Java Spring & AWS
Sep 7, 2021 - Oct 8, 2021
Monday to Friday
9:30 AM ET - 4:30 PM ET

Agenda: Day -2: Object Oriented Programming: Object, Class, Abstraction, Encapsulation, Inheritance & Polymorphism

- Introduction to Object Oriented Programming
- Objects and Classes in Java
- Scope, Instance and Static variables and methods in Java
  - Local Variables
  - Instance and static Variables
  - Instance methods and Class/static methods
- Create and import Java Packages
- Object class Methods
- Constructors
  - Default and Parameterized constructor
  - The this Reference
- Inheritance
  - extends Keyword
  - The super and this keyword
  - IS-A and HAS-A Relationship
  - The instance of Keyword
  - Types of Inheritance and Multiple Inheritance
- Interfaces
  - Declaring, Extending and Implementing
  - Extending Multiple Interfaces
  - default and static methods in Interfaces
  - Functional Interfaces and Lambda Expr
- Abstraction
  - Abstract Class and Abstract Methods
  - Inheriting the Abstract Class
- Modifiers in Java
  - Access Modifiers
    - Default and Public
    - Private and protected
  - Non-Access Modifiers
    - The static , final and abstract Mo
    - synchronized, transient and volat Modifiers
- Encapsulation
  - Benefits of Encapsulation
- Polymorphism
  - Static and Dynamic Polymorphism
- Rules for Method Overriding

OOPs (Object Oriented Programming system)

Object means a real word entity such as pen, chair, table etc. Object-**Oriented Programming** is a methodology or paradigm to design a program using classes and objects. It simplifies the software development and maintenance by providing some concepts.

- Object
- Class
- Inheritance
- Polymorphism
- Abstraction
- Encapsulation

Abstraction (continue)

Hiding internal details and showing functionality is known as abstraction. For example: phone call, we don't know the internal processing.

- Abstraction is hiding the functionality details.
- Abstraction is achieved by creating either Abstract Classes or Interfaces on top of your class.
- hide the unnecessary things from user so providing easiness.
- Hiding the internal implementation of software so providing security.

Encapsulation

Encapsulation is hiding information.

- A java class is the example of encapsulation. Java bean is the fully encapsulated class because all the data members are private here.
- Encapsulation is performed by constructing the class.
- Encapsulation links the data with the code that manipulates it.
  Encapsulation is the technique of making the fields in a class private and providing access to the fields via public methods.

Difference between Abstraction and Encapsulation

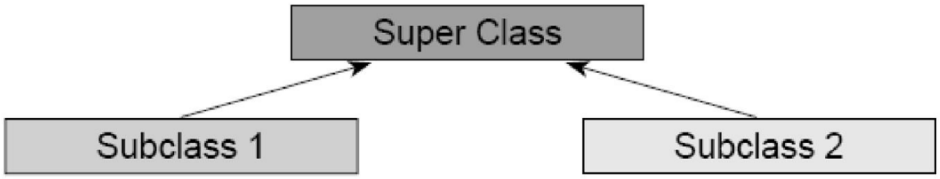
Encapsulation is hiding WHAT THE PHONE USES to achieve whatever it does; Abstraction is hiding HOW IT DOES it.

Encapsulation = Data Hiding + Abstraction.

Inheritance[IS-A]

- Is the ability to derive something specific from something generic.
- *aids in the reuse of code.*
- A class can inherit the features of another class and add its own modification.
- The parent class is the *super class* and the child class is known as the *subclass*.
- A subclass inherits all the properties and methods of the super class.

Inheritance



Types of Inheritance

- Single
- Multiple
- Multilevel
- Hierarchical
- Hybrid

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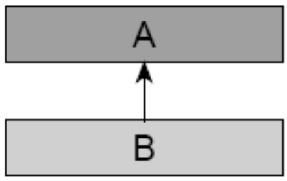
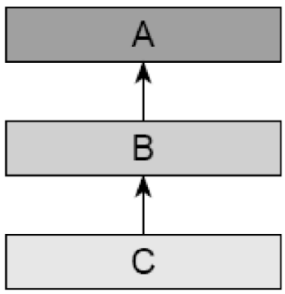
Single (level) inheritance

Classes have only base class

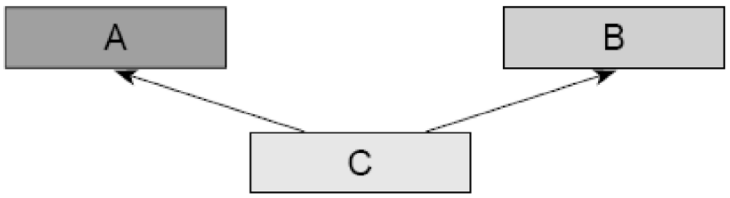


Multi level

There is no limit to this chain of inheritance (as shown below) but getting down deeper to four or five levels makes code excessively complex.

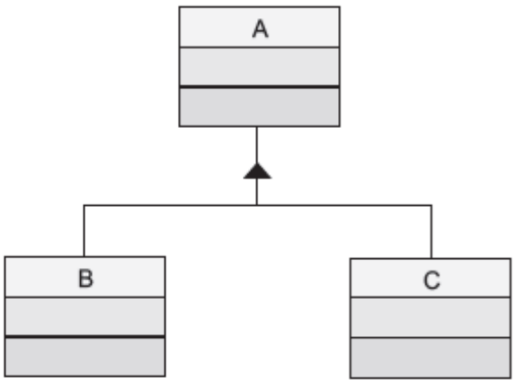


A class can inherit from more than one unrelated class



Hierarchical Inheritance

- In hierarchical inheritance, more than one class can inherit from a single class. Class C inherits from both A and B.



Object class Methods

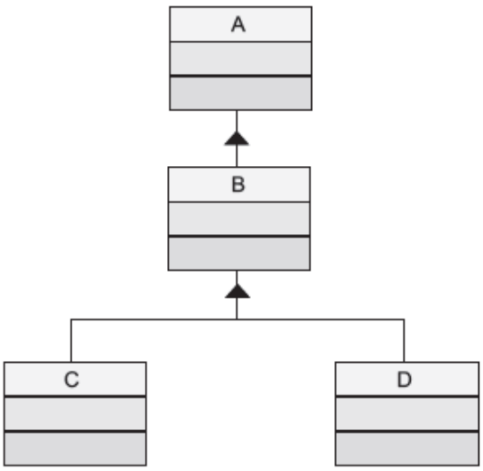
The **Object class** is the parent class of all the classes in java by default. In other words, it is the topmost class of java.

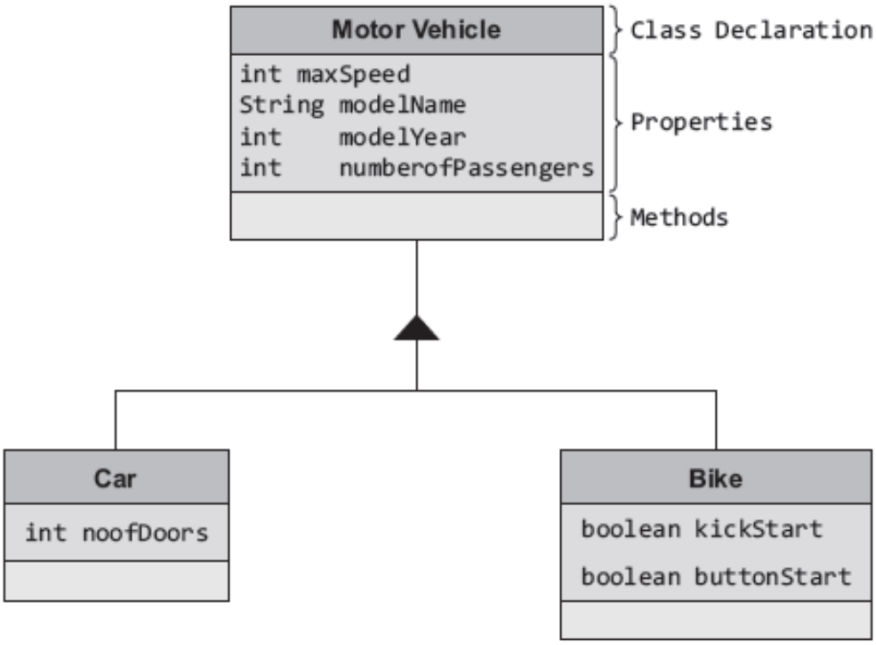
- The Object class is beneficial if you want to refer any object whose type you don't know. Notice that parent class reference variable can refer the child class object, know as upcasting.
- Let's take an example, there is getObject() method that returns an object but it can be of any type like Employee,Student etc, we can use Object class reference to refer that object. For example:

Object obj=getObject();//we don't know what object will be returned fro m this method

Hybrid Inheritance

- is any combination of the above defined inheritances





Aggregation in Java [HAS-A]

If a class have an entity reference, it is known as Aggregation. Aggregation represents HAS-A relationship.

- Consider a situation, Employee object contains many information's such as id, name, email ID etc. It contains one more object named address, which contains its own information's such as city, state, country, zip code etc. as given below.

```
class Employee{
int id;
String name;
Address address;//Address is a class
...
}
```

In such case, Employee has an entity reference address, so relationship is Employee HAS-A address.

When use Aggregation?

- Code reuse is also best achieved by aggregation when there is no is-a relations
- Inheritance should be used only if the relationship is-a is maintained througho lifetime of the objects involved; otherwise, aggregation is the best choice.

Super and this keywords

There can be a lot of usage of **java this keyword**. In java, this is a **re variable** that refers to the current object. Here is given the 6 usage of ja keyword.

- this can be used to refer current class instance variable.
- this can be used to invoke current class method (implicitly)
- this() can be used to invoke current class constructor.
- this can be passed as an argument in the method call.
- this can be passed as argument in the constructor call.
- this can be used to return the current class instance from the method.

super keyword in java

The **super** keyword in java is a reference variable which is used to refer immediate parent class object.

- Whenever you create the instance of subclass, an instance of parent class is created implicitly which is referred by super reference variable.

Usage of java super Keyword

- super can be used to refer immediate parent class instance variable.
- super can be used to invoke immediate parent class method.
- super() can be used to invoke immediate parent class constructor.

Polymorphism

- **Polymorphism in java** is a concept by which we can perform a *single action by 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.

Method Overloading in Java (Continued)

- If a class has multiple methods having same name but different in parameters, it is known as **Method Overloading**.
- If we have to perform only one operation, having same name of the methods increases the readability of the program.

Advantage of method overloading

- Method overloading *increases the readability of the program*.

Different ways to overload the method

- By changing number of arguments
- By changing the data type

Method Overriding

- a method in a subclass has the same name and type signature as a method in its superclass, then the method in the subclass is said to *override* the method in the superclass.
- it is a feature that supports polymorphism.
- When an overridden method is called through the subclass object, it will always refer to the version of the method defined by the subclass.
- The superclass version of the method is hidden.

Usage of Java Method Overriding

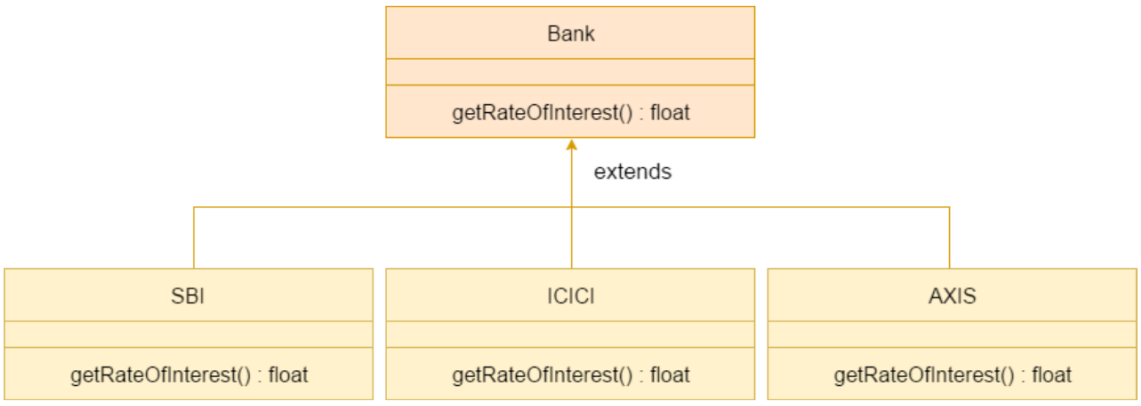
- Method overriding is used to provide specific implementation of a method that is already provided by its super class.
- Method overriding is used for runtime polymorphism

Rules for Java Method Overriding

- method must have same name as in the parent class
- method must have same parameter as in the parent class.
- must be IS-A relationship (inheritance).

Real example of Java Method Overriding:

Consider a scenario, Bank is a class that provides functionality to get rate of interest. But, rate of interest varies according to banks. For example, SBI, ICICI and AXIS banks could provide 8%, 7% and 9% rate of interest.



Difference between method overloading and method overriding in java

No.	Method Overloading	Method Overriding
1)	Method overloading is used *to increase the readability* of the program.	Method overriding is used *to provide implementation* of the method that provided by its super class.
2)	Method overloading is performed *within class*.	Method overriding occurs *in two classes* t A (inheritance) relationship.
3)	In case of method overloading, *parameter must be different*.	In case of method overriding, *paramet same*.
4)	Method overloading is the example of *compile time polymorphism*.	Method overriding is the example o *polymorphism*.
5)	In java, method overloading can't be performed by changing return type of the method only. *Return type can be same or different* in method overloading. But you must have to change the parameter.	*Return type must be same or covarian* overriding.

final keyword

- Declaring constants (used with variable and argument declaration)
  - final int MAX=100;
- Disallowing method overriding in chaild class (used with method declaration)
  - final void show (final int x)
- Disallowing inheritance (used with class declaration).
  - final class Demo {}

Optional Modifiers Used with Methods

Optional Modifiers	
Modifier	**Description**
`public, protected, default or private`	Can be one of these values. Defines the scope—what class can invoke which method. (see Chapter 6, Section 6.2.4)
`static`	The method can be invoked on the class without creating an instance of the class (see Chapter 4, section 4.7)
`abstract`	The class must be extended and abstract method must be overridden in the subclass (see Chapter 5, Section 5.5)
`final`	The method cannot be overridden in a subclass (see Chapter 5, Section 5.4)
`native`	The method is implemented in another language (out of scope of this book)
`synchronized`	The method requires that a monitor (lock) be obtained by calling code before the method is executed (see Chapter 8, Section 8.8)
`throws`	A list of exceptions thrown from this method (see Chapter 7, Section 7.2.3)

Access Modifiers in java

access modifiers and **non-access modifiers**.

- The access modifiers in java specifies accessibility (scope) of a data member, me constructor or class.
- There are 4 types of java access modifiers:
  - ➢ private
  - ➢ default
  - ➢ protected
  - ➢ public

There are many non-access modifiers such as static, abstract, synchronized, native volatile, transient etc. Here, we will learn access modifiers.

Access Modifiers in java

Visibility	Public	Protected	Default	Privat
From the same class	Yes	Yes	Yes	Yes
From any class in the same package	Yes	Yes	Yes	No
From a subclass in the same package	Yes	Yes	Yes	No
From a subclass outside the same package	Yes	Yes, *through inheritance*	No	No
From any non-subclass class outside the package	Yes	No	No	No

Command Line Arguments

- Suppose, you have a Java application, called sort, that sorts the lines in a file named Sort.text. You would invoke the Sort application as,
  - java Sort Example.txt
- When the application is invoked, the runtime system passes the command line arguments to the applications main( ) method via an array of string.
- In the statement above, command line arguments (Example.txt) is passed to the Sort application an array of String that contains a single string, i.e. Example.txt.
- This String array is passed to the main method and it is copied in *args*.

```
public static void main (String args[]) {
. . . . . .
} // end of the main( ) method
```

Wrapper classes

- Java is an object-oriented language and can view everything as an object. A simple file can be treated as an object (with java.io.File), an address of a system can be seen as an object (with java.util.URL), an image can be treated as an object (with java.awt.Image) and a simple data type can be converted into an object (with wrapper classes)
- The primitive data types are not objects; they do not belong to any class; they are defined in the language itself. Sometimes, it is required to convert data types into objects in Java language.

Wrapper classes

- Primitive Type Wrapper class
- boolean Boolean
- charCharacter
- byte Byte
- short Short
- int Integer
- longLong
- float Float
- double Double

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Importance of Wrapper classes

- To convert simple data types into objects, that is, to give object form to a data type; here constructors are used.
- To convert strings into data types (known as parsing operations), here methods of type parseXXX() are used.

Class Modifiers

A class declaration may include *class modifiers*.

- public
- protected
- private
- abstract
- static
- final

Field Modifiers (Unfolded)

Field Modifiers:

- public
- protected
- private
- static
- final
- transient
- volatile

- public means that **any class can access the data/methods**
- private means that **only the class can access the data/methods**
- protected means that only **the class and its subclasses can** access the data/methods

Access Modifiers (summary)

Access Modifier	Class or member can be referenced by…
public	