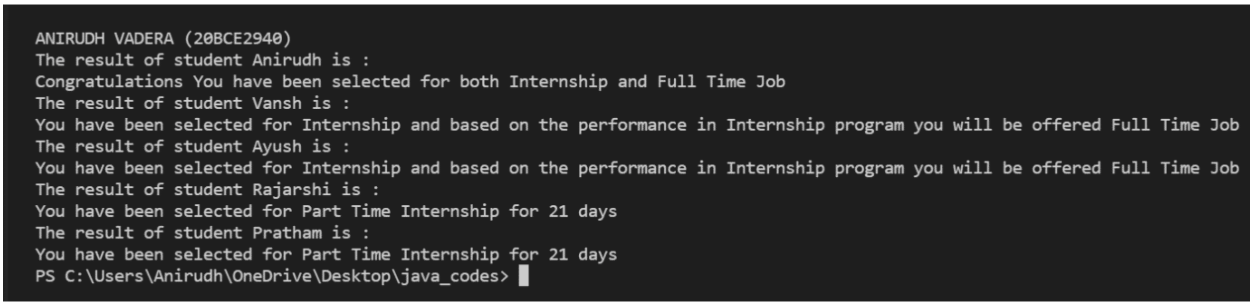


```
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        int n;
        System.out.println("Enter the number of Participants : ");
        n = in.nextInt();
        Participants[] array_object = new Participants[n];
        System.out.println("Enter the Participants Details: ");
        in.nextLine();
        String[] TestResultClassification = new String[n];
        for (int i = 0; i < n; i++) {
            System.out.println("Participant : " + (i + 1));
            System.out.print("Name : ");
            String Name = in.nextLine();
            System.out.print("Phno : ");
            int Phno = in.nextInt();
            in.nextLine();
            System.out.print("Branch : ");
            String Branch = in.nextLine();
            System.out.print("University : ");
            String University = in.nextLine();
            System.out.print("TestResultClassification : ");
            TestResultClassification[i] = in.nextLine();
            array_object[i] = new Participants(Name, Phno, Branch, University);
        }
        Participants.TestResultClassification = TestResultClassification;
        System.out.println();
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        Participants.display(array_object);
        in.close();
    }
```

OUTPUT:

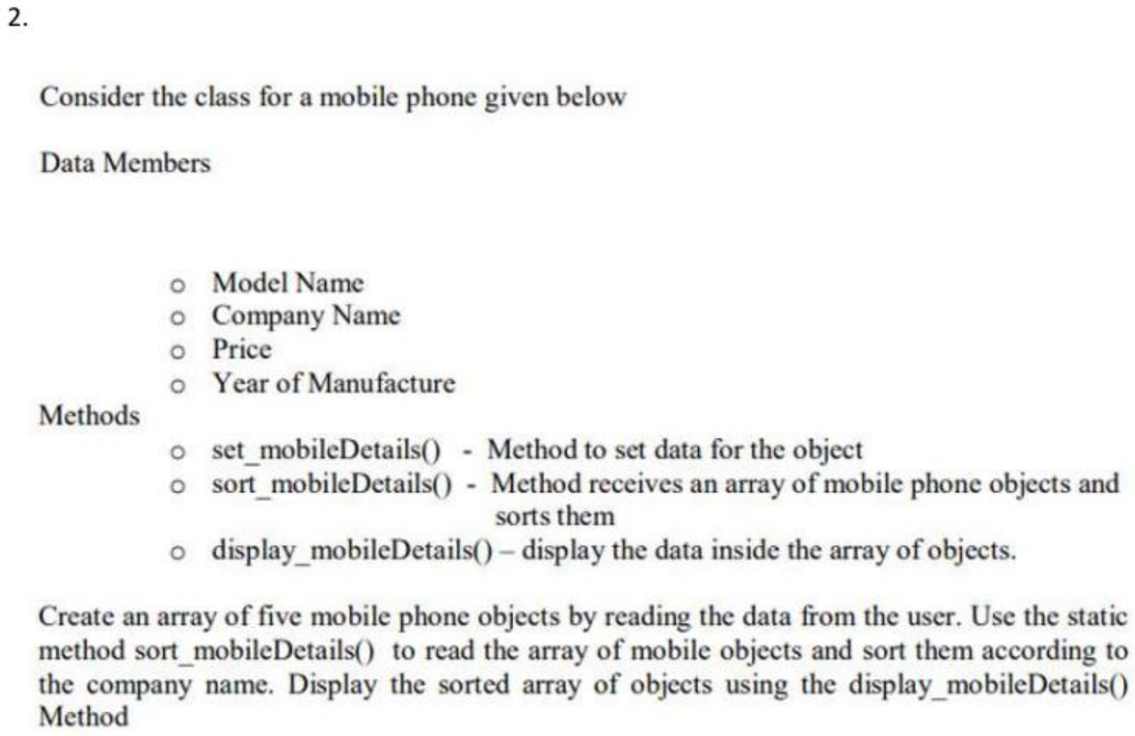


```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
deDetailsInExceptionMessages' '-cp' 'C:\Users\Anir
edhat.java\jdt_ws\java_codes_72fe121c\bin' 'Partic
Enter the number of Participants :
5
Enter the Participants Details:
Participant : 1
Name : Anirudh
Phno : 9695
Branch : CORE
University : VIT
TestResultClassification : L1
Participant : 2
Name : Vansh
Phno : 9695
Branch : IOT
University : VIT
TestResultClassification : L2
Participant : 3
Name : Ayush
Phno : 9695
Branch : CORE
University : VIT
TestResultClassification : L3
Participant : 4
Name : Rajarshi
Phno : 9695
Branch : IOT
University : VIT
TestResultClassification : L4
Participant : 5
Name : Pratham
Phno : 9695
Branch : CORE
University : VIT
TestResultClassification : L5
```



```
ANIRUDH VADERA (20BCE2940)
The result of student Anirudh is :
Congratulations You have been selected for both Internship and Full Time Job
The result of student Vansh is :
You have been selected for Internship and based on the performance in Internship program you will be offered Full Time Job
The result of student Ayush is :
You have been selected for Internship and based on the performance in Internship program you will be offered Full Time Job
The result of student Rajarshi is :
You have been selected for Part Time Internship for 21 days
The result of student Pratham is :
You have been selected for Part Time Internship for 21 days
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes> █
```

QUESTION 2:



2.

Consider the class for a mobile phone given below

Data Members

- Model Name
- Company Name
- Price
- Year of Manufacture

Methods

- set_mobileDetails() - Method to set data for the object
- sort_mobileDetails() - Method receives an array of mobile phone objects and sorts them
- display_mobileDetails() – display the data inside the array of objects.

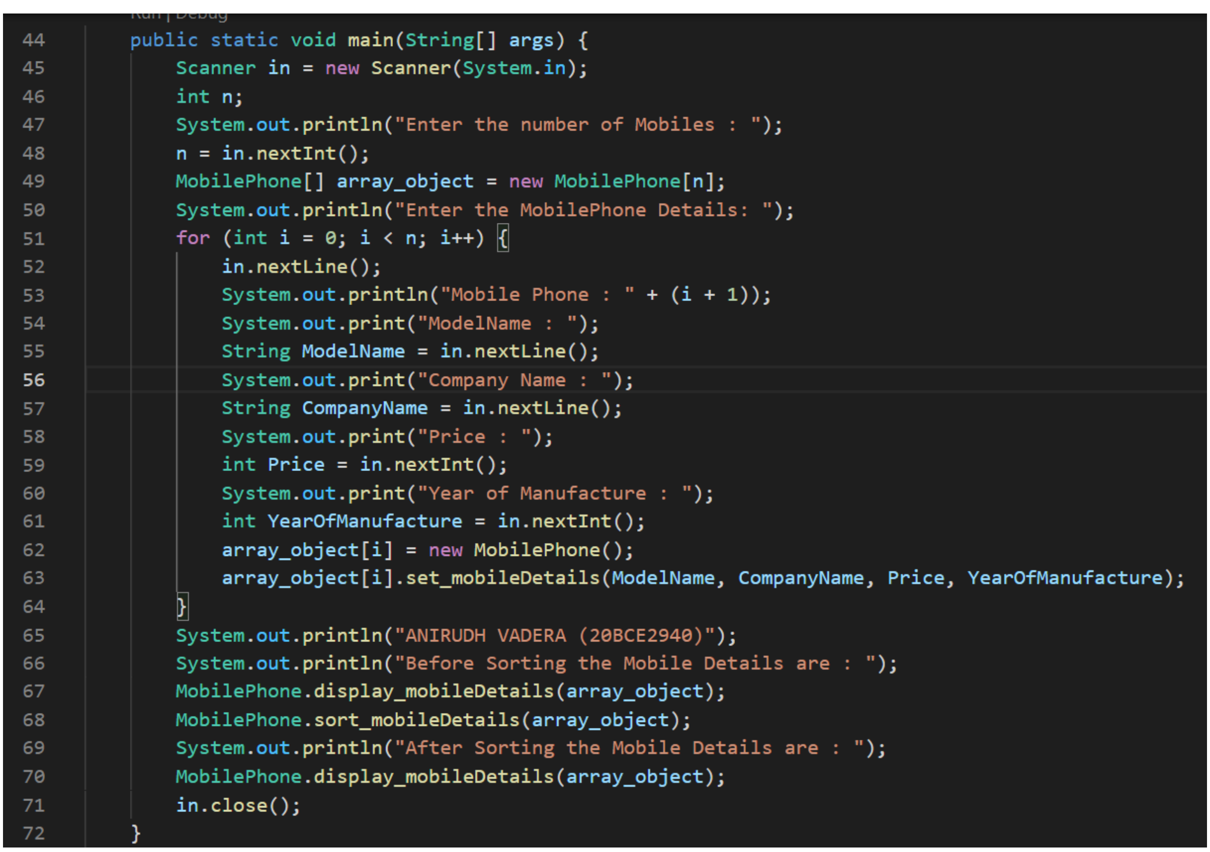
Create an array of five mobile phone objects by reading the data from the user. Use the static method sort_mobileDetails() to read the array of mobile objects and sort them according to the company name. Display the sorted array of objects using the display_mobileDetails() Method

CODE:

```
import java.util.Scanner;

public class MobilePhone {
    String ModelName;
    String CompanyName;
    int Price;
    int YearOfManufacture;

    void set_mobileDetails(String ModelName, String CompanyName, int Price,
int YearOfManufacture) {
        this.ModelName = ModelName;
        this.CompanyName = CompanyName;
        this.Price = Price;
        this.YearOfManufacture = YearOfManufacture;
    }

    static void sort_mobileDetails(MobilePhone[] mobilePhoneArray) {
        int min_idx = 0;
        MobilePhone temp;
        for (int i = 0; i < mobilePhoneArray.length - 1; i++) {
            min_idx = i;
            for (int j = i + 1; j < mobilePhoneArray.length; j++) {
                if
(mobilePhoneArray[min_idx].CompanyName.compareTo(mobilePhoneArray[j].CompanyNa
me) > 0) {
                    min_idx = j;
                }
            }
            if (min_idx != i) {
                temp = mobilePhoneArray[min_idx];
                mobilePhoneArray[min_idx] = mobilePhoneArray[i];
                mobilePhoneArray[i] = temp;
            }
        }
    }

    static void display_mobileDetails(MobilePhone[] mobilePhoneArray) {
        for (int i = 0; i < mobilePhoneArray.length; i++) {
            System.out.println("Details For Mobile : " + (i + 1));
            System.out.println("ModelName : " +
mobilePhoneArray[i].ModelName);
            System.out.println("CompanyName : " +
mobilePhoneArray[i].CompanyName);
            System.out.println("Price : " + mobilePhoneArray[i].Price);
            System.out.println("yearOfManufacture : " +
mobilePhoneArray[i].YearOfManufacture);
        }
    }

    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        int n;
        System.out.println("Enter the number of Mobiles : ");
        n = in.nextInt();
        MobilePhone[] array_object = new MobilePhone[n];
        System.out.println("Enter the MobilePhone Details: ");
        for (int i = 0; i < n; i++) {
            in.nextLine();
            System.out.println("Mobile Phone : " + (i + 1));
            System.out.print("ModelName : ");
            String ModelName = in.nextLine();
            System.out.print("Company Name : ");
            String CompanyName = in.nextLine();
            System.out.print("Price : ");
            int Price = in.nextInt();
            System.out.print("Year of Manufacture : ");
            int YearOfManufacture = in.nextInt();
            array_object[i] = new MobilePhone();
            array_object[i].set_mobileDetails(ModelName, CompanyName, Price,
YearOfManufacture);
```

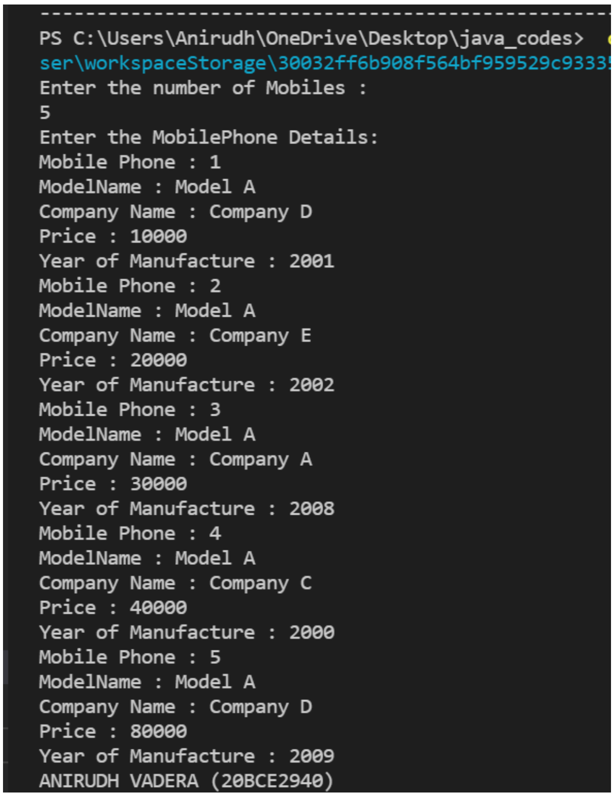
```
        }
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        System.out.println("Before Sorting the Mobile Details are : ");
        MobilePhone.display_mobileDetails(array_object);
        MobilePhone.sort_mobileDetails(array_object);
        System.out.println("After Sorting the Mobile Details are : ");
        MobilePhone.display_mobileDetails(array_object);
        in.close();
    }

}
```

CODE SNAPSHOT:

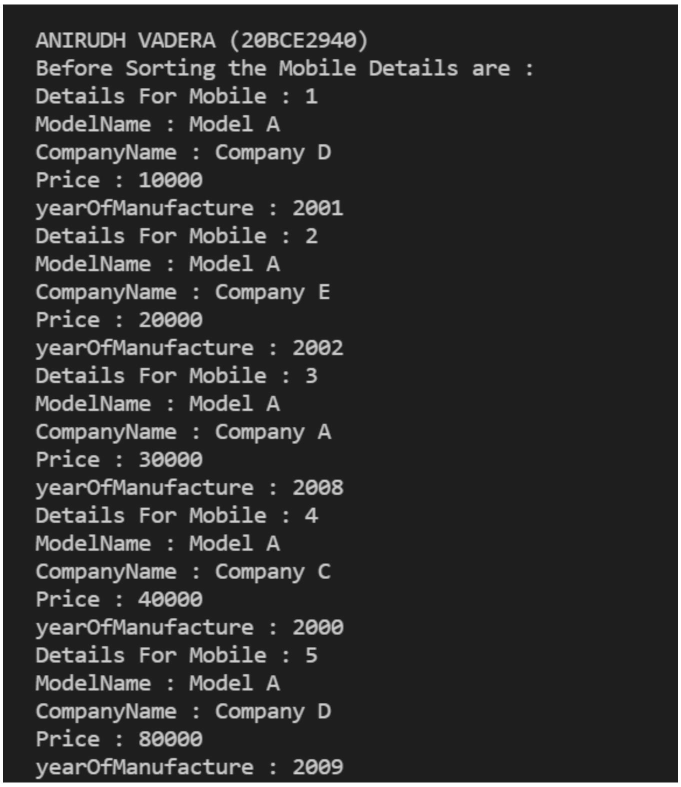


```
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        int n;
        System.out.println("Enter the number of Mobiles : ");
        n = in.nextInt();
        MobilePhone[] array_object = new MobilePhone[n];
        System.out.println("Enter the MobilePhone Details: ");
        for (int i = 0; i < n; i++) {
            in.nextLine();
            System.out.println("Mobile Phone : " + (i + 1));
            System.out.print("ModelName : ");
            String ModelName = in.nextLine();
            System.out.print("Company Name : ");
            String CompanyName = in.nextLine();
            System.out.print("Price : ");
            int Price = in.nextInt();
            System.out.print("Year of Manufacture : ");
            int YearOfManufacture = in.nextInt();
            array_object[i] = new MobilePhone();
            array_object[i].set_mobileDetails(ModelName, CompanyName, Price, YearOfManufacture);
        }
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        System.out.println("Before Sorting the Mobile Details are : ");
        MobilePhone.display_mobileDetails(array_object);
        MobilePhone.sort_mobileDetails(array_object);
        System.out.println("After Sorting the Mobile Details are : ");
        MobilePhone.display_mobileDetails(array_object);
        in.close();
    }
```

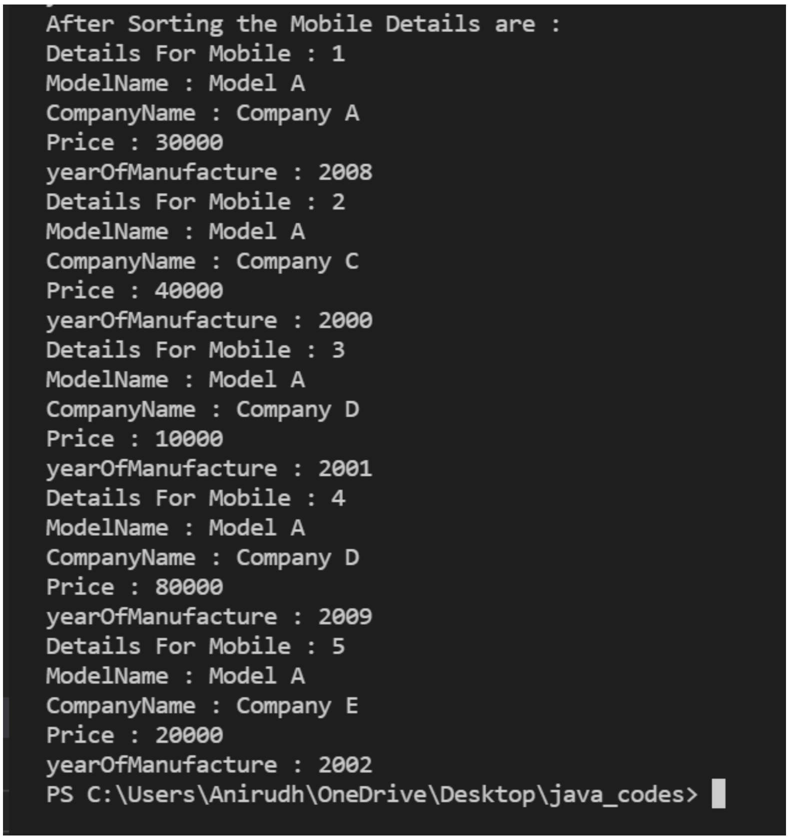
OUTPUT:



```
-----------------------------------------------------
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
ser\workspaceStorage\30032ff6b908f564bf959529c9333
Enter the number of Mobiles :
5
Enter the MobilePhone Details:
Mobile Phone : 1
ModelName : Model A
Company Name : Company D
Price : 10000
Year of Manufacture : 2001
Mobile Phone : 2
ModelName : Model A
Company Name : Company E
Price : 20000
Year of Manufacture : 2002
Mobile Phone : 3
ModelName : Model A
Company Name : Company A
Price : 30000
Year of Manufacture : 2008
Mobile Phone : 4
ModelName : Model A
Company Name : Company C
Price : 40000
Year of Manufacture : 2000
Mobile Phone : 5
ModelName : Model A
Company Name : Company D
Price : 80000
Year of Manufacture : 2009
ANIRUDH VADERA (20BCE2940)
```

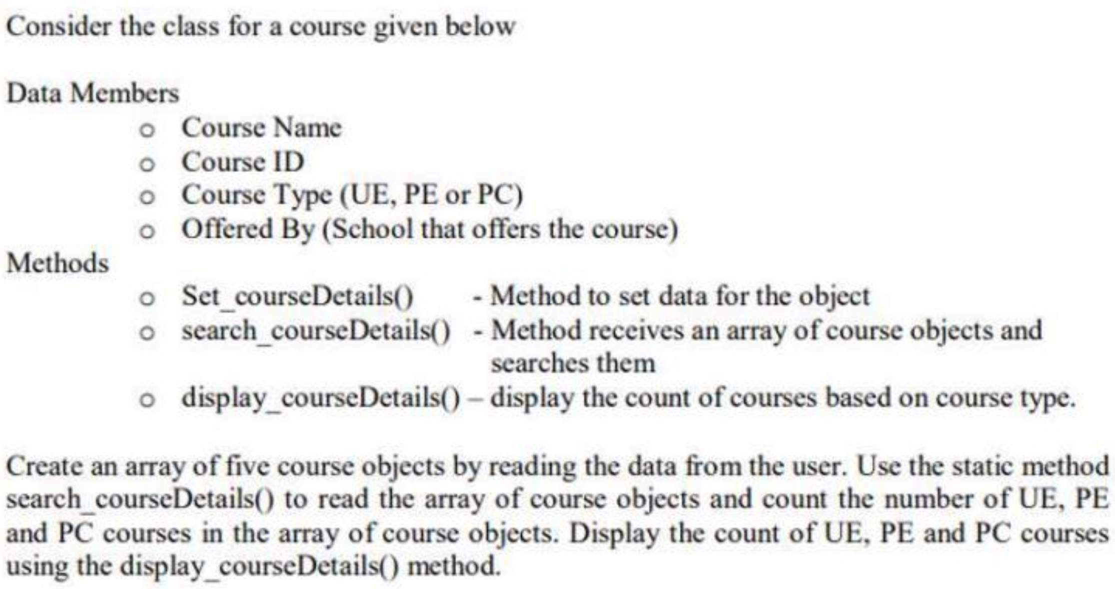


```
ANIRUDH VADERA (20BCE2940)
Before Sorting the Mobile Details are :
Details For Mobile : 1
ModelName : Model A
CompanyName : Company D
Price : 10000
yearOfManufacture : 2001
Details For Mobile : 2
ModelName : Model A
CompanyName : Company E
Price : 20000
yearOfManufacture : 2002
Details For Mobile : 3
ModelName : Model A
CompanyName : Company A
Price : 30000
yearOfManufacture : 2008
Details For Mobile : 4
ModelName : Model A
CompanyName : Company C
Price : 40000
yearOfManufacture : 2000
Details For Mobile : 5
ModelName : Model A
CompanyName : Company D
Price : 80000
yearOfManufacture : 2009
```



```
After Sorting the Mobile Details are :
Details For Mobile : 1
ModelName : Model A
CompanyName : Company A
Price : 30000
yearOfManufacture : 2008
Details For Mobile : 2
ModelName : Model A
CompanyName : Company C
Price : 40000
yearOfManufacture : 2000
Details For Mobile : 3
ModelName : Model A
CompanyName : Company D
Price : 10000
yearOfManufacture : 2001
Details For Mobile : 4
ModelName : Model A
CompanyName : Company D
Price : 80000
yearOfManufacture : 2009
Details For Mobile : 5
ModelName : Model A
CompanyName : Company E
Price : 20000
yearOfManufacture : 2002
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes> ▌
```

QUESTION 3:



Consider the class for a course given below

Data Members

- Course Name
- Course ID
- Course Type (UE, PE or PC)
- Offered By (School that offers the course)

Methods

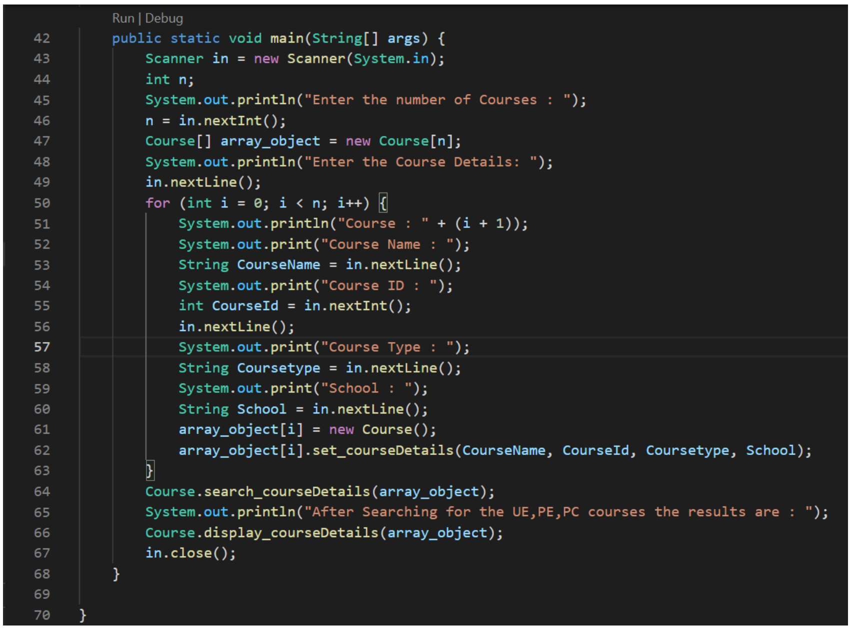
- Set_courseDetails() - Method to set data for the object
- search_courseDetails() - Method receives an array of course objects and searches them
- display_courseDetails() – display the count of courses based on course type.

Create an array of five course objects by reading the data from the user. Use the static method search_courseDetails() to read the array of course objects and count the number of UE, PE and PC courses in the array of course objects. Display the count of UE, PE and PC courses using the display_courseDetails() method.

CODE:

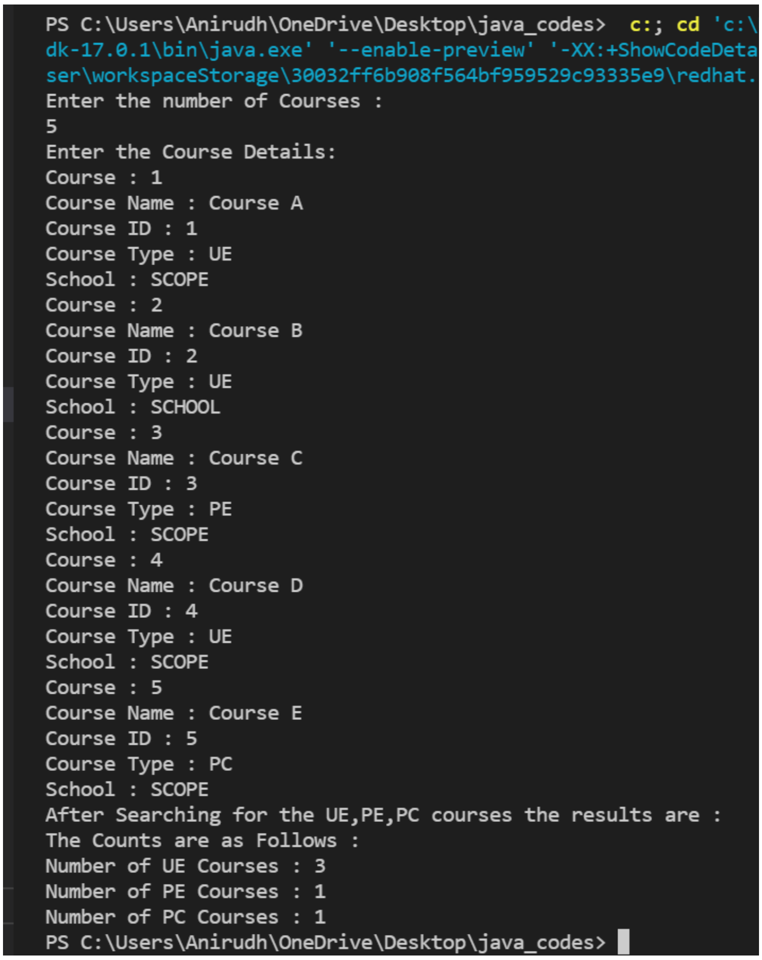
```java
import java.util.Scanner;

public class Course {
    String CourseName;
    int CourseId;
    String Coursetype;
    String School;
    static int count_UE;
    static int count_PE;
    static int count_PC;

    void set_courseDetails(String CourseName, int CourseId, String Coursetype, 
String School) {
        this.CourseName = CourseName;
        this.CourseId = CourseId;
        this.Coursetype = Coursetype;
        this.School = School;
    }

    static void search_courseDetails(Course[] courseArray) {
        for (int i = 0; i < courseArray.length; i++) {
            switch (courseArray[i].Coursetype) {
                case "UE":
                    Course.count_UE++;
                    break;
                case "PE":
                    Course.count_PE++;
                    break;
                case "PC":
                    Course.count_PC++;
                    break;
            }
        }
    }

    static void display_courseDetails(Course[] courseArray) {
        System.out.println("The Counts are as Follows : ");
        System.out.println("Number of UE Courses : " + Course.count_UE);
        System.out.println("Number of PE Courses : " + Course.count_PE);
        System.out.println("Number of PC Courses : " + Course.count_PC);
    }

    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        int n;
        System.out.println("Enter the number of Courses : ");
        n = in.nextInt();
        Course[] array_object = new Course[n];
        System.out.println("Enter the Course Details: ");
        in.nextLine();
        for (int i = 0; i < n; i++) {
            System.out.println("Course : " + (i + 1));
            System.out.print("Course Name : ");
            String CourseName = in.nextLine();
            System.out.print("Course ID : ");
            int CourseId = in.nextInt();
            in.nextLine();
            System.out.print("Course Type : ");
            String Coursetype = in.nextLine();
            System.out.print("School : ");
            String School = in.nextLine();
            array_object[i] = new Course();
            array_object[i].set_courseDetails(CourseName, CourseId,
Coursetype, School);
        }
        Course.search_courseDetails(array_object);
        System.out.println("After Searching for the UE,PE,PC courses the
results are : ");
        Course.display_courseDetails(array_object);
        in.close();
    }

}
```

CODE SNAPSHOT:



```java
    public static void main(String[] args) {
        Scanner in = new Scanner(System.in);
        int n;
        System.out.println("Enter the number of Courses : ");
        n = in.nextInt();
        Course[] array_object = new Course[n];
        System.out.println("Enter the Course Details: ");
        in.nextLine();
        for (int i = 0; i < n; i++) {
            System.out.println("Course : " + (i + 1));
            System.out.print("Course Name : ");
            String CourseName = in.nextLine();
            System.out.print("Course ID : ");
            int CourseId = in.nextInt();
            in.nextLine();
            System.out.print("Course Type : ");
            String Coursetype = in.nextLine();
            System.out.print("School : ");
            String School = in.nextLine();
            array_object[i] = new Course();
            array_object[i].set_courseDetails(CourseName, CourseId, Coursetype, School);
        }
        Course.search_courseDetails(array_object);
        System.out.println("After Searching for the UE,PE,PC courses the results are : ");
        Course.display_courseDetails(array_object);
        in.close();
    }

}
```

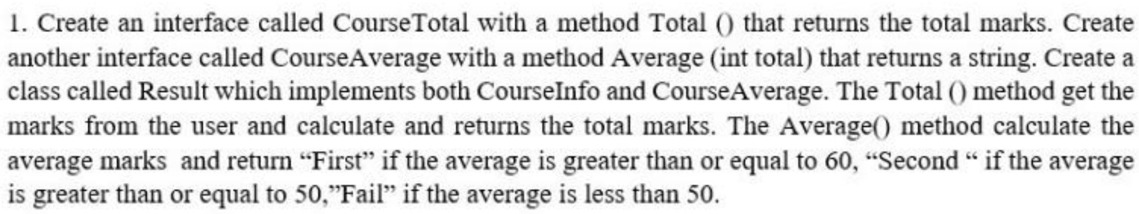
OUTPUT:



```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c:\
dk-17.0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDeta
ser\workspaceStorage\30032ff6b908f564bf959529c93335e9\redhat.
Enter the number of Courses :
5
Enter the Course Details:
Course : 1
Course Name : Course A
Course ID : 1
Course Type : UE
School : SCOPE
Course : 2
Course Name : Course B
Course ID : 2
Course Type : UE
School : SCHOOL
Course : 3
Course Name : Course C
Course ID : 3
Course Type : PE
School : SCOPE
Course : 4
Course Name : Course D
Course ID : 4
Course Type : UE
School : SCOPE
Course : 5
Course Name : Course E
Course ID : 5
Course Type : PC
School : SCOPE
After Searching for the UE,PE,PC courses the results are :
The Counts are as Follows :
Number of UE Courses : 3
Number of PE Courses : 1
Number of PC Courses : 1
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes> 
```

ACTIVITY – 5:

QUESTION 1:

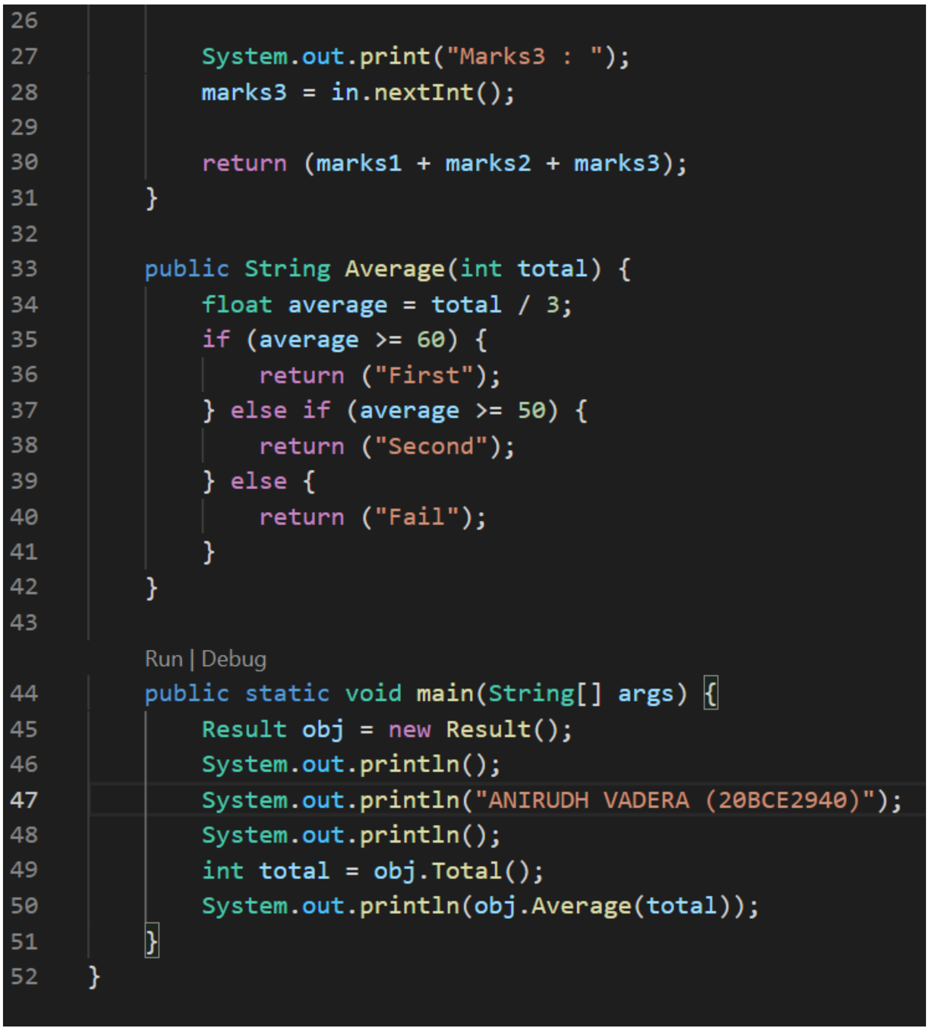


1. Create an interface called CourseTotal with a method Total () that returns the total marks. Create another interface called CourseAverage with a method Average (int total) that returns a string. Create a class called Result which implements both CourseInfo and CourseAverage. The Total () method get the marks from the user and calculate and returns the total marks. The Average() method calculate the average marks and return "First" if the average is greater than or equal to 60, "Second " if the average is greater than or equal to 50,"Fail" if the average is less than 50.

CODE:

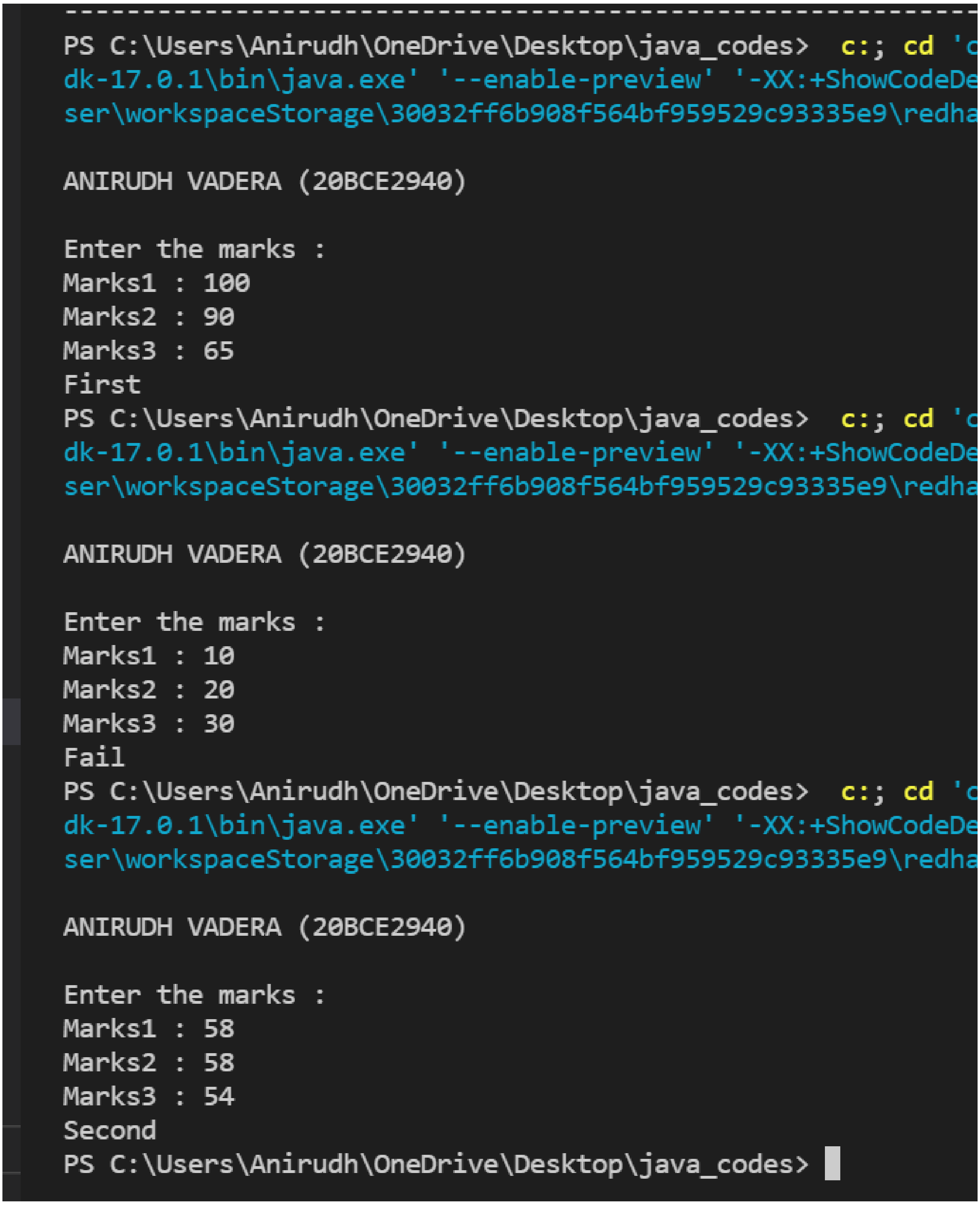
```
import java.util.Scanner;

interface CourseTotal {
    int Total();
}

interface CourseAverage {
    String Average(int total);
}

public class Result implements CourseTotal, CourseAverage {

    int marks1;
    int marks2;
    int marks3;

    Scanner in = new Scanner(System.in);

    public int Total() {
        System.out.println("Enter the marks : ");
        System.out.print("Marks1 : ");
        marks1 = in.nextInt();

        System.out.print("Marks2 : ");
        marks2 = in.nextInt();

        System.out.print("Marks3 : ");
        marks3 = in.nextInt();

        return (marks1 + marks2 + marks3);
    }

    public String Average(int total) {
        float average = total / 3;
        if (average >= 60) {
            return ("First");
        } else if (average >= 50) {
            return ("Second");
        } else {
            return ("Fail");
        }
    }

    public static void main(String[] args) {
        Result obj = new Result();
        System.out.println();
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        System.out.println();
        int total = obj.Total();
        System.out.println(obj.Average(total));
    }
}
```

CODE SNAPSHOT:



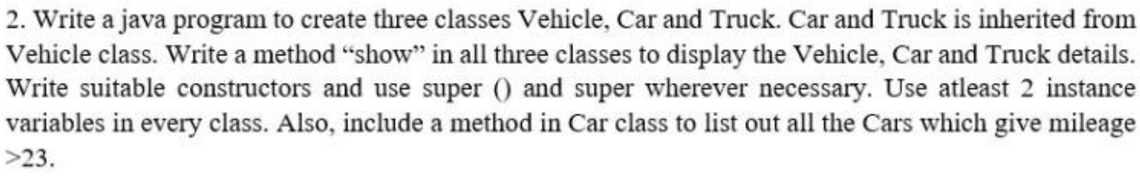
```

        System.out.print("Marks3 : ");
        marks3 = in.nextInt();

        return (marks1 + marks2 + marks3);
    }

    public String Average(int total) {
        float average = total / 3;
        if (average >= 60) {
            return ("First");
        } else if (average >= 50) {
            return ("Second");
        } else {
            return ("Fail");
        }
    }

    Run | Debug
    public static void main(String[] args) {
        Result obj = new Result();
        System.out.println();
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        System.out.println();
        int total = obj.Total();
        System.out.println(obj.Average(total));
    }
}
```

OUTPUT:



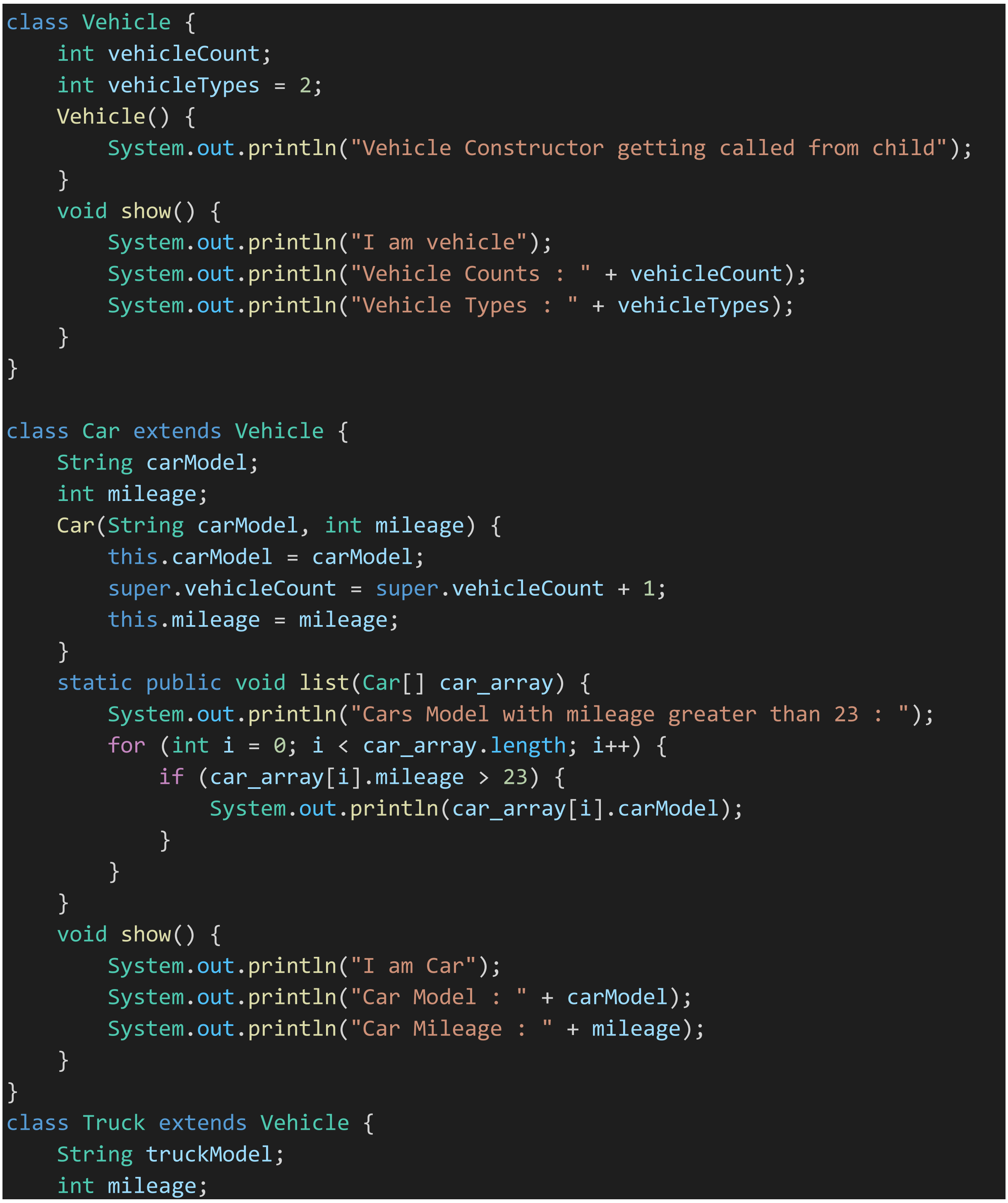
```
-----------------------------------------------------------------
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c
dk-17.0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDe
ser\workspaceStorage\30032ff6b908f564bf959529c93335e9\redha

ANIRUDH VADERA (20BCE2940)

Enter the marks :
Marks1 : 100
Marks2 : 90
Marks3 : 65
First
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c
dk-17.0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDe
ser\workspaceStorage\30032ff6b908f564bf959529c93335e9\redha

ANIRUDH VADERA (20BCE2940)

Enter the marks :
Marks1 : 10
Marks2 : 20
Marks3 : 30
Fail
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c
dk-17.0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDe
ser\workspaceStorage\30032ff6b908f564bf959529c93335e9\redha

ANIRUDH VADERA (20BCE2940)

Enter the marks :
Marks1 : 58
Marks2 : 58
Marks3 : 54
Second
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes> 
```

QUESTION 2:



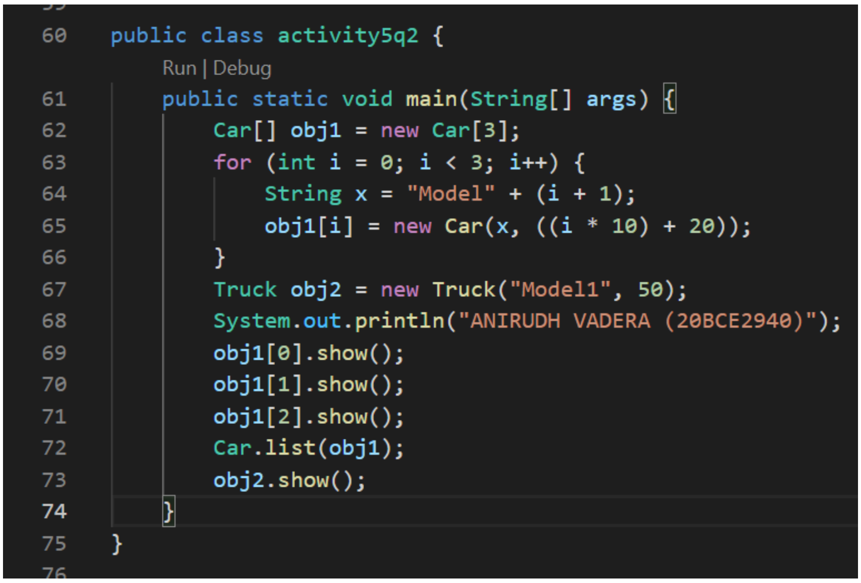
2. Write a java program to create three classes Vehicle, Car and Truck. Car and Truck is inherited from Vehicle class. Write a method "show" in all three classes to display the Vehicle, Car and Truck details. Write suitable constructors and use super () and super wherever necessary. Use atleast 2 instance variables in every class. Also, include a method in Car class to list out all the Cars which give mileage >23.

CODE:



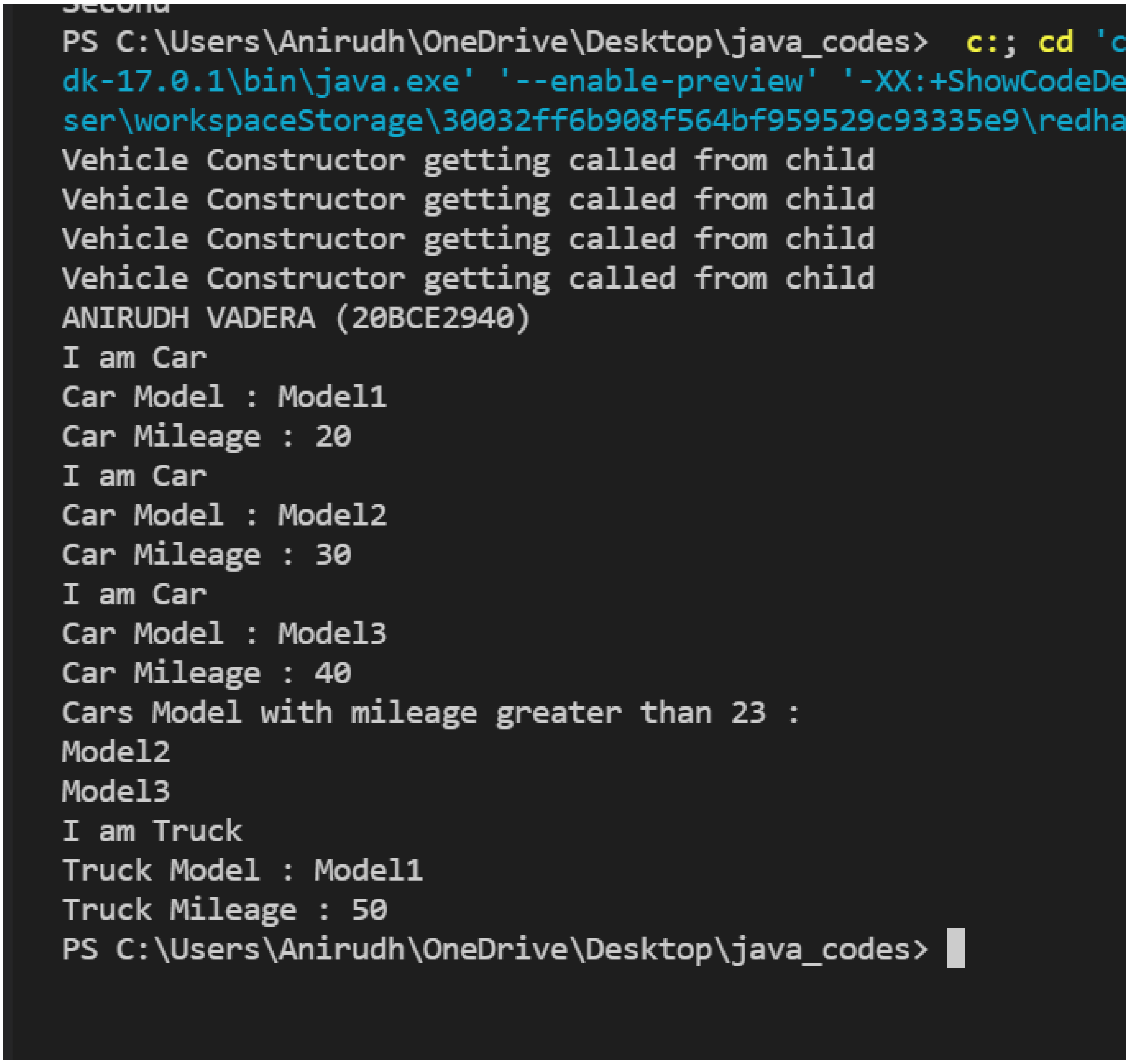
```java
class Vehicle {
    int vehicleCount;
    int vehicleTypes = 2;
    Vehicle() {
        System.out.println("Vehicle Constructor getting called from child");
    }
    void show() {
        System.out.println("I am vehicle");
        System.out.println("Vehicle Counts : " + vehicleCount);
        System.out.println("Vehicle Types : " + vehicleTypes);
    }
}

class Car extends Vehicle {
    String carModel;
    int mileage;
    Car(String carModel, int mileage) {
        this.carModel = carModel;
        super.vehicleCount = super.vehicleCount + 1;
        this.mileage = mileage;
    }
    static public void list(Car[] car_array) {
        System.out.println("Cars Model with mileage greater than 23 : ");
        for (int i = 0; i < car_array.length; i++) {
            if (car_array[i].mileage > 23) {
                System.out.println(car_array[i].carModel);
            }
        }
    }
    void show() {
        System.out.println("I am Car");
        System.out.println("Car Model : " + carModel);
        System.out.println("Car Mileage : " + mileage);
    }
}
class Truck extends Vehicle {
    String truckModel;
    int mileage;
    Truck(String truckModel, int mileage) {
        super();
        this.truckModel = truckModel;
        super.vehicleCount = super.vehicleCount + 1;
        this.mileage = mileage;
    }

    void show() {
        System.out.println("I am Truck");
        System.out.println("Truck Model : " + truckModel);
        System.out.println("Truck Mileage : " + mileage);
    }
}
public class activity5q2 {
    public static void main(String[] args) {
        Car[] obj1 = new Car[3];
        for (int i = 0; i < 3; i++) {
            String x = "Model" + (i + 1);
            obj1[i] = new Car(x, ((i * 10) + 20));
        }
        Truck obj2 = new Truck("Model1", 50);
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        obj1[0].show();
        obj1[1].show();
        obj1[2].show();
        Car.list(obj1);
        obj2.show();
    }
}
```

CODE SNAPSHOT:



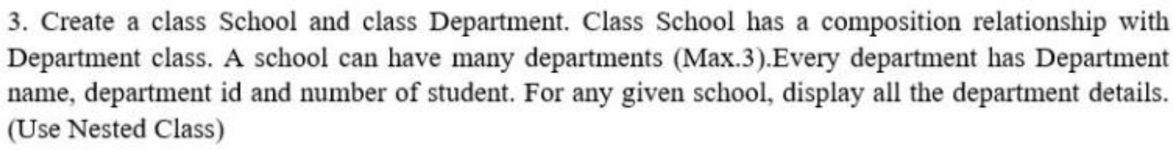
```
public class activity5q2 {
    public static void main(String[] args) {
        Car[] obj1 = new Car[3];
        for (int i = 0; i < 3; i++) {
            String x = "Model" + (i + 1);
            obj1[i] = new Car(x, ((i * 10) + 20));
        }
        Truck obj2 = new Truck("Model1", 50);
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        obj1[0].show();
        obj1[1].show();
        obj1[2].show();
        Car.list(obj1);
        obj2.show();
    }
}
```

OUTPUT:



```
Second
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd 'c
dk-17.0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCodeDe
ser\workspaceStorage\30032ff6b908f564bf959529c93335e9\redha
Vehicle Constructor getting called from child
Vehicle Constructor getting called from child
Vehicle Constructor getting called from child
Vehicle Constructor getting called from child
ANIRUDH VADERA (20BCE2940)
I am Car
Car Model : Model1
Car Mileage : 20
I am Car
Car Model : Model2
Car Mileage : 30
I am Car
Car Model : Model3
Car Mileage : 40
Cars Model with mileage greater than 23 :
Model2
Model3
I am Truck
Truck Model : Model1
Truck Mileage : 50
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes> 
```

QUESTION 3:

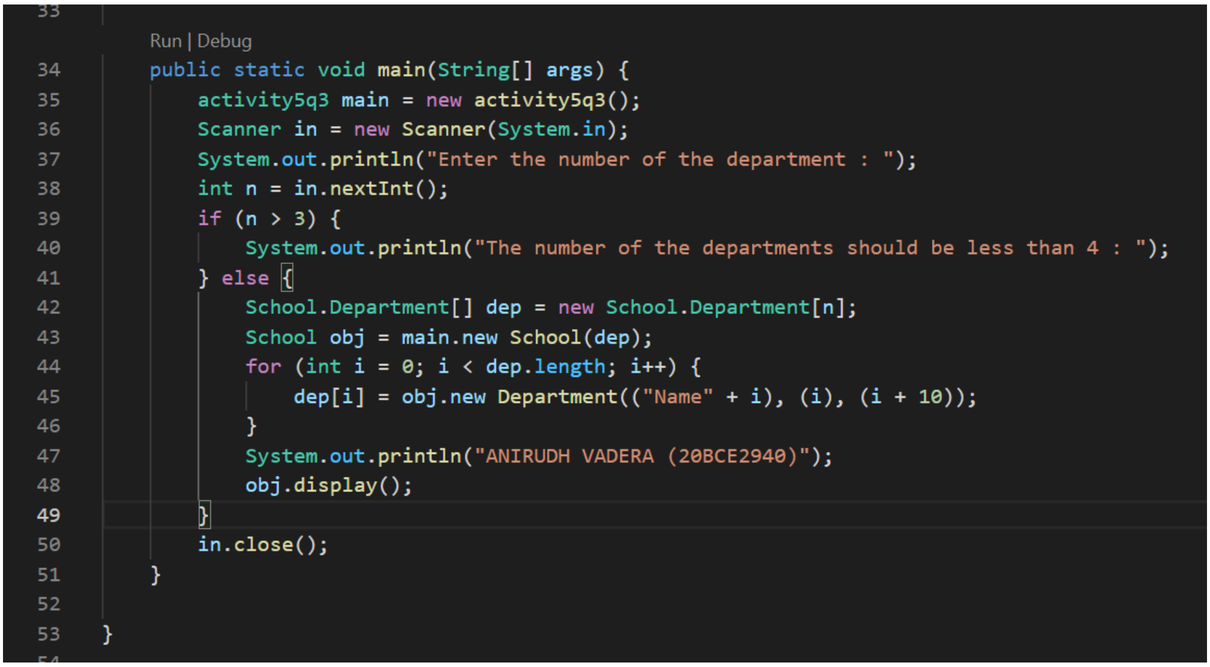


3. Create a class School and class Department. Class School has a composition relationship with Department class. A school can have many departments (Max.3).Every department has Department name, department id and number of student. For any given school, display all the department details. (Use Nested Class)

CODE:

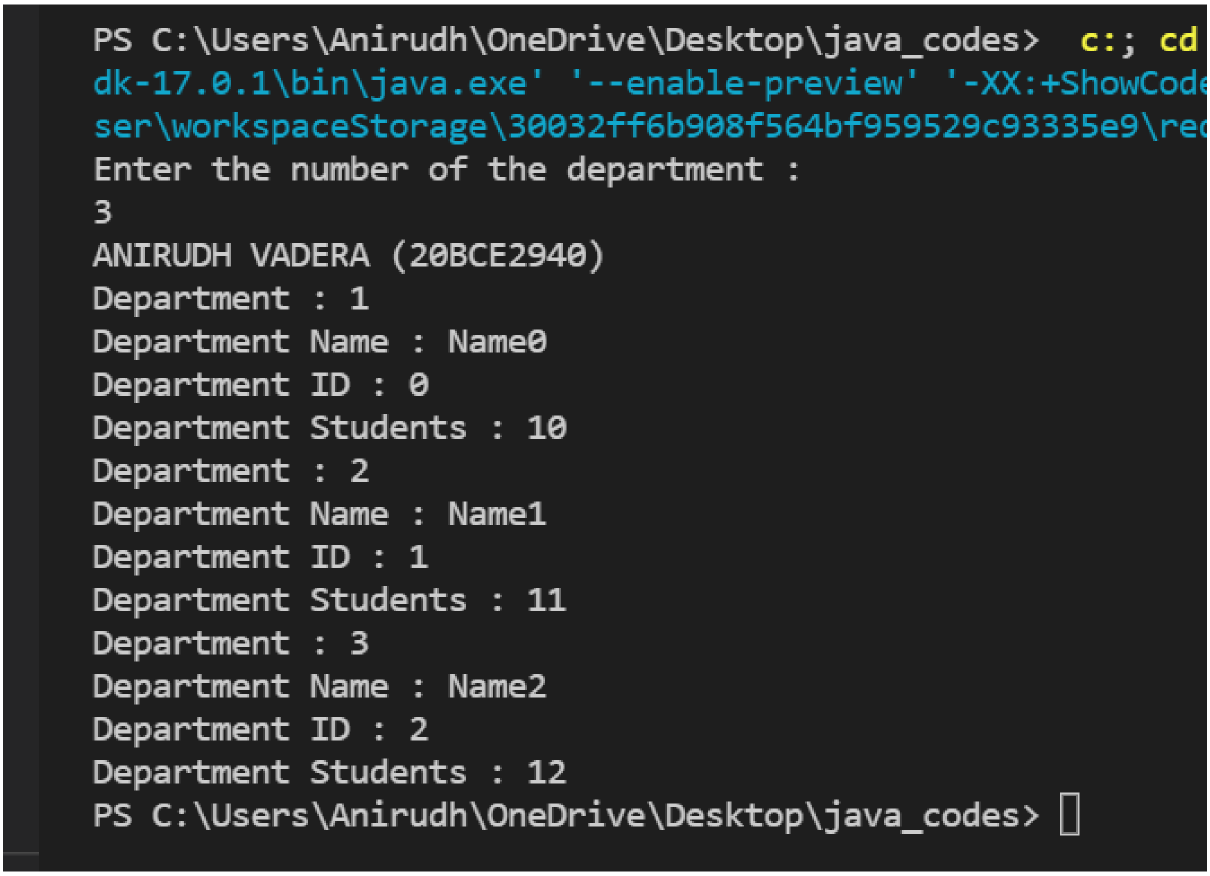
```
import java.util.Scanner;

public class activity5q3 {
    class School {
        Department[] department_array;

        School(Department[] department_array) {
            this.department_array = department_array;
        }

        class Department {
            String name;
            int id;
            int no_of_children;

            Department(String name, int id, int no_of_children) {
                this.name = name;
                this.id = id;
                this.no_of_children = no_of_children;
            }
        }

        void display() {
            for (int i = 0; i < department_array.length; i++) {
                System.out.println("Department : " + (i + 1));
                System.out.println("Department Name : " +
department_array[i].name);
                System.out.println("Department ID : " +
department_array[i].id);
                System.out.println("Department Students : " +
department_array[i].no_of_children);
            }
        }

    }

    public static void main(String[] args) {
        activity5q3 main = new activity5q3();
        Scanner in = new Scanner(System.in);
        System.out.println("Enter the number of the department : ");
        int n = in.nextInt();
        if (n > 3) {
            System.out.println("The number of the departments should be less 
than 4 : ");
        } else {
            School.Department[] dep = new School.Department[n];
            School obj = main.new School(dep);
            for (int i = 0; i < dep.length; i++) {
                dep[i] = obj.new Department(("Name" + i), (i), (i + 10));
            }
            System.out.println("ANIRUDH VADERA (20BCE2940)");
            obj.display();
        }
        in.close();
    }

}
```

CODE SNAPSHOT:



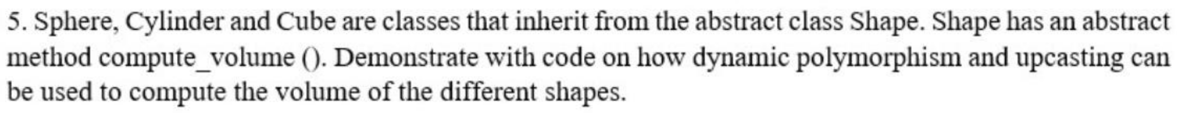
```
    public static void main(String[] args) {
        activity5q3 main = new activity5q3();
        Scanner in = new Scanner(System.in);
        System.out.println("Enter the number of the department : ");
        int n = in.nextInt();
        if (n > 3) {
            System.out.println("The number of the departments should be less than 4 : ");
        } else {
            School.Department[] dep = new School.Department[n];
            School obj = main.new School(dep);
            for (int i = 0; i < dep.length; i++) {
                dep[i] = obj.new Department(("Name" + i), (i), (i + 10));
            }
            System.out.println("ANIRUDH VADERA (20BCE2940)");
            obj.display();
        }
        in.close();
    }

}
```

OUTPUT:



```
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>  c:; cd
dk-17.0.1\bin\java.exe' '--enable-preview' '-XX:+ShowCode
ser\workspaceStorage\30032ff6b908f564bf959529c93335e9\re
Enter the number of the department :
3
ANIRUDH VADERA (20BCE2940)
Department : 1
Department Name : Name0
Department ID : 0
Department Students : 10
Department : 2
Department Name : Name1
Department ID : 1
Department Students : 11
Department : 3
Department Name : Name2
Department ID : 2
Department Students : 12
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes> 
```

QUESTION 5:



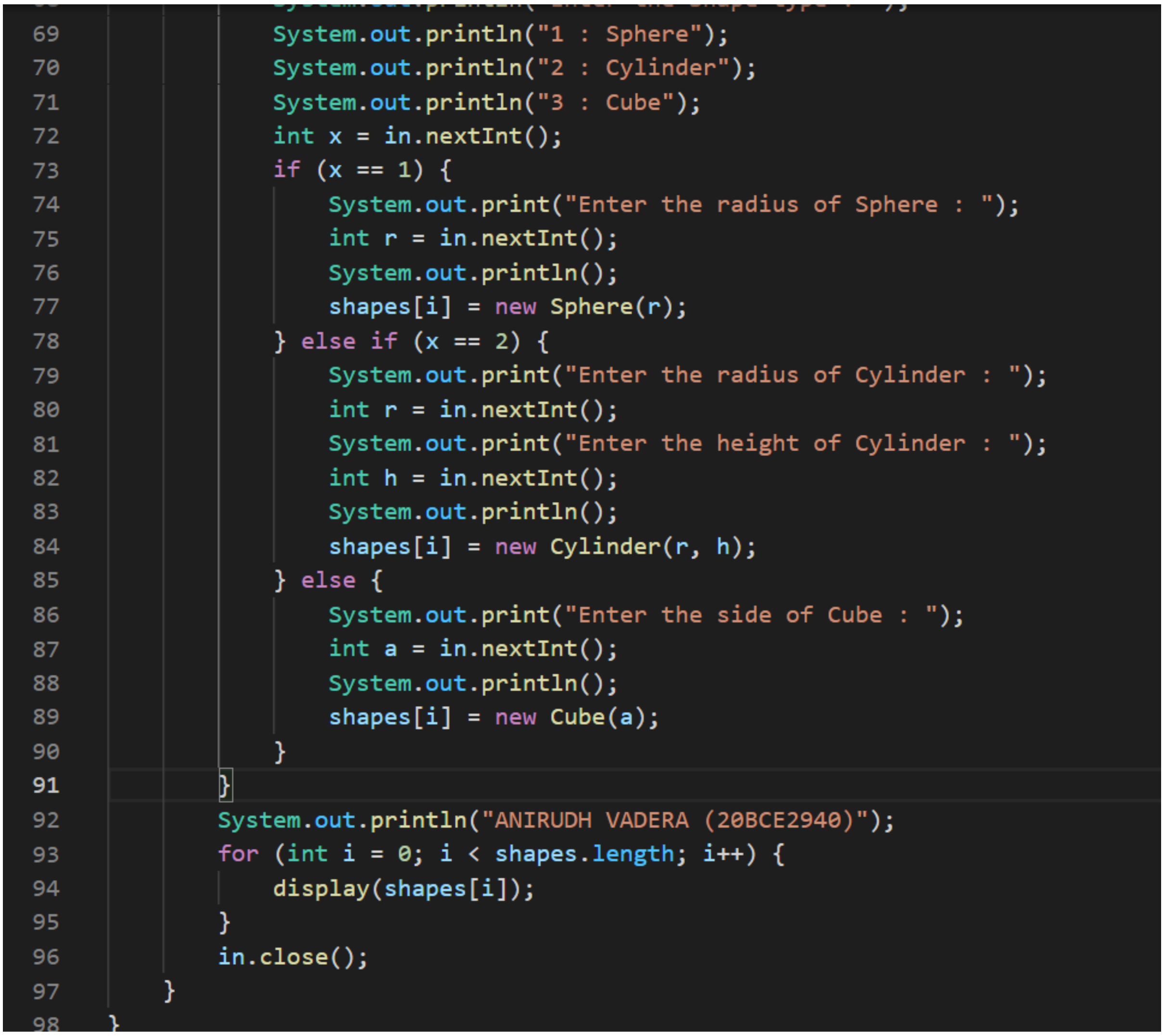
5. Sphere, Cylinder and Cube are classes that inherit from the abstract class Shape. Shape has an abstract method compute_volume (). Demonstrate with code on how dynamic polymorphism and upcasting can be used to compute the volume of the different shapes.

CODE:

```
import java.util.Scanner;

abstract class Shape {
    abstract void compute_volume();
}

class Sphere extends Shape {
    int r;
    double volume;

    Sphere(int r) {
        this.r = r;
        volume = (4 / 3) * Math.PI * r * r * r;
    }

    void compute_volume() {
        System.out.println("The Volume of Sphere is : ");
        System.out.println(volume);
    }
}

class Cylinder extends Shape {
    int r;
    int h;
    double volume;

    Cylinder(int r, int h) {
        this.r = r;
        this.h = h;
        volume = Math.PI * r * r * h;
    }

    void compute_volume() {
        System.out.println("The Volume of Cylinder is : ");
        System.out.println(volume);
    }
}
```

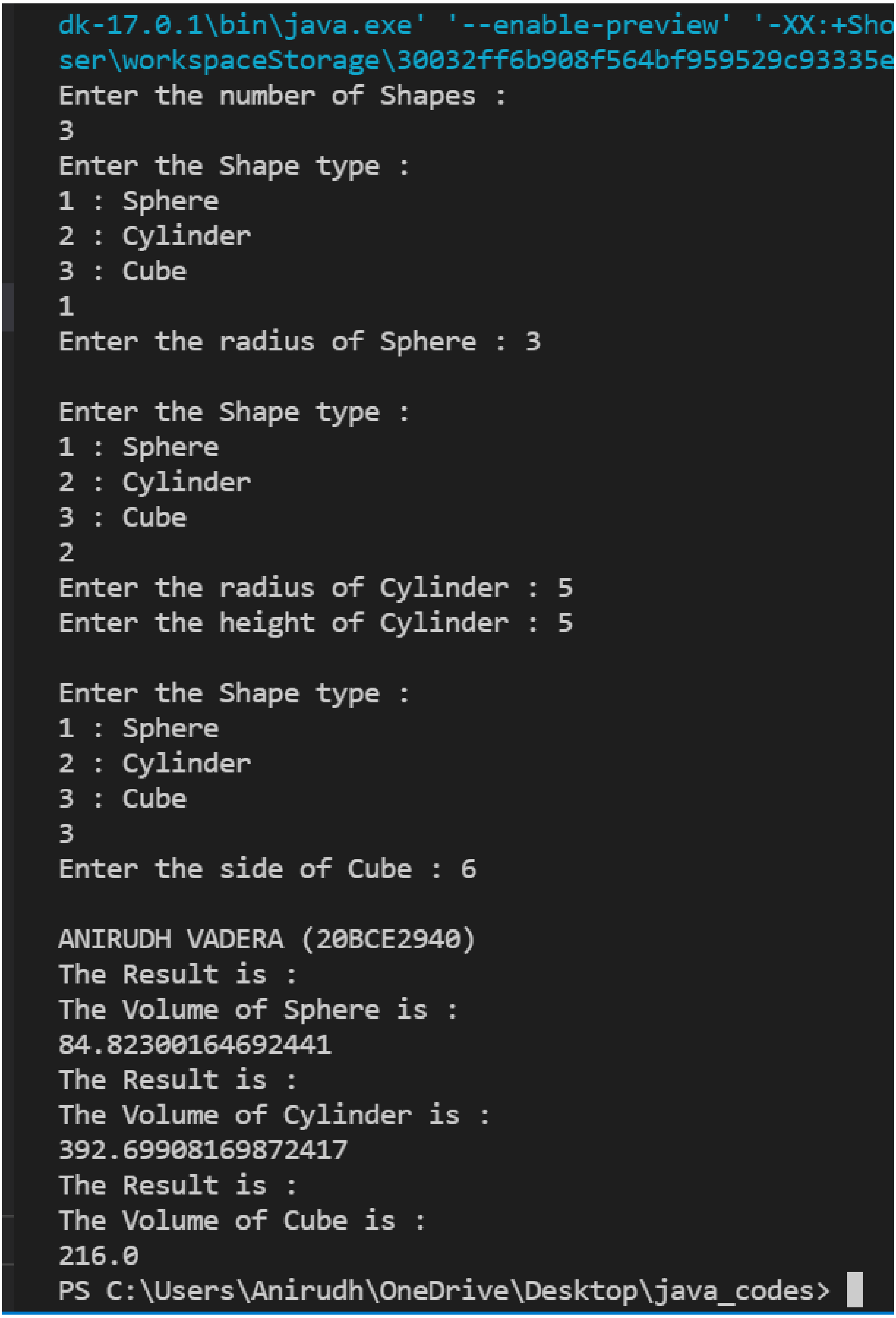
```java
class Cube extends Shape {
    int a;
    double volume;

    Cube(int a) {
        this.a = a;
        volume = a * a * a;
    }

    void compute_volume() {
        System.out.println("The Volume of Cube is : ");
        System.out.println(volume);
    }
}

public class activity5q5 {

    public static void display(Shape x) {
        System.out.println("The Result is : ");
        x.compute_volume();
    }

    public static void main(String[] args) {
        int n;
        System.out.println("Enter the number of Shapes : ");
        Scanner in = new Scanner(System.in);
        n = in.nextInt();
        Shape[] shapes = new Shape[n];
        for (int i = 0; i < shapes.length; i++) {
            System.out.println("Enter the Shape type : ");
            System.out.println("1 : Sphere");
            System.out.println("2 : Cylinder");
            System.out.println("3 : Cube");
            int x = in.nextInt();
            if (x == 1) {
                System.out.print("Enter the radius of Sphere : ");
                int r = in.nextInt();
                System.out.println();
                shapes[i] = new Sphere(r);
            } else if (x == 2) {
                System.out.print("Enter the radius of Cylinder : ");
                int r = in.nextInt();
                System.out.print("Enter the height of Cylinder : ");
                int h = in.nextInt();
                System.out.println();
                shapes[i] = new Cylinder(r, h);
            } else {
                System.out.print("Enter the side of Cube : ");
                int a = in.nextInt();
                System.out.println();
                shapes[i] = new Cube(a);
            }
        }
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        for (int i = 0; i < shapes.length; i++) {
            display(shapes[i]);
        }
        in.close();
    }
}
```

CODE SNAPSHOT:



```
            System.out.println("1 : Sphere");
            System.out.println("2 : Cylinder");
            System.out.println("3 : Cube");
            int x = in.nextInt();
            if (x == 1) {
                System.out.print("Enter the radius of Sphere : ");
                int r = in.nextInt();
                System.out.println();
                shapes[i] = new Sphere(r);
            } else if (x == 2) {
                System.out.print("Enter the radius of Cylinder : ");
                int r = in.nextInt();
                System.out.print("Enter the height of Cylinder : ");
                int h = in.nextInt();
                System.out.println();
                shapes[i] = new Cylinder(r, h);
            } else {
                System.out.print("Enter the side of Cube : ");
                int a = in.nextInt();
                System.out.println();
                shapes[i] = new Cube(a);
            }
        }
        System.out.println("ANIRUDH VADERA (20BCE2940)");
        for (int i = 0; i < shapes.length; i++) {
            display(shapes[i]);
        }
        in.close();
    }
}
```

OUTPUT:



```
dk-17.0.1\bin\java.exe' '--enable-preview' '-XX:+Sho
ser\workspaceStorage\30032ff6b908f564bf959529c93335e
Enter the number of Shapes :
3
Enter the Shape type :
1 : Sphere
2 : Cylinder
3 : Cube
1
Enter the radius of Sphere : 3

Enter the Shape type :
1 : Sphere
2 : Cylinder
3 : Cube
2
Enter the radius of Cylinder : 5
Enter the height of Cylinder : 5

Enter the Shape type :
1 : Sphere
2 : Cylinder
3 : Cube
3
Enter the side of Cube : 6

ANIRUDH VADERA (20BCE2940)
The Result is :
The Volume of Sphere is :
84.82300164692441
The Result is :
The Volume of Cylinder is :
392.69908169872417
The Result is :
The Volume of Cube is :
216.0
PS C:\Users\Anirudh\OneDrive\Desktop\java_codes>
```