

WEEK 10

1. Create class Person (Data Member- name, phone). Create two member inner classes Address (Data Member- House_No, Street, City, State; Method- displayAddr()) and DateOfBirth (Data Member- Day, Month, Year; Method- displayDOB()). Display() is the method of Person class which will display name, address and date of birth of a Person object.

```
>Main.java  Person.java
1 package week10_1;
2
3 class Person {
4     String name; 2 usages
5     String phone; 2 usages
6     private Address address; 2 usages
7     private DateOfBirth dob; 2 usages
8
9     public Person(String name, String phone, String houseNo, String street,
10                  String city, String state, int day, int month, int year) {
11         this.name = name;
12         this.phone = phone;
13         this.address = new Address(houseNo, street, city, state);
14         this.dob = new DateOfBirth(day, month, year);
15     }
16     public void Display() { 1 usage
17         System.out.println("---- Person Details ----");
18         System.out.println("Name: " + this.name);
19         System.out.println("Phone: " + this.phone);
20
21         this.address.displayAddr();
22         this.dob.displayDOB();
23         System.out.println("-----");
24     }
25
26     class Address {
27         String House_No; 2 usages
28         String Street; 2 usages
29         String City; 2 usages
30         String State; 2 usages
31
32         public Address(String houseNo, String street, String city, String state) {
33             this.House_No = houseNo;
34             this.Street = street;
35             this.City = city;
36             this.State = state;
37         }
38
39         public void displayAddr() { 1 usage
40             System.out.println("Address: " + this.House_No + ", " +
41                               this.Street + ", " + this.City + ", " + this.State);
42         }
43     }
44
45     class DateOfBirth {
46         int Day; 2 usages
47         int Month; 2 usages
48         int Year; 2 usages
49
50         public DateOfBirth(int day, int month, int year) { 1 usage
51             this.Day = day;
52             this.Month = month;
53             this.Year = year;
54         }
55
56         public void displayDOB() { 1 usage
57             System.out.println("Date of Birth: " +
58                               [this.Day + "/" + this.Month + "/" + this.Year]);
59         }
60     }
}
```

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```
>Main.java  Person.java
1 package week10_1;
2
3 public class Main {
4     public static void main(String[] args) {
5         Person person1 = new Person(
6             name: "Amit Kumar",
7             phone: "+91-9876543210",
8             houseNo: "123-B",
9             street: "Kamla Nagar",
10            city: "Agra",
11            state: "Uttar Pradesh",
12            day: 15,
13            month: 8,
14            year: 1990
15        );
16        person1.Display();
17    }
18 }
```

```
--- Person Details ---
Name: Amit Kumar
Phone: +91-9876543210
Address: 123-B, Kamla Nagar, Agra, Uttar Pradesh
Date of Birth: 15/8/1990
-----
```

2. Create class Edible. Within that define two static classes Fruit and Vegetable. Fruit class will have two methods- fruitDetails() is a static method and fruitPackaging() is a non-static method. Vegetable class also has similar methods - vegetableDetails() and vegetablePackaging(). Call all the four methods from main method.

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```
④ Main.java ④ Edible.java
1 package week10_2;
2
3 ▷ public class Main {
4
5 ▷     public static void main(String[] args) {
6
7         System.out.println("--- Demonstrating Fruit Class ---");
8         Edible.Fruit.fruitDetails();
9
10        Edible.Fruit myFruit = new Edible.Fruit();
11        myFruit.fruitPackaging();
12
13        System.out.println("\n--- Demonstrating Vegetable Class ---");
14        Edible.Vegetable.vegetableDetails();
15
16        Edible.Vegetable myVegetable = new Edible.Vegetable();
17        myVegetable.vegetablePackaging();
18    }
19}
```



```
④ Main.java ④ Edible.java
1 package week10_2;
2
3 ▷ public class Edible { 6 usages
4
5     public static class Fruit { 3 usages
6         public static void fruitDetails() { 1 usage
7             System.out.println("Static Method (Fruit)");
8         }
9         public void fruitPackaging() { 1 usage
10            System.out.println("Non-Static Method (Fruit)");
11        }
12    }
13    public static class Vegetable { 3 usages
14        public static void vegetableDetails() { 1 usage
15            System.out.println("Static Method (Vegetable)");
16        }
17        public void vegetablePackaging() { 1 usage
18            System.out.println("Non-Static Method (Vegetable)");
19        }
20    }
21}
```



```
--- Demonstrating Fruit Class ---
Static Method (Fruit)
Non-Static Method (Fruit)

--- Demonstrating Vegetable Class ---
Static Method (Vegetable)
Non-Static Method (Vegetable)
```

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3. Create three different minMaxAdd() methods to calculate minimum, maximum and addition of integers, real numbers and characters.

```
>Main.java ×  
1 package week10_3;  
2  
3 public class Main {  
4     public static void minMaxAdd(int a, int b) { 1 usage  
5         System.out.println("Integer");  
6         System.out.println("Min: " + Math.min(a, b));  
7         System.out.println("Max: " + Math.max(a, b));  
8         System.out.println("Sum: " + (a + b));  
9     }  
10    public static void minMaxAdd(double a, double b) { 1 usage  
11        System.out.println("Double (Real)");  
12        System.out.println("Min: " + Math.min(a, b));  
13        System.out.println("Max: " + Math.max(a, b));  
14        System.out.println("Sum: " + (a + b));  
15    }  
16    public static void minMaxAdd(char a, char b) { 1 usage  
17        System.out.println("Character");  
18        System.out.println("Min: '" + (char)Math.min(a, b) + "'");  
19        System.out.println("Max: '" + (char)Math.max(a, b) + "'");  
20        System.out.println("Sum (as int): " + (a + b));  
21    }  
22    public static void main(String[] args) {  
23        minMaxAdd( a: 10, b: 20);  
24        minMaxAdd( a: 7.5, b: 3.2);  
25        minMaxAdd( a: 'B', b: 'X');  
26    }  
27}
```

Integer

Min: 10
Max: 20
Sum: 30

Double (Real)

Min: 3.2
Max: 7.5
Sum: 10.7

Character

Min: 'B'
Max: 'X'
Sum (as int): 154

4. Create a class ObjectOriented which has methods- abstraction(), polymorphism() and inheritance(). Create a class JavaLanguage which inherits from ObjectOriented class and has its own methods- persistence() and interfaces(). Create an object of JavaLanguage class to access all of its own and parent's methods.

5. In previous question, create a new class C++ which also inherits from ObjectOriented class and has its own methods- template() and friendFunction(). Create an object of C++ class to access all of its own and parent's methods.

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```
© Main.java × © JavaLanguage.java © ObjectOriented.java © Cpp.java

1 package week10_4;
2
3 ▷ public class Main {
4 ▷     public static void main(String[] args) {
5
6         JavaLanguage myJava = new JavaLanguage();
7         System.out.println("Accessing Parent's Methods (from ObjectOriented)");
8         myJava.abstraction();
9         myJava.polymorphism();
10        myJava.inheritance();
11
12        System.out.println("\nAccessing Own Methods (from JavaLanguage)");
13        myJava.persistence();
14        myJava.interfaces();
15
16        Cpp myCpp = new Cpp();
17        System.out.println("\nAccessing Parent's Methods (from ObjectOriented)");
18        myCpp.abstraction();
19        myCpp.polymorphism();
20        myCpp.inheritance();
21
22        System.out.println("\nAccessing Own Methods (from CppLanguage)");
23        myCpp.template();
24        myCpp.friendFunction();
25    }
26
27 }
```

```
1.java © ObjectOriented.java × © JavaLanguage.java
package week10_4;
class ObjectOriented { 2 usages 2 inheritors
    public void abstraction() { 2 usages
        System.out.println("Abstraction");
    }

    public void polymorphism() { 2 usages
        System.out.println("Polymorphism");
    }

    public void inheritance() { 2 usages
        System.out.println("Inheritance");
    }
}

1.java © ObjectOriented.java © JavaLanguage.java
package week10_4;

class JavaLanguage extends ObjectOriented {

    public void persistence() { 1 usage
        System.out.println("Persistence");
    }

    public void interfaces() { 1 usage
        System.out.println("Interfaces");
    }
}
```

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```
© Main.java   © ObjectOriented.java   © JavaLanguage.java   © Cpp.java ×
1 package week10_4;
2
3 class Cpp extends ObjectOriented { 2 usages
4 >     public void template() { System.out.println("Templates"); }
5 >     public void friendFunction() { System.out.println("Friend Functions"); }
6 }
7
8
9
10
11
```

Accessing Parent's Methods (from ObjectOriented)

Abstraction
Polymorphism
Inheritance

Accessing Own Methods (from JavaLanguage)

Persistence
Interfaces

Accessing Parent's Methods (from ObjectOriented)

Abstraction
Polymorphism
Inheritance

Accessing Own Methods (from CppLanguage)

Templates
Friend Functions

6. Create class University which has data members- name and ranking. Create class Faculty that extends University class has data member- name and method- Details(). Create a new class Department which is derived from Faculty and has data member- name, chairman and method- Details() and Display() where Display() method calls Details() methods of both Faculty and Department class in its body. Create an object of Department class to Display() method and University ranking.

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```
>Main.java  University.java  Faculty.java  Department.java
1 package week10_6;
2
3 public class Main {
4     public static void main(String[] args) {
5         Department csDept = new Department(
6             uniName: "Stanford University",
7             ranking: 1,
8             facultyName: "School of Engineering",
9             deptName: "Computer Science",
10            chairman: "Dr. John Hennessy"
11        );
12        System.out.println("Calling Display()");
13        csDept.Display();
14        System.out.println("\nAccessing University Ranking directly:");
15        System.out.println("Ranking: " + csDept.ranking);
16    }
17 }
```

```
Main.java  University.java  Faculty.java  Department.java
1 package week10_6;
2
3 class University { 1 usage 2 inheritors
4     String name; 2 usages
5     int ranking; 2 usages
6
7     public University(String name, int ranking) {
8         this.name = name;
9         this.ranking = ranking;
10    }
11 }
```

```
Main.java  University.java  Faculty.java  Department.java
1 package week10_6;
2
3 class Faculty extends University { 1 usage 1 inheritor
4     String name; 2 usages
5
6     public Faculty(String uniName, int ranking, String facultyName) {
7         super(uniName, ranking);
8         this.name = facultyName;
9     }
10    public void Details() { 2 usages 1 override
11        System.out.println("University: " + super.name);
12        System.out.println("Faculty: " + this.name);
13    }
14 }
```

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```
④ Main.java   ④ University.java   ④ Faculty.java   ④ Department.java ×
1 package week10_6;
2
3 class Department extends Faculty { 2 usages
4     String name; 2 usages
5     String chairman; 2 usages
6
7     public Department(String uniName, int ranking, String facultyName, 1 usage
8                     String deptName, String chairman) {
9
10         super(uniName, ranking, facultyName);
11
12         this.name = deptName;
13         this.chairman = chairman;
14     }
15     @Override 2 usages
16     public void Details() {
17         System.out.println("Department: " + this.name);
18         System.out.println("Chairman: " + this.chairman);
19     }
20     public void Display() { 1 usage
21         super.Details();
22         this.Details();
23     }
24 }
```

Calling Display():
University: Stanford University
Faculty: School of Engineering
Department: Computer Science
Chairman: Dr. John Hennessy

Accessing University Ranking directly:
Ranking: 1

7. Create a class Employee (Data Members – empName, empId). Create two member inner classes: ● Salary (Data Members – basic, hra, pf; Method – displaySalary() to print salary details) ● JoiningDate (Data Members – day, month, year; Method – displayJoiningDate() to print joining date). In the Employee class, create a method displayEmployee() that prints the employee's name, ID, salary details, and joining date.

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```
© Main.java × © Employee.java
1 package week10_7;
2
3 public class Main {
4     public static void main(String[] args) {
5         Employee emp1 = new Employee( empName: "Rajesh Kumar",
6                                         empId: 101, basic: 80000, hra: 20000,
7                                         pf: 8000, day: 14, month: 10, year: 2021);
8         emp1.displayEmployee();
9     }
10 }
11

© Main.java      © Employee.java ×
1 package week10_7;
2
3 class Employee {
4     String empName;
5     int empId;
6     private Salary salary;
7     private JoiningDate joiningDate;
8     public Employee(String empName, int empId, double basic,
9                     double hra, double pf, int day, int month, int year) {
10        this.empName = empName;
11        this.empId = empId;
12        this.salary = new Salary(basic, hra, pf);
13        this.joiningDate = new JoiningDate(day, month, year);
14    }
15    public void displayEmployee() {
16        System.out.println("Employee Name: " + this.empName);
17        System.out.println("Employee ID: " + this.empId);
18        this.salary.displaySalary();
19        this.joiningDate.displayJoiningDate();
20    }
}
```

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```
21  class Salary {  
22      double basic;  
23      double hra;  
24      double pf;  
25  
26      public Salary(double basic, double hra, double pf) {  
27          this.basic = basic;  
28          this.hra = hra;  
29          this(pf);  
30      }  
31      public void displaySalary() {  
32          double total = (this.basic + this.hra) - this(pf);  
33          System.out.println("Salary Details for: " + empName);  
34          System.out.println("Basic Pay: " + this.basic);  
35          System.out.println("HRA: " + this.hra);  
36          System.out.println("PF: " + this(pf));  
37          System.out.println("Total Salary: " + total);  
38      }  
39  }  
40  class JoiningDate {  
41      int day;  
42      int month;  
43      int year;  
44      public JoiningDate(int day, int month, int year) {  
45          this.day = day;  
46          this.month = month;  
47          this.year = year;  
48      }  
49      public void displayJoiningDate() {  
50          System.out.println("Joining Date: " + this.day + "/" + this.month + "/" + this.year);  
51      }  
52  }  
53 }
```

```
Employee Name: Rajesh Kumar  
Employee ID: 101  
Salary Details for: Rajesh Kumar  
Basic Pay: 80000.0  
HRA: 20000.0  
PF: 8000.0  
Total Salary: 92000.0  
Joining Date: 14/10/2021
```

8. Create a class Shape with overloaded methods area():

- area(int side) – calculates area of a square.
- area(int length, int breadth) – calculates area of a rectangle.
- area(double radius) – calculates area of a circle.

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The screenshot shows a Java code editor with two files open:

- Main.java**:

```
package week10_8;

public class Main {
    public static void main(String[] args) {
        Shape myShape = new Shape();
        myShape.area( side: 10 );
        myShape.area( length: 20, breadth: 10 );
        myShape.area( radius: 7.5 );
    }
}
```
- Shape.java**:

```
package week10_8;

class Shape {
    public void area(int side) {
        int result = side * side;
        System.out.println("Area of the Square: " + result);
    }

    public void area(int length, int breadth) {
        int result = length * breadth;
        System.out.println("Area of the Rectangle: " + result);
    }

    public void area(double radius) {
        double result = Math.PI * radius * radius;
        System.out.printf("Area of the Circle: %.2f\n", result);
    }
}
```

```
Area of the Square: 100
Area of the Rectangle: 200
Area of the Circle: 176.71
```

9. Create a class Vehicle with a method run(). Create subclasses Bike and Car that override the run() method. In the main() method, use a reference of Vehicle to call run() for objects of Bike and Car.

The screenshot shows a Java code editor with four files open:

- Main.java**:

```
package week10_9;

public class Main {
    public static void main(String[] args) {
        Vehicle v1 = new Bike();
        Vehicle v2 = new Car();
        v1.run();
        v2.run();
    }
}
```
- Vehicle.java**:

```
package week10_9;

class Vehicle {
    public void run() {
        System.out.println("Vehicle is running.");
    }
}
```
- Bike.java**: (tab is visible)
- Car.java**: (tab is visible)

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>Main.java Vehicle.java Bike.java Car.java

```
1 package week10_9;
2
3 class Bike extends Vehicle { 1 usage
4     @Override 2 usages
5     public void run() {
6         System.out.println("Bike is running.");
7     }
8 }
```

Main.java Vehicle.java Bike.java Car.java

```
1 package week10_9;
2
3 class Car extends Vehicle { 1 usage
4     @Override 2 usages
5     public void run() {
6         System.out.println("Car is running.");
7     }
8 }
```

Bike is running.
Car is running.