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#### ****Polymorphism****

**Polymorphism in Java** is a concept by which we can perform a single action in different ways. Polymorphism is derived from 2 Greek words: poly and morphs. The word "poly" means many and "morphs" means forms. So polymorphism means many forms.

There are two types of polymorphism in Java: compile-time polymorphism and runtime polymorphism. We can perform polymorphism in java by method overloading and method overriding.

If you overload a static method in Java, it is the example of compile time polymorphism. Here, we will focus on runtime polymorphism in java.

#### Runtime Polymorphism in Java

**Runtime polymorphism** or **Dynamic Method Dispatch** is a process in which a call to an overridden method is resolved at runtime rather than compile-time.

In this process, an overridden method is called through the reference variable of a superclass. The determination of the method to be called is based on the object being referred to by the reference variable.

Let's first understand the upcasting before Runtime Polymorphism.

#### Upcasting

If the reference variable of Parent class refers to the object of Child class, it is known as upcasting. For example:

1. **class** A{}
2. **class** B **extends** A{}
3. A a=**new** B();//upcasting

For upcasting, we can use the reference variable of class type or an interface type. For Example:

1. **interface** I{}
2. **class** A{}
3. **class** B **extends** A **implements** I{}

Here, the relationship of B class would be:

B IS-A A

B IS-A I

B IS-A Object

Since Object is the root class of all classes in Java, so we can write B IS-A Object.

#### Example of Java Runtime Polymorphism

In this example, we are creating two classes Bike and Splendor. Splendor class extends Bike class and overrides its run() method. We are calling the run method by the reference variable of Parent class. Since it refers to the subclass object and subclass method overrides the Parent class method, the subclass method is invoked at runtime.

Since method invocation is determined by the JVM not compiler, it is known as runtime polymorphism.

1. **class** Bike{
2. **void** run(){System.out.println("running");}
3. }
4. **class** Splendor **extends** Bike{
5. **void** run(){System.out.println("running safely with 60km");}
7. **public** **static** **void** main(String args[]){
8. Bike b = **new** Splendor();//upcasting
9. b.run();
10. }
11. }

Output:

running safely with 60km.

#### Java Runtime Polymorphism Example: Bank

Consider a scenario where Bank is a class that provides a method to get the rate of interest. However, the rate of interest may differ according to banks. For example, SBI, ICICI, and AXIS banks are providing 8.4%, 7.3%, and 9.7% rate of interest.

#### Java Runtime Polymorphism with Data Member

A method is overridden, not the data members, so runtime polymorphism can't be achieved by data members.

In the example given below, both the classes have a data member speedlimit. We are accessing the data member by the reference variable of Parent class which refers to the subclass object. Since we are accessing the data member which is not overridden, hence it will access the data member of the Parent class always.

#### Rule: Runtime polymorphism can't be achieved by data members.

1. **class** Bike{
2. **int** speedlimit=90;
3. }
4. **class** Honda3 **extends** Bike{
5. **int** speedlimit=150;
7. **public** **static** **void** main(String args[]){
8. Bike obj=**new** Honda3();
9. System.out.println(obj.speedlimit);//90
10. }

Output:

90

#### Java Runtime Polymorphism with Multilevel Inheritance

Let's see the simple example of Runtime Polymorphism with multilevel inheritance.

1. **class** Animal{
2. **void** eat(){System.out.println("eating");}
3. }
4. **class** Dog **extends** Animal{
5. **void** eat(){System.out.println("eating fruits");}
6. }
7. **class** BabyDog **extends** Dog{
8. **void** eat(){System.out.println("drinking milk");}
9. **public** **static** **void** main(String args[]){
10. Animal a1,a2,a3;
11. a1=**new** Animal();
12. a2=**new** Dog();
13. a3=**new** BabyDog();
14. a1.eat();
15. a2.eat();
16. a3.eat();
17. }
18. }

**Output:**

eating

eating fruits

drinking Milk

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#### Encapsulation in Java

**Encapsulation in Java** is a process of wrapping code and data together into a single unit, for example, a capsule which is mixed of several medicines.



We can create a fully encapsulated class in Java by making all the data members of the class private. Now we can use setter and getter methods to set and get the data in it.

#### The ****Java Bean**** class is the example of a fully encapsulated class.

#### Advantage of Encapsulation in Java

By providing only a setter or getter method, you can make the class **read-only or write-only**. In other words, you can skip the getter or setter methods.

It provides you the **control over the data**. Suppose you want to set the value of id which should be greater than 100 only, you can write the logic inside the setter method. You can write the logic not to store the negative numbers in the setter methods.

It is a way to achieve **data hiding** in Java because other class will not be able to access the data through the private data members.

The encapsulate class is **easy to test**. So, it is better for unit testing.

The standard IDE's are providing the facility to generate the getters and setters. So, it is **easy and fast to create an encapsulated class** in Java.

#### Simple Example of Encapsulation in Java

Let's see the simple example of encapsulation that has only one field with its setter and getter methods.

File: Student.java

1. //A Java class which is a fully encapsulated class.
2. //It has a private data member and getter and setter methods.
3. **package** com.javatpoint;
4. **public** **class** Student{
5. //private data member
6. **private** String name;
7. //getter method for name
8. **public** String getName(){
9. **return** name;
10. }
11. //setter method for name
12. **public** **void** setName(String name){
13. **this**.name=name
14. }
15. }

File: Test.java

1. //A Java class to test the encapsulated class.
2. **package** com.javatpoint;
3. **class** Test{
4. **public** **static** **void** main(String[] args){
5. //creating instance of the encapsulated class
6. Student s=**new** Student();
7. //setting value in the name member
8. s.setName("vijay");
9. //getting value of the name member
10. System.out.println(s.getName());
11. }
12. }

Compile By: javac -d . Test.java

Run By: java com.javatpoint.Test

Output:

vijay

#### Read-Only class

1. //A Java class which has only getter methods.
2. **public** **class** Student{
3. //private data member
4. **private** String college="AKG";
5. //getter method for college
6. **public** String getCollege(){
7. **return** college;
8. }
9. }

Now, you can't change the value of the college data member which is "AKG".

1. s.setCollege("KITE");//will render compile time error

#### Write-Only class

1. //A Java class which has only setter methods.
2. **public** **class** Student{
3. //private data member
4. **private** String college;
5. //getter method for college
6. **public** **void** setCollege(String college){
7. **this**.college=college;
8. }
9. }

Now, you can't get the value of the college, you can only change the value of college data member.

1. System.out.println(s.getCollege());//Compile Time Error, because there is no such method
2. System.out.println(s.college);//Compile Time Error, because the college data member is private.
3. //So, it can't be accessed from outside the class

#### Another Example of Encapsulation in Java

Let's see another example of encapsulation that has only four fields with its setter and getter methods.

File: Account.java

1. //A Account class which is a fully encapsulated class.
2. //It has a private data member and getter and setter methods.
3. **class** Account {
4. //private data members
5. **private** **long** acc\_no;
6. **private** String name,email;
7. **private** **float** amount;
8. //public getter and setter methods
9. **public** **long** getAcc\_no() {
10. **return** acc\_no;
11. }
12. **public** **void** setAcc\_no(**long** acc\_no) {
13. **this**.acc\_no = acc\_no;
14. }
15. **public** String getName() {
16. **return** name;
17. }
18. **public** **void** setName(String name) {
19. **this**.name = name;
20. }
21. **public** String getEmail() {
22. **return** email;
23. }
24. **public** **void** setEmail(String email) {
25. **this**.email = email;
26. }
27. **public** **float** getAmount() {
28. **return** amount;
29. }
30. **public** **void** setAmount(**float** amount) {
31. **this**.amount = amount;
32. }
34. }

File: TestAccount.java

1. //A Java class to test the encapsulated class Account.
2. **public** **class** TestEncapsulation {
3. **public** **static** **void** main(String[] args) {
4. //creating instance of Account class
5. Account acc=**new** Account();
6. //setting values through setter methods
7. acc.setAcc\_no(7560504000L);
8. acc.setName("Sonoo Jaiswal");
9. acc.setEmail("sonoojaiswal@javatpoint.com");
10. acc.setAmount(500000f);
11. //getting values through getter methods
12. System.out.println(acc.getAcc\_no()+" "+acc.getName()+" "+acc.getEmail()+" "+acc.getAmount());
13. }
14. }

Output:

7560504000 Sonoo Jaiswal sonoojaiswal@javatpoint.com 500000.0

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**Video Links:**

https://youtu.be/szYzBC89CPE

<https://youtu.be/jg4MpYr1TBc>

**Reference Links:**

<https://www.javatpoint.com/runtime-polymorphism-in-java>

<https://www.javatpoint.com/encapsulation>

<https://www.tutorialspoint.com/java/java_encapsulation.htm>

<https://www.geeksforgeeks.org/encapsulation-in-java/>

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